ecdc
EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL

SURVEILLANCE REPORT

Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals

2011–2012

www.ecdc.europa.eu

ECDC SURVEILLANCE REPORT

Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals

2011–2012

This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Carl Suetens.

Contributing authors
Carl Suetens, Susan Hopkins, Jana Kolman, Liselotte Diaz Högberg.

Acknowledgements
We would like to thank Andrew J. Amato-Gauci, Ole Heuer, Phillip Zucs, Dominique L. Monnet, Denis Coulombier, many other colleagues at ECDC and the ECDC PPS coordination expert team members for their kind review of the report or otherwise contributing to the HAI-Net PPS project and especially all the national PPS coordination team members, local hospital staff, and other contributing experts for their hard work and dedication in collecting and reporting the data, reviewing the draft report or otherwise contributing to the success of this survey. More detail can be found in the Acknowledgements section on page 116.

The country summary sheets are included in Annex 2 of the online report at: www.ecdc.europa.eu/publications

Suggested citation: European Centre for Disease Prevention and Control. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. Stockholm: ECDC; 2013.

Stockholm, July 2013

ISBN 978-92-9193-485-0

doi 10.2900/86011

Catalogue number TQ-01-13-314-EN-C

Contents

Figures

Tables

Abbreviations

ARPAC project	Antimicrobial Resistance: Prevention and Control. 'Development of strategies for control and prevention of antibiotic resistance in European hospitals'
AST	Antimicrobial susceptibility testing
ATC	Anatomical therapeutic chemical
AU	Antimicrobial use
BSI	Bloodstream infection
CI	Confidence interval
CRI	Catheter-related infection
CVC	Central vascular catheter
CVS	Cardio-vascular system
DDD	Defined daily dose
EARS-Net	European Antimicrobial Resistance Surveillance Network (ECDC)
ECDC	European Centre for Disease Prevention and Control
EEA	European Econcomic Area
ESAC	European Surveillance of Antimicrobial Consumption project
ESAC-Net	European Surveillance of Antimicrobial Consumption Network (ECDC)
EU	European Union
FTE	Full-time equivalent
HAI	Healthcare-associated infection
HAI-Net	Healthcare-Associated Infections Surveillance Network (ECDC)
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
ICU	Intensive care unit
IPCD	Infection prevention and control doctor
IPCN	Infection prevention and control nurse
IPSE	Improving Patient Safety in Europe
IQR	Inter-quartile range
LOS	Length of stay
LTCF	Long-term care facility
LRTI	Lower respiratory tract infection
MRSA	Meticillin-resistant *Staphylococcus aureus*
NS	Non-susceptible
OR	Odds ratio
PCR	Polymerase chain reaction
PPS	Point prevalence survey
PVC	Peripheral vascular catheter
ROC	Receiver operating characteristic
SAUR	Standardised antimicrobial use ratio
SIR	Standardised infection ratio
UTI	Urinary tract infection
VRE	Vancomycin-resistant enterococci
WHO	World Health Organization

Overview

In 2011–2012, 29 EU/EEA Member States and Croatia participated in the first EU-wide, ECDC-coordinated point prevalence survey (PPS) of healthcare-associated infections (HAIs) and antimicrobial use in acute care hospitals. An estimated 2800 healthcare workers from 1200 hospitals across Europe were trained by national PPS coordinating staff to implement the standardised PPS methodology [1].

Data from a total of 273 753 patients in 1149 hospitals were submitted to ECDC. Of these, 231 459 patients from 947 hospitals were included in the final European sample for analysis. Data from a single ward were collected on a single day. The total time frame for data collection for all wards of a single hospital was 12 days on average (median nine days).

The prevalence of patients with at least one HAI in acute care hospitals in the PPS sample was 6.0% (country range 2.3%–10.8%). When extrapolated to the average daily number of occupied beds per country obtained by national questionnaire, the HAI prevalence was estimated at 5.7% (95% confidence interval 4.5–7.4%).

Of a total of 15 000 reported HAIs, the most frequently reported HAI types were respiratory tract infections (pneumonia 19.4% and lower respiratory tract 4.1%), surgical site infections (19.6%), urinary tract infections (19.0%), bloodstream infections (10.7%) and gastro-intestinal infections (7.7%), with *Clostridium difficile* infections accounting for 48% of the latter. Twenty-three percent of HAIs (n=3503) were present on admission. One third of HAIs on admission were surgical site infections.

The prevalence of HAIs varied from 4.8% (median HAI prevalence 3.9%, IQR 1.9–6.1%) in primary hospitals to 7.2% (median HAI prevalence 6.9% IQR 4.0–9.7%) in tertiary hospitals. HAI prevalence was highest in patients admitted to ICU, where 19.5% patients had at least one HAI compared with 5.2% on average for all other specialties combined.

The microorganisms most frequently isolated from HAIs were, in decreasing order, *Escherichia coli* (15.9%), *Staphylococcus aureus* (12.3%), *Enterococcus* spp. (9.6%), *Pseudomonas aeruginosa* (8.9%) *Klebsiella* spp. (8.7%), Coagulase-negative staphylococci (7.5%), *Candida* spp. (6.1%), *Clostridium difficile* (5.4%), *Enterobacter* spp. (4.2%), *Proteus* spp. (3.8%) and *Acinetobacter* spp. (3.6%). Selected antimicrobial susceptibility testing (AST) data were available on the day of the survey for 85.0% of microorganisms reported in HAIs. Meticillin resistance was reported in 41.2% of *S. aureus* isolates with known AST results. Vancomycin resistance was reported in 10.2% of isolated enterococci. Third-generation cephalosporin resistance was reported in 33.4% of all Enterobacteriaceae and was highest in *K. pneumoniae*. Carbapenem resistance was reported in 7.6% of all included Enterobacteriaceae, also highest in *K. pneumoniae*, and in 31.8% of *P. aeruginosa* isolates and 81.2% of *Acinetobacter baumannii* isolates.

The prevalence of patients receiving at least one antimicrobial agent was 35.0% (country range 21.4–54.7%). A total of 110 151 antimicrobial agents was reported in 80 951 patients: 70.9% of the patients received one antimicrobial, 23.4% received two and 5.7% received three or more antimicrobials. The overall prevalence of antimicrobial use extrapolated to the total number of occupied beds in Europe was 32.7% (95% confidence interval 29.4–36.2%).

Antimicrobials were administered parenterally in 70.6% of the cases and the reason for antimicrobial use was documented in the patient's medical records for 79.4%.

The prevalence of antimicrobial use was lowest in psychiatric patients (3.5%) and highest among patients in intensive care units (ICU) (56.5%). Antimicrobials were most frequently prescribed for treatment of an infection (68.4%): community-acquired infection (47.6%), hospital-acquired infection (19.1%) and infection acquired in a long-term care facility (1.8%). Surgical prophylaxis was the indication for 16.3% of the prescriptions and was prolonged for more than one day in 59.2% of cases.

Out of a total of 222 different antimicrobials reported at the fifth ATC level, 21 (9.5%) accounted for 75% of the total antimicrobial use in European hospitals. The most frequently prescribed antibiotic, amoxicillin with enzyme inhibitor (J01CR02), represented 11.0% of all antimicrobial agents and was used in 79.2% of hospitals. The median number of different antimicrobials (ATC fifth level) reported, per hospital, was 20 (IQR 12–29).

Reported prevalence of HAIs and antimicrobial use depended on the sensitivity of reporting HAIs, as shown by validation studies performed during the national PPS in four countries and by a pilot PPS validation study in 2011. The four national validation surveys found that the HAI prevalence was underreported with an average sensitivity of 71.9% and an average specificity of 99.4%, with lower sensitivity in low-prevalence countries and a high sensitivity in one high prevalence country. These validation results suggest that the overall weighted HAI prevalence of 5.7% is likely to be a slight underestimate. They also emphasised the need for validation surveys in all countries during future PPSs. Validity of the other epidemiological data (e.g. types of HAI, microbiological data, risk factors, etc) and of the prevalence of antimicrobial use was good. The average sensitivity for the prevalence of antimicrobial use was 95.0% and the specificity 99.4%.

The data collected during this first EU-wide PPS had many limitations, several of which may be improved in future surveys by enhanced training of hospital staff in HAI case definitions and PPS methodology, performing validation studies during future PPSs, increasing the number of participating hospitals in countries with low representativeness, adapting the protocol where needed and, in the longer term, reinforcing efforts to improve the capacity for first-line diagnostic testing of infectious diseases and the quality of medical records in European hospitals.

Through the ECDC PPS, a major step has been made in improving skills in surveillance of HAIs and antimicrobial use and raising awareness among healthcare workers across Europe. Nevertheless, considerable training to harmonise the interpretation of case definitions as well as additional validation efforts and an enhanced diagnostic capacity in EU/EEA Member States are still needed before true comparisons, including risk adjustments, of prevalence figures of HAIs between countries can be made. Direct comparisons of prevalence percentages between countries were not an objective of the ECDC PPS and should not be made without taking case mix, confidence intervals and data validity into account.

In order to maximise the prevention of HAIs and antimicrobial resistance in European healthcare institutions, the continued implementation of the Council Recommendation (2009/C 151/01) on Patient Safety, including the Prevention and Control of Healthcare Associated Infections is crucial. Repeated prevalence surveys will continue to support this council recommendation, and measure the effect of the implementation of the specific recommendations from this one.

Specific recommendations from the findings of the ECDC PPS include continued support for laboratory capacity to improve diagnostic testing of HAIs, improvement of HAI surveillance systems by integrating regular validation studies, the promotion of ECDC surgical site and ICU incidence surveillance methodologies, implementation of standardised surveillance for consumption of alcohol hand rub and *C. difficile* infections and development of guidance for the prevention and control of HAIs with carbapenem-resistant gram-negative bacteria.

In addition, the ECDC PPS identified several areas for targeted improvement of antimicrobial use in several European countries including: reducing the use of broad-spectrum antimicrobials, adherence to single dose surgical prophylaxis, reducing medical prophylaxis use, targeting a change from parenteral to oral administration of antibiotics and improving the documentation of the reason for antimicrobial prescribing in the patient's records.

Summary of results

Introduction

When the coordination of the EU-funded network IPSE (Improving Patient Safety in Europe) and the surveillance component HELICS (Hospitals in Europe Link for Infection Control through Surveillance) for healthcare-associated infections (HAIs) were transferred to ECDC in July 2008 to form the new HAI surveillance network HAI-Net, the plan to perform an EU-wide PPS of HAIs was adopted by ECDC, based on the recommendations of the external evaluation of the IPSE network and on the conclusions of an expert group meeting organised in January 2009.

In 2011–2012, 29 EU/EEA Member States and Croatia participated in the first EU-wide, ECDC-coordinated point prevalence survey (PPS) of HAIs and antimicrobial use in acute care hospitals.

All countries used the same standardised protocol developed during a two year collaborative effort involving more than 100 experts from EU/EEA Member States, EU enlargement countries and different international organisations [1]. An estimated 2800 healthcare workers from 1200 hospitals across Europe were trained by national PPS coordinating staff to implement the standardised PPS methodology. The objectives of the ECDC PPS of HAIs and antimicrobial use in acute care hospitals were:

- to estimate the total burden (prevalence) of HAIs and antimicrobial use in acute care hospitals in the EU;
- to describe HAIs (sites, microorganisms including markers of antimicrobial resistance) and antimicrobials prescribed (compounds, indications):
  - by type of patients, specialties or healthcare facilities; and
  - by EU country, adjusted or stratified;
- to disseminate results to policy makers and practitioners at local, regional, national and EU levels in order to:
  - raise awareness;
  - train and reinforce surveillance structures and skills;
  - identify common EU problems and set up priorities accordingly; and
  - evaluate the effect of strategies and to inform future local/regional/national policies (repeated PPS);
- to provide a standardised tool for hospitals to identify targets for quality improvement.

Characteristics of hospitals and patients

Data from a total of 273 753 patients in 1149 hospitals were submitted to ECDC. Of these, 231 459 patients from 947 hospitals were included in the final European sample for analysis. Surveys in the four administrations of the United Kingdom (England, Northern Ireland, Scotland, Wales) were organised independently and submitted separately. Therefore data from 33 different data sources (countries or administrations) were included, and the term 'country' is used for all data sources for simplicity.

Representativeness of the PPS data by country was evaluated based on compliance with the recommended sampling methodology of hospitals and sample size. Representativeness was optimal or good in 25 (76%) countries and poor or very poor in 8 (24%) countries. Countries (and number of hospitals) with optimal representativeness were Bulgaria (n=42), Cyprus (n=8), Germany (n=46), Finland (n=59), France (n=54), Hungary (n=29), Ireland (n=50), Italy (n=49), Latvia (n=15), Luxembourg (n=9), Malta (n=3), Portugal (n=57), Slovakia (n=40), Slovenia (n=21), UK-England (n=51), UK-Northern Ireland (n=16), UK-Scotland (n=52); good representativeness was obtained in Belgium (n=52), Greece (n=37), Iceland (n=2), Lithuania (n=44), the Netherlands (n=33), Poland (n=35), Spain (n=59), UK-Wales (n=22); representativeness was poor in Austria (n=9), Czech Republic (n=14), Estonia (n=4), Croatia (n=11), Norway (n=7), Romania (n=10) and very poor in Denmark (n=3) and Sweden (n=4).

Data from a single ward were collected on a single day. The total time frame for data collection for all wards of a single hospital was 12 days on average (median nine days). Of all hospitals included, 28.4% of the total were primary hospitals, 31.8% were secondary hospitals, 21.5% were tertiary hospitals and 11.9% were specialised hospitals.

Alcohol hand rub consumption data were provided by 820 hospitals from 31 countries. The median hand rub consumption was 18.7 litres per 1000 patient-days and was significantly lower in primary hospitals than in tertiary hospitals ($p<0.001$).

The number of single rooms was provided by 928 hospitals from all 33 countries. The median percentage of single-room beds (as a percentage of the total number of beds) was 9.9% (25th percentile 3.9%, 75th percentile 23.5%). The median percentage of single-room beds was less than 5% in Bulgaria, Greece, Hungary, Poland, Portugal, Romania, Slovakia and Slovenia, but more than 50% in France.

The number of infection prevention and control nurses (IPCN) fulltime equivalents (FTE) was available for 866 hospitals from 32 countries. Of those, 118 (13.6%) hospitals from 12 countries reported to have no IPCN, varying from less than 20% of hospitals in Germany, Greece, Hungary and Slovenia to 89.7% of hospitals in Slovakia. The median number of IPCN FTE per 250 beds was 1.00 (interquartile range 0.54–1.66) and ranged from zero in Latvia, Lithuania, Romania and Slovakia to 2.14 FTE per 250 beds in UK-Scotland.

The median age of the patients surveyed was 64 years. This varied according to country from 52 years in Latvia to 71 years in UK-Wales. Overall, 11.2% surveyed were under 18 years old, 39.9% were aged between 18 and 64 years and 48.9% were 65 years or older (38.1% 65–84 years old and 10.8% were 85 years old or over).

The average sex ratio male to female (M:F) was 0.89:1 with the highest proportion of female patients in Hungary and UK-Scotland and the highest proportion of male patients in Greece and Spain.

Twenty-seven percent of the patients had undergone surgery since their admission to the hospital (lowest in UK-Northern Ireland and highest in the Netherlands).

Overall, 5.2% of patients surveyed were classified as having diagnoses that were rapidly fatal (within one year), 16.1% as ultimately fatal and 66.3% as non-fatal diagnoses. The percentage of patients with an expected rapidly fatal outcome varied from 0.7% in Latvia to 9.3% in France. Twelve percent of patients were not classified into a category and this varied between 99.7% (Norway) and 0.5% (Slovenia and Spain).

A peripheral vascular catheter was present in 46.7% of patients, varying between 30.6% in France and 70.6% in Greece. Urinary catheters were present in 17.2% of patients varying between 6.4% in Lithuania and 30.7% in Greece. Central vascular catheters were present in 7.5% of patients, varying from 3.0% in Bulgaria to 13.6% in Belgium. Only 2.3% of patients were intubated at the time of the survey and this varied from 0.5% in Sweden and 1.3% in France and Latvia to 4.0% in Portugal and 4.5% in Greece.

Healthcare-associated infections

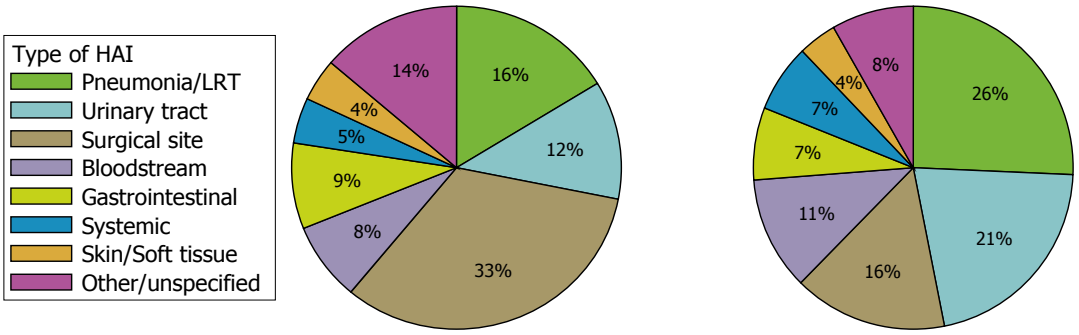
The prevalence of patients with at least one HAI in acute care hospitals in the European PPS sample was 6.0% (country range 2.3%–10.8%). When extrapolated to the average daily number of occupied beds per country obtained by national questionnaire, the HAI prevalence was estimated at 5.7% (95% confidence interval 4.5–7.4%). The number of patients with an HAI on any given day in European acute care hospitals was estimated at 81 089 (95%CI 64 624–105 895). The total annual number of patients with an HAI in European acute care hospitals in 2011–2012 was estimated at 3.2 million, with a confidence interval ranging from 1.9 million to 5.2 million patients.

The prevalence of HAIs varied according to the hospital type and varied considerably within each hospital type. Primary hospitals recorded the lowest HAI prevalence of 4.8% (median HAI prevalence 3.9%, IQR 1.9–6.1%), in secondary hospitals HAI prevalence was 5.0% (median HAI prevalence 4.5% IQR 2.7–6.8%), in tertiary hospitals 7.2% (median HAI prevalence 6.9%, IQR 4.0–9.7%) and in specialised hospitals 6.0% (median HAI prevalence 4.0%, IQR 1.6–6.7%).

Of a total of 15 000 reported HAIs, the most frequently reported HAI types were respiratory tract infections (pneumonia 19.4% and lower respiratory tract 4.1%), surgical site infections (19.6%), urinary tract infections (19.0%), bloodstream infections (10.7%) and gastro-intestinal infections (7.7%), with *Clostridium difficile* infections representing 48% of the latter and 3.6% of all HAIs. Twenty-three percent of HAIs (n=3503) were present on admission. Of those, 54.7% were associated with a previous stay in the same hospital, 31.1% with a previous stay in another hospital and for 14.2% the origin was other or unknown. One third of HAIs at admission were surgical site infections (Figure 1).

A total of 11 322 HAIs (75.5%) started during the current hospital stay, 97.0% of which were attributed to the current hospital stay. For 175 HAIs (1.2%) the presence on admission was unknown. Of those, 97 (55.4%) were attributed to the same hospital, 36 (20.6%) to another acute care hospital and for 42 (24.0%) the origin was unknown. The 11 322 HAIs that started during the current hospital stay occurred in 10 341 patients, yielding an overall prevalence of 4.5%. The median duration of hospital stay until onset of the HAI was 12 days (mean 21.8 days). In patient-based data, the median length of stay of patients with an HAI was 11 days until onset of infection and 16 days until the time of the survey. The median length of stay until survey date in patients without an HAI was five days.

Figure 1. Distribution of HAI types by presence of HAI on admission, HAI present on admission (left) HAI onset during hospitalisation (right)



LRT: Lower respiratory tract

HAI prevalence was highest among patients admitted to ICU, where 19.5% patients had at least one HAI compared with 5.2% on average for all other specialties combined. The most common HAI types in the ICU were respiratory infections and bloodstream infections. Urinary tract infections were the dominant HAI type in geriatrics, while surgical site infections were the most frequent infection type in surgery and obstetrics and gynaecology. Among paediatric patients, clinical sepsis constituted an important segment of HAIs.

The most frequently isolated microorganisms in HAIs were, in decreasing order, *Escherichia coli* (15.9%), *Staphylococcus aureus* (12.3%), *Enterococcus* spp. (9.6%), *Pseudomonas aeruginosa* (8.9%) *Klebsiella* spp. (8.7%), Coagulase-negative staphylococci (7.5%), *Candida* spp. (6.1%), *Clostridium difficile* (5.4%), *Enterobacter* spp. (4.2%), *Proteus* spp. (3.8%) and *Acinetobacter* spp. (3.6%). The predominant families of microorganisms were gram-positive cocci in surgical site infections and bloodstream infections, Enterobacteriaceae in urinary tract infections, non-fermenting gram-negative bacteria (especially *Pseudomonas aeruginosa* and *Acinetobacter baumannii*) in respiratory tract infections and anaerobes (especially *Clostridium difficile*) were the most frequently reported family in gastro-intestinal tract infections.

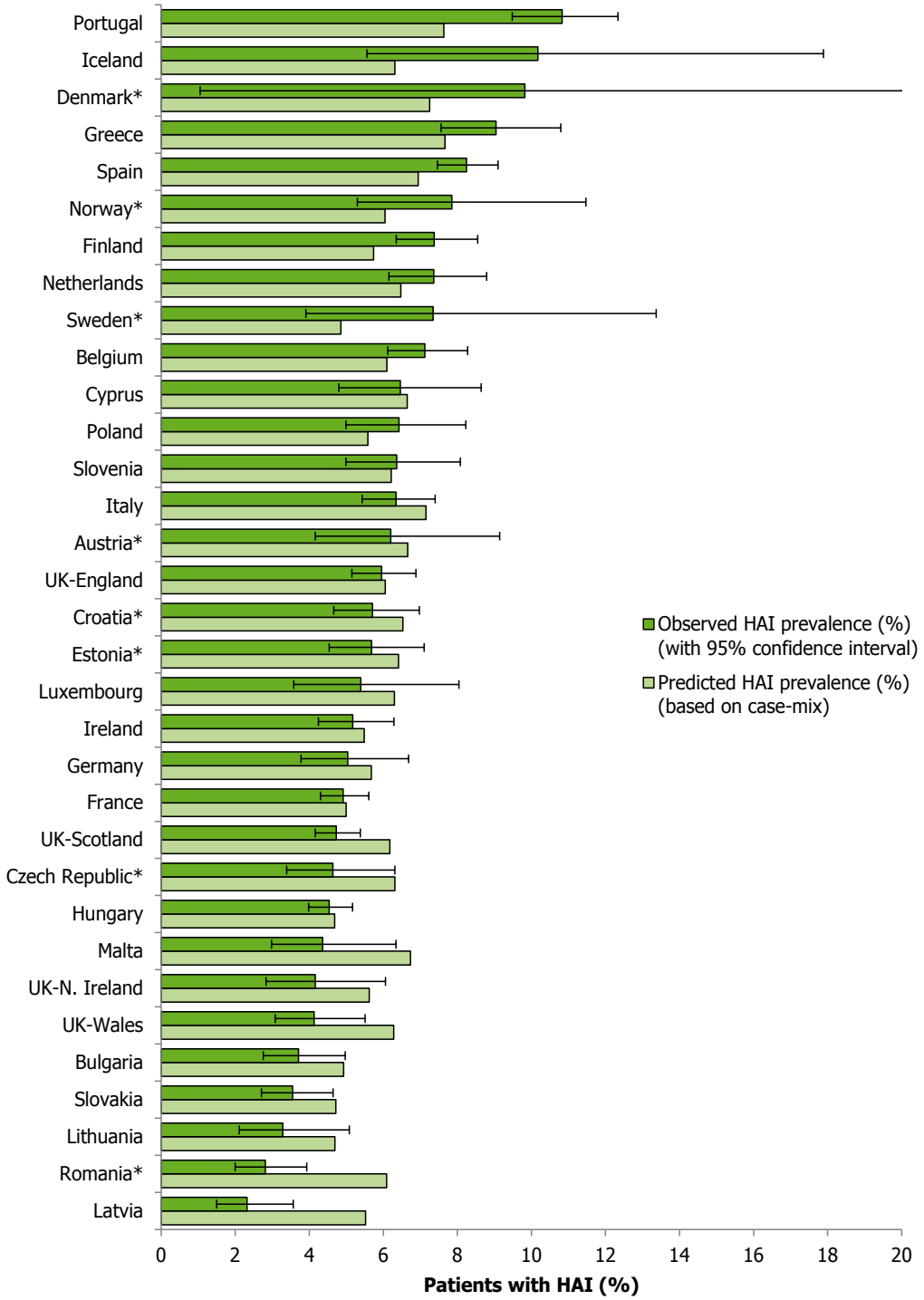
Selected antimicrobial susceptibility testing (AST) data were available on the day of the survey for 85.0% of microorganisms reported in HAIs. Meticillin resistance was reported in 41.2% of *S. aureus* isolates with known AST results. Vancomycin resistance was reported in 10.2% of isolated enterococci. Third-generation cephalosporin resistance was reported in 33.4% of all Enterobacteriaceae and was highest in *K. pneumoniae*. Carbapenem resistance was reported in 7.6% of all included Enterobacteriaceae, also highest in *K. pneumoniae,* and in 31.8% of *P. aeruginosa* isolates and 81.2% of *A. baumannii* isolates.

The HAI prevalence (percentage of patients with at least one HAI) by country ranged from 2.3% in Latvia (95% confidence interval 1.3–3.9%) to 10.8% (9.5–12.4%) in Portugal. HAI prevalence was associated with the type of hospitals and the severity of the patient case mix (age, co-morbidities, invasive devices, specialties, length of stay), but the risk factors measured in the PPS only explained 37% of the variation of the HAI prevalence between countries.

The majority of the countries (26 out of 33) reported the same three types of HAI as their most common: pneumonia and lower respiratory tract infection, surgical site infection and urinary tract infection (Annex 2). These three HAI types accounted for more than half of the HAIs in all countries, except Sweden (48%) and for more than 70% of HAIs in Lithuania and Iceland.

The percentage of pneumonia and lower respiratory infections varied between 12.0% in Sweden and 36.3% in Lithuania. Pneumonia were microbiologically confirmed (PN1, 2 or 3) in 18.2% of pneumonia, ranging from 1.4% in Slovenia to 55.4% in Croatia. Urinary tract infections varied between 10.1% in Cyprus and 30.7% in France and were microbiologically confirmed (UTI-A) in 65.8% of cases, from 37.5% in Cyprus to 94.1% in France. Surgical site infections varied between 8.8% in Luxembourg and 29.0% in Spain. Superficial surgical site infections made up 30.7% of all surgical site infections, from 12.2% in Estonia to 66.7% in Iceland. Bloodstream infections were highest in Greece at 18.9% and Cyprus at 19.0% and lowest in Iceland at 2.0% and were secondary to another infection in 28.8% of cases, ranging from 0% in Iceland, Latvia and Romania to 40% or more in Belgium, Denmark, Estonia, Germany, Luxembourg, Malta, the Netherlands, Norway, Slovenia and Sweden. No gastro-intestinal infections were detected in Iceland whereas 17.9% of all HAIs in Hungary were gastro-intestinal. Skin and soft tissue infections were a small category of HAIs in this survey with 4.1% overall, varying from none in Sweden to 6.1% in Greece.

Figure 2. Observed HAI prevalence with 95% confidence intervals and predicted HAI prevalence based on case mix and hospital characteristics, by country, ECDC PPS 2011–2012

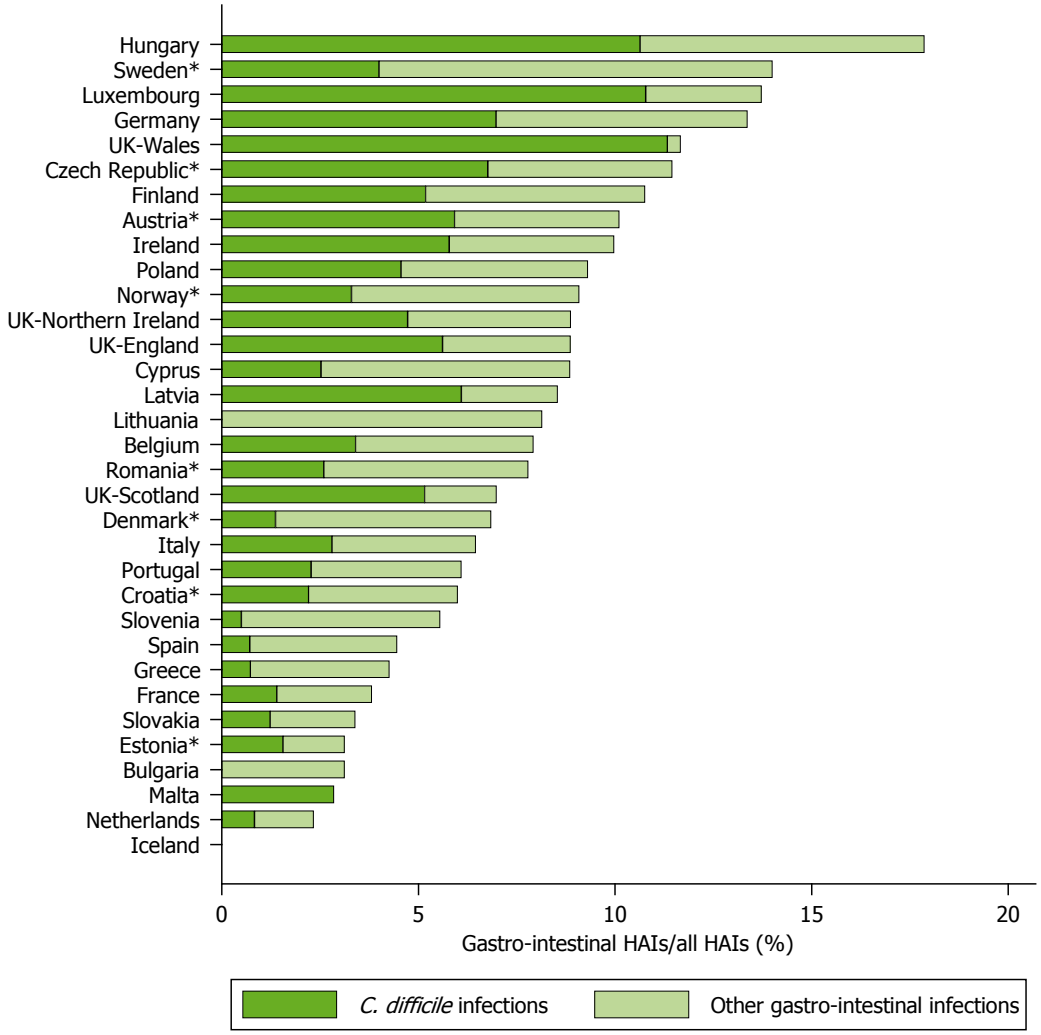


**Country representativeness of the PPS data was optimal or good in 25 (76%) countries, and poor or very poor in 8 (24%) countries. Countries (number of participating hospitals) with poor representativeness were: Austria (n=9), Croatia (n=11), Czech Republic (n=14), Estonia (n=4), Norway (n=7), Romania (n=10) and countries with very poor representativeness were Denmark (n=3) and Sweden (n=4). Denmark: upper limit of 95% confidence interval not included, HAI prevalence=9.8% (95% CI 1.0–52.7).*

Certain diagnoses relied on laboratory tests more than others. The inter-country variation on epidemic clones, testing and laboratory methodologies may have influenced the prevalence of certain HAIs. For example the percentage of *C. difficile* infection varied from 0% in Bulgaria and Lithuania to more than 10% of all HAIs in Hungary and UK-Wales. In some countries with a relatively high proportion of healthcare-associated gastro-intestinal infections, no or very few cases of *C. difficile* infection were reported, which is more likely to be due to

lack of diagnostic testing than to absence of *C. difficile*, because even in endemic circumstances, it is expected to be responsible for a large proportion of healthcare-associated diarrhoea (Figure 3).

Figure 3. *Clostridium difficile* infections and other gastro-intestinal infections (excluding hepatitis) as a percentage of all HAIs, by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

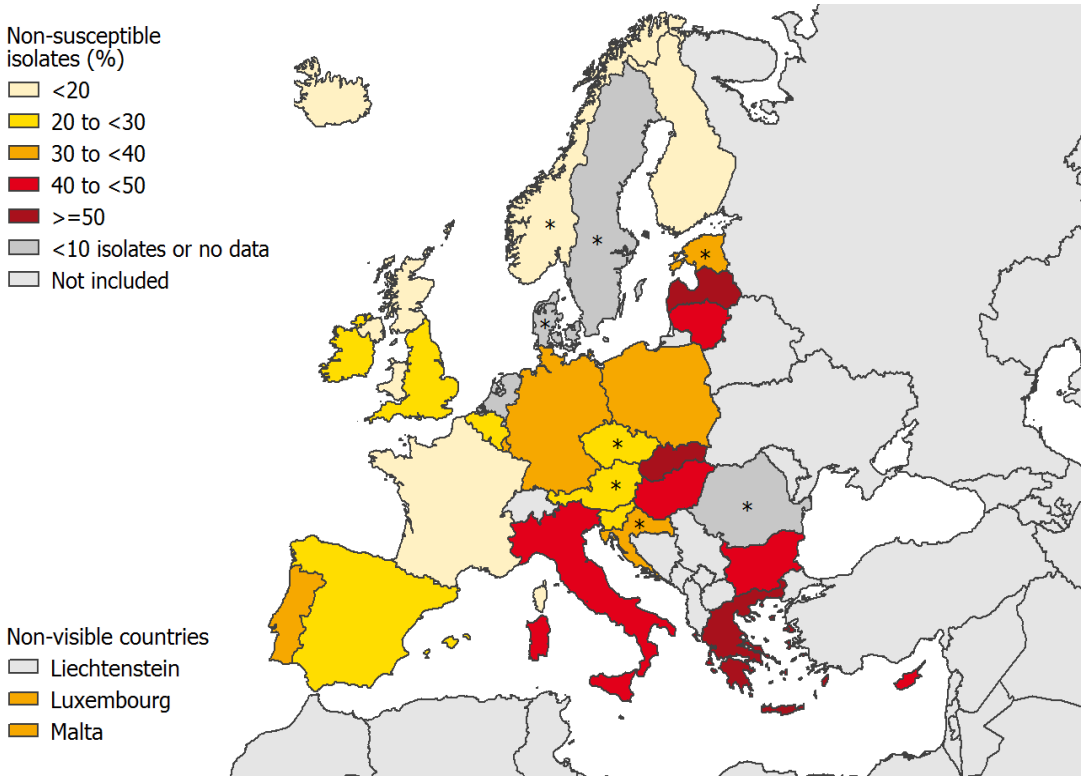
The most frequently reported microorganisms in HAIs were the most common in almost all countries with some rank differences. They represented from 73.2% of all microorganisms in Norway to 93.4% in Portugal and even 99.9% in Sweden. The highest percentage of *E. coli* was observed in France (26.6%) and the lowest in Cyprus (3.9%). *E. coli* was one of the three most common microorganisms in most of the countries, except in Cyprus, Denmark, Greece, Romania and UK-Northern Ireland. *S. aureus* was most common in Malta (26.5%) and least common in Greece (3.0%). The percentage of enterococci varied between 4.5% in the Czech Republic and Norway and more than 20% of all microorganisms in Denmark and Sweden. *P. aeruginosa* ranged from 0% in Iceland and Latvia to 16.8% in Greece. *Klebsiella* spp. (79.0% of which were *K. pneumoniae*) varied from less than 4% in Iceland, Sweden, UK-England, UK-Northern Ireland and UK-Wales to 17.6% in Greece. The highest percentages of *Candida* spp. were reported from Denmark (19.4%), Iceland (10.8%) and Sweden (10.3%). *Clostridium difficile* was the most common in Hungary (20.6%) and UK-Wales (18.9%). The percentage of *Enterobacter* spp. was 6% or more in Belgium, Estonia, the Netherlands, Poland and Slovenia. No *Acinetobacter* spp. were reported from nine countries, but in four countries (Latvia, Romania, Bulgaria and Greece), the percentage of these bacteria ranged from 10.6% to almost 17%. Other less common microorganisms, but important because of their epidemic potential or intrinsic resistance to antimicrobials were *Serratia* spp., *Stenotrophomonas maltophilia* and *Aspergillus* spp., that represented respectively 1.1%, 1.0% and 0.4% of all microorganisms.

The percentage of microorganisms with known antimicrobial susceptibility testing (AST) results varied between 47.4% in Sweden and 100% in Malta. In the Netherlands, the method for collecting AST data differed from the ECDC protocol since only data on non-susceptible isolates were collected.

Twenty-six countries reported at least 10 isolates of *S. aureus* with known susceptibility results for meticillin. Six countries reported less than 20% of meticillin-resistance in *S. aureus* (MRSA) isolates in HAIs. Norway and the Netherlands reported no MRSA isolates. In Cyprus, Italy, Portugal and Romania over 60% of *S. aureus* isolates in HAIs were MRSA.

Non-susceptibility to third-generation cephalosporins among Enterobacteriaceae isolates in HAIs was the lowest in Norway (7.7%, one of 13 isolates) and over 40% in eight of 29 countries that reported more than 10 isolates with known AST results (Figure 46). The highest percentage of non-susceptibility to third-generation cephalosporins was observed in Greece (63.9% of 183 isolates) and Latvia (71.4% of 14 isolates). Ten of 28 countries reported no Enterobacteriaceae isolate that was not susceptible to carbapenems. Three countries reported over 20% of Enterobacteriaceae isolates resistant to carbapenem with the highest level (39.9%) being reported from Greece.

Figure 4. Percentage of Enterobacteriaceae isolates from HAIs non-susceptible to third-generation cephalosporins, by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. Countries with <10 isolates with known antimicrobial susceptibility results not shown. The Netherlands: only non-susceptible isolates reported; for other isolates it is unknown whether the isolates were sensitive or whether the result was not available (24 out of 142 Enterobacteriaceae isolates were non-susceptible to third-generation cephalosporins).*

Antimicrobial use

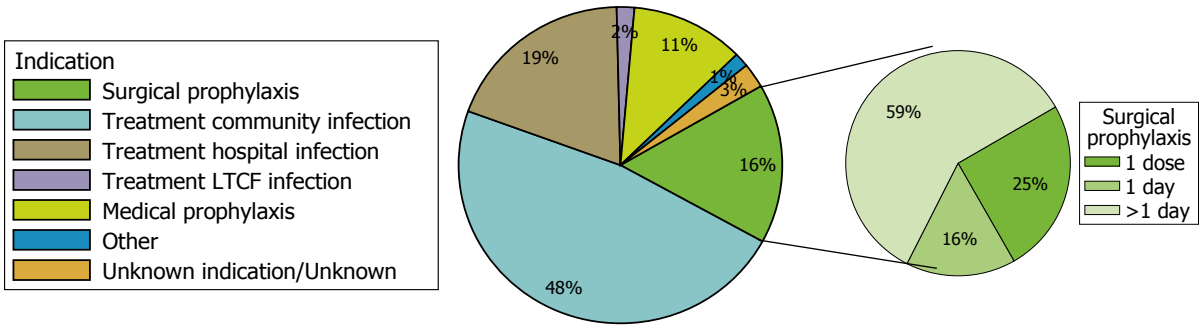
The prevalence of patients receiving at least one antimicrobial agent was 35.0% (country range 21.4%–54.7%). A total of 110 151 antimicrobial agents was reported in 80 951 patients or on average 1.36 antimicrobials per patient receiving antimicrobials: 70.9% of the patients received one antimicrobial, 23.4% received two and 5.7% received three or more antimicrobials. The prevalence of antimicrobial use was lowest in psychiatric patients (3.5%) and highest in ICU patients (56.5%).

Antimicrobials were administered parenterally in 70.6% of the cases and the reason for antimicrobial use was documented in the patient's medical records for 79.4%.

The overall prevalence of antimicrobial use extrapolated to the total number of occupied beds in Europe was 32.7% (29.4–36.2%) and 466 226 (419 284–515 690) patients were estimated to receive at least one antimicrobial on any given day in European acute care hospitals in 2011–2012.

Antimicrobials were most frequently prescribed for treatment of an infection (68.4%): a community-acquired infection (47.6%), a hospital-acquired infection (19.1%) or an infection acquired in a long-term care facility (1.8%). Surgical prophylaxis was the indication in 16.3% of prescriptions: 59.2% for more than one day, 15.8% for one day and only 25.0% for less than one day (Figure 55).

Figure 5. Indications for antimicrobial use in European acute care hospitals, ECDC PPS 2011–2012



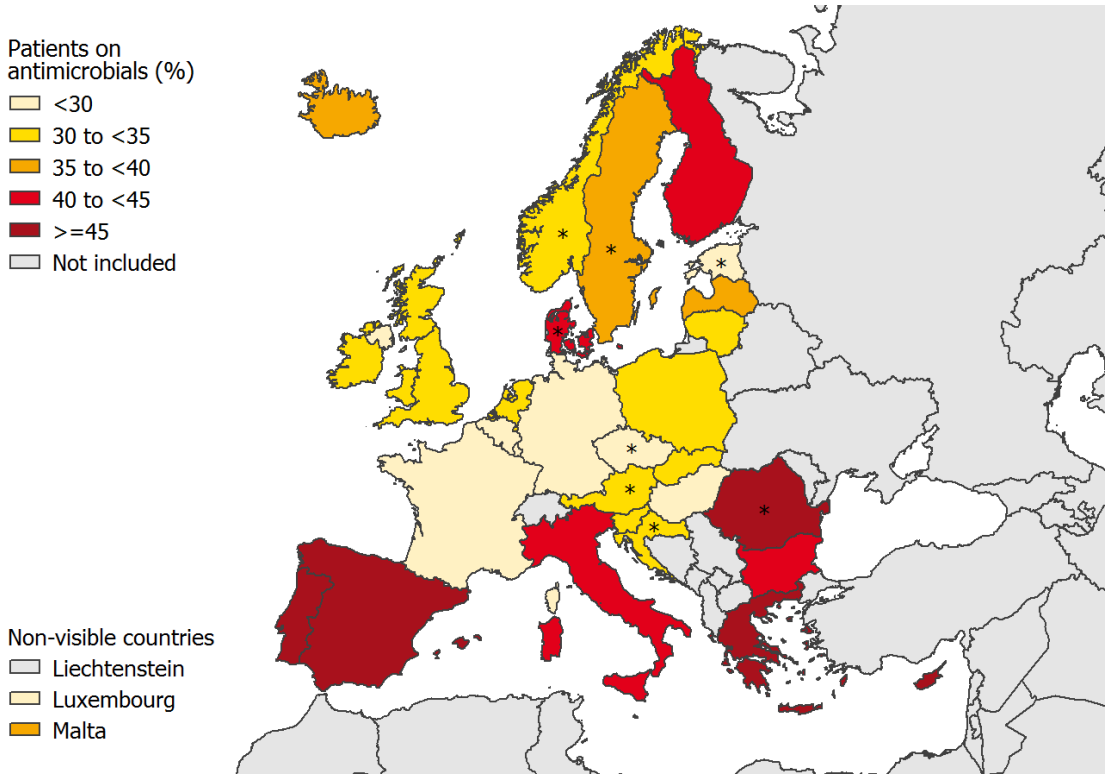
LTCF: long-term care facility

Antibacterials for systemic use (ATC group J01) accounted for 92.5% of all reported antimicrobials. Out of a total of 222 different antimicrobials reported at the fifth ATC level, 21 (9.5%) accounted for 75% of the total antimicrobial use in European hospitals. The most frequently prescribed antibiotic, amoxicillin with enzyme inhibitor (J01CR02), represented 11.0% of all antimicrobial agents and was used in 79.2% of hospitals. The median number of different antimicrobials (ATC fifth level) reported per hospital was 20 (IQR 12–29). Antimycotics for systemic use (ATC group J02) accounted for 3.3% overall.

The prevalence of antimicrobial use varied significantly by hospital type ($p<0.001$). Primary hospitals recorded the lowest prevalence of antimicrobial use at 31.7% (median 31.8%, IQR 25.0–41.7%), in secondary hospitals it was 35.8% (median 36.3% IQR 29.7–44.6%), in tertiary hospitals, 37.4% (median 38.4% IQR 30.7–46.6%) and in specialised hospitals it was similar to the prevalence in primary hospitals at 31.9%, but with a larger variation between hospitals (median 29.8%, IQR 16.9–43.1).

The prevalence of antimicrobial use in acute care hospitals ranged from 21.4% (95% CI 19.8–23.1%) in France to 54.7% (95% CI 51.7–57.7%) in Greece (Figure 6).

Figure 6. Prevalence of antimicrobial use (percentage of patients receiving antimicrobials) in acute care hospitals, ECDC PPS 2011–2012



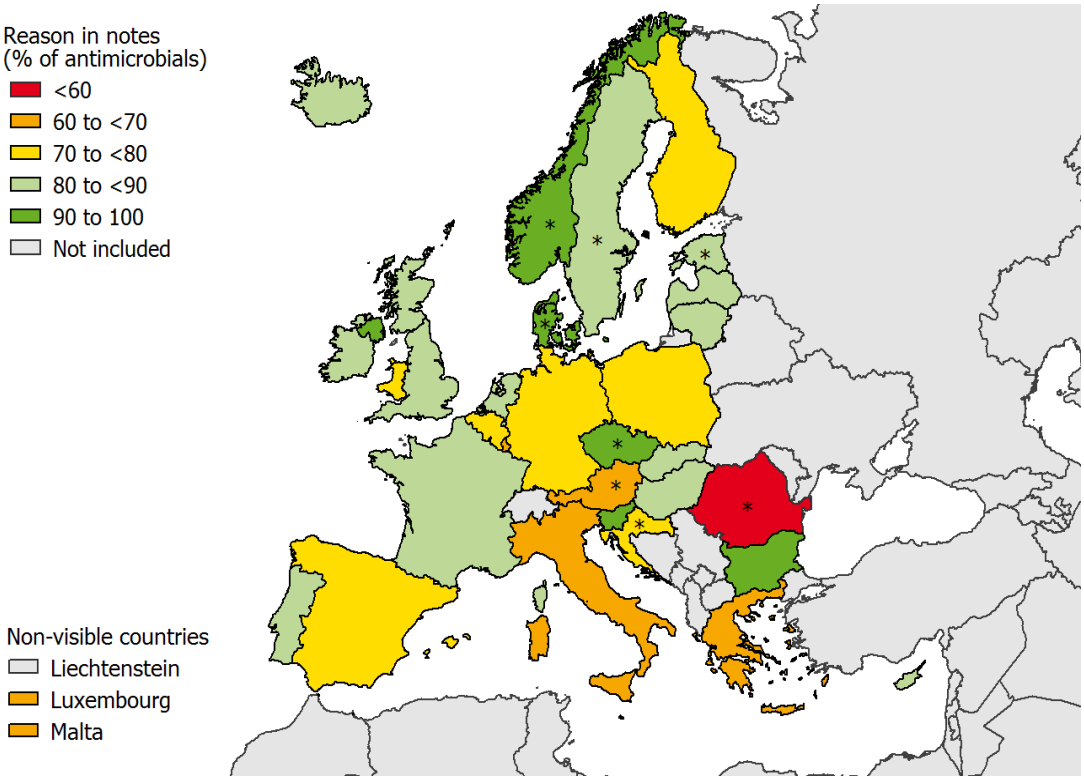
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Indications for antimicrobial use varied considerably by country. The percentage of antimicrobials prescribed for treatment of a community infection was lowest in Cyprus (24.6%) and highest in Latvia (68.4%). Treatment of a

hospital infection was closely correlated with the prevalence of HAIs as per case definition with a relative frequency varying from 7.4% of antimicrobials in Romania to 29.7% of antimicrobials in UK-Wales. The percentage of antimicrobials prescribed for treatment of a long-term-care-associated infection varied from 0% in Denmark, Estonia, Lithuania, Romania and UK-Wales to 5.0% in Cyprus, 5.2% in Germany and 6.9% in France. Surgical prophylaxis accounted for less than 10% of antimicrobials in UK-Wales (4.6%), UK-Northern Ireland (7.0%), Denmark (8.2%), UK-Scotland (9.0%) and France (9.1%) but for more than 30% of antimicrobials in Cyprus (33.1%) and Romania (42.0%). The percentage of surgical prophylaxis prescribed for more than one day was lowest in UK-Northern Ireland (10.7%) and highest in Romania (92.3%). Medical prophylaxis accounted for less than 5% of antimicrobials in Sweden (1.0%), Latvia (3.8%) and Estonia (4.4%), but for more than 20% in Cyprus (22.4%) and Italy (23.8%). Other indications for antimicrobial use were most frequent in Hungary (4.9% of all antimicrobials). The percentage of antimicrobials for which the indication was unknown varied between 0% in Cyprus and 13.7% in Luxembourg.

The reason for antimicrobial use was documented in the patient's medical records for 79.4% of prescriptions (country median 80.6%) and ranged from 49.5% in Romania to 98.0% in Bulgaria (Figure 7).

Figure 7. Percentage of antimicrobials for which the reason for use was documented in the patient's records, by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Discussion

The prevalence of patients with HAI extrapolated to the average daily number of occupied beds per country was estimated at 5.7% (95% CI 4.5–7.4%). The point estimate of 5.7% was slightly lower than the 7.1% found in the review of national point prevalence surveys in 2008 [2] and the prevalence of 7.1% found in the ECDC pilot PPS in 2010 [3], though the 95% confidence interval in 2011–2012 included the previous percentages.

Underascertainment of HAIs because of a lack of diagnostic testing was frequently mentioned as a problem, especially in low-resource countries. HAI prevalence also depended on the sensitivity of reporting HAIs, as shown by validation studies performed during the national PPS in four countries and by a pilot PPS validation study in 2011. The four national validation surveys found on average a sensitivity of 71.9% and a specificity of 99.4%, with lower sensitivity in low-prevalence countries and a high sensitivity in one high-prevalence country. These HAI validation results from a few countries suggest that the observed large differences between countries are smaller in reality and that the overall weighted HAI prevalence of 5.7% is likely to be a slight underestimate. They also emphasised the need for validation surveys in all countries for HAIs during future PPSs.

In the four countries that validated their PPS data, the sensitivity of the primary PPS data collectors for detecting and reporting a patient receiving antimicrobials was on average 95.0% and varied between 93.1% in Bulgaria and 96.8% in Spain. The specificity for detecting and reporting a patient receiving antimicrobials was high in all countries and 99.4% on average, lowest in Hungary (98.8%) and highest in Spain (100%).

The total annual number of patients with at least one HAI in acute care hospitals in the EU/EEA and Croatia was estimated at 3.2 million patients per year with a wide 95% confidence interval of 1.9 to 5.2 million patients per year. The point estimate of 3.2 million was lower than the 2008 estimate of 4.1 million patients/year with an HAI in Europe [2] even though the 2008 estimate was included in the 2011–2012 confidence interval. The main reason for this difference was the lower prevalence in 2011–2012 and the relatively even lower incidence estimate of 3.5% compared to 5.1% in 2008. The 2008 incidence estimate was based on a prevalence-to-incidence conversion using the same method (Rhame and Sudderth formula), but using length-of-stay parameters from literature rather than derived from the data. Because of this, the prevalence-to-incidence ratio was 1.39 in 2008 while it was 1.63 in 2011–2012. The third parameter that varied between the two estimates was the number of hospital discharges per year which was estimated to be 81 million for 27 EU Member States in 2008 (based on available Eurostat data), while in the ECDC PPS the estimated total was 90 million discharges for 29 EU/EEA Member States and Croatia based on the numbers reported by the national PPS coordinating centres. In addition, the estimates for 2011–2012 were first made for each country separately and summed up for Europe, while in 2008 only a total estimate was made. Not surprisingly, the additional number of countries and discharges in 2011–2012 compared with 2008 did not compensate for the lower HAI incidence estimate. Finally, the number of HAIs per patient with an HAI (1.1) was similar in 2011–2012 to the PPS review in 2008. The point estimate of the total number of HAIs per year was 3.5 million HAIs in 2011–2012 compared with 4.5 million HAIs per year in 2008.

The 95% confidence intervals of the country-specific burden estimates derived from the 2011–2012 data included previously published burden estimates in individual countries, obtained using similar or different methods: the previous point estimate of 125 000 patients per year with an HAI in Belgium fell within the 2011–2012 interval of 73 556–159 292 [4], the Finnish point estimate of 45 854 patients per year with an HAI [5] was included in the 2011–2012 interval of 27 354–51 461, the estimated range of 400 000 to 600 000 HAIs per year in Germany [6] fell within the ECDC PPS interval of 321 321–1 025 716 and the older point estimate by Plowman et al. of 320 994 patients per year with an HAI for UK-England [7] was considerably higher than the ECDC PPS point estimate of 243 746 patients, but also fell within the confidence interval.

The most common infection types in the ECDC PPS sample were pneumonia (19.4%, together with lower respiratory tract infections accounting for 23.5% of HAIs), surgical site infections (19.6%), urinary tract infections (19.0%), and bloodstream infections (10.7%). In the 2008 PPS review, urinary tract infections were the most frequent HAI type, accounting for 27% of infections, followed by pneumonia and lower respiratory tract infections (24%), surgical site infections (17%) and bloodstream infections (10.5%). The lower relative frequency of urinary tract infections in the ECDC PPS was probably explained to some extent by the fact that asymptomatic urinary tract infections were excluded from the ECDC PPS while they were included in many of the national surveys in the 2008 PPS review, representing on average 20.0% of urinary tract infections in the 2008 review of studies that specified the proportion of asymptomatic infections. In the ECDC 2011–2012 PPS, urinary tract infections were also more frequent in Germany and France, resulting in a higher relative frequency on any given day of 22.2% of urinary tract infections after extrapolation to the total number of occupied beds, while the relative frequency of respiratory tract infections decreased to 22.5%. When converting site-specific prevalence to incidence rates per year, the relative frequency of HAI types with a shorter length of stay from date of onset until PPS date logically increased, resulting in urinary tract infections being the most frequent HAI type (25.2%), while the relative frequency of HAI types with a longer length of stay, such as bloodstream infections, decreased. The ECDC PPS confidence interval of the estimated total number of healthcare-associated bloodstream infections per year included a recent estimate of 242 692 – 414 477 bloodstream infections per year for Europe based on national estimates [8].

The percentage of HAIs with microbiological results (54.1%) was lower than the results of the 2008 PPS review (61.7%). In the ECDC PPS, PPS surveyors were not supposed to revisit files of patients with an HAI after the PPS day to collect microbiological data, while in some of the national protocols included in the review, microbiological data were added when they became available after the PPS day (e.g. in France). Another reason for the overall lower percentage in the ECDC PPS, was that the Netherlands did not report any microbiological data for HAIs on admission due to a methodological discrepancy in their protocol. For these two reasons, the percentage in the ECDC PPS is likely to be an underestimate of the true percentage of HAIs that are microbiologically documented.

The four microorganisms most frequently isolated from HAIs in the ECDC PPS – *E. coli* (15.9% of microorganisms), *S. aureus* (12.3%), *Enterococcus* spp. (9.6%) and *P. aeruginosa* (8.9%) – were the same as in the 2008 PPS review. *Klebsiella* spp. (8.7%) and *C. difficile* (5.4%) were, however, more common in 2011–2012 than in the 2008 review (based on studies carried out during the previous 10-year period). This observation was consistent with the recent epidemics of extended spectrum beta-lactamase- and carbapenemase-producing *K. pneumoniae* [9] and of new virulent PCR ribotypes of *C. difficile* [10,11]. The distribution of the relative frequency of *Klebsiella spp.* by country was largely determined by the proportion of *K. pneumoniae*. *Clostridium difficile*, which in the 2008 PPS review made up less than 2% of all microorganisms in HAIs in national PPSs performed

before the start of the epidemic of PCR ribotype 027, accounted for more than 4% of all microorganisms in 17 countries in 2011–2012 (up to 20.6% in Hungary), indicating an increased incidence of *C. difficile* infections in more than half of the countries. In addition, infections with *C. difficile* are most likely underdiagnosed in several countries, as shown by the variability of the percentage of healthcare-associated gastro-intestinal infections that were confirmed as cases of *C. difficile* infection and by the absence of a correlation between the oral treatment of *C. difficile* infection and the prevalence of the infection in some countries (e.g. Lithuania).

Antimicrobial resistance data in microorganisms isolated from HAIs were only collected for selected bug–drug combinations. Because of the cross-sectional (single day) study design, the numbers of microorganisms for which antimicrobial susceptibility data were known by country was relatively small, and results should therefore be interpreted with caution. Nevertheless, the countries reporting the highest and the lowest resistance percentages roughly corresponded to the ECDC PPS and the European Antimicrobial Resistance Surveillance Network (EARS-Net) findings. All resistance markers by country were significantly correlated at the $p<0.05$ level between the two databases. The rank order was most similar for MRSA and third-generation cephalosporin resistance in *K. pneumoniae* ($p<0.001$), and less for carbapenem resistance in *P. aeruginosa* ($p=0.04$). Despite the good correlations, resistance percentages by country reported from the ECDC PPS were with very few exceptions higher than corresponding figures reported by EARS-Net. The difference was the largest for vancomycin-resistant Enterococci and third-generation cephalosporin and carbapenem resistance in *E. coli*, and least for MRSA, third-generation cephalosporin resistance in *K. pneumoniae* and carbapenem resistance in *P. aeruginosa*. EARS-Net includes both community- and healthcare-associated infections, and these differences might be a reflection of a larger proportion of community-acquired vancomycin-resistant enteroccoci and *E. coli* infections compared with MRSA, *K. pneumoniae* and *P. aeruginosa*. In addition, EARS-net only includes invasive isolates which might further explain differences in resistance percentages compared with the ECDC PPS.

The ECDC PPS also provided, for the first time, data on infection control structure and process indicators at the hospital level in all EU/EEA Member States: alcohol-based hand rub consumption as a proxy indicator of hand hygiene, the percentage of single-room beds as a proxy indicator of isolation capacity of patients carrying microorganisms requiring enhanced infection prevention and control measures, and full-time equivalents of specialised infection prevention and control staff. However, these need to be interpreted with caution because they may, in some cases, not necessarily reflect what they are supposed to measure. The way the number of litres of alcohol hand rub is collected varies between hospitals and countries and may be based on volumes dispensed by the hospital pharmacy or volumes purchased (or otherwise obtained) in the given year, but not necessarily dispensed or used by the healthcare workers in the same year. In addition, the indicator does not take into account the consumption of other hand hygiene agents (e.g. medicated liquid soap), the wastage of hand rub (e.g. replacement of hand rub dispensers before they are empty), hand rub usage for other purposes than hand hygiene and does not distinguish between usage by visitors, patients and healthcare workers. Finally, alcohol hand rub consumption measured at one point in time should be interpreted with caution, especially in relation to other indicators (e.g. percentage antimicrobial resistance) measured at the same time, because the observed level of use could equally precede or be the consequence of the other indicator ('chicken or egg' problem). For example, the high alcohol hand rub consumption in Greek hospitals may be the reflection of increased efforts to control antimicrobial resistance (unless it is explained by one of the factors listed above). In Scandinavian countries, however, it would seem plausible that the high use of alcohol hand rub may have contributed to the low levels of observed antimicrobial resistance (in the PPS and in surveillance systems for antimicrobial resistance such as EARS-Net). In addition, one FTE of specialised infection control staff does not necessarily mean that 100% of that person's time is used for infection control/hospital hygiene-related tasks, nor does it reflect the quality of the specialised training that this person had prior to taking up his/her function as an infection control nurse or doctor in the hospital.

For all results presented in this report, one has to keep in mind that the PPS sample was not representative for eight (24%) countries. Results for these countries, especially in Denmark and Sweden, could be heavily biased as a result of the very low number of participating hospitals and low sample size. Low sample size also results in large confidence intervals and in a lack of sufficient numbers to calculate certain indicators, e.g. the antimicrobial resistance markers, for which, as with EARS-Net, a minimum of 10 isolates with known antimicrobial susceptibility results was required. Also in some countries with a sufficiently large sample size, the representativeness was less than optimal because hospitals participated on a voluntary basis rather than based on a systematic sampling process as recommended in the protocol (or, alternatively, on a nearly exhaustive sample). However, when the number of participating hospitals is sufficiently large, even voluntary participation often tends to result in fairly representative samples, as shown in many national HAI surveillance systems. In addition, risk adjustment allowed adjusting for differences in case mix, also for those resulting from less representative samples. Finally, the average length of stay and size of the hospitals in the ECDC PPS were very similar to the overall national averages in most countries, which also supported good overall representativeness of the data.

The indicator which by far is the most difficult to interpret is the main result of the ECDC PPS: the prevalence of HAIs. Validation studies carried out in four countries during the national PPS showed that the sensitivity of the national PPS teams tended to be rather low (72% on average), resulting in underestimation of the true HAI

prevalence, in particular in countries with lower national HAI prevalence and/or for which the observed HAI prevalence was lower than predicted based on the case mix. In Spain, where the HAI prevalence was higher than that predicted, the sensitivity was high and the number of false-positive HAIs was larger. The number of countries that performed validation was, however, too small to give an overall estimate of the sensitivity and specificity of the HAI prevalence in the ECDC PPS. More (10) countries participated in the pilot PPS validation study in November 2011 (with two hospitals per country), prior to the 'full' validation of national PPSs in 2012. The overall sensitivity in that study was higher (83%), however the conditions of the pilot validation study were very different and may not apply to the 'real life' ECDC PPS.

Low sensitivity (false negatives, or underreporting) of HAI is a frequently encountered problem in national HAI surveillance systems. Low specificity (false positives, or overreporting) is usually less of a problem, and was also less of an issue for the ECDC PPS validation studies. Lack of diagnostic testing was frequently mentioned as a problem during the PPS and supporting diagnostic capacity in Europe continues to be a priority. The ECDC PPS did unfortunately not collect (a) proxy indicator(s) of the frequency of diagnostic testing, such as the denominator for blood cultures taken or stool samples processed for *C. difficile* that would have enabled a better interpretation of the HAI prevalence results.

While differences in data validity (sensitivity and specificity) and case ascertainment most likely had a major impact on the prevalence of patients with HAIs per country, the European average prevalence is likely to be more valid because it is based on a mixture of countries and hospitals with varying sensitivity and specificity, underreporting but also overreporting. In addition, the validity of the other HAI data (e.g. isolated microorganisms, types of HAIs, antimicrobial resistance markers, origin of HAIs) is also less affected (as supported by the results of the validation surveys), therefore indicators such as relative frequencies and percentage resistance are more valid even though they are based on smaller numbers (large confidence intervals) and the frequency of some infection types or microorganisms may be influenced by a specific lack of diagnostic testing or case ascertainment.

Data validity was less of a problem for the prevalence of antimicrobial use because sensitivity and specificity of the prevalence of patients with antimicrobial use were high in the four national PPS validation surveys and in the pilot PPS validation study. However, the ECDC PPS results showed that the indication for antimicrobial use, in particular the intention to treat a hospital-acquired infection, was strongly correlated with HAI prevalence. Therefore, the prevalence and relative frequency of this indication is subject to the same validity issues as for the prevalence of HAIs.

Recommendations

At least 20% of HAIs, are estimated to be preventable by sustained and multifaceted infection prevention and control programmes, including surveillance of HAIs [12]. The proportion preventable by employing current evidence-based strategies is highest for device-associated infections and surgical site infections [13].

In order to maximise the prevention of HAIs and antimicrobial resistance in European healthcare institutions, the continued implementation of the Council Recommendation (2009/C 151/01) on Patient Safety, including the Prevention and Control of Healthcare Associated Infections [14] is crucial. The main components of the Council Recommendation with regard to HAI prevention and control are reiterated below, together with the specific action points that were identified in the first implementation report of the Council Recommendation [15].

- Have infection prevention and control programmes in place at national and hospital level, including recommendations on organisational and structural arrangements, diagnostic and therapeutic procedures (for example antimicrobial stewardship), resource requirements, surveillance objectives, training and information to patients.
- Continue the development of guidance on the prevention and control of HAIs and antimicrobial resistance at EU level and have guidelines available at national and hospital level.
- Improve surveillance by:
  - repeating national point prevalence surveys of HAIs as a means to monitor the burden of HAIs in all types of healthcare institutions, to identify priorities and targets for intervention, to evaluate the impact of interventions and to raise awareness,
  - ensuring that surveillance of targeted infection types is in place, e.g. surveillance of HAIs in ICUs and surveillance of surgical site infections,
  - implementing surveillance systems for the timely detection and reporting of alert healthcare-associated organisms and strengthening the ability to respond to the spread (including across borders) of such organisms and prevent their introduction into healthcare settings,
  - developing an evaluation system with a set of indicators in Member States to assess the implementation of the strategy/action plan and its success in improving the prevention and control of HAIs.
- Enhance infection prevention and control staffing and training by:
  - ensuring adequate numbers of specialised infection control staff with time set aside for this task in hospitals and other healthcare institutions,

  - improving the training of specialised infection control staff and better aligning qualifications between Member States.
- Improve the information for patients and strengthen their involvement in the compliance with infection prevention and control measures.
- Develop research at EU level in the area of the prevention and control of HAIs, including studies on cost-effectiveness of prevention and control measures.

Regarding recommendations for the improvement of antimicrobial prescribing in hospitals, it is important to bear in mind the principles of the Council Recommendation of 15 November 2001 on the prudent use of antimicrobial agents in human medicine (2002/77/EC) [16].

Based on ECDC PPS results, additional or specific recommendations can be proposed in the area of prevention and control of HAIs, antimicrobial resistance and antimicrobial use in acute care hospitals. These suggestions include the following.

- Continued support for increased diagnostic testing capacity for HAIs in EU/EEA Member States.
- Implement EU-standardised surveillance of alcohol hand rub consumption, complemented if possible by hand hygiene compliance monitoring.
- Implement standardised surveillance of *C. difficile* infections at local, national and EU level.
- Develop guidance for the prevention and control of HAIs with carbapenem-resistant gram-negative bacteria.
- Enhance EU surveillance of HAIs with carbapenem-resistant gram-negative bacteria, e.g. by improving the EARS-Net surveillance of antimicrobial resistance with regard to the origin of the infection (community- or healthcare-associated) and coverage of other infection types and antimicrobial resistance markers.
- Support the timely detection of new epidemics with alert microorganisms and support the implementation of appropriate prevention and control measures accordingly, e.g. by promoting the use by Member States of the ECDC epidemic intelligence system (EPIS) for antimicrobial resistance.
- Develop or improve antimicrobial stewardship programmes to improve antimicrobial prescribing in acute care hospitals, in particular:
  - rationalise the use of broad-spectrum antimicrobials (e.g. carbapenems),
  - limit the excessive prolongation of surgical prophylaxis,
  - rationalise the use of antimicrobials for medical prophylaxis,
  - promote the practice of changing the route of administration of antimicrobials from parenteral to oral when possible,
  - improve the documentation of the reason for antimicrobial prescribing in the clinical notes.
- Report hospital antimicrobial consumption to ESAC-Net in defined daily dose per number of patient-days rather than per number of inhabitants.

In addition to the recommendations for the prevention of HAIs and the improvement of antimicrobial prescribing in acute care hospitals, the experience of the ECDC PPS suggests the following recommendations for future repeated PPSs in Europe:

- EU-wide PPS initiatives can increase surveillance skills in Member States as well as enable countries to execute studies using a common protocol. However, considerable additional training of healthcare workers is needed to harmonise the interpretation of HAI case definitions and other key terms in the ECDC PPS protocol.
- National PPSs should be repeated at least once every five years. ECDC will organise a second coordinated PPS in all Member States in 2016–2017, but will also support the organisation, data collection, validation and analysis of national PPSs in 2013–2015. In particular, EU/EEA Member States with poor sample representativeness in the 2011–2012 ECDC PPS are encouraged to perform a second PPS during the intermediate period in the recommended number of hospitals in accordance with the ECDC PPS protocol.
- National PPS coordinating centres should perform validation studies during the national PPSs, and perform at least one national PPS with simultaneous validation before the end of 2017. International validation should be considered.
- The ECDC PPS protocol should be evaluated and adjusted where needed. Particular emphasis should be given to the inclusion of long-term-care wards in acute care hospitals, the inclusion of HAIs present on admission from other types of healthcare institutions, revision of certain case definitions, discussion on the possibility of adding certain variables to improve usefulness of data (e.g. date of start antimicrobial in hospital, acquisition of an HAI in ICU, site for antimicrobial and medical prohylaxis, type of surgery), consideration of further refining/improving infection control indicators and adding (a) proxy indicator(s) for the frequency of diagnostic testing.

Conclusions

The data collected during this first EU-wide PPS had many limitations, several of which may be improved in future surveys by enhanced training for hospital staff in HAI case definitions and PPS methodology, performing validation

studies during future PPSs, increasing the number of participating hospitals in countries with poor representativeness, adapting the protocol where needed and, in the longer term, reinforcing efforts to improve the capacity for first-line diagnostic testing of infectious diseases and the quality of medical records in European hospitals.

Through the ECDC PPS, a major step has been made in increasing skills in surveillance of HAIs and antimicrobial use and raising awareness among healthcare workers across Europe. The survey provided the most comprehensive EU-wide database on HAIs and antimicrobial use in European acute care hospitals to date and from the results has made recommendations that should be further developed and implemented across Europe. Repeated PPS can monitor the impact of these recommendations and other key epidemiological indicators in the field of HAIs, infection prevention and control, antimicrobial use and antimicrobial resistance in HAIs.

Background and objectives

In 2008, the European Centre for Disease Prevention and Control (ECDC) estimated that each year approximately 4.1 million patients acquire a healthcare-associated infection (HAI) in European acute care hospitals and that 37 000 of these patients die as a direct consequence of their infection [2]. This estimate was based on a review of 30 national or multicentre point prevalence surveys (PPSs) of HAIs in 19 countries that had been carried out between 1996 and 2007 and showed an average HAI prevalence of 7.1% in European acute care hospitals. However, major methodological differences between the surveys made cross-country comparison impossible [17] and emphasised the need for a standardised methodology to estimate and monitor the complete HAI disease burden in Europe. Since the implementation of hospital-wide continuous incidence surveillance is very resource demanding, there was broad consensus among European HAI surveillance experts that repeated prevalence surveys were the most efficient approach to addressing this challenge. When the coordination of the EU-funded network IPSE (Improving Patient Safety in Europe) [18] and its HAI surveillance component HELICS (Hospitals in Europe Link for Infection Control through Surveillance) were transferred to ECDC in July 2008 to form the new HAI surveillance network HAI-Net, the plan to perform an EU-wide PPS of HAIs was adopted by ECDC, based on the recommendations of the external evaluation of the IPSE network and on the conclusions of an expert group that met in January 2009. Given the transition of the coordination of the EU-funded surveillance network of antimicrobial consumption, ESAC, to ECDC in 2010 and the need to integrate surveillance activities, it was also agreed to include the hospital PPS component of ESAC [19–22] as part of the ECDC PPS protocol.

ECDC subsequently developed a protocol for PPSs of HAIs and antimicrobial use in acute care hospitals through seven expert meetings held from 2009 to 2011. More than 100 experts and representatives from all EU Member States, two EEA countries, four EU enlargement countries, international partners (the European Society of Intensive Care Medicine, WHO Regional Office for Europe, the United States Centers for Disease Control and Prevention (CDC)), ESAC and ECDC contributed to the development of the protocol.

As part of the protocol development process, several support projects were outsourced by ECDC. A concordance study between IPSE/HELICS and CDC/NHSN definitions estimated differences in case classification and provided the scientific background evidence for using the agreed European HAI case definitions [23]. From June to October 2010, a pilot survey including nearly 20 000 patients was conducted in 66 hospitals in 23 European countries [3]. Training material was developed and a train-the-trainer course delivered for national PPS coordinating teams (contract outsourced to Health Protection Agency, London, UK). Software for free use by the hospitals was developed, first through a contract (Scientific Institute of Public Health, Brussels, Belgium) and then from September 2011 by ECDC. The final protocol for the full-scale PPS in Member States was established at a conference jointly organised by the Belgian EU Presidency and ECDC (PPS workshop in November 2010) [24]. At this workshop, it was agreed that all Member States would perform a first national PPS according to the ECDC methodology during one of three possible periods (May–June 2011, September–October 2011, or May–June 2012) and that national PPSs should subsequently be conducted at least once every five years.

The protocol provides a standardised methodology to Member States and hospitals in response to article II.8.c of Council Recommendation 2009/C 151/01 of 9 June 2009 on patient safety, including the prevention and control of HAIs [14]. It also integrates the main variables of the ESAC hospital PPS protocol on antimicrobial use, thereby providing support to Council Recommendation 2002/77/EC of 15 November 2001 on the prudent use of antimicrobial agents in human medicine [16].

The objectives of the ECDC PPS of HAIs and antimicrobial use in acute care hospitals were:

- to estimate the total burden (prevalence) of HAIs and antimicrobial use in acute care hospitals in the EU;
- to describe HAIs (sites, microorganisms including markers of antimicrobial resistance) and antimicrobials prescribed (compounds, indications)
  - by type of patients, specialties or healthcare facilities; and
  - by EU country, adjusted or stratified;
- to disseminate results to policy makers and practitioners at local, regional, national and EU levels in order to:
  - raise awareness;
  - train and reinforce surveillance structures and skills;
  - identify common EU problems and set up priorities accordingly; and
  - evaluate the effect of strategies and to inform future local/regional/national policies (repeated PPS);
- to provide a standardised tool for hospitals to identify targets for quality improvement.

Methodology

Participation

National PPS contact points in EU Member States, Iceland, Norway and Croatia agreed to organise a PPS in their countries based on the ECDC PPS protocol during one of three suggested periods, depending on national planning of other coordinated activities in hospitals or in accordance with the national repeated PPS schedule. The three periods were chosen to fall outside the winter period (higher antimicrobial use) and summer holidays (lower staffing). An additional fourth period (September–November 2012) was added later, as requested by Croatia and Denmark. National contact points for the ECDC PPS were mostly general contact points for HAI surveillance (HAI-Net) previously nominated by Member States on ECDC's request. In a few cases, specific contact points were nominated for the national PPS coordination.

Data for the United Kingdom were collected independently by the four UK administrations. For this reason, and on the request of the overall surveillance coordination of the United Kingdom, data are reported separately for UK-England, UK-Northern Ireland, UK-Scotland and UK-Wales in this report. The total of different PPS data sources or networks was therefore 33. For simplicity, the term 'country' is used for the four UK administrations throughout the report and the term 'Europe' is used for the country total.

Protocol

Standard and light protocols

The final ECDC PPS protocol used for the EU-wide PPS (version 4.2) was distributed to Member States in early May 2011. It was available for staff members of the national PPS coordinating centres on a protected website (ECDC's HAI-Net extranet), together with training material, software and a questions & answers section. The edited version V4.3 – including some minor clarifications compared to V4.2 – was published on ECDC's website on 5 May 2012 [1]. We refer to the latter document for methodological details and will highlight a few key aspects only in the current chapter.

In accordance with the recommendations of the PPS expert meetings, the protocol offered two methods for the collection of denominator data in the hospitals: a patient-based data collection (referred to as the standard protocol) and a less labour-intensive unit-based data collection (light protocol). According to the standard protocol, demographic and risk factor data were to be collected for every inpatient, also for those without an HAI or not receiving any antimicrobial. According to the light protocol, denominator data were to be aggregated at the ward level and within each ward, for each patient/consultant specialty (specialty of the main disease of the patient or of the consulting physician in charge of the patients, depending on what was the usual practice for this variable at the hospital or country level). Both protocol versions used the same inclusion criteria, assumed the same case finding process and collected exactly the same information on HAIs and antimicrobial use. Results for both protocol versions were therefore presented together, except for the analysis of patient risk factors which was only possible for data collected using the patient-based protocol.

Sampling of hospitals

Countries were recommended to draw a representative sample of acute care hospitals applying systematic random sampling to the national list of hospitals ranked according to hospital type and size. No European definition of an acute care hospital was given, national definitions were allowed to be applied. The required sample size per country was calculated for an estimated HAI prevalence of 7% with a precision of +/-1%. This resulted in a sample size of approximately 8 000 to 10 000 patients in 25 to 50 hospitals, depending on the average hospital size in the country and the estimated design effect resulting from clustering of HAIs within hospitals (see protocol). Countries with fewer than 25 hospitals were recommended to include all hospitals. Countries had the possibility to submit more than the recommended number of hospitals to ECDC, but were then asked to indicate for each hospital whether it belonged to the representative national sample or not. Submission of more than the required number of hospitals was done because ECDC provided a complete national data analysis and individual hospital feedback reports to the national PPS coordinators for all submitted hospitals. For the European analysis in this report, however, hospitals not belonging to the national representative sample were excluded to avoid overrepresentation of certain countries (Belgium, Portugal and Spain).

The sample representativeness was evaluated and categorised in four levels (optimal, good, poor and very poor) depending on compliance with the recommended sampling methodology, as follows:

Optimal:

- systematic random sample of 25–60 hospitals (depending on hospital size in the country) and inclusion of at least 75% of these hospitals;

- inclusion of ≥75% of all acute care hospitals or occupied acute care hospital beds in the country, and required sample size achieved.

Good:

- invitation of all hospitals, achieving a good response in terms of required number of patients and hospitals and drawing a systematic sample of these, if appropriate;
- selection of a sufficient number of representative hospitals and patients using another methodology;
- required sample size not achieved, but inclusion of ≥75% of all acute care hospitals or occupied acute care hospital beds in the country.

Poor:

- between 5 and 25 hospitals included in countries with more than 25 acute care hospitals and required sample size not achieved;
- less than 5 hospitals included in countries with more than 5 acute care hospitals but inclusion of 50–75% of all acute care hospitals or occupied acute care hospital beds in the country.

Very poor:

- inclusion of less than 5 hospitals and less than 50% of all acute care hospitals and less than 50% of all occupied acute care hospital beds.

Within the hospital, all eligible patients had to be included. Sampling of patients was not included as a methodological option for the full PPS because this would have increased the required number of hospitals and would have affected the usefulness of the data at the hospital level.

Inclusion criteria

All patients admitted to the ward before 8:00 am on the day of the survey and not discharged from the ward at the time of the survey were included. Day-case wards or centres and long-term-care wards were excluded.

Questionnaires (data collection forms) and definitions

Data were collected at national, hospital, ward and patient level (for the latter, including infection and antimicrobial use data if any) on standardised data collection forms (questionnaires). The hospital questionnaire collected data on hospital type and size (number of beds), hospital statistics (number of patient-days and discharges in the preceding year) as well as structure and process indicators (alcohol hand rub use, number of single-bed rooms, number of infection prevention and control nurse and doctor full time equivalents).

Four hospital type categories (primary, secondary, tertiary and specialised) were defined as follows:

1. Primary

- Often referred to as 'district hospital' or 'first-level referral'.
- Few specialties (mainly internal medicine, obstetrics–gynaecology, paediatrics, general surgery or only general practice).
- Limited laboratory services are available for general, but not for specialised pathological analysis.
- Often corresponds to general hospital without teaching function.

2. Secondary

- Often referred to as 'provincial hospital'.
- Hospital is highly differentiated by function with five to ten clinical specialties, such as haematology, oncology, nephrology, ICU.
- Takes some referrals from other (primary) hospitals.
- Often corresponds to general hospital with teaching function.

3. Tertiary

- Often referred to as 'central', 'regional' or 'tertiary-level' hospital.
- Highly specialised staff and technical equipment (ICU, haematology, transplantation, cardio-thoracic surgery, neurosurgery).
- Clinical services are highly differentiated by function.
- Specialised imaging units.
- Provides regional services and regularly takes referrals from other (primary and secondary) hospitals.
- Often a university hospital or associated with a university.

4. Specialised hospital

- Single clinical specialty, possibly with sub-specialties.
- Highly specialised staff and technical equipment.

Data on ward type and ward survey date were collected in the ward questionnaire in both standard and light protocols. In the light protocol, ward data were complemented by the aggregated denominators for the total ward and for each consultant/patient specialty. Patient data in the light protocol were collected only for patients with an HAI and/or receiving antimicrobials and included consultant/patient specialty and demographics only (age, gender and date of admission). In the standard protocol, patient data were collected for all patients and also included risk factors, i.e. surgery since admission, the McCabe severity of illness score [25] and presence of invasive devices. HAI data included the HAI type corresponding to one of the HAI case definitions, the origin of HAIs, the date of onset for HAIs that were not present on admission, the presence of invasive devices in the 48 hours before onset of the HAI (for pneumonia, urinary tract infections and bloodstream infections), isolated microorganisms and selected antimicrobial resistance data. Data on antimicrobial use included the antimicrobial agent, the route of administration, the indication for antimicrobial use, the site of diagnosis for treatment intention of an infection (e.g. respiratory tract) and whether the reason for prescribing the antimicrobial agent was documented in the patient's charts or not. For data on treatment intention, the aim was to record what the physicians or other prescribers thought they were treating. In order to do so, it was recommended to check all patient records and to request additional information from doctors, nurses or pharmacists if needed. The appropriateness of prescriptions was not to be discussed and suspected or confirmed infections for which a treatment was prescribed did not need to match any case definition.

The national questionnaire collected data on the method used for sampling hospitals, the number of acute care hospitals (both the total number for the country and the number included in the PPS), the previous year's aggregated hospital statistics for all acute care hospitals in the country (total number of beds, discharges and patient-days), for all beds and for acute care beds only. When national denominator data were missing, available data from Eurostat were used [26].

In November 2012, an additional national questionnaire was sent to collect data on the coordination of the national PPS, the training provided to participating hospitals, the translation of PPS tools (forms, protocol and codebook, methodological differences between the national and ECDC PPS protocols, the software tools used, the perceived opinion of participating hospitals of the ECDC PPS, problems encountered with the PPS methodology and validation of PPS data. Responses to this additional national questionnaire were received from 31 of 33 countries (no replies received from Cyprus and Greece).

Case definitions for healthcare-associated infections

European case definitions were used that had been previously developed by HELICS or other European projects [27–31]. Otherwise, case definitions from the National Healthcare Safety Network (NHSN, formerly NNIS) at the United States Centers for Disease Control and Prevention (CDC) were used [32]. For the purposes of the ECDC PPS protocol, an infection was defined as active on the day of the survey when:

1. signs and symptoms were present on the date of the survey;
OR
2. signs and symptoms were no longer present but the patient was still receiving treatment for that infection on the date of the survey. In this case, the symptoms and signs occurring from the start of treatment until the date of the survey were checked to ascertain that the infection matched one of the case definitions for HAIs.

An active infection was defined as healthcare-associated (associated with acute care hospital stay only, for the purpose of this protocol) when:

1. the onset of the signs and symptoms was on Day 3 of the current admission or later (with Day 1 being the day of admission);
OR
2. the signs and symptoms were present on admission or became apparent before Day 3, but the patient had been discharged from an acute care hospital less than two days before admission;
OR
3. the signs and symptoms of an active surgical site infection were present on admission or started before Day 3, and the surgical site infection occurred within 30 days of a surgical intervention (or in the case of surgery involving an implant, a deep or organ/space surgical site infection that developed within a year of the intervention);
OR
4. the signs and symptoms of a *Clostridium difficile* infection were present on admission or started before Day 3, with the patient having been discharged from an acute care hospital less than 28 days before the current admission.

In the HAI section, data on microorganisms and the respective resistant phenotype were collected. Only results that were already available at the time of the survey were included. HAI case definitions used in the ECDC PPS were also published under the EU legislation on communicable diseases [33].

Inclusion of antimicrobial agents

For antimicrobial use, the Anatomical Therapeutic Chemical (ATC) classification system of the World Health Organization Collaborating Centre for Drug Statistics Methodology was used [34]. Antimicrobial agents for systemic use within the ATC groups A07AA (intestinal anti-infectives), D01BA (dermatological antifungals for systemic use), J01 (antibacterials for systemic use), J02 (antimycotics for systemic use), J04 antimycobacterials as second-line treatment of e.g. MRSA infections (rifampicin) or for treatment of mycobacteria other than tuberculosis (MOTT) and P01AB (nitroimidazole-derived antiprotozoals) were included. Antiviral agents and antimicrobials for the treatment of tuberculosis were not included.

Data collection and processing

The protocol recommended that data from any given ward should all be collected on a single day. The total time frame for data collection for all wards of a single hospital was recommended not to exceed two to three weeks.

Data on wards, patients, HAIs and antimicrobial use were retrieved from patient charts in the hospital wards and/or other sources of information available in the hospital (e.g. hospital information system, laboratory database) using standardised data collection forms.

The number and type of healthcare workers involved in the data collection were not assessed. However, they were assessed during the pilot PPS. They were – in decreasing order of frequency – infection prevention and control staff, ward nurses and physicians, infectious disease physicians, medical specialist trainees, microbiologists, pharmacists and other hospital staff [3]. In some countries, national or regional PPS coordination staff also participated in the data collection process.

To facilitate data entry at hospital level, ECDC developed and provided a standalone software HelicsWin.Net which was first distributed via a protected website (ECDC's HAI-Net extranet) and a further developed version (V3.0) was published online as freeware on 5 May 2012 [35]. HelicsWin.Net V3.0 allowed hospitals to enter and validate their PPS data, and to export them in different formats, including the format required to upload data in ECDC's TESSy system. Hospitals were asked to send the export files to the national PPS coordination centre. Export files did not contain any personal identifiers. Individual hospital data files were appended by the national centre and uploaded in TESSy. National data were collected by the national coordinators and submitted separately to TESSy.

The ECDC software HelicsWin.Net was used by 21 (64%) countries. Eight countries (France, Germany, Greece, Hungary, Ireland, the Netherlands, Spain and UK-Northern Ireland) used a national web-based system, four countries (Germany, the Netherlands, UK-Wales and UK-Scotland) used a system based on optical character recognition (OCR), and three countries used a self-developed standalone application (Lithuania, Slovenia, the Netherlands). In Germany and the Netherlands, more than one software solution was used. Regardless of the data entry tool applied, national data had to be submitted to TESSy.

In 20 of 31 (65%) countries that replied to the additional national questionnaire sent in November 2012, the majority (80–100%) of data was entered at the hospital level. In ten countries (Czech Republic, Denmark, Germany, Finland, Latvia, Malta, Romania, Slovakia, Slovenia and Sweden), more than 80% of the data was entered at the level of the national or regional PPS coordination centres. In one country (Italy), 90% of the data entry was outsourced to a data entry company.

Data quality reports were available in TESSy and could be downloaded after upload. In addition, detailed reports by hospital were produced by ECDC using Stata v12 (StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP) and Excel v2007 (Microsoft. Microsoft Excel 2007, Redmond, Washington) and sent to the national PPS coordinators within two weeks after data submission (except for a longer delay for the first countries submitting data), together with the national results. These Excel reports also included preliminary European data available at that moment, and were produced for all submitted data, even for hospitals that did not belong to the national representative sample. Preliminary European results were presented to national PPS coordination staff during the Joint annual meeting of the Antimicrobial Resistance and Healthcare-Associated Infections (ARHAI) Networks organised by ECDC in Berlin, November 2012. When needed, countries re-uploaded corrected data in TESSy, e.g. because of errors detected in the feedback reports provided by ECDC or because the comparative analysis of country results presented at the ARHAI meeting revealed errors that were not detected before.

National PPS protocols and tools

Twenty of 31 countries who replied to the additional national questionnaire (65%) used an unmodified (though possibly translated) version of the ECDC protocol. France, the Netherlands and Spain used an adapted version of the (previous) national PPS protocol, while Denmark, Germany, Hungary, Ireland, Lithuania, Slovenia, UK-Northern Ireland and UK-Wales made changes (e.g. addition of variables or categories of variables) to the ECDC protocol for the national protocol. In France, the national protocol covered not only acute care hospitals, but also rehabilitation,

long-term care and home care. Nevertheless, the hospital sample submitted to ECDC only included acute care hospitals. France also included HAIs with examination results available after the survey, but added a variable to flag these and excluded them from the data submitted to ECDC. Denmark adapted some HAI case definitions to better fit national diagnostic methods. Germany also included HAIs on admission imported from long-term care facilities. In Hungary, the ECDC PPS protocol was adapted by excluding the light option and allowing the collection of any type of antimicrobial resistance for any microorganism. Nevertheless, antimicrobial resistance data as per the original ECDC PPS protocol were submitted to TESSy. Ireland rewrote and reformatted the ECDC protocol for ease of use, but made no changes in content. In Lithuania, data on carbapenem resistance were only collected for *K. pneumoniae*, not for other Enterobacteriaceae.

In the Netherlands, the adaptation of the national repeated PPS protocol to the ECDC PPS protocol resulted in three remaining discrepancies. First, data on resistant microorganisms were collected using a different code in the microorganism list, but no data were collected on whether other microorganisms of the same species were sensitive or their antimicrobial susceptibility results were unknown. Therefore, antimicrobial resistance data from the Netherlands were not included in the European analysis, but were reported separately in a footnote. Second, for HAIs present on admission, data collection in the Netherlands was incomplete: the HAI type was only recorded for surgical site infections, while other HAI types were reported as 'other' HAIs. In addition, other infection data such as microbiological results were not collected for HAIs present on admission in the Netherlands and they were registered based on the diagnosis of the physician at admission and nòt based on the definitions of HAIs in the PPS protocol. Third, in the Dutch protocol only antibacterials were registered; antimycotics were not registered.

Spain also adapted the national protocol, keeping additional variables (not submitted to ECDC) such as the type of surgery performed since hospital admission (which was also included in other national protocols, e.g. in Greece) and infection data on community-acquired infections. However, there were no discrepancies in the Spanish protocol for the variables included in the ECDC protocol. In UK-Northern Ireland, the ECDC PPS protocol was adapted by excluding the light option and removing antimicrobials not used anywhere in the country. In UK-Scotland, the PPS protocol was modified as follows: a variable was added to collect whether local antimicrobial policy was met, additional guidance was provided for the interpretation of the McCabe score and several algorithms were added to help with the interpretation of key aspects. In UK-Wales, the ECDC PPS protocol was slightly adapted so to include the modified data collection tools.

Nine of 31 (29%) countries did not translate any of the protocol components (Ireland, Luxembourg, Malta, Norway, Sweden, United Kingdom administrations). Twelve countries translated all protocol components (the protocol itself, the codebook including the HAI case definitions and the data collection forms), eleven countries only translated some components.

Training

Training of hospital staff in the methodology of the ECDC PPS was considered a priority throughout the development of the protocol and the preparation of the EU-wide PPS. In 2010, ECDC outsourced the development of a training curriculum for a one-day course for participating hospitals to the Health Protection Agency in London (in collaboration with Health Protection Scotland). In March 2011, a 3-day train-the-trainer course was delivered to 60 national PPS coordination staff to optimise consistency of national training courses across Europe. Standardised training material was made available in English.

Thirty out of 31 countries that replied to the additional national questionnaire organised at least one training course for participating hospital staff. On average, four courses were organised per country (median three courses) with a mean duration of 9.2 hours (median 7 hours) per course. The mean number of hospital staff trained during the PPS courses was 104 participants per country (median 78, range 5–436) from on average 40 hospitals (median 29, range 1–177). The total number of hospital staff trained in Europe by the national PPS coordinating teams for the purpose of the ECDC PPS was estimated at approximately 2800 people.

Validation of PPS data

Validation of PPS data was done by external validation teams visiting a subset of participating hospitals and re-examining a sample of patient files included in the national (primary) PPS. The main objective of the validation PPS was to estimate the sensitivity and specificity of the primary PPS based on the number of false-negative and false-positive patients with an HAI or antimicrobial use. Validation teams consisted of members of the national PPS coordination centre, possibly complemented by additional experts trained by the coordination centre for this purpose, and applied the ECDC PPS protocol, with special emphasis on HAI case definitions, as precisely as possible (gold standard).

Validation of national PPS data was done in two stages. First a pilot validation protocol was developed by ECDC and experts from Member States in August and September 2011 to test different methods of validation with regard to timing (same day as the PPS, within one week after the PPS or later when most patients had already left the

hospital) and blinding (validation team blinded to the results of the primary PPS or not). In November 2011, the pilot protocol was tested in 20 hospitals in 10 countries (two hospitals per country) in a study outsourced by ECDC to the Glasgow Caledonian University. Experience from the pilot validation PPS suggested blinded validation on the same day of the primary PPS (simultaneous with the primary PPS data collection or shortly after) as the method of choice for future validation. This recommendation was integrated by ECDC in the final validation protocol in March 2012 and PPS coordinating centres were invited to perform (full) national validation of the primary PPS data against a modest financial support (10 000 EUR per country). Four countries agreed to validate their national PPS data in 2012 and one country used the ECDC protocol to validate the data without a support contract with ECDC. Because of the additional workload related to the validation besides the primary PPS, the minimal requirement for the sample size was set to 250 patients in five hospitals per country. Nevertheless, the recommended sample size for optimal representativeness of the validation sample was 750 patients in 25 hospitals, to detect a sensitivity of 80% with a precision of 10%, assuming HAI prevalence of 7%.

In order to estimate the sensitivity and specificity of the national PPS, the percentage and 95% confidence intervals of false positives and false negatives of the validation sample were applied to the total national PPS population.

Data analysis

Data were processed and analysed by ECDC using Stata v12 (StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP.).

Recoding of variables

Because of differences in interpretation leading to inconsistent reporting between hospitals and/or countries, the following variables were recoded before analysis:

- The specialty of the main disease of the patient or of the consulting physician in charge of the patients (patient/consultant specialty) was recoded to the corresponding ICU specialty if the patient was in an ICU but had a patient/consultant specialty that was not an ICU specialty. For example, a patient in a mixed ICU ward with a patient/consultant specialty 'general surgery' (PPS protocol code SURGEN) was attributed a patient/consultant specialty 'surgical ICU' (PPS protocol code ICUSUR).
- Negative microorganism codes for reported *C. difficile* infections were replaced by the microorganism *C. difficile* in the analysis. Even though the diagnosis of *C. difficile* infections can be made without a positive microbiological test (pseudomembranous colitis confirmed by colonoscopy or characteristic colonic histopathology), these cases are rare (approximately 4% of cases of *C. difficile* infection in the German CDAD-KISS surveillance in 2011 [36]) and *C. difficile* was assumed to be the causal microoganism for all these cases. In addition, cases with a positive toxin test were reported with a positive microbiological result (even in the absence of positive culture) by some but not by all hospitals or countries. The variable 'positive toxin test for *C. difficile*', which was included in the pilot PPS protocol, was removed after the pilot because it was not recorded consistently. The recoding of negative microorganism codes for *C. difficile* infections resulted in the addition of 84 (15.2%) *C. difficile* microorganism records in 16 of 30 countries which reported *C. difficile* infections (Austria 5 records added of a total of 19 *C. difficile* microorganism records, Belgium 7/37, Czech Republic 2/13, Finland 9/42, Germany 3/38, Greece 3/6, Hungary 8/54, Italy 4/32, Latvia 2/5, the Netherlands 1/5, Norway 1/4, Poland 2/25, Portugal 3/28, Spain 1/9, UK-England 29/93, UK-Scotland 4/31).
- The origin of HAIs was recoded from 'unknown' to 'current hospital' if the date of onset was given and the day of onset of the HAI was on Day 3 or later (n=92 HAIs in 13 countries).

Indicators

The prevalence of HAIs was reported as the percentage of patients with at least one HAI over the total number of patients. The HAI prevalence was never reported as the ratio of HAIs (x 100) over the number of patients (which is, historically, often done in HAI prevalence surveys) because this indicator is not a true percentage as the numerator is not entirely included in the denominator.

For HAI types and microorganisms, relative frequencies were reported using the total number of HAIs or microorganisms as the denominator.

Antimicrobial resistance data were collected for selected bug–drug combinations only (see ECDC PPS protocol) 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 (resistant bacteria only for meticillin-resistant *S. aureus* and vancomycin-resistant *Enterococcus* spp.). Resistance for *Enterococcus* spp. was also reported for motile enterococci (enterococci other than *E. faecium* and *E. faecalis*). In the analysis by country, countries for which fewer than 10 isolates were reported were excluded, as per the standard EARS-Net analysis [37]. Data from the Netherlands were not included in the analysis of antimicrobial resistance data (see

under 'National PPS protocols and tools'). In Lithuania, data on carbapenem resistance were not collected for Enterobacteriaceae other than *K. pneumoniae*.

The prevalence of antimicrobial use was reported as the percentage of patients receiving at least one antimicrobial agent. For antimicrobial agents, relative frequencies among the total number of antimicrobials are given. The relative frequency at the fifth ATC level was reported as the Drug Utilization 75% (DU75%), describing 75% of the antimicrobial use in participating hospitals [38].

The distribution of antimicrobial groups and agents followed the WHO/ATC classification except for further classification of quinolone antibacterials (ATC group J01M) into three generations based on their chemical structure and antimicrobial activity as described by the ESAC project and used by the European Surveillance of Antimicrobial Consumption network ESAC-Net [39, 40].

In addition to the relative use of antimicrobial groups and agents, the prevalence of antimicrobial use among the total number of hospitalised patients was also reported for carbapenems (ATC groups J01DH), for glycopeptide antibacterials (ATC group J01XA), for parenteral polymyxins (ATC group J01XB) and/or tigecycline (J01AA12) as an indicator of empirical or documented therapy of carbapenem-resistant gram-negative bacteria [41], for use of oral metronidazole (P01AB01) and/or oral vancomycin (A07AA09) as an indicator of the oral treatment of *C. difficile* infections, and for the use of antimycotics (ATC group J02 and nystatin).

Three infection control structure and process indicators were collected at the hospital level: 1) the consumption of alcohol hand rub (litres consumed in the previous year) as a proxy (surrogate) indicator of hand hygiene, 2) the number of single-bed rooms as a proxy indicator for isolation capacity of patients infected or colonised with microorganisms requiring enhanced infection control measures and 3) the number of full time equivalent (FTE) infection prevention and control nurses (IPCN) and doctors (IPCD) available in the hospital at the time of the survey. Alcohol hand rub consumption was reported as the number of litres per 1000 patient-days. Single beds were reported as the percentage of single-room beds among the total number of beds, which was preferred as a proxy indicator for isolation capacity by the national PPS experts rather than the percentage of single-bed rooms among the total number of rooms, because of large variations in the number of beds per room between countries. The number of FTE IPCN was reported per 250 beds in line with the standard derived from the SENIC study [42]. Infection prevention and control doctors represent a more heterogeneous group of professionals in Europe, with predominantly a medical microbiology background, but also commonly a public health or epidemiological medical background, sometimes also other medical backgrounds or other professionals such as pharmacists, with a special training in infection prevention and control/hospital hygiene (based on data from the TRICE project). Given the heterogeneity of this group, a straightforward FTE standard is not available in literature. For this reason and to facilitate comparison with the FTE for IPCN, the FTE of IPCD was also expressed per 250 hospital beds.

Statistical analysis

In order to adjust for clustering of HAIs and antimicrobial use in selected hospitals (also referred to as over-dispersion or intra-cluster correlation), the national prevalence figures for HAIs and antimicrobial use were reported with 95% confidence intervals adjusted for the design effect using the survey (svy) procedure in Stata v12.

Relationships between two dichotomous variables were examined using the chi square test and crude odds ratios with 95% confidence intervals. Categorical variables were examined using logistic regression and the analysis of continuous variables was done using linear regression and/or quantile regression, as appropriate. The correlation between two continuous variables was examined using the Pearson and Spearman correlation coefficients.

Multiple logistic regression models were developed on a systematic sample of two thirds of the data and validated on the other third. One model was developed for the prediction of the presence of any HAI and another model for receiving at least one antimicrobial agent on the day of the survey. For the prediction of HAIs, risk factors for an HAI with onset during the current hospital stay were considered before onset of the HAI: length of stay until the day of onset of the HAI, presence of invasive devices before HAI onset (by using the variable presence of invasive device before HAI in the infection data), and McCabe score estimated without the influence of the infection, if any (as defined in the ECDC PPS protocol). The presence of a central or peripheral vascular catheter was excluded from both models because of the correlation with the parenteral administration of antimicrobials. After each model, risk scores were developed by multiplying and rounding each regression coefficient by a factor of 10, and goodness-of-fit and discriminatory accuracy of the model were assessed using the risk scores. Goodness-of-fit was assessed on eight smaller random sub-samples of the data using the Hosmer–Lemeshow chi square test. The discriminatory accuracy of the multiple logistic regression models was assessed using receiver operating characteristic (ROC) analysis. Random effect logistic regression analysis models (including country-level random effects) were performed to examine the effect on regression coefficients. For light protocol data with aggregated denominator data by patient/consultant specialty, logistic regression for grouped data was used to construct a risk model for HAIs and antimicrobial use, including patient/consultant specialty, hospital type and hospital size.

The level of statistical significance was set at 1 per mille ($p<0.001$) for patient-based analyses and at 5% ($p<0.05$) for analyses of data aggregated at hospital or country level.

The standardised infection ratio (SIR) and the standardised antimicrobial use ratio (SAUR) were calculated as the number of observed patients divided by the number of predicted (or expected) patients with at least one HAI or antimicrobial, respectively. The number of predicted patients with one or more HAI or on one or more antimicrobial was calculated by summing up, for each country, the individual probabilities for each patient (values between 0 and 1) after fitting the European model. Standardised ratios <1 indicate a lower prevalence than predicted, standardised ratios >1 indicate a higher prevalence than predicted based on the (country's) case mix after applying the European risk model. We preferred to use the terms 'predicted' instead of the more commonly used term 'expected' (statistically speaking these terms are synonyms in this context) because the term 'expected value' might be misinterpreted as referring to 'good practice'. In the case of the prevalence of HAIs and antimicrobial use, the predicted or expected value after applying the risk model based on the total European risk model does not mean that this value is a good practice standard.

Burden estimates were calculated as the total number of patients with an HAI and on antimicrobials, respectively, on any given day and, for HAIs only, the total number of patients acquiring at least one HAI per year.

The number of patients with an HAI or on antimicrobials on any given day was calculated by applying the national prevalence figures with 95% confidence intervals on the total number of beds in acute care hospitals, multiplied by the occupancy rate in the year for which national denominator data were available. The occupancy rate was defined as the (national) number of patient-days in acute care hospitals * 100 / (number of beds in acute care hospitals * 365 days).

Estimates of the total number of patients per year with an HAI were calculated after conversion of the national prevalence percentages to incidence of HAIs using the formula by Rhame and Sudderth [43]:

$$I_{estimated} = P\frac{LA}{(LN\text{-}INT)}$$

where

P = Prevalence, defined by the percentage of patients with at least one HAI on the survey day.
LA = Average length of hospital stay, derived from the number of patient-days and the number of discharges for the year preceding the PPS in the hospitals participating in the survey (hospital questionnaire data).
LN = Average length of hospital stay of infected patients (admission to discharge date). Since the discharge date was not known at the time of the PPS, the length of stay of infected patients was calculated as up to survey date.
INT = Average length between date of admission and date of onset of HAI. If a patient had multiple infections on the day of the survey, the date of onset of the first infection is considered.

The terms LA, LN and INT in the Rhame and Sudderth formula were assumed to be derived for the incidence series (cohort of patients) from which the PPS sample is taken on a given day, not from the PPS sample itself. In the PPS sample, patients with a longer length of stay, such as patients with an HAI or use of antimicrobials, were overrepresented. Also among patients with an HAI (or on antimicrobials), those with the longest length of stay were overrepresented in a PPS, meaning that also the term INT in the formula was likely to be biased if derived directly from the PPS data. We therefore assessed the correlation between the overall length of stay in participating hospitals (LA, from hospital data) with the length of stay until survey date in the PPS sample (in patient-based data), to define the best way to approach the terms LN and INT in the formula. In addition, PPS simulations were performed on data from the European surveillance of HAIs in ICU (HAI-Net ICU), with varying proportions of patients staying one or two days, to derive the best mathematical relationship between $(LN\text{-}INT)_{pps}$ with $(LN\text{-}INT)_{cohort}$. For patients with an HAI on admission, the term INT was set to zero (or date of onset=date of hospital admission). For antimicrobial use, the prevalence-to-incidence conversion was not possible because the start date of the administration of antimicrobials was not collected in the ECDC PPS protocol.

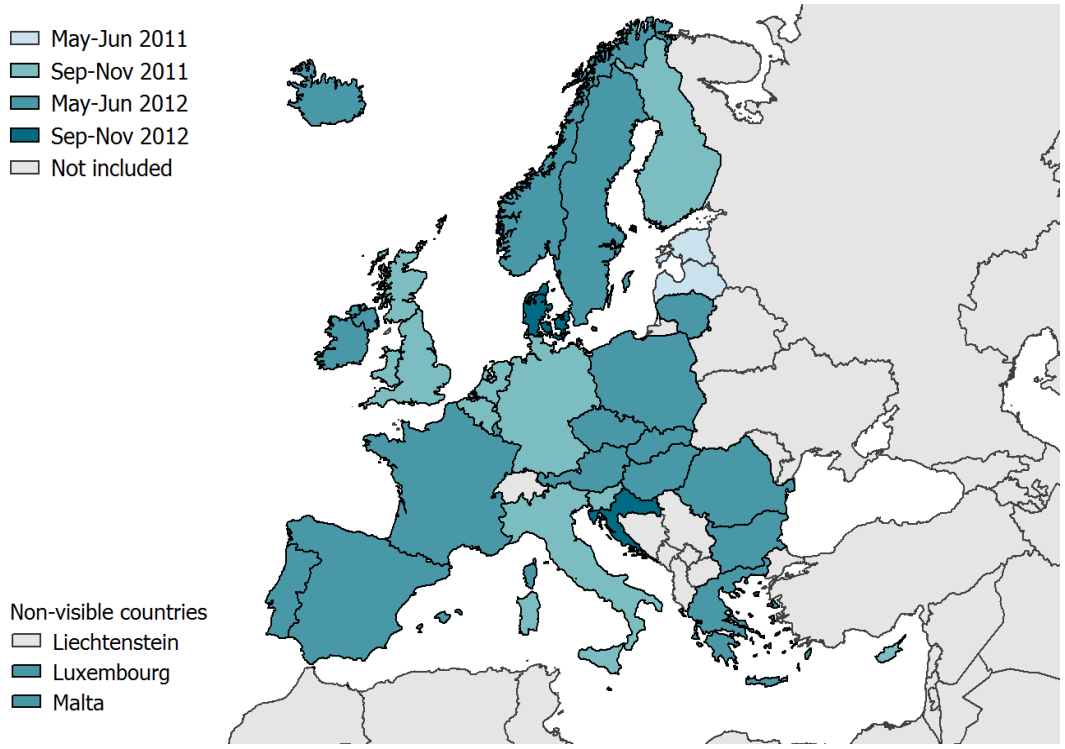
Results

Participation

A total of 30 countries (all EU Member States, Norway, Iceland and Croatia) participated in the European PPS from May 2011 until November 2012. The majority of countries performed their PPS in May and June 2012 (Figure 8). Since the surveys in the four UK administrations (England, Northern Ireland, Scotland, Wales) were organised independently, data from 33 different national/sub-national surveys were submitted to ECDC. For simplicity, the term 'country' was used for all 33 data sources throughout the report.

On average, the data collection at the national level (first ward in first hospital until last ward in last hospital) lasted 57 days (median 50 days). Overall, an estimated 3200 hospitals participated, but 1938 of these were French hospitals of which only a representative sample was submitted to ECDC. Data from 1149 hospitals and 273 753 patients were submitted to ECDC. To obtain similar precision in prevalence estimates for all participating countries, a representative sub-sample of hospitals was drawn from the data submitted for countries that were overrepresented (Belgium, Portugal, Spain) in the original sample. After this adjustment, a total of 231 459 patients from 947 hospitals were included in the final European sample.

Figure 8. Period of participation in the first EU-wide PPS, 2011–2012



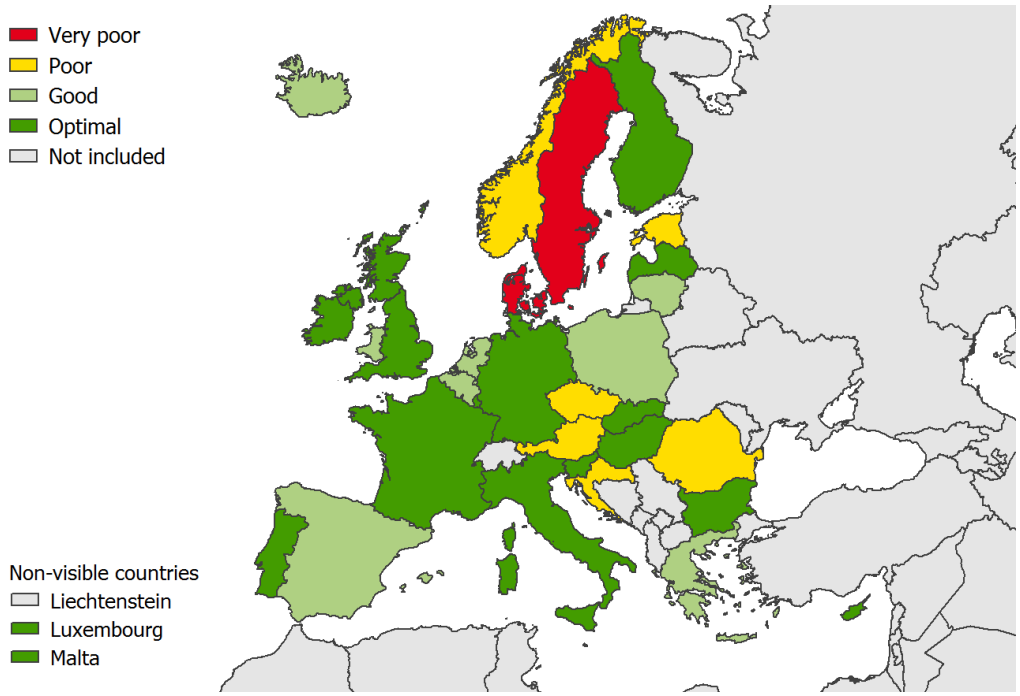
The recommended systematic random sampling methodology was not followed by all countries. Good or optimal representativeness was obtained in 25 of 33 national surveys (76%) (Table 1): by strictly following the recommendation (optimal); by inviting all hospitals, achieving a good response and drawing a systematic sample, if appropriate (good or optimal); by selecting a sufficient number of representative hospitals using another methodology (good); or by including all (optimal) or nearly (>75%) all (good) hospitals or hospital beds in smaller countries. Overall, approximately 11% of all acute care hospitals in EU/EEA countries and Croatia were included in the PPS sample. In eight countries, the number of hospitals or hospital beds included in the PPS was too small to consider the samples as representative of the total hospital population. These hospitals were nevertheless included, but care should be taken in interpretating results from these countries.

Table 1. Total number of acute care hospitals and hospital beds, and participation in the ECDC PPS by country, 2011–2012

Country	N of acute care hospitals	N of trusts	N of hospital beds, total[a]	N of hospital beds, acute care[a]	N of hospitals in final PPS database	Hosp. in PPS, % of total	N of patients in PPS	% of acute care beds[b]	Sample representativeness[c]
Austria	189	N/A	64008	46029	9	5	4321	10	Poor
Belgium	194	106	70170	44871	52	27	13758	34	Good
Bulgaria	241	N/A	50041	38506	42	17	8952	26	Optimal
Croatia	60	N/A	24831	15546	11	26	4923	35	Poor
Cyprus	8	N/A	2958	2769	8	100	1037	42	Optimal
Czech Republic	158	N/A	73746	51216	14	9	3774	8	Poor
Denmark	52	23	19405	15895	3	6	682	5	Very poor
Estonia	40	N/A	7145	4647	4	10	2076	50	Poor
Finland	59	UNK	31361	9601	59	100	9712	112	Optimal
France	1558	N/A	416710	224385	54	3	9670	5	Optimal
Germany	1736	N/A	674473	462457	46	3	9604	2	Optimal
Greece	137	N/A	54704	45729	37	27	8247	20	Good
Hungary	108	N/A	71818	41421	29	27	10180	27	Optimal
Iceland	8	N/A	1046	-	2	25	462	80*	Good
Ireland	60	N/A	14046	10226	50	83	9030	98	Optimal
Italy	1023	UNK	213187	171376	49	5	14784	10	Optimal
Latvia	17	UNK	11920	7503	15	88	3447	51	Optimal
Lithuania	92	73	22190	16359	44	48	7761	53	Good
Luxembourg	9	N/A	2721	2112	9	100	1744	92	Optimal
Malta	3	N/A	1874	1119	3	100	757	75	Optimal
Netherlands	96	UNK	76980	50095	33	34	7540	17	Good
Norway	60	23	16117	11602	7	12	1465	14	Poor
Poland	795	N/A	251456	166646	35	4	8067	5	Good
Portugal	101	UNK	35601	29404	57	56	10418	39	Optimal
Romania	311	UNK	134736	92777	10	2	2417	3	Poor
Slovakia	112	N/A	34850	25693	40	36	8397	36	Optimal
Slovenia	21	N/A	9367	7545	21	95	5628	83	Optimal
Spain	550	UNK	145459	113123	59	11	13520	13	Good
Sweden	80	N/A	25566	18947	4	5	613	4	Very poor
UK-England	253	167	196103	158928	51	31	25727	18	Optimal
UK-Northern Ireland	16	5	7276	4255	16	100	3992	104	Optimal
UK-Scotland	52	N/A	24916	19025	52	100	11902	70	Optimal
UK-Wales	89	9	12868	9952	22	25	6852	77	Good
Europe	**8288**		**2 799 649**	**1 921 561**	**947**	**11**	**231 459**	**13**	**Optimal or good 25/33 countries**

(a) Data extracted from Eurostat, year 2010; the total number of hospital beds includes curative (acute care), psychiatric, long-term care and other hospital beds; also see Annex 1 (Table A1.7) for national denominator data reported in TESSy.
*(b) Number of surveyed patients as a percentage of the total number of acute care beds in the country, assuming an occupancy of 90% at the time of the survey (N of patients in PPS*100/(N of acute care beds*0.90); this percentage may be higher than 100% because other beds may have been included in the PPS or because the total number of acute care beds is imprecise.*
(c) Sample representativeness appreciation based on compliance with recommended sampling methodology of hospitals and sample size (see text).
**Estimation of percentage of acute care beds by national PPS coordinator (see text).*

Figure 9. Sample representativeness in the ECDC PPS by country, 2011–2012



Sample representativeness appreciation based on compliance with recommended sampling methodology of hospitals and sample size (see text).

In the Czech Republic, the originally planned PPS sample included 28 hospitals as recommended, but in 14 hospitals without infection control staff the PPS could not be carried out because a new law was passed in April 2012 under which only staff working in the hospital are allowed to access patient records. Therefore, the external regional public health epidemiologists who were trained to perform the survey in hospitals without internal infection control staff could not access patient records in these hospitals (unless with informed consent of each patient, which was impossible to organise). In Iceland the representativeness was evaluated to be good because the number of included beds was estimated to represent more than 80% of all acute care beds in the country, even though the PPS sample only included two hospitals (the two main acute care hospitals in the country). The other hospitals in Iceland are small, represent a mixture of advanced primary care centres and nursing homes with only few truly acute care beds. The precise number of acute care beds in Iceland is unknown, but the number of 1046 also includes an important number of non-acute care beds. In Estonia, only acute care hospitals with infection control staff in place (n=19) were invited to participate. Two of the four hospitals that agreed to participate were the largest hospitals in Estonia, therefore approximately 50% of all acute care beds in the country were included in the PPS and representativeness was considered poor, rather than very poor as in Denmark and Sweden, where a similarly low number of hospitals was included. In Denmark, one of the three included hospitals excluded about half of the wards, which further added to the very poor representativeness of the Danish sample. In Croatia, more hospitals initially agreed to participate and were trained, but they declined in the end because of the short timeframe of the survey (final period with short deadline for data submission). In Belgium, Portugal and Spain, data from more hospitals were submitted to ECDC (Belgium: 70, Spain: 177, Portugal: 101) and a random sample was taken by ECDC to avoid overrepresentation of these countries in the final database.

The large majority of hospitals (92.7%) used the patient-based (standard) protocol. The unit-based (light) protocol was used by all hospitals in Denmark, Germany and Romania, by five of 11 hospitals in Croatia and by one hospital in Latvia and Portugal. The number of days spent by the surveyors to collect data for 100 patients (excluding data entry and verification) was 2.6 days on average for the light protocol (median 2.5 days) and 3.2 days for the standard protocol (median 2.7 days). The median time spent to collect data for 100 patients varied from 0.7 days in Sweden to 3.9 days in UK-Scotland. The median number of days spent for data collection in all wards was 5 days by hospital (IQR 2–8 days). The median time frame from the start of the PPS until the end of the PPS (including weekends) by hospital was 9 days (IQR 2–17 days) with a mean of 12.2 days.

Hospital and patient characteristics

Hospital type and size

The mean size of hospitals (total number of beds) included in the PPS was 390 beds (Table 2), slightly higher than the European average of 338 beds (as can be deduced from Table 1). The median size of hospitals included in the PPS was 300 beds and varied from 132 beds in Norway to 694 in Estonia. The mean number of acute care beds in included hospitals was 358 beds (median 272 beds) and the mean number of ICU beds was 19 (median 10 beds). Almost half (45.8%) of the hospitals reported to have excluded at least one ward from the PPS, most of them in accordance with the exclusion criteria of the protocol (long-term care wards, accident and emergency wards, day-case centres and non-acute psychiatric wards).

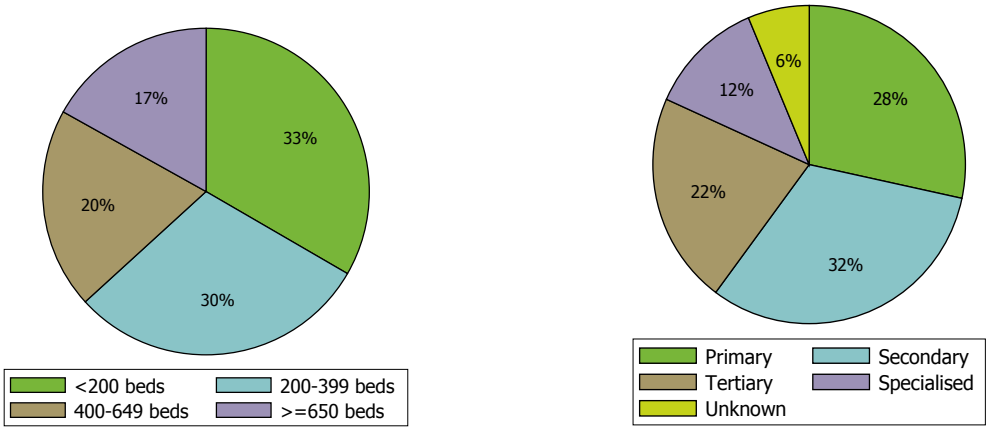
Of all hospitals included, 28.4% of the total were primary hospitals, 31.8% were secondary hospitals, 21.5% were tertiary hospitals and 11.9% were specialised hospitals. The hospital type was not reported for 6.3% of hospitals. Among the 113 specialised hospitals there were 14 surgical or orthopaedic hospitals, 14 paediatric, 12 obstetric hospitals, 11 cardiopulmonary (including cardiovascular surgery), 10 psychiatric hospitals, 7 oncology hospitals, 7 infectious disease hospitals, 17 other (14 'Private/independent', two mixed, one geriatric hospital) and 9 hospitals for which the specialisation was not specified. Thirteen hospitals were reported as primary, secondary or tertiary even though a specialisation was given (e.g. three paediatric hospitals).

Table 2. Type and size of hospitals included in the ECDC PPS 2011–2012

	N of hospitals	% of total	Hospital size (number of beds)					
			Mean	P10	P25	P50	P75	P90
Primary	269	28.4	233	60	103	175	312	450
Secondary	301	31.8	412	150	237	350	510	697
Tertiary	204	21.5	698	260	410	643	927	1225
Specialised	113	11.9	213	30	99	167	253	410
Unknown	60	6.3	279	59	91	163	348	595
Total	**947**	**100.0**	**390**	**89**	**152**	**300**	**522**	**835**

N=number; P=percentile.

Figure 10. Hospital size (number of hospital beds, left) and type of hospital (right) in 947 hospitals included in the ECDC PPS 2011–2012



Length of stay

The average length of stay (LOS) in the participating hospitals, based on the hospital statistics collected at hospital level (number of discharges and patient-days in the most recent year), was 5.1 days (hospital median 5.8 days, country mean 5.7 days, country median 5.8 days) and varied from 2.5 days in Norway to 7.8 days in Iceland. The median occupancy rate in participating hospitals in the most recent year (year preceding the PPS for 65% of hospitals) was 71.9%.

At national level, the average LOS in 27 countries that provided national denominator data for the number of discharges and patient-days in acute care hospitals was 6.4 days (country median 6.4 days) when all beds were included. Considering national denominator data for acute care beds only (provided by 18 countries), the average LOS was 5.3 days (country median 5.3 days). The average LOS in hospitals participating in the PPS correlated well

with the overall national mean LOS (Pearson correlation coefficient rho 0.69, p<0.001) and even better with the national LOS for acute care beds only (rho 0.89, p<0.001) (Figure 11).

In patient-based data (standard protocol, n=30 countries), the mean LOS from admission until the survey date was (surprisingly) 11.2 days, about twice as long as the average LOS reported by these hospitals. The median LOS from admission until the survey date was 6 days or 5.5 days if the median of hospital medians by country was considered. The mean LOS until the survey day was not significantly correlated with the LOS at the hospital level, but the median LOS until the survey day was, except for UK-England, UK-Scotland and UK-Wales (Figure 12). The correlation coefficient between the hospital LOS and the median LOS until survey day was 0.16 (NS) with UK-England and UK-Wales included, but 0.48 (p<0.05) when these three observations were excluded.

Figure 11. Correlation between the mean length of stay (in days) in participating hospitals (hospital data) and the mean length of stay for all hospitals in the country (national data), including all beds (left, n=27 countries) and acute care beds only (right, n=18 countries)

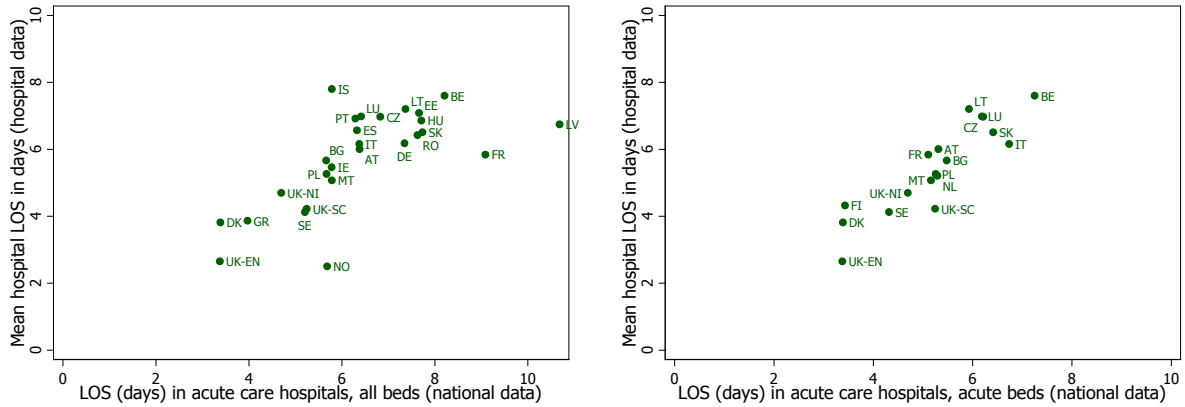
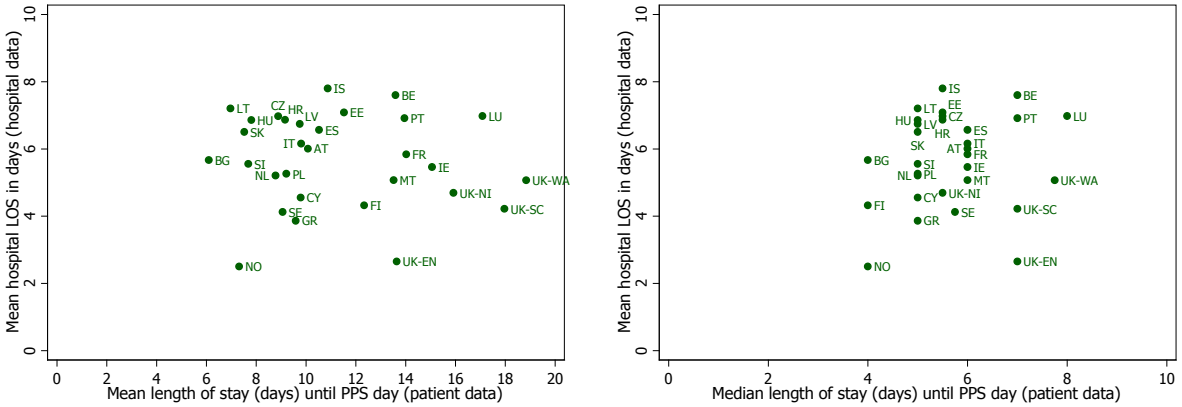


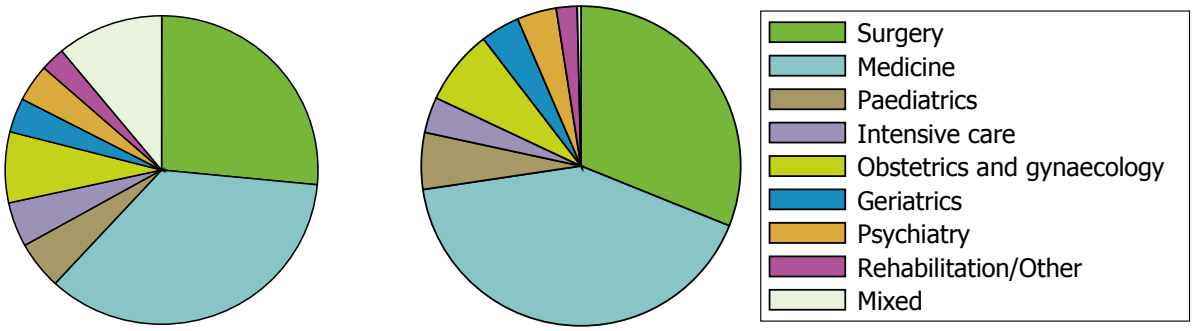
Figure 12. Correlation between the mean length of stay (in days) in participating hospitals (hospital data) and the mean (left) and median (right) length of stay from date of admission until the survey date (patient data, n=30 countries with patient-based data)



Ward and patient/consultant specialty

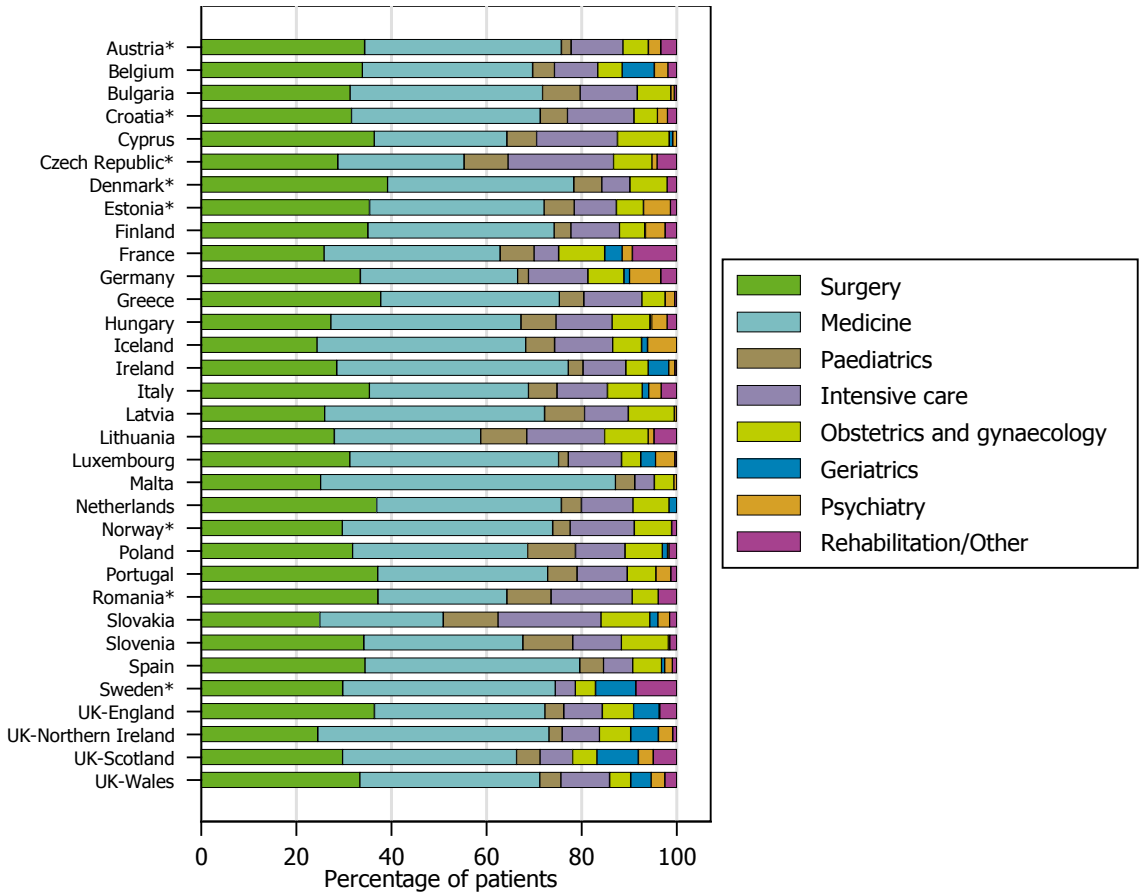
Medical specialties such as general medicine, cardiology or neurology were the most common and accounted for 35.4% of the ward specialties and 42.6% of the specialties of the main disease of the patient or of the consultant in charge of the patient (Figure 13). Surgical specialties were the second most common category of ward specialties and patient/consultant specialties with 26.5% and 31.1%, respectively. Overall, the patient/consultant specialty corresponded to the ward specialty for only 83.1% of the patients. The main reason for this was that 11.7% of patients with a medical specialty and 13.7% of the patients with a surgical specialty were admitted to 'mixed' wards. Similarly, of 10 803 patients admitted to ICU, 3170 patients (29.3%) were reported with a non-ICU patient/consultant specialty. Of those, cardiology accounted for 16.9%, general medicine 11.2%, neonatology 10.3%, general surgery 9.3%, cardiac surgery 5.5%, paediatrics 5%, and a variety of more than 30 other specialties accounted for the remaining 41.8%. For these patients, patient/consultant specialties were recoded to the intensive care ward specialty for further analysis because of the higher risk of HAI and antimicrobial use associated with the stay in the ICU. After recoding, intensive care specialties represented 5.0% of the total patient/consultant specialties.

Figure 13. Comparison of ward (left) versus patient/consultant (right) specialty, ECDC PPS 2011–2012



The distribution of patient/consultant specialties varied greatly between countries (Figure 14). The percentage of surgical specialties varied from 19.7% in Iceland to 44.2% in Romania (median 32.4%, mean 31.4%), medical specialties from 25.0% in Romania to 50.8% in Lithuania (median 41.5%, mean 41.3%), paediatric specialties from 0.0% in Sweden to 14.4% in Romania (median 5.4%, mean 5.6%), intensive care specialties from 1.3% in Sweden to 10.3% in Cyprus (median 5.2%, mean 5.2%), obstetrics and gynaecology from 2.8% in Sweden to 13.4% in Cyprus (median 7.6%, mean 7.4%), geriatrics from 0% in 14 countries to 14.9% in Belgium and 16.1% in UK-Scotland (median 0.3%, mean 2.9%), psychiatry from 0% in 5 countries to 14.7% in Iceland and 15.1% in Estonia and rehabilitation or other specialties from 0% in 5 countries to 15.3% in France (median 1.3%, mean 2.1%). The detailed distribution of patient/consultant specialties by country is given in Annex 1 (Table A1.2).

Figure 14. Distribution of patient/consultant specialty by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Patient demographics and risk factors (patient-based data only)

Patient-based (standard protocol) data were submitted by 30 countries for a total of 215 537 patients from 881 hospitals. The distribution of the patient demographics and risk factors is given in Table 3. Details by country are given in Annex 1 (Table A1.1).

The median age in the patients surveyed was 64 years. This varied according to country from 52 years in Latvia to 71 years in UK-Wales. Overall, 11.2% surveyed were under 18 years old, 39.9% were aged between 18 and 64 years and 48.9% were aged 65 years or older (38.1% 65–84 years and 10.8% aged 85 years or more).

The average male-to-female ratio was 0.89:1 with the highest proportion of female patients in Hungary (M:F ratio 0.76:1) and UK-Scotland (0.77:1) and the highest proportion of male patients in Greece (1.19:1) and Spain (1.13:1).

Twenty-seven percent of the patients had undergone surgery since their admission to the hospital (lowest in UK-Northern Ireland (16.8%) and highest in the Netherlands (33.7%)).

Overall, 5.2% of patients surveyed were classified as having diagnoses that were rapidly fatal (within one year), 16.1% as ultimately fatal and 66.3% as non-fatal diagnoses. The percentage of patients with an expected rapidly fatal outcome varied from 0.7% in Latvia to 9.3% in France. Twelve percent of patients were not classified into a category and this varied between 0.5% (Slovenia and Spain) and 99.7% (Norway).

A peripheral vascular catheter was present in 46.7% of patients, varying between 30.6% in France and 70.6% in Greece. Urinary catheters were present in 17.2% of patients varying between 6.4% in Lithuania and 30.7% in Greece. Central vascular catheters were present in 7.5% of patients, varying from 3.0% in Bulgaria to 13.6% in Belgium. Only 2.3% of patients were intubated at the time of the survey and this varied from 0.5% in Sweden and 1.3% in France and Latvia to 4.0% in Portugal and 4.5% in Greece.

Table 3. Distribution of the patient demographics, patient-based data, ECDC PPS 2011–2012

	N of patients	Median age (yrs)	Age category						Sex ratio M:F	Median length of stay until day of PPS (days)
			% < 1 month	% 1–11 months	% 1–17 years	% 18–64 years	% 65–84 years	% 85+ years		
Europe	215 537	64	3.5	2.4	5.3	39.9	38.1	10.8	0.89:1	6
Country P25	2 492	60	2.5	1.1	3.8	39.0	35.6	6.3	0.84:1	5
Country P50	7 651	63	3.7	1.9	5.0	40.4	38.2	9.9	0.89:1	6
Country P75	9 702	66	4.6	3.2	6.8	43.4	40.5	11.9	0.95:1	7

P: percentile.

Table 4. Distribution of the patient risk factors, patient-based data, ECDC PPS 2011–2012

	N of patients	% Surgery since admission	McCabe score				Invasive device use			
			% Non-fatal	% Ultimately fatal	% Rapidly fatal	% Missing	% CVC	% PVC	% Urinary catheter	% Intubation
Europe	215 537	26.9	66.3	16.1	5.2	12.3	7.5	46.7	17.2	2.3
Country P25	2 492	24.5	62.7	10.4	3.2	2.8	5.0	39.8	12.6	1.7
Country P50	7 651	27.1	69.6	16.6	4.4	5.5	6.7	45.8	16.2	2.1
Country P75	9 702	30.2	76.1	20.6	5.8	13.8	9.5	54.3	19.5	2.8

CVC: central vascular catheter; PVC: peripheral vascular catheter; P: percentile; see Annex 1 (Table A1.1) for data by country.

Hospital indicators

Alcohol hand rub consumption

Alcohol hand rub consumption data were provided by 820 hospitals from 31 countries. Data from 15 hospitals were discarded as outliers, leaving 805 (88.2%) hospitals for analysis. The median hand rub consumption was 18.7 litres per 1000 patient-days and was significantly lower in primary hospitals than in tertiary hospitals (p<0.001, Table 5). The consumption was also lower in 184 (22.9%) hospitals that provided hand rub data only for wards that were included in the PPS. The median consumption in these hospitals was 16.8 L/1000 patient-days compared with 19.3 L/1000 patient-days for the 621 hospitals that provided total hospital data (p<0.001, adjusted for hospital type and country).

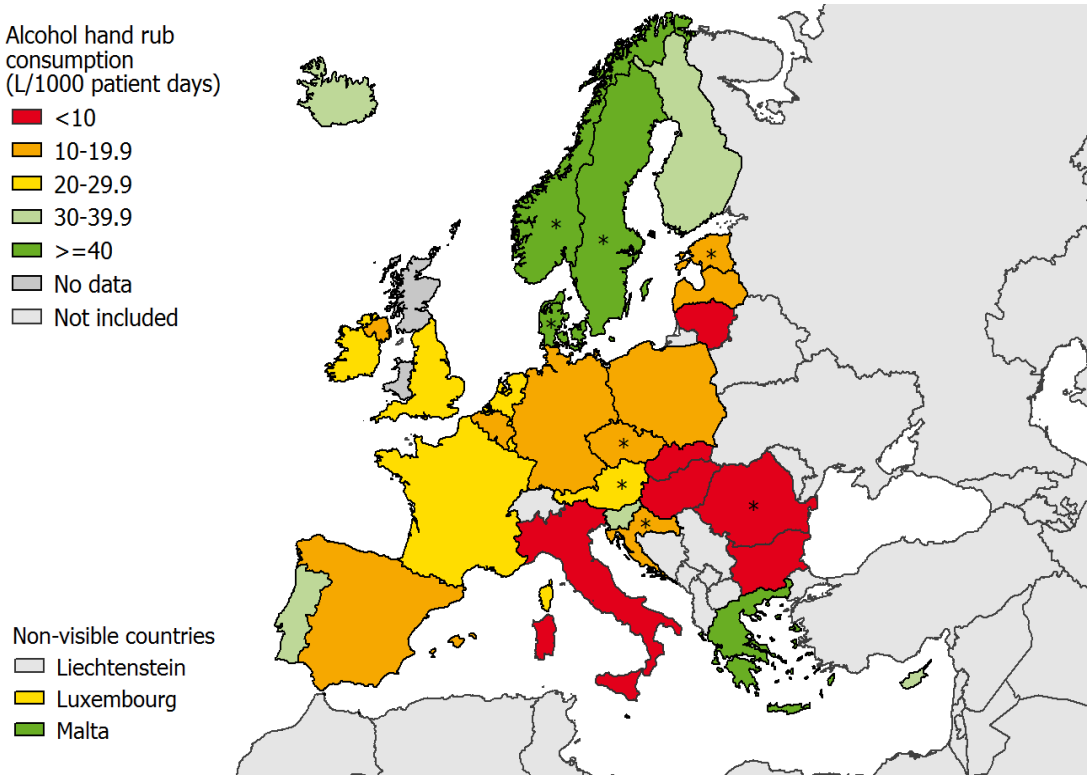
Table 5. Alcohol hand rub consumption (litres per 1000 patient-days) by hospital type, ECDC PPS 2011–2012 (data for the preceding year, 2010 or 2011)

Hospital type	N of hospitals	Mean	P10	P25	P50	P75	P90
Primary	237	20.3	3.2	8.6	15.6	25.7	39.2
Secondary	247	23.5	4.0	8.2	16.8	28.8	52.0
Tertiary	177	27.2	6.8	13.1	21.0	35.3	55.1
Specialised	85	25.2	4.6	11.5	20.6	34.2	44.6
Unknown	59	28.0	11.9	18.4	25.2	32.6	48.7
Europe	**805**	**23.9**	**4.7**	**10.3**	**18.7**	**30.6**	**49.9**

P: percentile.

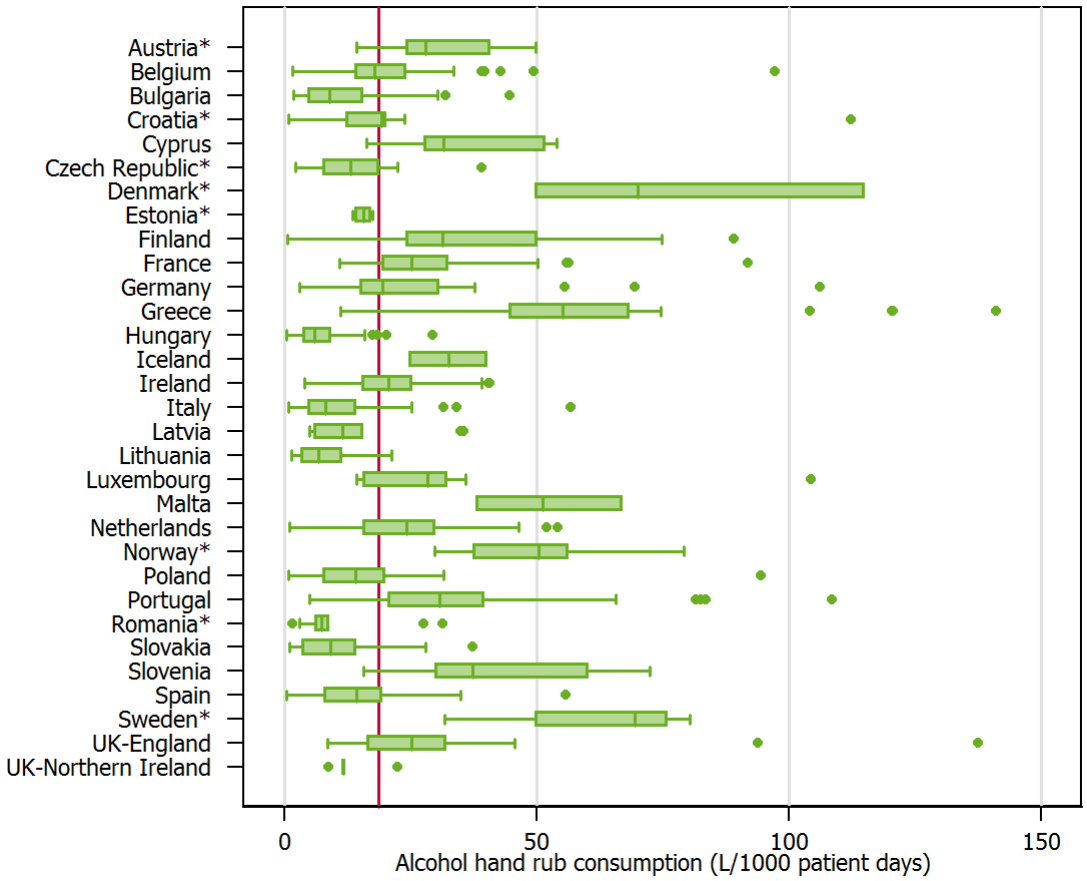
The median hospital alcohol hand rub consumption varied greatly between countries, from less than 10 L/1000 patient-days in Bulgaria, Hungary, Lithuania, Italy, Romania and Slovakia to more than 50 L/1000 patient-days in Denmark, Greece, Norway, Malta and Sweden (Figures 15, 16).

Figure 15. Median alcohol hand rub consumption (litres per 1000 patient-days), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Figure 16. Distribution of the consumption of alcohol hand rub (litres per 1000 patient-days) by country, ECDC PPS 2011–2012

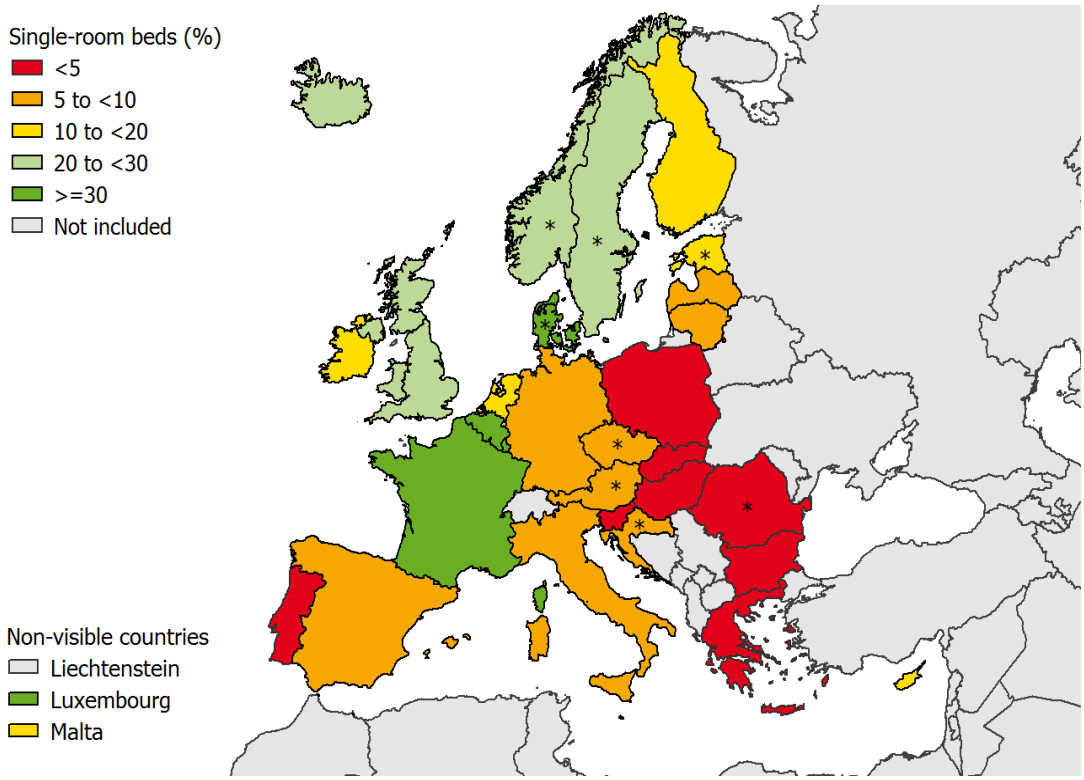


**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. Red vertical line=median (18.7 litres/1000 patient-days).*

Single rooms/beds

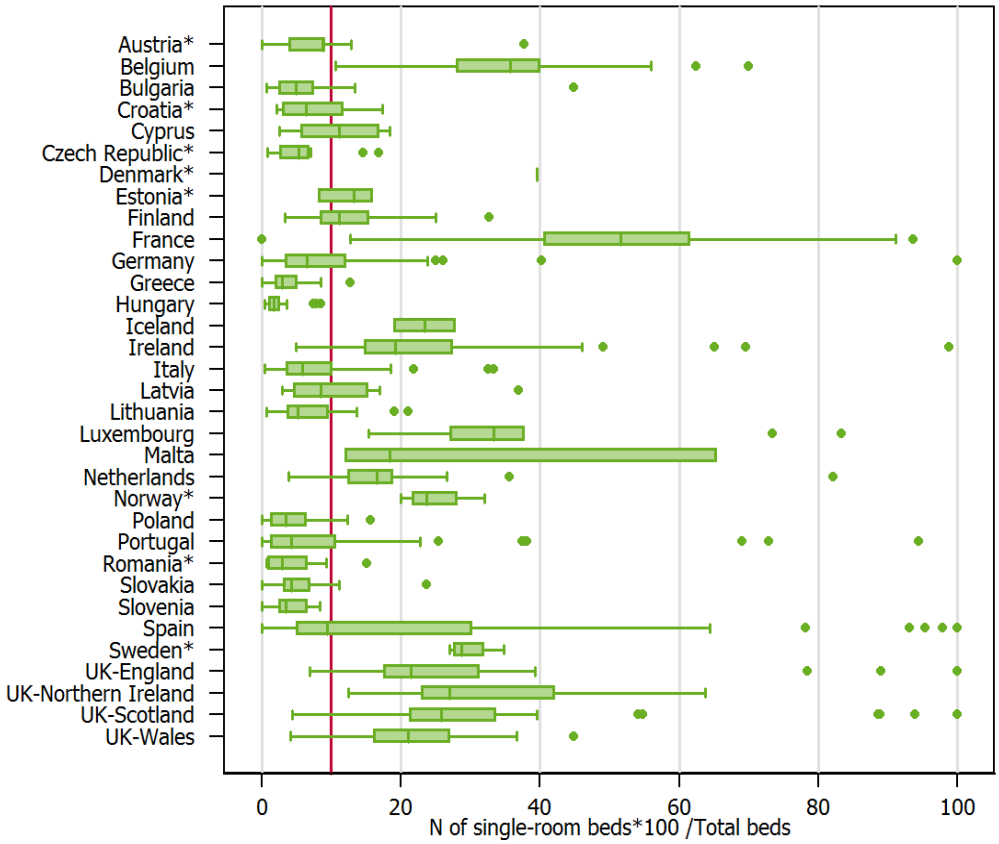
The number of single rooms was provided by 928 hospitals from all 33 countries. Data from 35 hospitals were discarded as outliers, leaving 893 (94.3%) hospitals for analysis. The country median percentage of single-bed rooms (as a percentage of the total number of rooms) was 24.2% (25th percentile 11.1%, 75th percentile 50.0%) and the country median percentage of single-room beds (as a percentage of the total number of beds) was 11.1% (25th percentile 5.2%, 75th percentile 23.4%). The median percentage of single-room beds was less than 5% in Bulgaria, Greece, Hungary, Poland, Portugal, Romania, Slovakia and Slovenia, but more than 50% in France (Figures 17, 18). The overall hospital median was 25.6% of single-bed rooms and 9.9% of single-room beds, with a median room size of 2.4 beds per room (25th percentile 1.9 beds, 75th percentile 3.1 beds).

Figure 17. Median percentage of single-room beds among the total number of hospital beds, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia and Romania and very poor in Denmark and Sweden.*

Figure 18. Distribution of the percentage of single-room beds by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia and Romania and very poor in Denmark and Sweden. Red vertical line=median (9.9%).*

The percentage of single-room beds was significantly higher in specialised hospitals and in hospitals of unknown type (p<0.001, Table 6). It did not depend significantly on whether data were reported for rooms from wards that were included in the PPS only (n=352 hospitals, median 8.3%) or for the total hospital (n=507 hospitals, median 10.7%).

Table 6. Percentage of single-room beds among the total number of hospital beds by hospital type, ECDC PPS 2011–2012

Hospital type	N of hospitals	Mean of means	P10	P25	P50	P75	P90
Primary	259	14.2	1.5	3.8	9.1	18.4	30.4
Secondary	281	13.9	1.8	3.4	8.8	21.5	32.1
Tertiary	190	13.6	2.1	3.9	8.4	19.0	30.5
Specialised	108	24.5	1.0	4.0	15.4	33.9	69.5
Unknown	55	52.7	22.6	39.3	51.6	69.5	83.3
Total	**893**	**17.6**	**1.8**	**3.9**	**9.9**	**23.5**	**40.7**

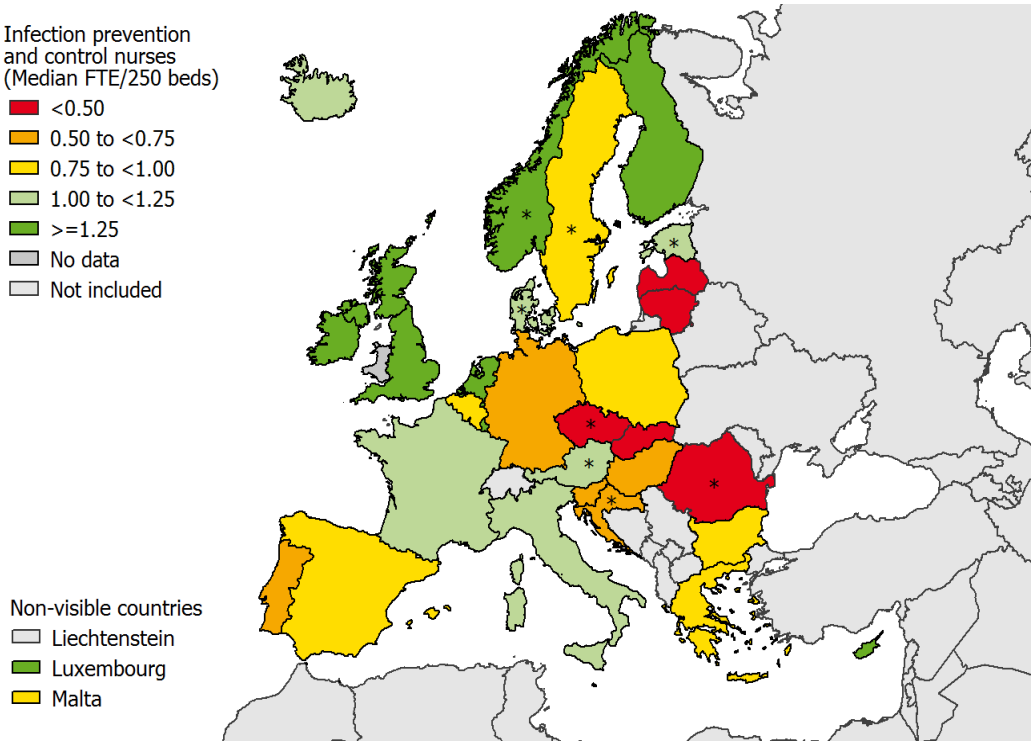
P: percentile.

Infection control staff

Infection prevention and control nurses

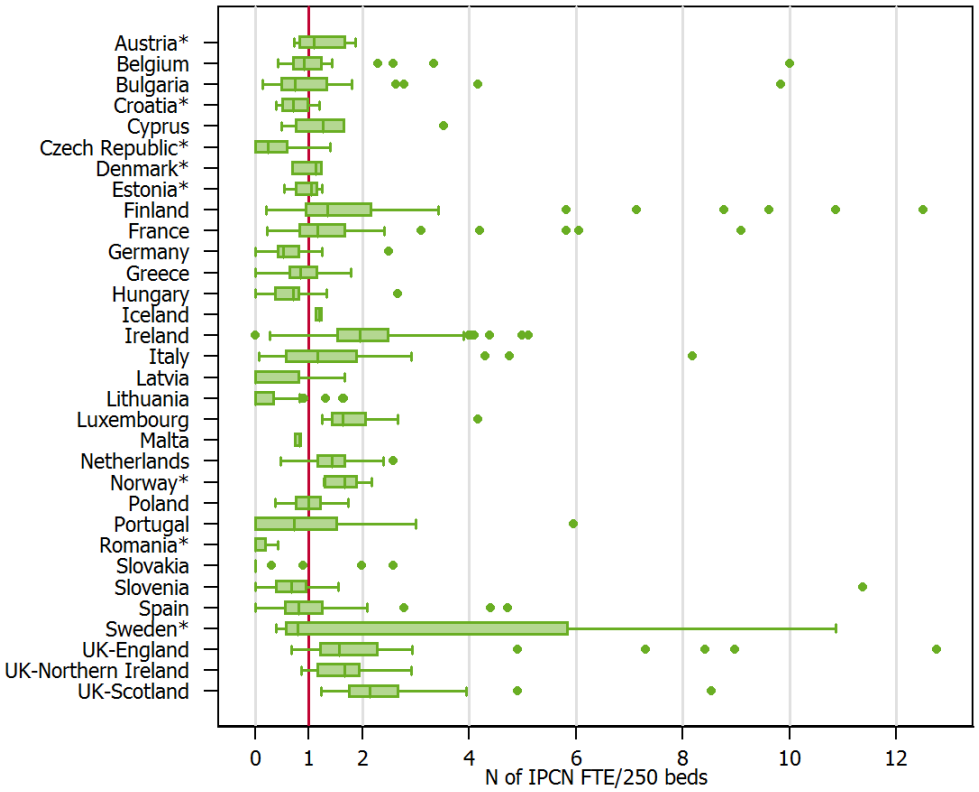
The number of infection prevention and control nurses (IPCN) fulltime equivalents (FTE) was provided by 879 hospitals from 32 countries. Data from 13 hospitals were discarded as outliers, leaving 866 (91.4%) hospitals for analysis. In 20 countries, 100% of the hospitals had at least a part-time IPCN in place. In 118 (13.6%) hospitals from 12 countries no IPCNs were reported, varying from less than 20% of hospitals without IPCN in Germany, Greece, Hungary and Slovenia to 89.7% of hospitals without IPCN in Slovakia. Using the SENIC literature standard [42] of one infection control nurse per 250 beds as reference (green vertical line in Figure 19 below), the median number of IPCN FTE per 250 beds was 1.00 (IQR 0.54–1.66) and ranged from 0.0 in Latvia, Lithuania, Romania and Slovakia to 2.14 FTE per 250 beds in UK-Scotland (Figures 19, 20).

Figure 19. Median number of infection prevention and control nurse full-time equivalents (FTE) per 250 hospital beds (n=866 hospitals), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia and Romania and very poor in Denmark and Sweden.*

Figure 20. Number of infection prevention and control nurse (IPCN) full-time equivalents (FTE) per 250 hospital beds by country (n=866 hospitals), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia and Romania and very poor in Denmark and Sweden. Red vertical line=median (1.00 IPCN FTE/250 beds).*

The number of IPCN FTE per 250 beds decreased significantly with increasing hospital size (p<0.001, Table 7) and was significantly higher in hospitals of unknown type, also after adjustment for hospital size (p<0.05, Table 8).

Table 7. Distribution of the number of infection prevention and control nurse FTE per 250 hospital beds by hospital size, ECDC PPS 2011–2012

N of beds	N of hospitals	Mean	P10	P25	P50	P75	P90
<200	287	1.77	0.00	0.50	1.39	2.23	3.52
200-399	264	1.10	0.00	0.67	0.96	1.41	2.07
400-649	167	1.00	0.00	0.52	0.87	1.30	1.82
≥650	148	1.12	0.25	0.46	0.76	1.32	1.75
Total	**866**	**1.31**	**0.00**	**0.54**	**1.00**	**1.66**	**2.49**

Note: 60 hospitals expressed the number of FTE for included wards only, which explains the slightly different number of hospitals by hospital size category from those in Table 2. P: percentile.

Table 8. Distribution of the number of infection prevention and control nurse FTE per 250 hospital beds by hospital type, ECDC PPS 2011–2012

Hospital type	N of hospitals	Mean of means	P10	P25	P50	P75	P90
Primary	249	1.39	0.00	0.31	1.04	1.75	2.92
Secondary	269	1.22	0.00	0.66	1.00	1.69	2.24
Tertiary	193	1.12	0.16	0.50	0.81	1.34	1.77
Specialised	95	1.57	0.00	0.64	1.24	1.96	3.01
Unknown	60	1.61	0.48	0.83	1.21	1.70	2.80
Total	**866**	**1.31**	**0.00**	**0.54**	**1.00**	**1.66**	**2.49**

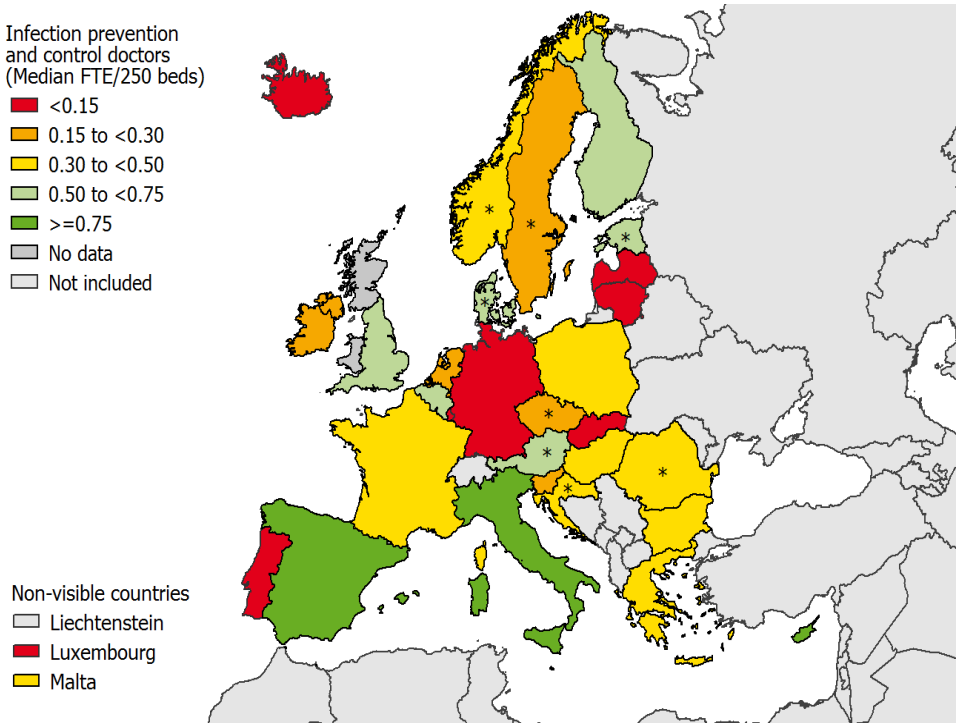
P: percentile.

Infection prevention and control doctors

The number of infection prevention and control doctors (IPCD) FTE was provided by 794 hospitals from 31 countries. Data from 15 hospitals were discarded as outliers, leaving 779 (82.3%) hospitals for analysis. Of those, 207 (26.6%) hospitals from 19 countries reported to have no IPCD, varying from less than 25% of hospitals in Austria, France, Hungary, the Netherlands, Norway, Slovenia and Spain to more than 75% of hospitals without IPCD in Luxembourg, Portugal and Slovakia.

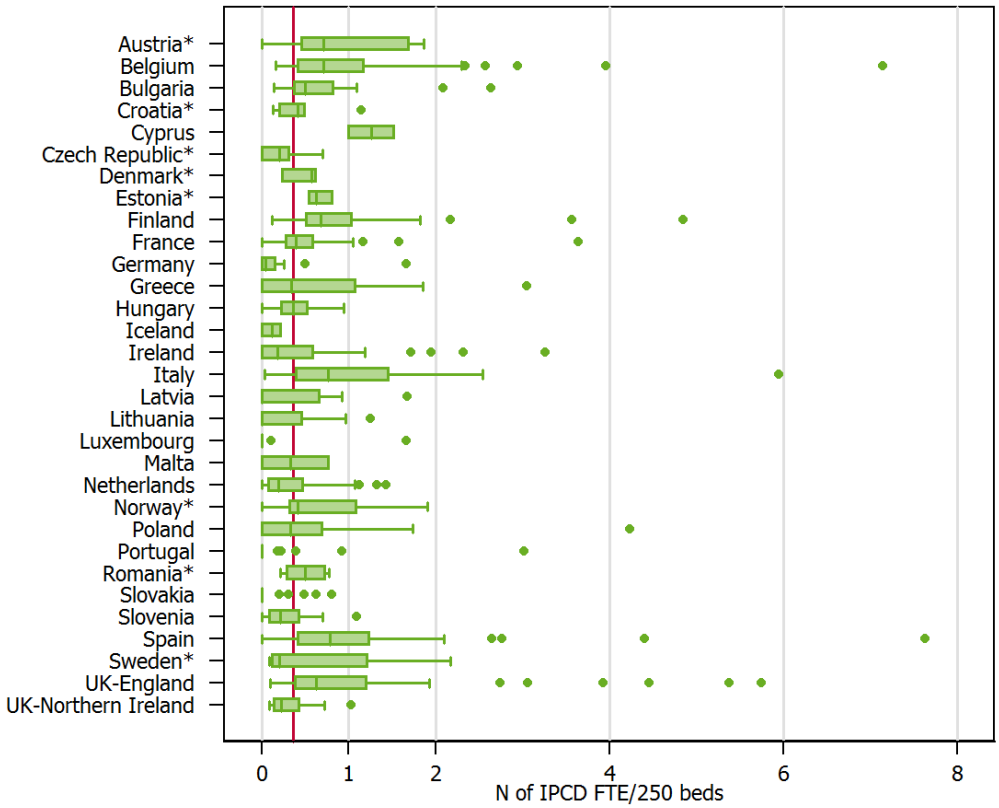
The median number of IPCD FTE per 250 beds was 0.36 (IQR 0–0.72) and ranged from 0 in Latvia, Lithuania, Luxembourg, Portugal and Slovakia to 1.26 FTE/250 beds in Cyprus (Figures 21, 22).

Figure 21. Median number of infection prevention and control doctor full-time equivalents (FTE) per 250 hospital beds (n=779 hospitals), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia and Romania and very poor in Denmark and Sweden.Red vertical line=median (1.00 IPCN FTE/250 beds).*

Figure 22. Number of infection prevention and control doctor (IPCD) full-time equivalents (FTE) per 250 hospital beds, by country (n=779 hospitals), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia and Romania and very poor in Denmark and Sweden. Red vertical line=median (1.00 IPCN FTE/250 beds). Red vertical line=median (0.36 IPCD FTE/250 beds).*

The median number of FTE IPCD per 250 beds was significantly higher in secondary hospitals ($p<0.05$), although this did not remain statistically significant after adjustment for hospital size and country (Table 9). There was also no significant correlation with hospital size (Table 10).

Table 9. Distribution of the number of infection prevention and control doctor FTE per 250 hospital beds by hospital type, ECDC PPS 2011–2012

Hospital type	N of hospitals	Mean of means	P10	P25	P50	P75	P90
Primary	214	0.51	0.00	0.00	0.25	0.70	1.46
Secondary	243	0.61	0.00	0.00	0.42	0.78	1.27
Tertiary	177	0.55	0.00	0.10	0.32	0.70	1.36
Specialised	86	0.60	0.00	0.00	0.33	0.80	1.45
Unknown	59	0.53	0.16	0.28	0.40	0.61	1.04
Total	**779**	**0.56**	**0.00**	**0.00**	**0.36**	**0.72**	**1.32**

P: percentile.

Table 10. Distribution of the number of infection prevention and control doctor FTE per 250 hospital beds by hospital size, ECDC PPS 2011–2012

N of beds	N of hospitals	Mean of means	P10	P25	P50	P75	P90
<200	245	0.65	0.00	0.00	0.30	0.79	1.71
200-399	246	0.56	0.00	0.00	0.41	0.83	1.16
400-649	152	0.50	0.00	0.09	0.43	0.59	1.04
≥650	136	0.49	0.03	0.17	0.28	0.55	0.99
Total	**779**	**0.56**	**0.00**	**0.00**	**0.36**	**0.72**	**1.32**

P: percentile.

Healthcare-associated infections

Main results, aggregated

Prevalence and type of infection

Out of the total of 231 459 patients in the database, 13 829 patients (6.0%; 95% confidence interval 5.7–6.3%) were reported to have at least one HAI. Of those, 12 760 (92.3%) patients had one HAI, 966 (7.0%) had two HAIs and 103 (0.7%) had three or more HAIs on the day of the survey. A total of 15 000 HAIs (1.1 HAI per infected patient) were reported. Ninety-five percent of patients with an HAI were receiving at least one antimicrobial on the day of the survey.

The most frequently reported HAI types were pneumonia and lower respiratory tract infections (19.4% and 4.1% respectively), surgical site infections (19.6%), urinary tract infections (19.0%), bloodstream infections (10.6%) and gastro-intestinal infections (7.6%), with *C. difficile* infections accounting for 48% of the latter or 3.6% of all HAIs. Systemic infections (n=934 HAIs or 6.2% of total) included clinical sepsis in neonates (n=155) and in other patients (n=654). Skin and soft tissue infections represented 4.0% of the total. Of these, 38.2% were skin infections, 32.4% soft tissue infections (necrotising fascitis, infectious gangrene, necrotising cellulitis, infectious myositis, lymphadenitis, or lymphangitis), 20.2% decubitus ulcers and 3.8% burn infections. The remaining HAI types made up 9.6% of HAI cases and included 454 eye, ear, nose or mouth infections (3.0%, of which 268 infections of the oral cavity), 245 bone and joint infections (1.6%, of which osteomyelitis 43.7%, joint or bursa infections 44.5%, disc space infections 7.4% and unspecified bone/joint infections 4.5%), 233 microbiologically confirmed catheter-related infections without positive blood culture (1.6%), 204 cardiovascular system infections (1.4%, including 129 arterial or venous infections), 97 central nervous system infections (0.7%, with 65 meningitis cases) and 87 reproductive tract infections (0.6%). The detailed distribution of HAI types is given by country in Annex 1 (Table A1.3).

Table 11. Prevalence of HAI by HAI type and relative frequency of HAI types, ECDC PPS 2011–2012

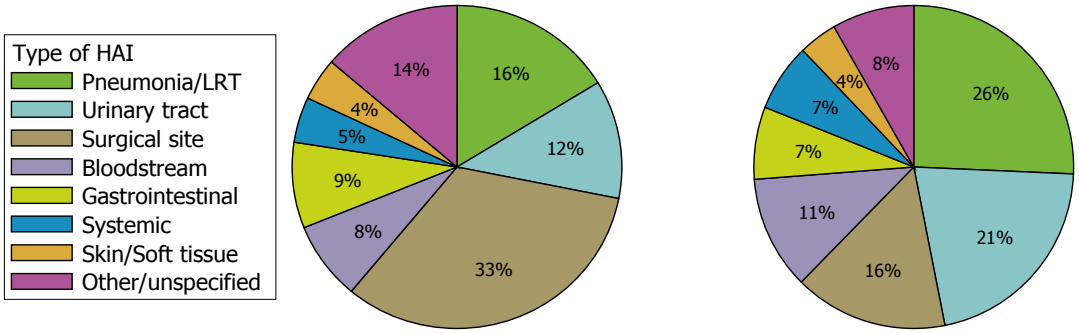
	N of patients with HAI	HAI%	N of HAIs	Rel%
All HAI types	**13829**	**6.0**	**15000**	**100**
Pneumonia	2902	1.3	2907	19.4
Other lower respiratory tract infections	607	0.3	609	4.1
Surgical site infections	2933	1.3	2941	19.6
Urinary tract infections	2848	1.2	2848	19.0
Bloodstream infections	1576	0.7	1585	10.6
Catheter-related infections without bloodstream infection	233	0.1	233	1.6
Cardiovascular system infections	203	0.1	204	1.4
Gastro-intestinal system infections[(a)]	1130	0.5	1134	7.6
Skin and soft tissue infections	598	0.3	599	4.0
Bone and joint infections	243	0.1	245	1.6
Central nervous system infections	97	0.0	97	0.6
Eye, ear, nose or mouth infection	454	0.2	454	3.0
Reproductive tract infections	87	0.0	87	0.6
Systemic infections[(b)]	933	0.4	934	6.2
Other/unknown	123	0.1	123	0.8

(a) including Clostridium difficile *infections 3.6%.*
(b) including clinical sepsis 5.4%.

Characteristics: origin, time to infection onset, association to device use

Twenty-three percent of HAIs (n=3503) were present on admission. Of those, 54.7% were associated with a previous stay in the same hospital (Table 12). One third of HAIs on admission were surgical site infections (Figure 23). The higher percentage of other or unspecified HAI types in HAIs present on admission (13.7%) is mainly due to the fact that in the Netherlands the HAI type on admission was only specified for surgical site infections, not for other HAIs at admission (see methods).

Figure 23. Distribution of HAI types by presence of HAI on admission (left) and HAI onset during hospitalisation (right), ECDC PPS 2011–2012



LRT: Lower respiratory tract.

A total of 11 322 HAIs (75.5%) started during the current hospital stay, 97.0% of which were attributed to the current hospital stay. For 175 HAIs (1.2%) the presence on admission was unknown. Of those, 97 (55.4%) were attributed to the same hospital, 36 (20.6%) to another acute care hospital and for 42 (24.0%) the origin was unknown. The 11 322 HAIs starting during the current hospital stay occurred in 10 341 patients, yielding an overall prevalence of 4.5%. The median duration of hospital stay until onset of the HAI was 12 days (mean 21.8 days). From the patient-based data, the median length of stay of patients with an HAI was 11 days until onset of infection and 16 days until the time of the survey. The median length of stay until survey date in patients without HAI was five days.

The presence of relevant invasive devices in the days preceding the HAI onset was recorded for pneumonia (presence of intubation in the 48 hours before onset), urinary tract infections (presence of a urinary catheter in the seven days before onset) and bloodstream infections (presence of a vascular catheter in the 48 hours before onset). Healthcare-associated pneumonia were device-associated in 33% of the cases and urinary tract infections in 59.5%. Bloodstream infections were reported as catheter-related in 39.5% and secondary to another infection site in 28.8%. For 31.7% of the bloodstream infections, the origin was unknown, either after clinical ascertainment of possible sources of the infection (19.6%), or because data were missing (12.2%).

Table 12. Characteristics of HAIs: origin of HAIs, association with invasive device use, origin of bloodstream infections, ECDC PPS 2011–2012

	Number of HAIs	Percentage
Total number of HAIs	**15000**	**100.0**
Origin of HAI		
HAIs present on admission	3503	23.4
Origin:		
Same hospital	1917	54.7
Other hospital	1088	31.1
Other origin/unknown	498	14.2
HAIs with onset during current hospitalisation	11322	75.5
Origin:		
Same hospital	10985	97.0
Other hospital	116	1.0
Other origin/unknown	221	2.0
Day of HAI onset[(a)]		
Day 1–2	407	3.6
Day 3–4	1328	11.7

	Number of HAIs	Percentage
Day 5–7	1947	17.2
Day 8–14	2901	25.6
Day 15–21	1453	12.8
> Day 21	3132	27.7
Missing date of HAI onset	154	1.4
HAI presence at admission unknown	175	1.2
Device-associated HAIs		
Pneumonia, total[b]	2907	100.0
Intubation within 48h before onset	966	33.2
No intubation	1733	59.6
Presence of intubation unknown	208	7.2
Urinary tract infections, total	2848	100.0
Urinary catheter within 7d before onset	1694	59.5
No urinary catheter	1026	36.0
Presence of urinary catheter unknown	128	4.5
Bloodstream infections, primary[c]	1129	100.0
Vascular catheter within 48h before onset	647	57.3
No vascular catheter	213	18.9
Presence of vascular catheter unknown	269	23.8
Origin of bloodstream infections (BSI)[d]		
Total BSI	1585	100.0
Catheter-related (C) BSI[e]	626	39.5
C-CVC	527	33.2
Of which CRI3-CVC	345	65.5
C-PVC	99	6.2
Of which CRI3-PVC	52	52.5
Secondary (S) BSI[f]	456	28.8
S-Pulmonary infection	65	4.1
S-Urinary tract infection	127	8.0
S-Surgical site infection	79	5.0
S-Digestive tract infection	78	4.9
S-Skin/soft tissue infection	35	2.2
S-Other infection sites	72	4.5
BSI of unknown origin & missing	503	31.7
BSI of unknown origin[g]	310	19.6
Missing BSI origin	193	12.2

BSI: bloodstream infection; CVC: central vascular catheter; PVC: peripheral vascular catheter; CRI: catheter-related infection (with positive catheter tip microbiological results, see case definitions); CRI3: CRI with positive blood culture.
(a) HAIs with onset during current hospitalisation only.
(b) includes pneumonia subcategories PN1-PN5, PN-Nos and pneumonia in neonates (NEO-PNEU).
(c) Primary BSI = catheter-related BSI (including CRI3) and BSI of unknown origin.
(d) Including CRI3.
(e) C=catheter-related: clinical and/or microbiological (CRI3) evidence of relationship to central (C-CVC) or peripheral (C-PVC) vascular catheter.
(f) BSI secondary to another infection site.
(g) BSI origin was verified and confirmed to be unknown.

Microorganisms isolated from HAIs

For 54.1% of HAIs a microorganism was reported, ranging from 38.5% in pneumonia and lower respiratory tract infections to 94.7% in bloodstream infections. The microorganisms most frequently isolated from HAIs were, in decreasing order, *E. coli* (15.9%), *S. aureus* (12.3%), *Enterococcus* spp. (9.6%), *P. aeruginosa* (8.9%) *Klebsiella* spp. (8.7%), Coagulase-negative staphylococci (7.5%), *Candida* spp. (6.1%), *C. difficile* (5.4%), *Enterobacter* spp. (4.2%), *Proteus* spp. (3.8%) and *Acinetobacter* spp. (3.6%). Other less common microorganisms, but important because of their epidemic potential or intrinsic resistance to antimicrobials, were *Serratia* spp., *Stenotrophomonas maltophilia* and *Aspergillus* spp., that accounted for, respectively, 1.1%, 1.0% and 0.4% of all microorganisms.

The predominant families of microorganisms were gram-positive cocci in surgical site infections and bloodstream infections, Enterobacteriaceae in urinary tract infections, non-fermenting gram-negative bacteria (especially *P. aeruginosa* and *A. baumannii*) in respiratory tract infections and anaerobes (especially *C. difficile*) were the most frequently reported family in gastro-intestinal tract infections (Table 13).

Table 13. Microorganisms isolated in healthcare-associated infections by infection type, ECDC PPS 2011–2012

	All HAIs, Number	All HAIs, %	Pneumonia/ Lower respiratory tract	Surgical site infections	Urinary tract infections	Bloodstream infections	Gastro-intestinal tract infections
Number of HAIs, all	15000	100.0	3516	2941	2848	1585	1134
Number of HAIs with microorganisms, all	8114	54.1	38.5	43.7	66.9	94.7	69.0
Number of microorganisms	10076	100.0	1777	2351	2168	1722	889
Gram-positive cocci	3296	32.7	19.8	46.3	16.8	47.4	11.4
Staphylococcus aureus	1243	12.3	12.6	17.9	1.8	15.9	0.8
Coagulase-negative staphylococci	752	7.5	1.7	9.6	1.4	18.5	1.7
Enterococcus spp.	969	9.6	2.2	14.5	12.5	8.2	7.5
Streptococcus spp.	246	2.4	2.7	3.6	0.7	2.8	1.0
Other gram-positive cocci	86	0.9	0.6	0.9	0.4	1.9	0.3
Gram-negative cocci	41	0.4	1.2	0.2	0.1	0.3	0.0
Gram-positive bacilli	78	0.8	0.5	1.2	0.2	1.0	0.9
Enterobacteriaceae	3647	36.2	32.1	32.5	65.1	29.4	13.2
Citrobacter spp.	91	0.9	0.8	1.1	1.4	0.4	0.6
Enterobacter spp.	422	4.2	5.0	5.4	3.9	3.4	2.2
Escherichia coli	1601	15.9	8.8	14.0	36.2	11.0	5.6
Klebsiella spp.	872	8.7	11.4	6.0	12.0	9.8	3.9
Proteus spp.	380	3.8	2.4	3.6	7.9	2.0	0.3
Serratia spp.	115	1.1	2.6	0.7	0.6	1.6	0.3
Other Enterobacteriaceae	166	1.6	1.1	1.8	3.1	1.3	0.1
Non-fermenting gram-negative bacteria	1593	15.8	35.3	12.8	11.1	13.0	4.7
Acinetobacter spp.	366	3.6	8.7	2.9	1.5	4.1	0.3
Pseudomonas aeruginosa	901	8.9	17.4	7.6	8.4	6.1	2.5
Stenotrophomonas maltophilia	100	1.0	3.2	0.6	0.0	1.0	0.6
Pseudomonadaceae family, other	82	0.8	1.4	0.9	0.8	0.5	0.4
Haemophilus spp.	72	0.7	3.5	0.1	0.0	0.1	0.2
Legionella spp.	3	0.0	0.2	0.0	0.0	0.0	0.0
Other non-Enterobacteriaceae	69	0.7	0.9	0.7	0.4	1.1	0.7

	All HAIs, Number	All HAIs, %	Pneumonia/ Lower respiratory tract	Surgical site infections	Urinary tract infections	Bloodstream infections	Gastro-intestinal tract infections
Anaerobic bacilli	658	6.5	0.1	2.5	0.0	1.2	62.3
Bacteroides spp.	46	0.5	0.1	1.1	0.0	0.7	0.3
Clostridium difficile	548	5.4	0.0	0.1	0.0	0.0	61.3
Other anaerobes	64	0.6	0.1	1.2	0.0	0.5	0.7
Other bacteria	23	0.2	0.3	0.3	0.3	0.1	0.0
Fungi	681	6.8	10.5	4.2	6.3	7.5	4.4
Candida spp.	610	6.1	7.8	3.9	6.2	7.4	4.3
Aspergillus spp.	42	0.4	2.0	0.1	0.0	0.0	0.0
Other parasites	29	0.3	0.7	0.2	0.1	0.2	0.1
Virus	59	0.6	0.3	0.0	0.0	0.1	3.1
Negative codes[(a)]	6648	45.0	61.5	41.4	33.1	5.3	31.0
Micro-organism not identified	1473	10.0	13.5	8.5	9.6	1.8	6.8
Examination not done	1629	11.0	18.8	10.9	5.5	0.3	7.4
Sterile examination	524	3.5	3.4	3.2	2.1	0.4	2.3
Not (yet) available/missing	3022	20.5	25.8	18.8	16.0	2.8	14.6

(a) Negative codes: percentage of total number of HAIs.

Selected antimicrobial susceptibility testing (AST) data were available on the day of the survey for 85.0% of microorganisms reported for HAIs. Meticillin resistance was reported in 41.2% of *S. aureus* isolates with known AST results. Vancomycin resistance was reported in 10.2% of isolated enterococci and was 3.5 times higher among *E. faecium* than *E. faecalis*. In motile enterococci (44/969 *Enterococcus* spp.), vancomycin susceptibility data were reported for 20 isolates, four (20%) of which were non-susceptible. Non-susceptibility to third-generation cephalosporins was reported in 33.4% of all Enterobacteriaceae included for the selected antimicrobial resistance markers (Table 14) and was highest among *K. pneumoniae* and lowest for *Proteus* spp. Non-susceptibility to carbapenems was reported for 7.6% of all included Enterobacteriaceae, also highest among *K. pneumoniae,* and in 31.8% of *P. aeruginosa* isolates and 81.2% of *A. baumannii* isolates. However, since resistant clones tend to be epidemic, overall European resistance percentages are strongly influenced by the data of relatively few countries that reported higher numbers of these microorganisms (see below for results by country). For example, in countries with a high percentage of *A. baumannii* isolates non-susceptible to carbapenems, the relative frequency of *Acinetobacter* spp. (of which 86.6% were reported as *A. baumannii*) was also higher.

Table 14. Antimicrobial resistance markers in microorganisms reported in healthcare-associated infections, ECDC PPS 2011–2012

	N of isolates	N with known result	N NS	% NS
Gram-positive cocci				
Staphylococcus aureus (MRSA)	1196	1071	441	41.2
Enterococci, VAN-R (VRE)	929	755	77	10.2
Enterococcus faecalis, VAN-R	538	455	25	5.5
Enterococcus faecium, VAN-R	235	205	39	19.0
Enterobacteriaceae, 3GC-NS	3419	2851	953	33.4
Escherichia coli, 3GC-NS	1535	1292	304	23.5
Klebsiella spp., 3GC-NS	842	726	385	53.0
Klebsiella pneumoniae, 3GC-NS	665	594	337	56.7
Klebsiella oxytoca, 3GC-NS	110	87	24	24.4
Enterobacter spp., 3GC-NS	397	343	139	40.5
Enterobacter aerogenes, 3GC-NS	79	69	38	55.1
Enterobacter cloacae, 3GC-NS	264	233	94	40.3
Citrobacter spp., 3GC-NS	88	69	24	34.8
Proteus spp., 3GC-NS	368	295	68	23.1
Serratia spp., 3GC-NS	111	81	21	25.9
Morganella spp., 3GC-NS	78	45	12	26.7
Enterobacteriaceae, CAR-NS	3356	2787	212	7.6
Escherichia coli, CAR-NS	1510	1267	46	3.6
Klebsiella spp., CAR-NS	842	719	139	19.3
Klebsiella pneumoniae, CAR-NS	665	589	133	22.6
Klebsiella oxytoca, CAR-NS	109	84	0	0
Enterobacter spp., CAR-NS	394	340	12	3.5
Enterobacter aerogenes, CAR-NS	79	69	4	5.8
Enterobacter cloacae, CAR-NS	263	233	7	3.0
Citrobacter spp., CAR-NS	87	68	1	1.5
Proteus spp., CAR-NS	359	286	19	6.6
Serratia spp., CAR-NS	105	75	1	1.3
Morganella spp., CAR-NS	77	44	2	4.6
Other gram-negative bacteria, CAR-NS				
Pseudomonas aeruginosa, CAR-NS	878	756	240	31.8
Acinetobacter baumannii, CAR-NS	316	292	237	81.2

N=number, NS=non-susceptible, N with known result: N of isolates with known susceptibility results, N NS=number of NS isolates (only resistant isolates for MRSA, VRE and VAN-R), %NS=N NS/N with known results, MRSA=meticillin-resistant Staphylococcus aureus*, VRE=vancomycin-resistant enterococci, VAN=vancomycin, 3GC=Third-generation cephalosporin, CAR=carbapenem. Data from following countries were excluded because of methodological divergence of the national protocol: the Netherlands, excluded for all bug–drug combinations and Lithuania, excluded for all carbapenem results in Enterobacteriaceae except for* Klebsiella pneumoniae*.*

Results by hospital type, medical specialty and patient risk factors

The prevalence of HAIs varied by hospital type and considerably within each hospital type. HAI prevalence was 5.0% in primary hospitals (median HAI prevalence 4.1%, IQR 2.1–6.3%), 5.0% in secondary hospitals (median 4.5% IQR 2.7–6.8%), 7.4% in tertiary hospitals (median 7.2% IQR 4.2–10.0%) and 6.0% in specialised hospitals (median 4.3% IQR 2.0–6.1%) (Table 15, Figure 24).

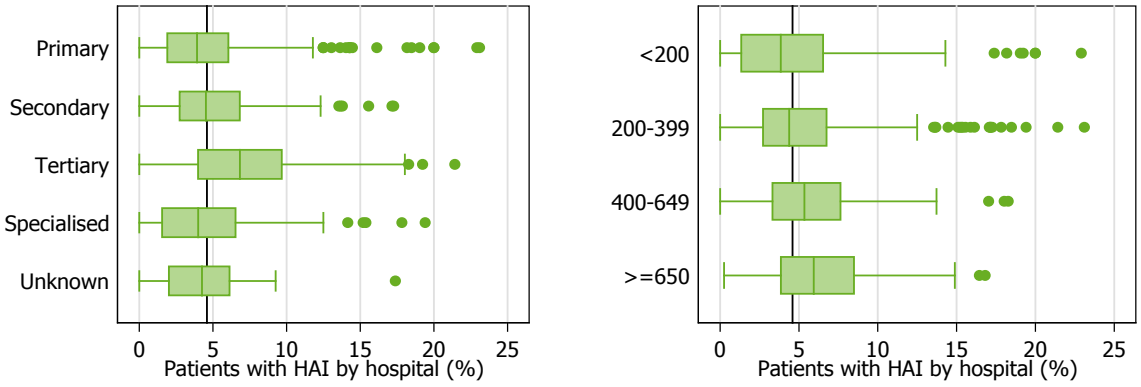
Table 15. Percentile distribution of the prevalence of HAI (percentage patients with an HAI) by hospital type, ECDC PPS 2011–2012

	N of hospitals	N of patients	Pts with HAI	HAI%	P10	P25	P50	P75	P90
Primary	269	36 399	1814	5.0	0.0	2.1	4.1	6.3	10.1
Secondary	301	79 964	4020	5.0	1.3	2.7	4.5	6.8	8.7
Tertiary	204	90 173	6631	7.4	2.8	4.2	7.2	10.0	13.2
Specialised	113	13 998	833	6.0	0.0	1.6	4.0	6.7	11.4
Unknown	60	10 925	531	4.9	0.0	2.0	4.3	6.1	7.9
Total	**947**	**231 459**	**13 829**	**6.0**	**0.7**	**2.7**	**4.7**	**7.5**	**10.4**

*HAI%: HAI prevalence= number of patients with at least 1 HAI *100 / total number of patients in category; P=percentile.*

The prevalence of HAIs also increased significantly with hospital size, from a median of 3.8% (IQR 1.4–6.6) in hospitals with fewer than 200 beds to a median of 5.9% (IQR 3.9–8.5) in hospitals with 650 beds or more (Figure 24).

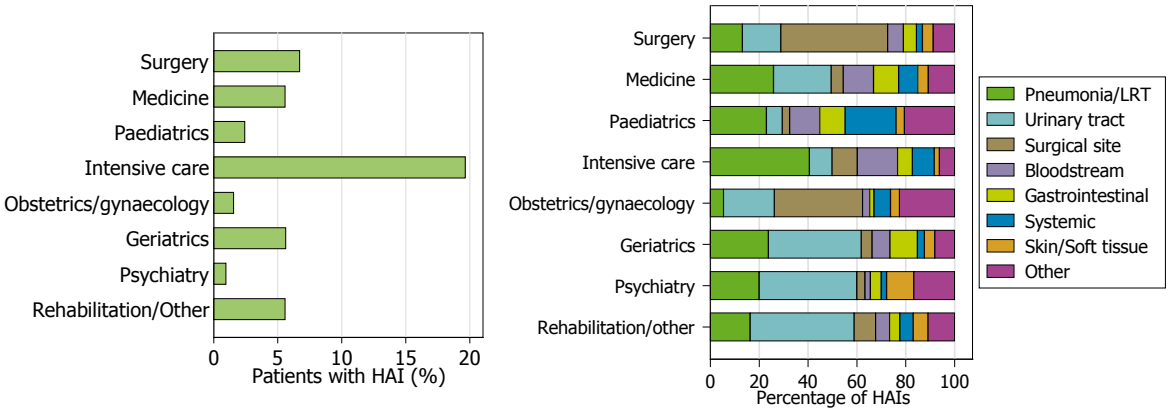
Figure 24. Prevalence of HAI (percentage patients with an HAI) by hospital type (left) and size (n of beds) (right), n=947 hospitals, ECDC PPS 2011–2012



Vertical black line=overall median.

HAI prevalence was highest among patients admitted to ICUs, where 19.5% of patients had at least one HAI compared with an average of 5.2% for all other specialties combined (Figure 25). ICU patients accounted for 5.0% of the total hospital population, but for 16.5% of all patients with an HAI. The PPS protocol did not distinguish between HAIs associated with staying in the ICU and HAIs associated with staying in another hospital ward or hospital. The most common HAI types in the ICU were respiratory infections (pneumonia and lower respiratory tract infections) and bloodstream infections. Urinary tract infections were the dominant HAI type in geriatrics, psychiatry and rehabilitation/other specialties, while surgical site infections were the most common infection type in surgery and obstetrics and gynaecology. Among paediatric patients, clinical sepsis accounted for an important segment of HAIs, as shown by the high proportion of systemic infections in Figure 25.

Figure 25. Prevalence of HAI (percentage of patients with an HAI) (left) and distribution of HAI types (right) by patient/consultant specialty, n=231 459 patients, ECDC PPS 2011–2012



LRT: Lower respiratory tract.

Patient risk factors could be analysed for standard (patient-based) protocol data only and included 215 537 patients in 30 countries, or 93% of the total number of patients included in the survey. The overall HAI prevalence among these patients was 6.1% (Table 16). All risk factors except hospital size (not included in final model) were significantly associated with HAI prevalence at the p<0.001 level after adjustment for all factors in the model. Also 34 of 47 (72%) risk factor sub-levels included in the model were significantly associated at the p<0.001 level, while five risk factor levels were included for consistency though not significantly associated at the p<0.01 level (cardiology, unknown surgery, unknown length of stay, secondary and unknown hospital types). The strongest independent associations (adjusted odds ratio ≥2 or ≤0.5) were observed for length of stay in the hospital before the onset of HAI, the presence of intubation and urinary catheters (before the onset of pneumonia and urinary tract infections, respectively), the high-risk specialties haematology and bone marrow transplantation and burns care and the low-risk specialties dermatology, obstetrics and maternity, and psychiatry. The association with the presence of central and peripheral vascular catheters was not examined because of the association of parenteral treatment with HAIs. The discriminatory power of the model as measured by the area under the ROC curve was 0.7672 for the model development sample (two thirds of the data) and 0.7692 for the validation (other) third of the data. The model goodness-of-fit tested on sub-samples of the data was good with non-significant Hosmer–Lemeshow Chi Square tests for six out of eight tested random sub-samples.

Table 16. Patient risk factors for HAIs with crude and adjusted odds ratios derived from multiple logistic regression model, n=215 537 patients in 30 countries (standard protocol data only), ECDC PPS 2011–2012

	N of patients	% of total	N of pts with ≥1 HAI	Pts with HAI %	Crude OR (95%CI)			Adjusted OR* (95%CI)		
All patients (standard protocol)	215 537	100.0	13 053	6.1	-			-		
Age										
1–44 years (ref.)	47 100	21.9	1 586	3.4	ref.			ref.		
<1 month	7 592	3.5	293	3.9	1.1	(1.0 -	1.3)	1.4	(1.1 -	1.7)
1–11 months	5 135	2.4	331	6.4	2.0	(1.8 -	2.3)	1.4	(1.2 -	1.7)
45–74 years	88 726	41.2	5 920	6.7	2.1	(1.9 -	2.2)	1.2	(1.1 -	1.3)
75–84 years	43 665	20.3	3 207	7.3	2.3	(2.1 -	2.4)	1.3	(1.2 -	1.4)
≥85 years	23 319	10.8	1 494	6.4	1.9	(1.8 -	2.1)	1.2	(1.1 -	1.3)
Male gender	101 137	46.9	6 967	6.9	1.4	(1.3 -	1.4)	1.1	(1.1 -	1.2)
Length of stay (days)[a]										
1–3 days	71 551	33.2	1 601	2.2	ref.			ref.		
4–7 days	58 713	27.2	3 364	5.7	2.7	(2.5 -	2.8)	2.3	(2.2 -	2.5)
8–14 days	42 059	19.5	3 326	7.9	3.8	(3.5 -	4.0)	2.9	(2.7 -	3.1)
≥15 days	42 169	19.6	4 711	11.2	5.5	(5.2 -	5.8)	3.9	(3.6 -	4.2)
Unknown	1 045	0.5	51	4.9	2.2	(1.7 -	3.0)	1.6	(1.1 -	2.4)
McCabe score										
Non-fatal	142 925	66.3	6 191	4.3	ref.			ref		
Ultimately fatal	34 780	16.1	3 585	10.3	2.5	(2.4 -	2.6)	1.7	(1.6 -	1.8)
Rapidly fatal	11 275	5.2	1 519	13.5	3.4	(3.2 -	3.7)	1.9	(1.8 -	2.1)
Unknown	26 557	12.3	1 758	6.6	1.6	(1.5 -	1.7)	1.2	(1.1 -	1.3)
Surgery since admission										

	N of patients	% of total	N of pts with ≥1 HAI	Pts with HAI %	Crude OR (95%CI)			Adjusted OR* (95%CI)		
No surgery	155 733	72.3	7 358	4.7	ref.			ref		
NHSN surgery	43 456	20.2	4 399	10.1	2.3	(2.2 -	2.4)	1.8	(1.7 -	1.9)
Minimal/non-NSHN surgery	13 882	6.4	1 122	8.1	1.8	(1.7 -	1.9)	1.6	(1.5 -	1.8)
Unknown	2 466	1.1	174	7.1	1.5	(1.3 -	1.8)	1.2	(1.0 -	1.5)
Presence of invasive devices										
Intubation [a]	4 796	2.2	1 475	30.8	7.6	(7.2 -	8.1)	2.2	(2.0 -	2.5)
Urinary catheter [a]	36 783	17.1	5 205	14.2	3.6	(3.5 -	3.7)	2.0	(1.9 -	2.1)
Central vascular catheter [b]	16 086	7.5	3 896	24.2	-			-		
Peripheral vascular catheter [b]	99 867	46.3	7 618	7.6	-			-		
Patient/consultant specialty										
All other specialties (ref.)	106 861	49.6	6 300	5.9	ref.			ref		
Digestive tract surgery	4 384	2.0	447	10.2	1.8	(1.6 -	2.0)	1.5	(1.3 -	1.7)
Cardiovascular surgery	5 018	2.3	493	9.8	1.7	(1.6 -	1.9)	1.2	(1.1 -	1.4)
Transplant/cancer surgery	1 157	0.5	139	12.0	2.2	(1.8 -	2.6)	1.4	(1.1 -	1.7)
Ear/nose/throat surgery	2 963	1.4	84	2.8	0.5	(0.4 -	0.6)	0.6	(0.5 -	0.8)
Ophthalmology	1 441	0.7	12	0.8	0.1	(0.1 -	0.2)	0.3	(0.1 -	0.5)
Urology	5 656	2.6	307	5.4	0.9	(0.8 -	1.0)	0.7	(0.6 -	0.9)
Burns care	184	0.1	42	22.8	4.7	(3.3 -	6.7)	3.3	(2.2 -	5.2)
Endocrinology	2 297	1.1	85	3.7	0.6	(0.5 -	0.8)	0.7	(0.5 -	0.9)
Cardiology	12 330	5.7	534	4.3	0.7	(0.7 -	0.8)	0.9	(0.8 -	1.0)
Dermatology	1 298	0.6	18	1.4	0.2	(0.1 -	0.4)	0.3	(0.2 -	0.6)
Haematology/BMT	3 547	1.6	580	16.4	3.1	(2.8 -	3.4)	2.8	(2.5 -	3.2)
Nephrology	2 988	1.4	239	8.0	1.4	(1.2 -	1.6)	1.3	(1.1 -	1.6)
Pneumology	8 721	4.0	396	4.5	0.8	(0.7 -	0.8)	0.8	(0.7 -	0.9)
Rheumatology	1 487	0.7	38	2.6	0.4	(0.3 -	0.6)	0.5	(0.3 -	0.8)
Infectious diseases	3 144	1.5	262	8.3	1.5	(1.3 -	1.7)	1.7	(1.4 -	2.0)
Paediatrics general	7 856	3.6	141	1.8	0.3	(0.2 -	0.3)	0.6	(0.5 -	0.7)
Medical ICU	2 506	1.2	431	17.2	3.3	(3.0 -	3.7)	1.7	(1.4 -	1.9)
Surgical ICU	1 973	0.9	487	24.7	5.2	(4.7 -	5.8)	1.7	(1.4 -	1.9)
Paediatric ICU	753	0.3	118	15.7	3.0	(2.4 -	3.6)	1.9	(1.4 -	2.5)
Neonatal ICU	2 138	1.0	233	10.9	2.0	(1.7 -	2.2)	1.7	(1.3 -	2.1)
Mixed & other ICU	3 134	1.5	832	26.5	5.8	(5.3 -	6.3)	1.9	(1.7 -	2.2)
Obstetrics/maternity	11 444	5.3	121	1.1	0.2	(0.1 -	0.2)	0.4	(0.3 -	0.5)
Gynaecology	5 049	2.3	137	2.7	0.4	(0.4 -	0.5)	0.7	(0.6 -	0.9)
Geriatrics	8 982	4.2	499	5.6	0.9	(0.9 -	1.0)	0.8	(0.7 -	0.9)
Psychiatry	8 226	3.8	78	0.9	0.2	(0.1 -	0.2)	0.2	(0.2 -	0.3)
Hospital type										
Primary	31 401	14.6	1 556	5.0	ref.			ref		
Secondary	75 275	34.9	3 862	5.1	1.0	(1.0 -	1.1)	1.0	(0.9 -	1.1)
Tertiary	85 363	39.6	6 371	7.5	1.5	(1.5 -	1.6)	1.2	(1.1 -	1.3)
Specialised	12 573	5.8	733	5.8	1.2	(1.1 -	1.3)	1.1	(1.0 -	1.2)
Unknown	10 925	5.1	531	4.9	1.0	(0.9 -	1.1)	0.9	(0.8 -	1.1)
Hospital size [c]										
<200 beds	21 039	9.8	973	4.6	ref.			-		
200–399 beds	49 141	22.8	2 708	5.5	1.2	(1.1 -	1.3)	-		
400–649 beds	56 311	26.1	3 445	6.1	1.3	(1.2 -	1.4)	-		
650–899 beds	39 053	18.1	2 501	6.4	1.4	(1.3 -	1.5)	-		
≥900 beds	49 993	23.2	3 426	6.9	1.5	(1.4 -	1.6)	-		

BMT: bone marrow transplant
**Adj. OR: Adjusted odds ratio in final multiple logistic regression model; only specialties that were significant in the final model are displayed, see Annex 1 for HAI prevalence % in other specialties.*
(a) Length of stay in days until onset of HAI if HAI during current hospitalisation, presence of intubation before pneumonia, presence of urinary catheter before urinary tract infection.
(b) CVC and PVC: Odds ratios not calculated and variables not included in model because of correlation with treatment of HAI (parenteral antimicrobial treatment).
(c) Hospital size: not included in final model (overall effect not significant).

Results by country[i]

HAI prevalence, observed and predicted based on case mix

The prevalence of HAIs is known to be influenced by a variety of factors such as the type of hospital and healthcare system, the severity of the patient case mix (co-morbidities), methodological differences such as different interpretations of the case definitions for HAIs, differences in availability of diagnostic tests, differences in the level of training and skills of healthcare workers applying the definitions and differences in reporting behaviour between hospitals and between countries. The latter are largely determined by possible legal or financial incentives or disincentives for reporting HAIs. Some of these determinants were included in the protocol and were used to interpret the observed HAI prevalence results (see below), but others were not measured in the PPS and therefore their influence could not be assessed. Comparing crude prevalence percentages of HAI between countries without taking into account differences in case mix, representativeness and confidence intervals and differences in sensitivity and specificity is therefore not meaningful.

Using the multiple logistic regression model shown in Table 16, a predicted prevalence was determined for each country applying the average European individual patient risk factors in each country and then summing up the individual patient probabilities for each country (sum of probabilities=predicted or 'expected' number of HAIs). For light protocol data (7% of the patients), a model including patient/consultant specialty, hospital type and hospital size was used (model not shown). The predicted and observed HAI prevalence by country are graphically represented in Figure 26. Observed HAI prevalence percentages are also displayed with 95% confidence intervals, indicating that by chance the result of the PPS might as well have been on the lower or the upper limit of the interval, e.g. if other hospitals had been randomly selected or if the survey had been performed on another day.

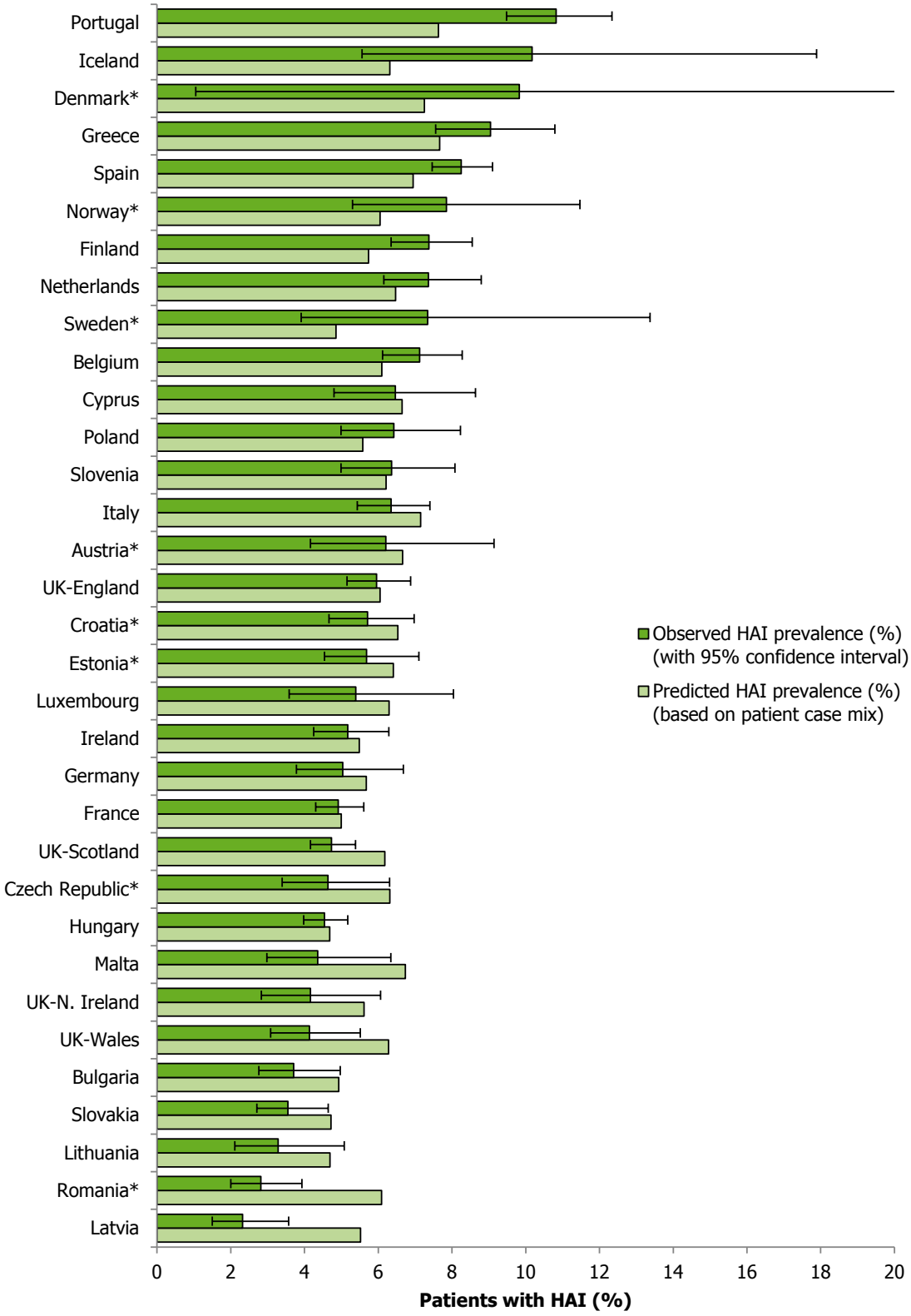
The HAI prevalence (percentage of patients with an HAI) by country ranged from 2.3% in Latvia (95% CI 1.3–3.9%) to 10.8% (95% CI 9.5–12.4%) in Portugal. When the total number of occupied acute care hospital beds per country was taken into account (see burden estimates, Table 24), the weighted HAI prevalence in Europe was 5.7% (95% CI 4.5%–7.4%). The mean of the country prevalence percentages was 6.0%, the country median was 5.7%.

The correlation between the observed and predicted prevalence by country is shown in Figure 27 (correlation coefficient Pearson's rho 0.61, $p<0.001$, R-squared 0.37; Spearman's rho 0.55, $p<0.01$). In six countries the observed prevalence was almost identical to the predicted prevalence (Hungary, France, Ireland, UK-England, Slovenia and Cyprus).

The ratio of the observed divided by the predicted prevalence (standardised infection ratio, SIR) varied from 0.42 in Latvia and 0.46 in Romania to 1.42 in Portugal, 1.50 in Sweden and 1.62 in Iceland.

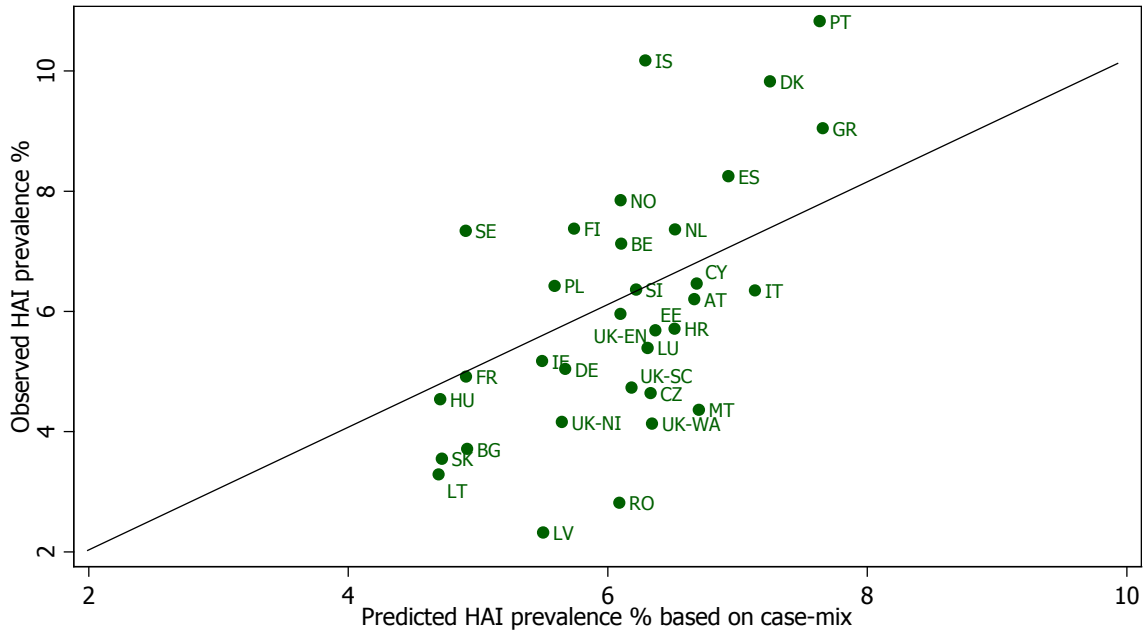
[i] Note: representativeness of the PPS data by country was evaluated based on compliance with the recommended sampling methodology of hospitals and sample size. Representativeness was optimal or good in 25 (76%) countries and poor or very poor in 8 (24%) countries. Countries (and number of hospitals) with optimal representativeness were Bulgaria (n=42), Cyprus (n=8), Finland (n=59), France (n=54), Germany (n=46), Hungary (n=29), Ireland (n=50), Italy (n=49), Latvia (n=15), Luxembourg (n=9), Malta (n=3), Portugal (n=57), Slovakia (n=40), Slovenia (n=21), UK-England (n=51), UK-Northern Ireland (n=16), UK-Scotland (n=52); good representativeness was obtained in Belgium (n=52), Greece (n=37), Iceland (n=2), Lithuania (n=44), Netherlands (n=33), Poland (n=35), Spain (n=59), UK-Wales (n=22); poor representativeness in Austria (n=9), Croatia (n=11), Czech Republic (n=14), Estonia (n=4), Norway (n=7), Romania (n=10) and very poor represenativeness in Denmark (n=3) and Sweden (n=4).

Figure 26. Observed HAI prevalence with 95% confidence intervals and predicted HAI prevalence based on patient case mix and hospital characteristics, by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. Denmark: upper limit of 95% confidence interval not included, HAI prevalence=9.8% (95% CI 1.0–52.7).*

Figure 27. Correlation between the observed and predicted prevalence of HAI, by country, ECDC PPS 2011–2012



Line: Observed prevalence = predicted prevalence (Standardised Infection Ratio (SIR) =1). Countries below the line have a SIR lower than 1, countries above the line have a SIR higher than 1. The smaller the distance between the dot and the line, the closer the observed prevalence comes to the predicted prevalence based on case mix.

Validation of national HAI PPS data

In 2012, four countries performed a validation survey during the national PPS using the ECDC PPS validation protocol (Table 17). All validation PPS data were collected by a national external validation team on the same day as the primary PPS in the validated hospitals and wards. In the Bulgarian validation survey the total number of validated patients was higher than the recommended sample size while other countries validated approximately the minimally required number of patients. The sensitivity of the primary PPS data collectors for detecting and reporting an HAI was on average 71.9% and varied from 57.8% in Ireland to 94.0% in Spain. The specificity for detecting and reporting an HAI was high in all countries, though slightly lower in Spain with 99.0%. When applying the validation sensitivity and specificity to the (primary) HAI prevalence results in these countries, the estimated 'true' HAI prevalence was found on average to be 6.6% compared with an average observed prevalence of 5.3% in patients with at least one HAI. In the country with the highest prevalence of the four validation countries, the true prevalence estimate was slightly lower than the observed because of relatively few false-negative HAIs (high sensitivity) and a higher percentage of false-positive HAIs (lower specificity), while in the countries with a lower observed prevalence the sensitivity was lower (higher percentage of false-negative HAIs), resulting in higher true prevalence estimates. These results from a few countries suggest that the large differences observed between HAI prevalence across Member States are in reality smaller and that the overall weighted HAI prevalence of 5.7% is likely to be a slight underestimate. These few observations also show that a lower sensitivity in a particular country does not necessarily mean that the observed prevalence was below the predicted one, since in Hungary and Ireland the observed and predicted HAI prevalence were similar. The estimated predicted prevalence, however, is influenced by the average sensitivity and specificity of the primary European PPS data and would therefore also be underestimated if the overall observed (primary) HAI prevalence was underestimated.

Table 17. Results of national PPS validation surveys from four countries: HAI prevalence, ECDC PPS 2011–2012

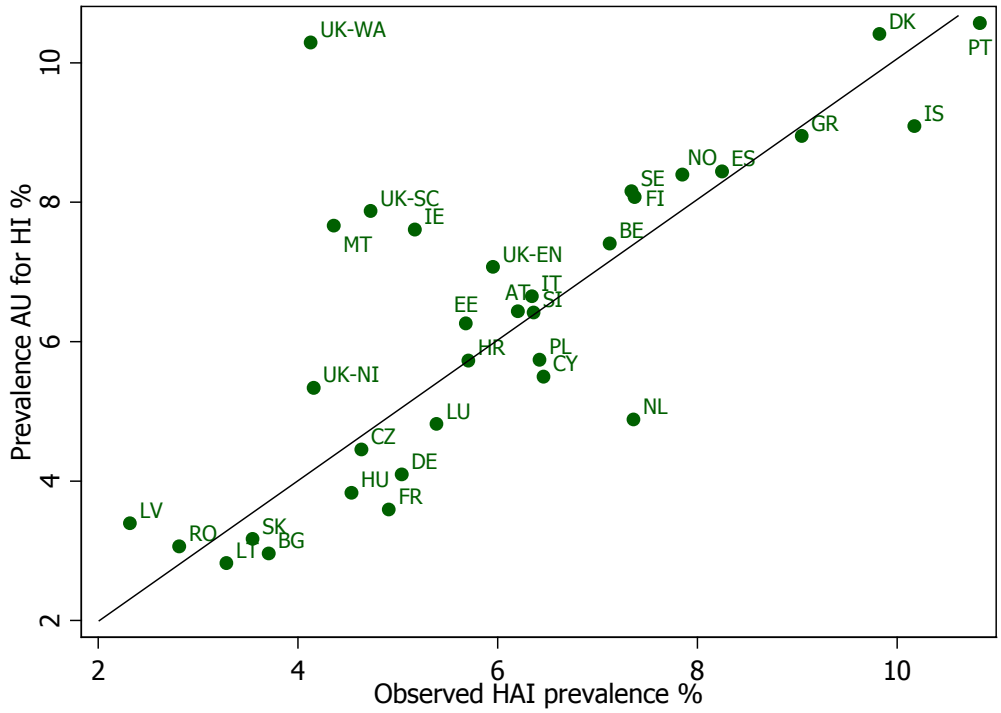
Country	N of hosp.	N of pts	Se % (95%CI)	Sp % (95%CI)	pPPS HAI Pr % (95%CI)	True HAI Pr % (95%CI)
Bulgaria	30	1280	61.6 (51.3–71.8)	99.9 (99.8–100.0)	3.7 (2.8–5.0)	5.9 (5.0–7.1)
Hungary	5	274	74.1 (43.9–91.9)	99.6 (98.3–100.0)	4.5 (4.0–5.2)	5.6 (3.3–8.2)
Ireland	10	342	57.8 (36.9–75.4)	99.2 (98.0–99.8)	5.2 (4.2–6.3)	7.7 (5.0–10.8)
Spain	5	239	94.0 (69.2–99.9)	99.0 (97.5–99.8)	7.7 (7.2–8.2)	7.2 (5.4–9.9)
Mean			**71.9**	**99.4**	**5.3**	**6.6**

Se: sensitivity; Sp: specificity; pPPS HAI Pr: HAI prevalence (% of patients with HAI) of the primary national PPS; True HAI Pr: estimated true HAI prevalence after adjustment for validation sensitivity and specificity.

HAI versus antimicrobial treatment of a hospital infection

Another possible reason for a low reported HAI prevalence may be the lack of diagnostic tests or missing elements in the patient files preventing confirmation that the case definition of a particular type of HAI was met. Clinicians may have nevertheless labelled such cases 'hospital infections' and treated them accordingly. As a result, the prevalence of antimicrobial use for treating prescriber-labelled 'hospital infection' would be expected to be higher than the prevalence of confirmed HAIs as per case definition. Figure 28 surprisingly shows a very good correlation (Pearson's rho=0.75, p<0.001; Spearman's rho 0.72, p<0.001) between the percentage of patients with confirmed HAI as per case definition (observed HAI prevalence) and the prevalence of patients receiving at least one antimicrobial for the treatment of a 'hospital infection'. In countries below the diagonal line in the figure, prescribers tended to label an infection as 'hospital-acquired' with higher specificity than the PPS data collectors while in countries above the line, the PPS data collection had higher specificity, which may indeed be related to the lack of diagnostic evidence to confirm an HAI as per the case definition. On average, however, the assessment of the PPS data collectors was quite similar to the assessment of the prescribers or physicians in charge of the patient. This was not the case in Ireland, Malta, UK-Scotland and, especially, in UK-Wales (where the reported HAI prevalence was 4.1% whereas the prevalence of antimicrobial use for treatment of a hospital infection was 10.3%). Unlike in most other countries where hospital PPS staff collected the data, the entire national PPS data in the 22 included Welsh hospitals was collected by an external survey team that has reportedly been quite specific in applying the HAI case definition criteria. The position of the Netherlands on Figure 28 is explained by the fact that in that country, 18.7% of HAIs were reported in patients not receiving antimicrobials (compared with 4.5% of HAIs in all other countries combined).

Figure 28. Correlation between the observed prevalence of HAI and the prevalence of antimicrobial use for prescriber-labelled 'treatment of a hospital infection'*, by country, ECDC PPS 2011–2012



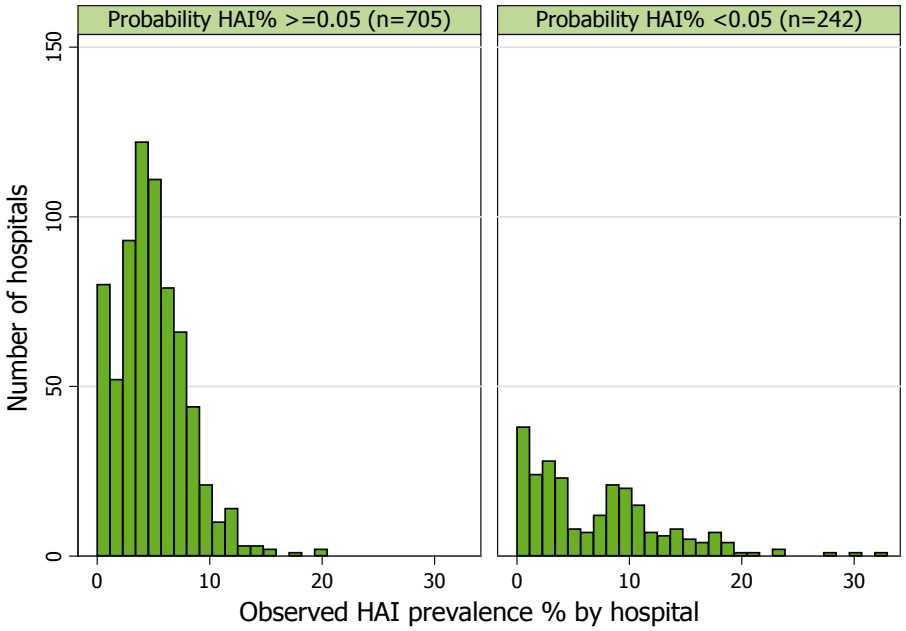
**Percentage of patients receiving antimicrobials for treatment intention of a hospital infection; line: HAI prevalence equal to prevalence of antimicrobial treatment for hospital infection.*

Probability of HAI prevalence by hospital

In order to explore the extent to which the difference between the observed and expected prevalence at the country level is explained by a relatively limited number of hospitals (e.g. zero-reporting hospitals or hospitals with very high HAI prevalence), the probability of the observed HAI prevalence was calculated for each of the 947 hospitals based on the number of surveyed patients and the predicted HAI prevalence in each hospital. In 242 (25.6%) hospitals, the probability of the observed HAI prevalence was lower than 5%, meaning that if the PPS had been repeated 100 times under similar conditions, the observed prevalence would have been found in less than 5% of the surveys. In other words, in one quarter of the hospitals, the observed prevalence was significantly different (at the p<0.05 level) from the predicted prevalence, taking into account the number of surveyed patients. Figure 29 shows that the distribution of low probability HAI prevalence results by hospital was bimodal. It also

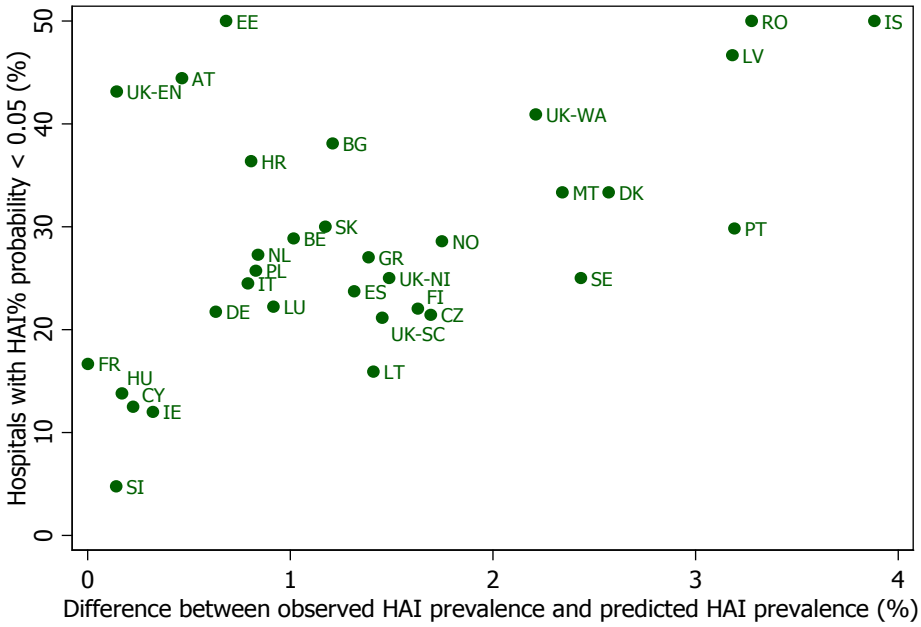
shows that a large proportion of the low HAI prevalence results (including hospitals reporting zero HAIs) were in fact not significantly different from the predicted prevalence. For example, only for 15 of 84 (17.9%) hospitals without HAIs was the probability of the observed result lower than 5%.

Figure 29. Distribution of the observed HAI prevalence, by hospital, according to the probability of the observed result (n=947 hospitals), ECDC PPS 2011–2012



On the other hand, in hospitals with large numbers of patients such as in UK-England and Estonia, even small differences between the observed and expected prevalence may become statistically significant due to the larger sample size, which explains why in these two countries the HAI prevalence was significantly different from the predicted prevalence in more than 40% of the hospitals, while the national observed prevalence was very close to predicted (Figure 30). Overall, Figure 30 shows that the larger the difference is between the observed and predicted prevalence at the national level, the higher the percentage of hospitals with 'unexpected' results tends to be (Pearson's rho=0.52, p<0.01; Spearman's rho 0.42, p<0.05), but with large variations between countries and an important impact of the average hospital size in Austria, Estonia and UK-England.

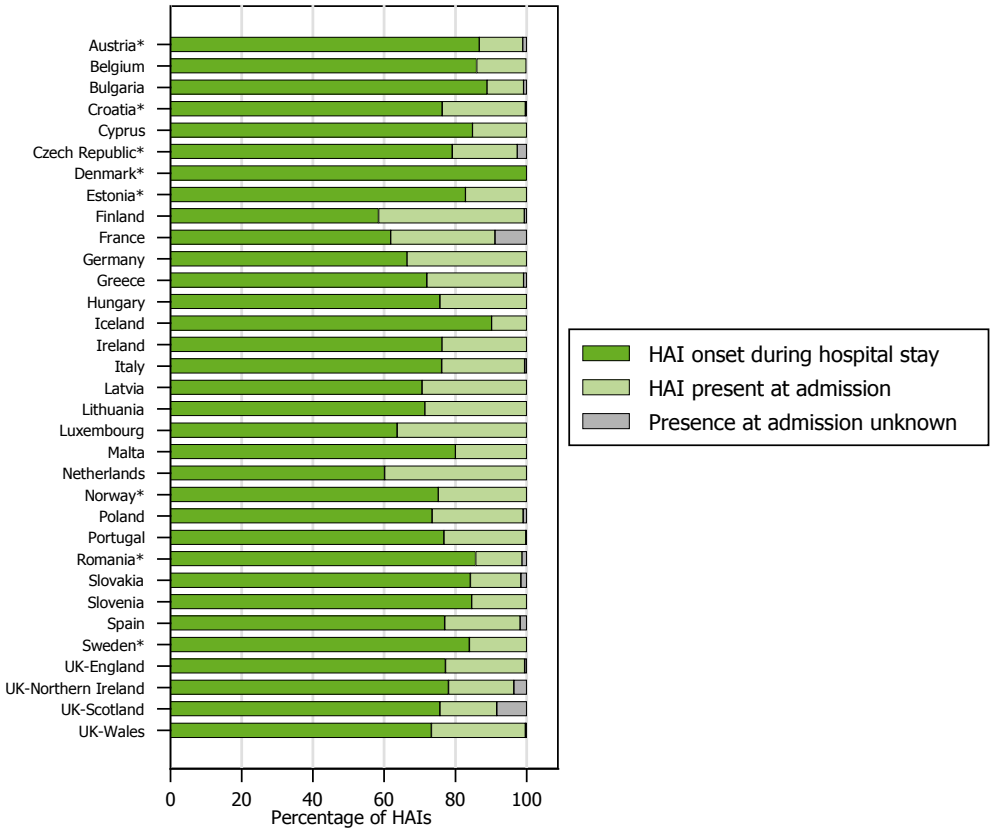
Figure 30. Relationship between the absolute difference between the observed and predicted HAI prevalence and the percentage of hospitals with a lower than 5% probability of the observed HAI prevalence, ECDC PPS 2011–2012



Onset and origin of HAIs

The percentage of HAIs present on admission varied from 0% in Denmark to more than 35% of HAIs in Luxembourg (36.3%), the Netherlands (39.8%) and Finland (40.9%) (Figure 31).

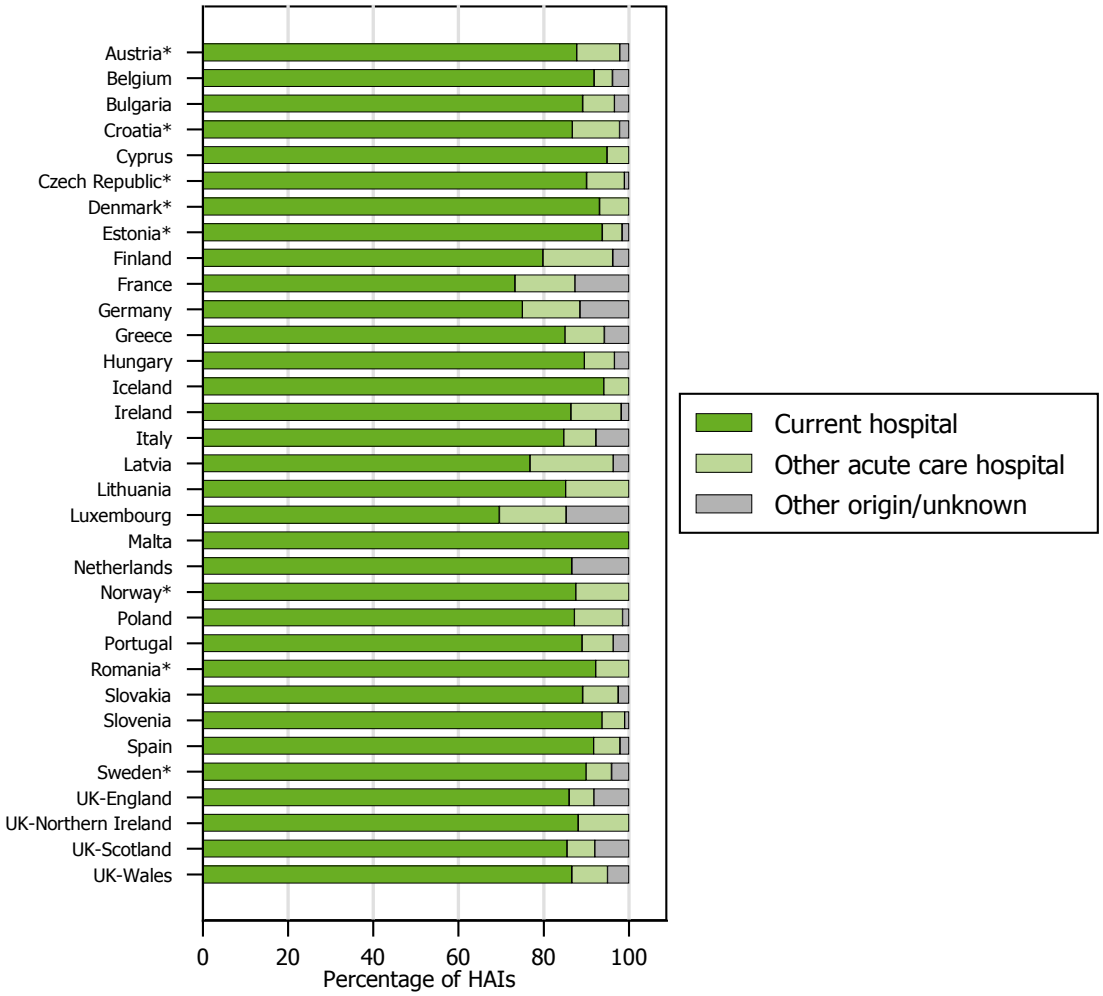
Figure 31. Percentage of HAIs present on admission, by country, ECDC PPS 2011–2012



HAIs present on admission in the Netherlands were registered based on the diagnosis of the physician at admission, and not based on the definitions of HAIs in the protocol.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

The percentage of HAIs attributed to the current hospital stay or to a previous stay in the same hospital ranged from less than 75% in Luxembourg (69.5%) and France (72.9%) to 100% in Malta (Figure 32).

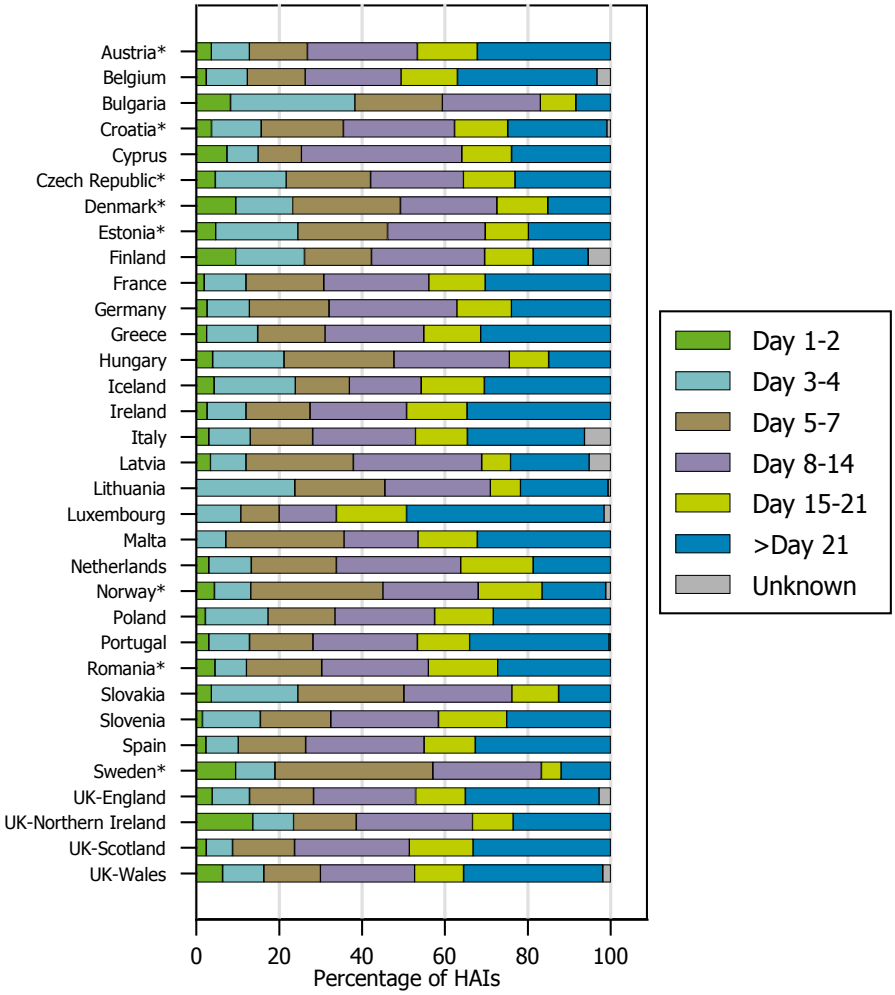
Figure 32. Origin of HAIs, by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

For HAIs starting during the current hospitalisation, the median time from hospital admission until HAI onset varied from less than seven days in Bulgaria (6 days, mean 9.5 days) and Sweden (6 days, mean 10.5 days) to 21 days in Luxembourg (mean 27.2 days). The percentage of HAIs with onset before the third day of hospital stay ranged from 0% in Lithuania, Luxembourg and Malta to 13.6% in UK-Northern Ireland (Figure 33).

Figure 33. Distribution of the day of onset of HAIs not present on admission, by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Types of healthcare-associated infection

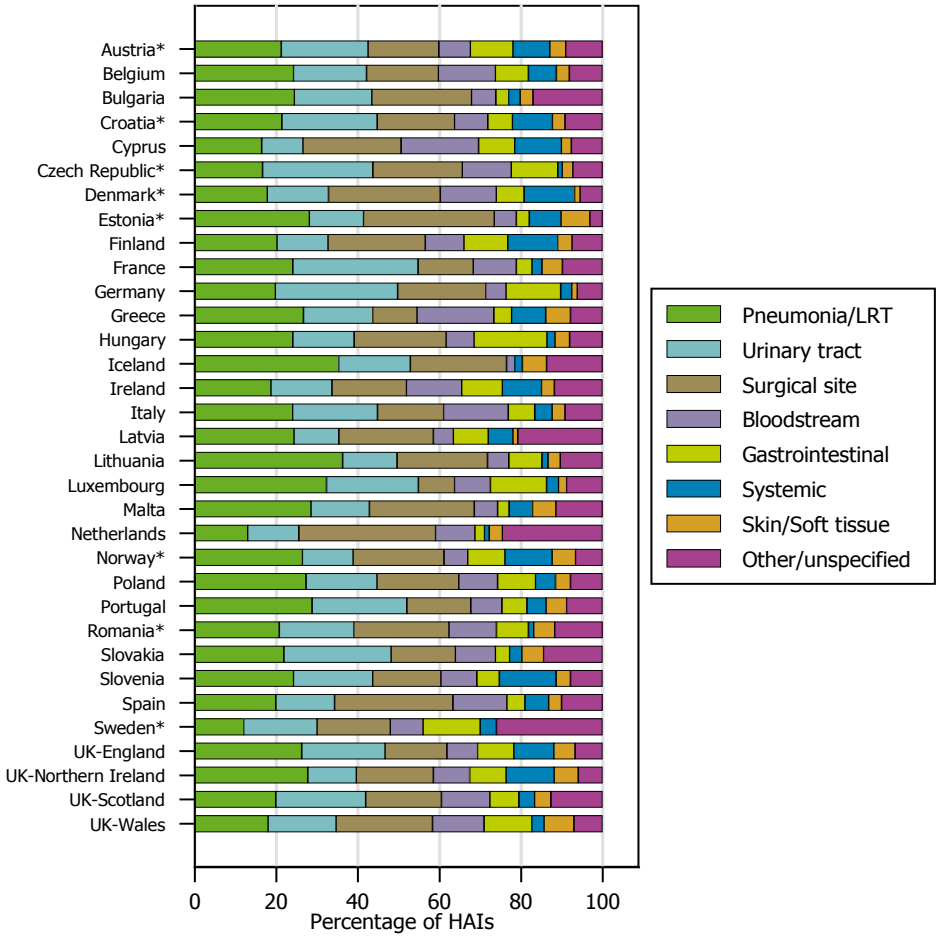
The majority of the countries (26 of 33) reported the same three types of HAI as their most common: pneumonia and lower respiratory tract infection, surgical site infection and urinary tract infection (Figure 34, Annex 1). These three HAI types accounted for more than half of the HAIs in all countries, except Sweden (48%) and for more than 70% of HAIs in Lithuania and Iceland.

The percentage of pneumonia and lower respiratory infections varied between 12.0% in Sweden and 36.3% in Lithuania. Pneumonia were microbiologically confirmed (PN1, 2 or 3) in 18.2% of pneumonia, ranging from 1.4% in Slovenia to 55.4% in Croatia. Urinary tract infections varied between 10.1% in Cyprus and 30.7% in France and were microbiologically confirmed (UTI-A) in 65.8% of cases, from 37.5% in Cyprus to 94.1% in France. The proportion of surgical site infections varied between 8.8% in Luxembourg and 29.0% in Spain. Superficial surgical site infections accounted for 30.7% of surgical site infections, from 12.2% in Estonia to 66.7% in Iceland. Bloodstream infections were highest in Greece at 18.9% and Cyprus at 19.0% and lowest in Iceland at 2.0% and were secondary to another infection in 28.8% of cases, ranging from 0% in Iceland, Latvia and Romania to 40% or more in Belgium, Denmark, Estonia, Germany, Luxembourg, Malta, the Netherlands, Norway, Slovenia and Sweden. No gastro-intestinal infections were detected in Iceland whereas 17.9% of all HAIs in Hungary were gastro-intestinal. Skin and soft tissue infections were a small category of HAIs in this survey with 4.1% overall, varying from none in Sweden to 6.1% in Greece.

Certain HAI diagnoses relied on laboratory tests more than others. The inter-country variation on epidemic clones, testing and laboratory methodologies may have influenced the prevalence of certain HAIs. For example the percentage of *C. difficile* infection varied from 0% in Bulgaria and Lithuania to 10.6% of all HAIs in Hungary and 11.3% in UK-Wales (Figure 35). In some countries with a relatively high proportion of healthcare-associated gastro-intestinal infections, no, or very few, cases of *C. difficile* infection were reported, which is more likely to be

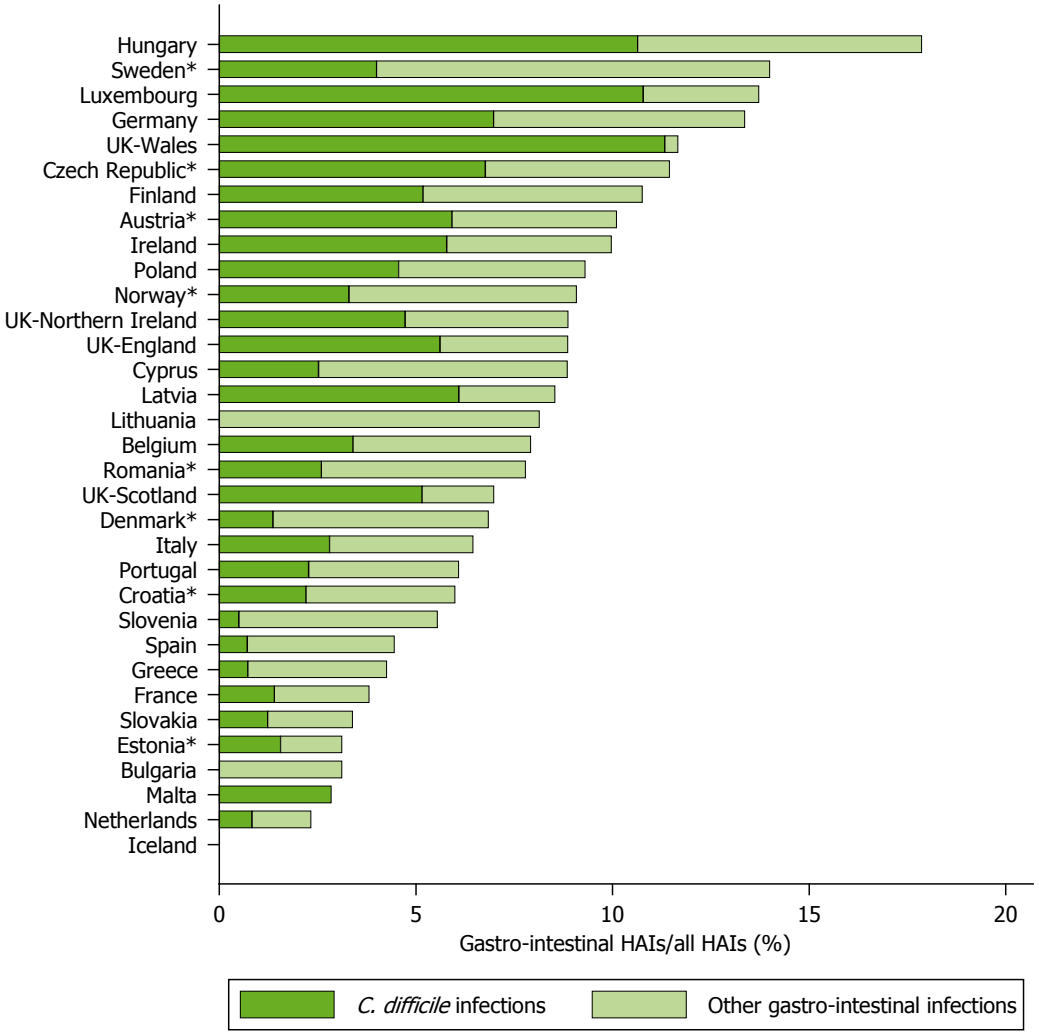
due to lack of diagnostic testing than to absence of *C. difficile*, because even in endemic circumstances, it is expected to be responsible for a considerable proportion of healthcare-associated diarrhoea. *C. difficile* was responsible, on average, for 48.0% of all gastro-intestinal infections (excluding hepatitis).

Figure 34. Distribution of HAI types, by country, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. LRT: Lower resipratory tract.*

Figure 35. *Clostridium difficile* infections and other gastro-intestinal infections (excluding hepatitis) as a percentage of all HAIs, by country, ECDC PPS 2011–2012



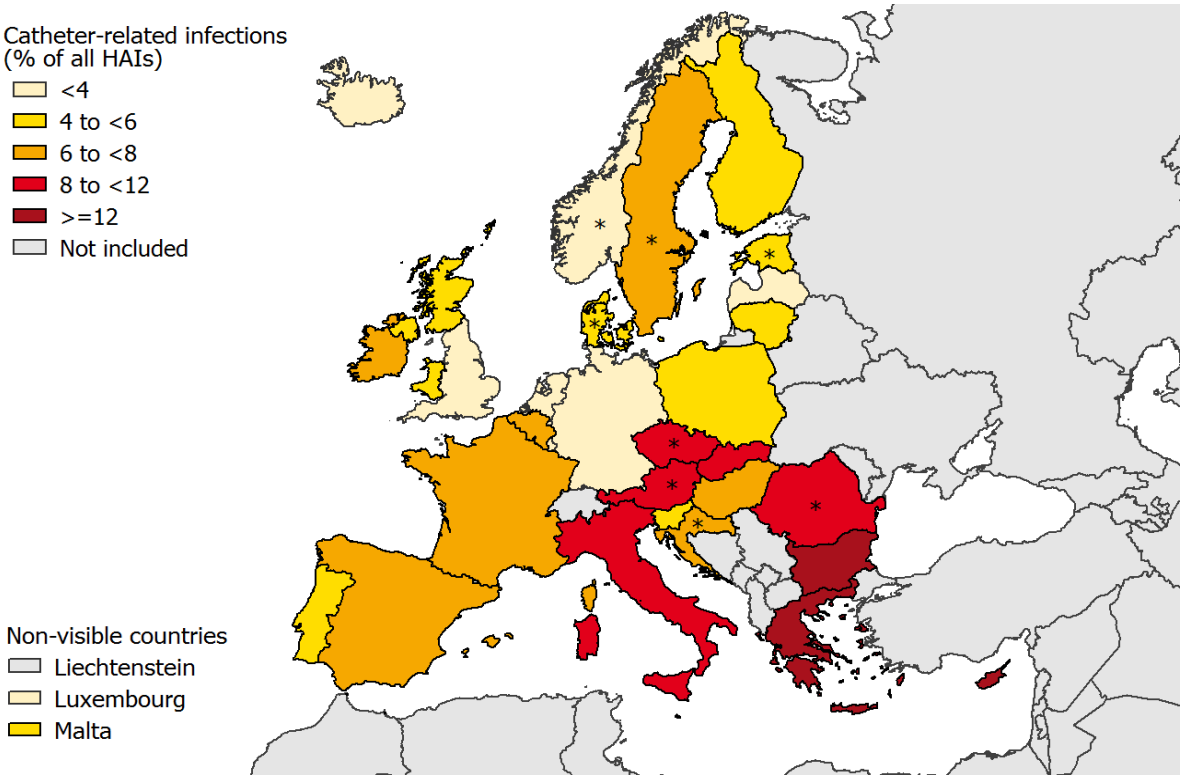
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Clinical sepsis, the prevalence of which is also strongly influenced by the availability of diagnostic tests, accounted for 86.7% of systemic infections and 5.5% of all HAIs, ranging from 0% in Romania to 13.6% in Slovenia.

The category 'other/unspecified' HAI types varied from 3.3% in Estonia to 26.0% in Sweden (Figure 34). Of these, 18.6% were oral cavity infections (EENT-ORAL), which accounted for 20.0% of all HAIs in Sweden, 7.8% in Iceland and 7.5% in UK-Scotland, while none were reported in Estonia, Latvia, Lithuania and Romania. The second most common group (17.0%) was bone and joint infections (osteomyelitis 8.1%, joint or bursa infections 8.3%, disc space infections 1.4% and unspecified bone/joint infections 0.8%), varying from 12.2% of all HAIs in Latvia to 0% in Denmark, Estonia and Iceland. Central and peripheral vascular catheter-related infections without positive blood culture (CRI1 and CRI2) accounted for 16.2% of other HAI types, ranging from 0% in Iceland, Denmark and Sweden to 6.3% in Austria. Infections of the cardiovascular system (CVS) accounted for 14.1% in this category (9.8% arterial or venous infections (CVS-VASC)) and varied between 0% in Cyprus and 8.2% of all HAIs in Bulgaria. In the Netherlands, 82.3% of the HAIs in this category (n=121/147) were unspecified, due to the fact that the type of HAI on admission was only specified for surgical site infections in the national protocol.

Catheter-related infections, with or without positive blood culture or positive catheter tip culture (BSI with origin C-CVC or C-PVC, NEO-CNSB or NEO-LCBI with origin C-CVC or C-PVC, CRI of all types and CVS-VASC) made up 6.7% of all HAIs, ranging from 2.0% in Iceland and 2.9% in Luxembourg to 19.0% in Cyprus (Figure 36).

Figure 36. Relative frequency of catheter-related infections as a total of all HAIs, by country, ECDC PPS 2011–2012

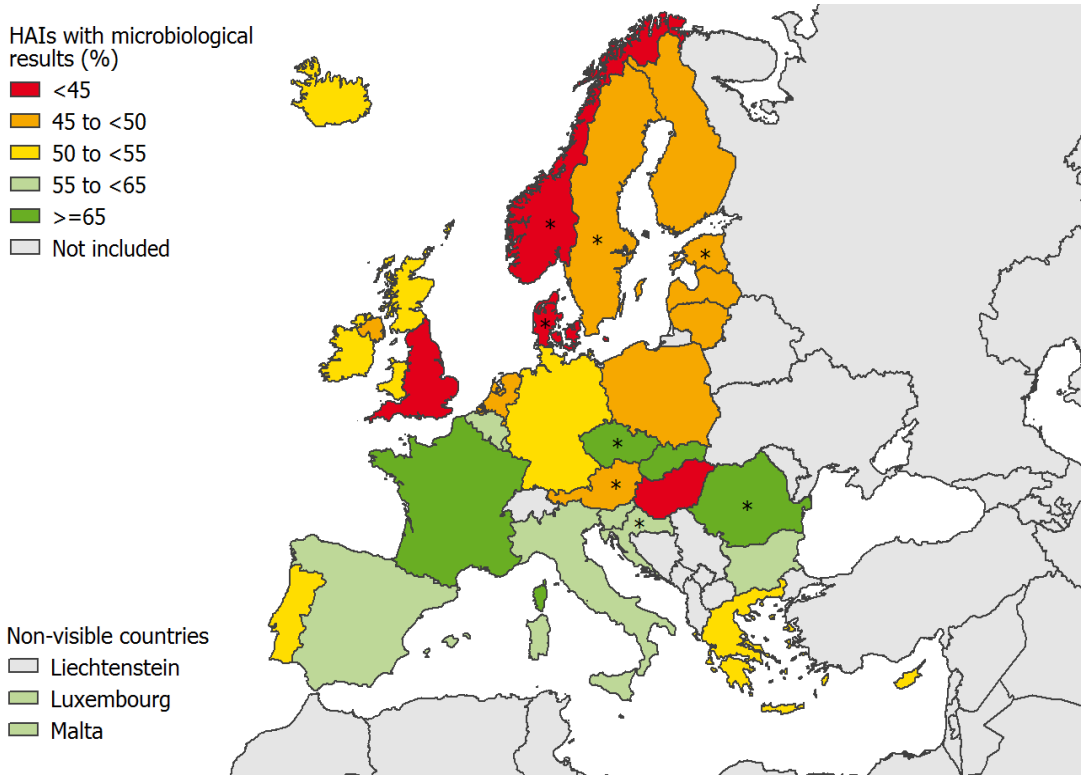


Catheter-related infections with or without positive blood culture or positive catheter tip culture = BSI with origin C-CVC or C-PVC, NEO-CNSB or NEO-LCBI with origin C-CVC or C-PVC, CRI of all types and CVS-VASC.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Microorganisms isolated from HAI

The percentage of HAIs documented with microbiological results ranged from 40.2% in UK-England to 80.5% in Romania (Figure 37). The detailed distribution of microorganisms and negative results (no examination done, result not (yet) available, sterile examination or microorganism non identified) is given by country in Annex 1 (Table A1.4).

Figure 37. Percentage of HAIs with non-negative microbiological results on the PPS day, ECDC PPS 2011–2012



The Netherlands: including HAI present on admission for which no microbiological data were collected in the national protocol; without HAIs on admission, the percentage HAIs with microbiological results in the Netherlands was 76.9%.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

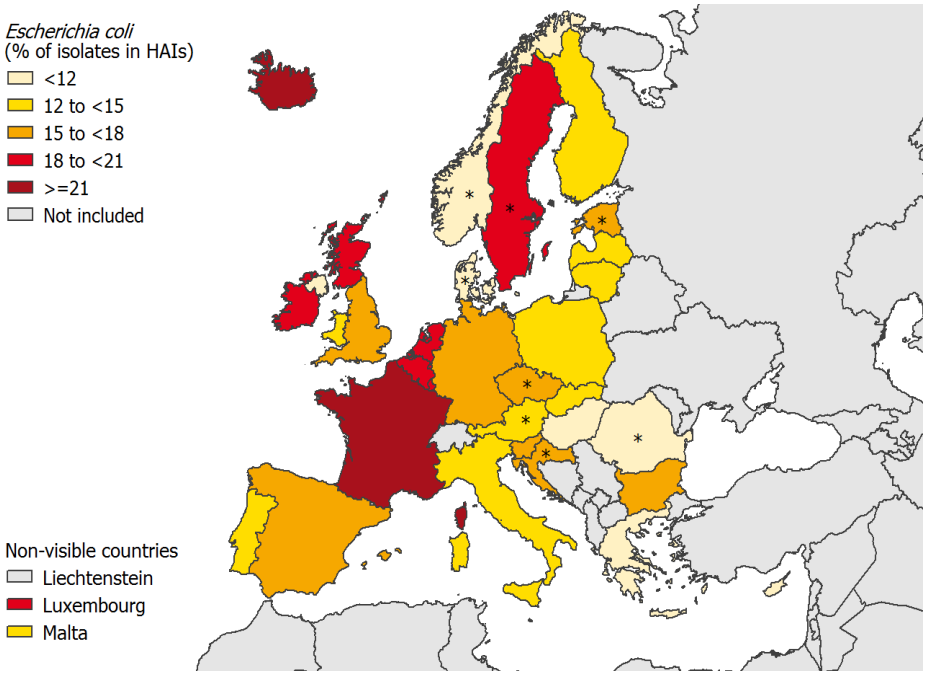
The microorganisms most frequently reported from HAIs were the most common in almost all countries with some rank differences (Table 18). They range from 73.2% of all microorganisms in Norway to 93.4% in Portugal and even 99.9% in Sweden. The highest percentage of *E. coli* was observed in France (26.6%) and the lowest in Cyprus (3.9%). *E. coli* was one of the first three most common microorganisms in most of the countries, except in Cyprus, Denmark, Greece, Romania and UK-Northern Ireland (Figure 38). *Staphylococcus aureus* was most common in Malta (26.5%) and least common in Greece (3%) (Figure 39). The percentage of enterococci varied between 4.5% in the Czech Republic and Norway and more than 20% of all microorganisms in Denmark and Sweden (Figure 40). *Pseudomonas aeruginosa* ranged from 0% in Iceland and Latvia to 16.8% in Greece. *Klebsiella* spp. (79.0% of which were *K. pneumoniae*) varied from less than 4% in Iceland, Sweden, UK-England, UK-Northern Ireland and UK-Wales to 17.6% in Greece (Figure 41). The percentage of coagulase-negative staphylococci was lowest in Romania (2.9%) and highest in Denmark, Iceland, Latvia and Sweden. The highest percentages of *Candida* spp. were reported from Denmark (19.4%), Iceland (10.8%) and Sweden (10.3%). One quarter (24.7%) of *Candida* spp. were non-albicans species, varying between no non-albicans *Candida* spp. in seven countries with less than 10 *Candida* isolates, and 40% or more of *Candida* spp. in Denmark, Hungary, Luxembourg and Slovakia. *Clostridium difficile* was the most common in Hungary (20.6%) and UK-Wales (18.9%) (Figure 42). The percentage of *Enterobacter* spp. was 6% or more in Belgium, Estonia, the Netherlands, Poland and Slovenia. *Proteus* spp. were most common in Slovakia (8.0%) and UK-Northern Ireland (10.1%). No *Acinetobacter* spp. were reported from nine countries, but in four countries (Latvia, Romania, Bulgaria and Greece), the percentage of these bacteria ranged from 10.6% to almost 17% (Figure 43).

Table 18. Relative frequency (percentage) of microorganisms most commonly reported for HAIs, by country, ECDC PPS 2011–2012

	Total number of isolates	*Escherichia coli*	*Staphylococcus aureus*	*Enterococcus* spp.	*Pseudomonas aeruginosa*	*Klebsiella* spp.	*Coag.-negative staphylococci*	*Candida* spp.	*Clostridium difficile*	*Enterobacter* spp.	*Proteus* spp.	*Acinetobacter* spp.
Austria*	176	14.8	8.5	13.1	11.4	6.8	10.2	8.0	9.7	5.7	2.8	0.6
Belgium	904	19.6	10.7	7.9	9.5	7.7	8.6	5.6	4.2	6.1	5.1	0.7
Bulgaria	258	17.1	9.7	13.2	7.8	10.1	7.4	3.9	0.0	4.7	4.7	14.3
Croatia*	227	15.4	12.8	7.0	14.5	11.9	7.5	5.3	3.1	3.1	4.8	4.8
Cyprus	51	3.9	21.6	3.9	13.7	11.8	5.9	5.9	5.9	2.0	5.9	7.8
Czech Republic*	177	16.4	18.6	4.5	8.5	12.4	6.8	4.0	7.3	4.5	5.1	0.0
Denmark*	36	5.6	8.3	22.2	2.8	5.6	16.7	19.4	2.8	0.0	0.0	0.0
Estonia*	78	17.9	14.1	11.5	5.1	7.7	3.8	3.8	2.6	9.0	3.8	3.8
Finland	471	13.0	13.2	13.2	6.2	6.2	9.6	5.1	8.5	3.8	1.3	1.5
France	402	26.6	14.2	10.2	7.0	4.2	8.0	2.5	1.7	4.7	5.0	2.0
Germany	369	17.6	13.3	14.6	4.6	7.9	5.1	4.6	10.0	4.3	4.1	0.0
Greece	564	8.3	3.0	8.9	16.8	17.6	5.0	3.7	1.1	3.2	4.6	16.8
Hungary	257	10.5	12.8	8.9	7.0	6.6	7.0	5.8	20.6	2.7	1.2	4.7
Iceland	37	21.6	5.4	16.2	0.0	0.0	13.5	10.8	0.0	2.7	5.4	0.0
Ireland	310	19.7	14.8	11.0	3.5	6.8	7.1	7.1	9.4	2.6	2.9	0.6
Italy	841	12.7	8.3	7.1	10.7	13.4	9.3	9.4	3.8	3.8	3.9	5.7
Latvia	47	12.8	12.8	8.5	0.0	17.0	14.9	0.0	10.6	4.3	0.0	10.6
Lithuania	181	13.8	16.0	11.6	6.6	9.9	7.7	5.0	0.0	1.7	5.0	5.0
Luxembourg	76	18.4	10.5	7.9	6.6	6.6	9.2	9.2	14.5	2.6	3.9	0.0
Malta	34	14.7	26.5	11.8	2.9	5.9	2.9	8.8	2.9	5.9	0.0	0.0
Netherlands	329	20.1	14.3	12.2	7.0	9.1	5.2	3.3	1.5	7.6	3.6	0.6
Norway*	67	11.9	20.9	4.5	1.5	7.5	11.9	7.5	6.0	0.0	0.0	1.5
Poland	324	14.8	8.3	10.2	10.5	12.0	9.6	2.8	7.7	7.4	4.0	3.1
Portugal	775	14.1	17.0	11.2	13.3	9.4	4.3	6.5	3.7	4.0	3.4	6.5
Romania	74	6.8	18.9	6.8	8.1	13.5	2.7	4.1	2.7	0.0	5.4	12.2
Slovakia	287	15.0	7.7	5.9	10.8	12.5	7.0	7.3	1.7	4.9	8.0	3.5
Slovenia	312	17.0	7.7	11.2	10.6	11.2	6.4	8.0	0.6	7.1	4.5	1.6
Spain	1024	16.8	10.5	11.6	10.4	6.6	9.1	8.7	0.9	4.1	2.8	2.1
Sweden*	29	20.7	6.9	27.6	0.0	0.0	17.2	10.3	6.9	3.4	6.9	0.0
UK-England	725	17.0	15.0	5.4	7.3	3.4	5.8	6.5	12.4	3.6	2.9	0.8
UK-Northern Ireland	99	8.1	14.1	12.1	4.0	3.0	7.1	7.1	8.1	2.0	10.1	0.0
UK-Scotland	355	20.3	23.9	6.8	2.0	4.2	8.5	3.7	8.7	1.7	2.3	0.8
UK-Wales	180	14.4	18.3	6.1	3.9	2.2	6.7	5.0	18.9	0.6	1.7	0.0
Europe	**10076**	**15.9**	**12.3**	**9.6**	**8.9**	**8.7**	**7.5**	**6.1**	**5.4**	**4.2**	**3.8**	**3.6**
Country P25	76	12.8	8.5	7.0	3.9	5.9	5.9	4.0	1.7	2.6	2.8	0.0
Country P50	257	15.0	13.2	10.2	7.0	7.7	7.4	5.8	4.2	3.8	3.9	1.5
Country P75	369	17.9	16.0	12.1	10.5	11.8	9.3	8.0	8.7	4.7	5.0	4.8

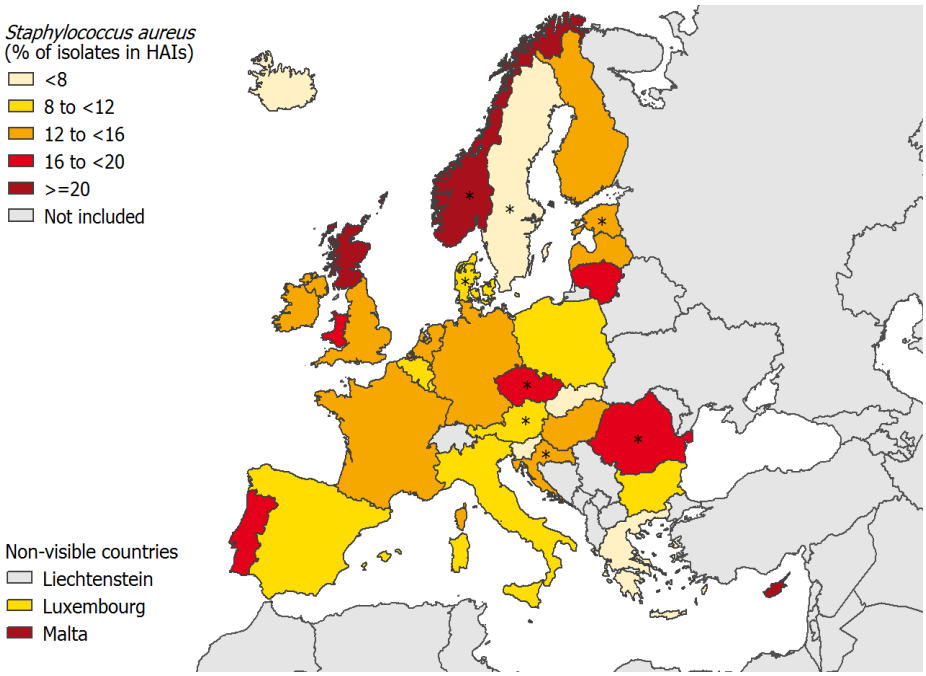
P=percentile.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Figure 38. Relative frequency of *Escherichia coli* isolates as a percentage of all microorganisms reported for HAIs, by country (n=1601 isolates), ECDC PPS 2011–2012



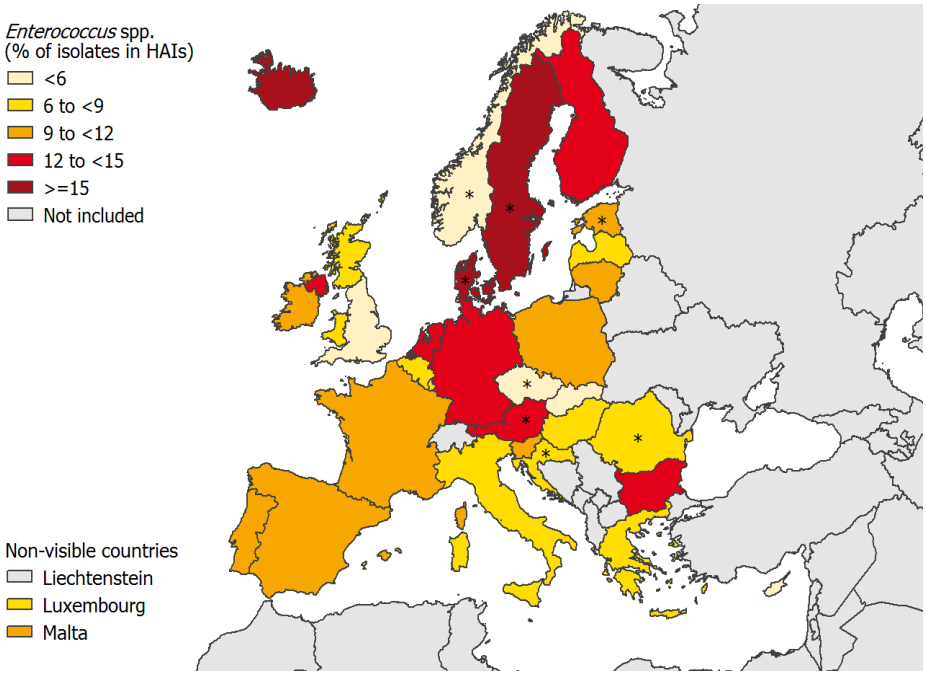
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. See table 18 for total number of microorganisms by country.*

Figure 39. Relative frequency of *Staphylococcus aureus* as a percentage of all microorganisms reported for HAIs, by country (n=1243 isolates), ECDC PPS 2011–2012



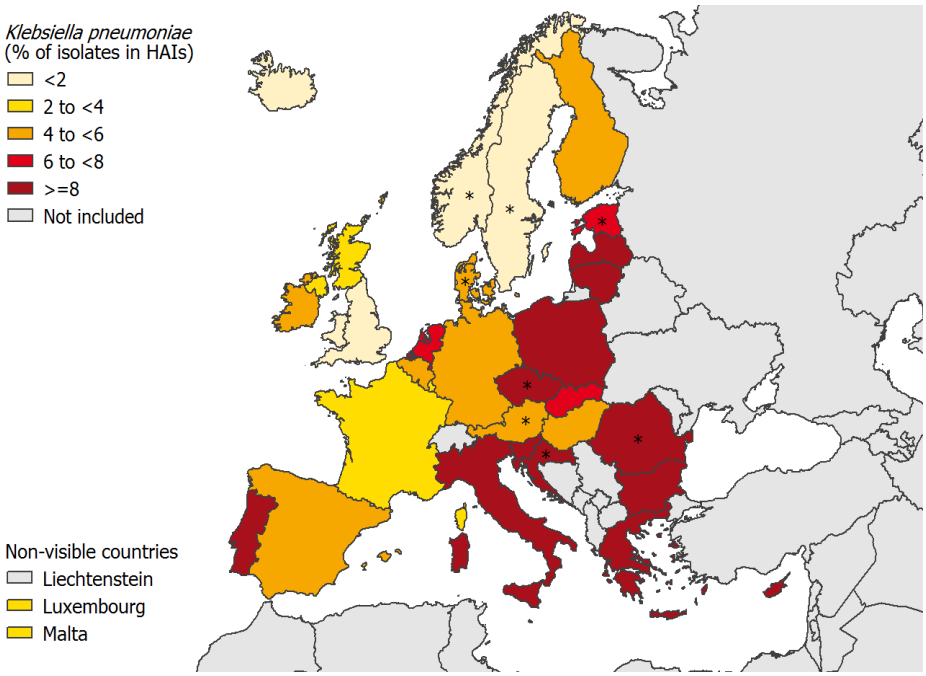
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. See table 18 for total number of microorganisms by country.*

Figure 40. Relative frequency of *Enterococcus* spp. as a percentage of all microorganisms reported for HAIs, by country (n=969 isolates), ECDC PPS 2011–2012



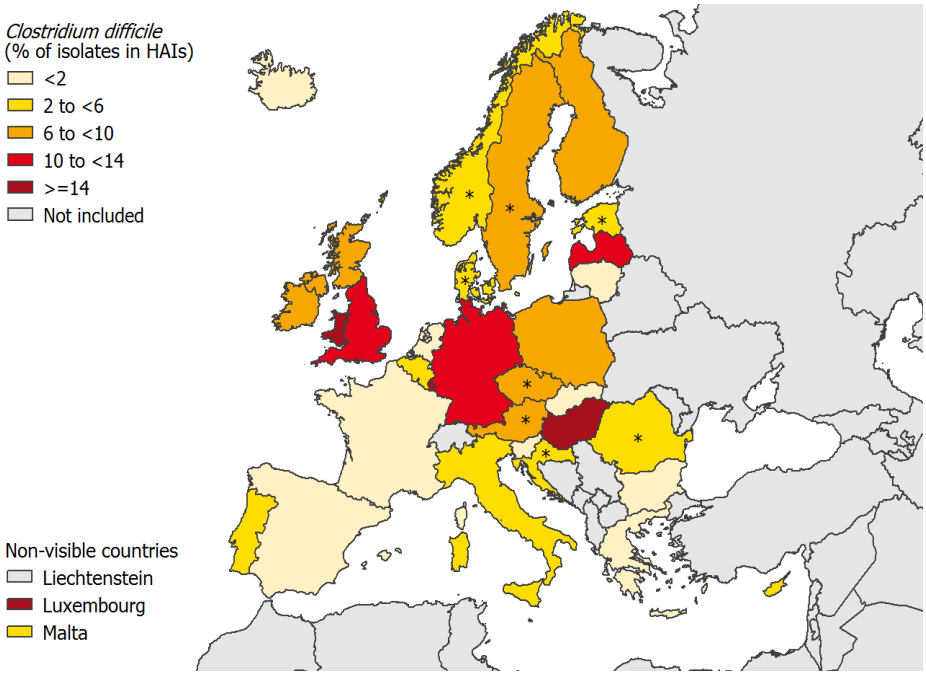
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. See table 18 for total number of microorganisms by country.*

Figure 41. Relative frequency of *Klebsiella pneumoniae* as a percentage of all microorganisms reported for HAIs, by country (n=689 isolates), ECDC PPS 2011–2012



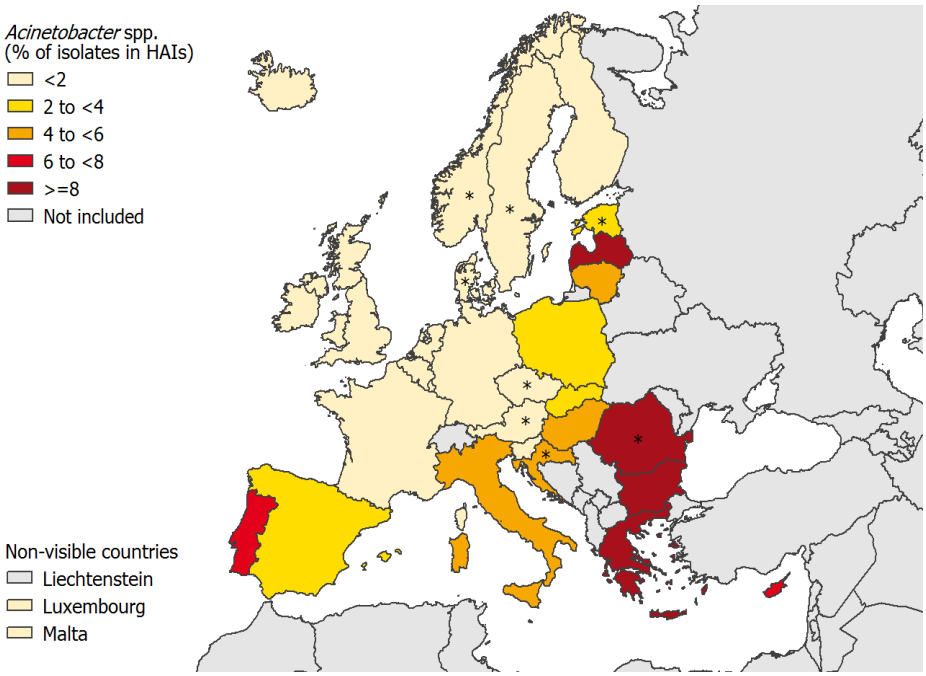
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. See table 18 for total number of microorganisms by country.*

Figure 42. Relative frequency of *Clostridium difficile* as a percentage of all microorganisms reported for HAIs, by country (n=548 isolates), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. See table 18 for total number of microorganisms by country.*

Figure 43. Relative frequency of *Acinetobacter* spp. as a percentage of all microorganisms reported for HAIs, by country (n=366 isolates), ECDC PPS 2011–2012

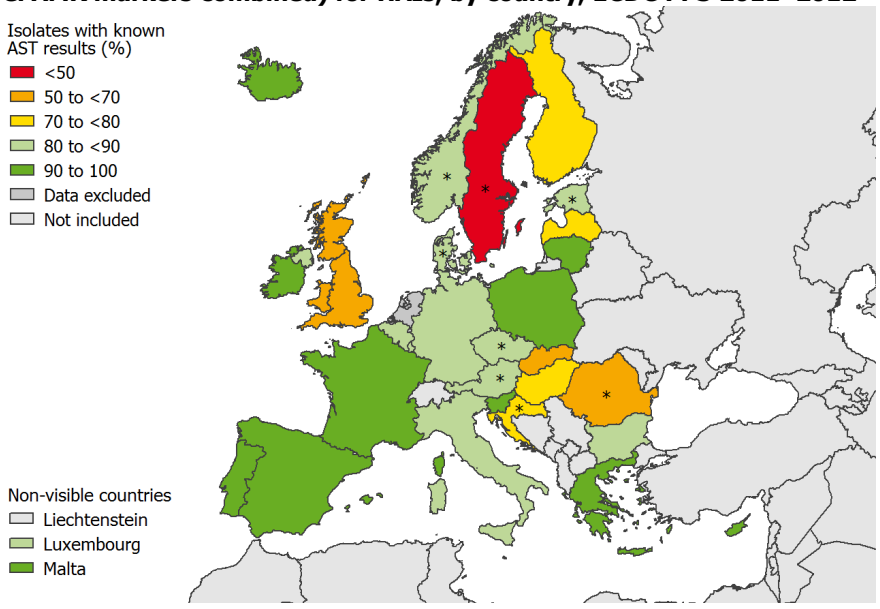


**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden. See table 18 for total number of microorganisms by country.*

Antimicrobial resistance in HAI

The percentage of microorganisms with known AST results varied between 47.4% in Sweden and 100% in Malta (Figure 44). In the Netherlands, the method for collecting AST data differed from the ECDC protocol since only data on non-susceptible isolates were collected. So for unavailable AST data it was unknown whether the isolates were sensitive or whether the result was not tested or not available at the time of the survey. Data for the Netherlands are therefore excluded from the maps.

Figure 44. Percentage of isolates with known antimicrobial susceptibility testing (AST) results (first-level AMR markers combined) for HAIs, by country, ECDC PPS 2011–2012

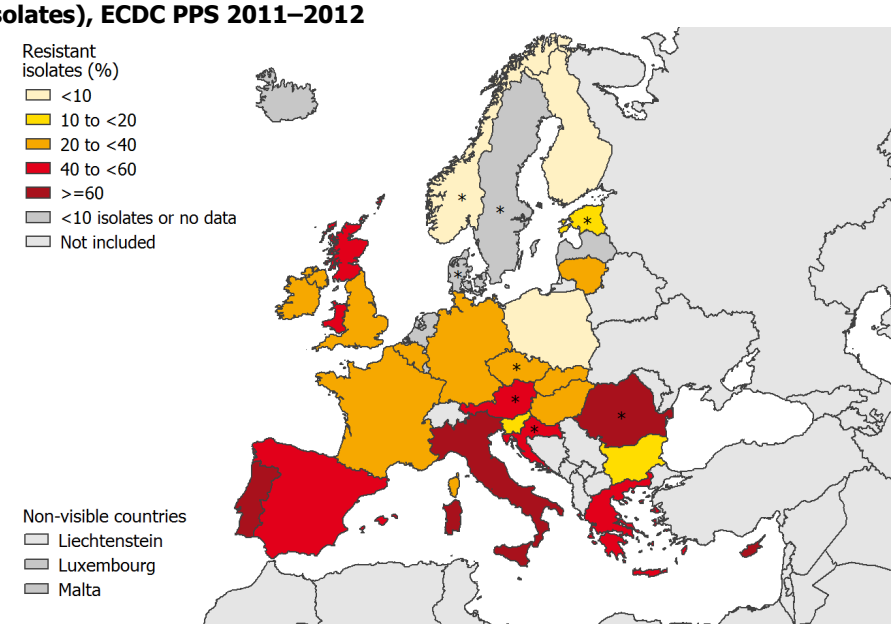


First-level antimicrobial resistance markers in PPS: MRSA, VRE, Enterobacteriaceae non-susceptible to third-generation cephalosporins, Pseudomonas aeruginosa *and* Acinetobacter baumannii *non-susceptible to carbapenems. Data from the Netherlands were excluded for reasons explained above.*
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Staphylococcus aureus

Twenty six countries reported at least 10 isolates of *S. aureus* with known susceptibility results for meticillin. Six countries reported less than 20% meticillin-resistance in *S. aureus* (MRSA) isolates from HAIs. Norway and the Netherlands reported no MRSA isolates. In Cyprus, Italy, Portugal and Romania, over 60% of *S. aureus* isolates from HAIs were MRSA (Figure 45).

Figure 45. Percentage of meticillin-resistant *S. aureus* isolates from HAIs, by country (n=1071 isolates), ECDC PPS 2011–2012

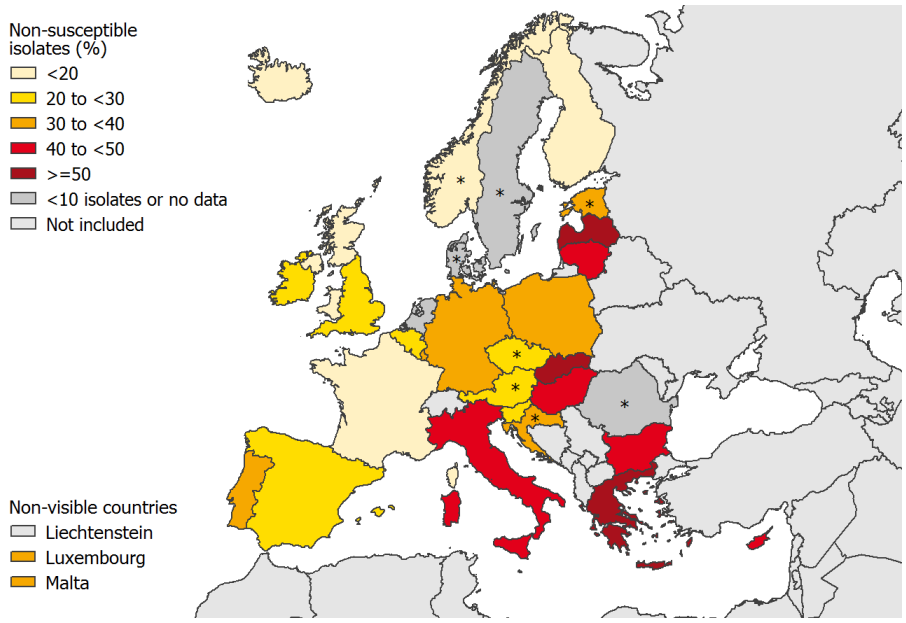


Countries with <10 isolates with known antimicrobial susceptibility results not shown. The Netherlands: only resistant isolates reported in national protocol, n of reported MRSA isolates: 0/47 S.aureus isolates.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Enterobacteriaceae

Non-susceptibility to third-generation cephalosporins among Enterobacteriaceae isolates from HAIs was the lowest in Norway (7.7%, one of 13 isolates) and over 40% in eight of 29 countries that reported more than 10 isolates with known AST results (Figure 46). The highest percentage of non-susceptibility to third-generation cephalosporins was observed in Greece (63.9% of 183 isolates) and Latvia (71.4% of 14 isolates).

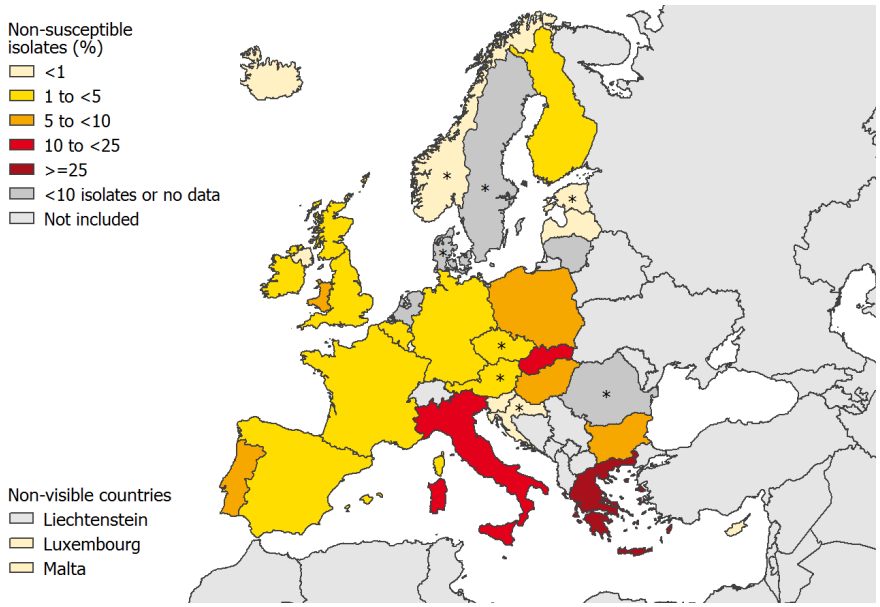
Figure 46. Percentage of Enterobacteriaceae isolates from HAIs non-susceptible to third-generation cephalosporins by country (n=2851 isolates), ECDC PPS 2011–2012



Countries with <10 isolates with known antimicrobial susceptibility results not shown. The Netherlands: only non-susceptible isolates reported (24 out of 142 Enterobacteriaceae isolates were non-susceptible to third-generation cephalosporins).
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Ten of 28 countries reported no Enterobacteriaceae not susceptible to carbapenems. Three countries reported over 20% of enterobacteria isolates resistant to carbapenem with the highest level in Greece (39.9%) (Figure 47).

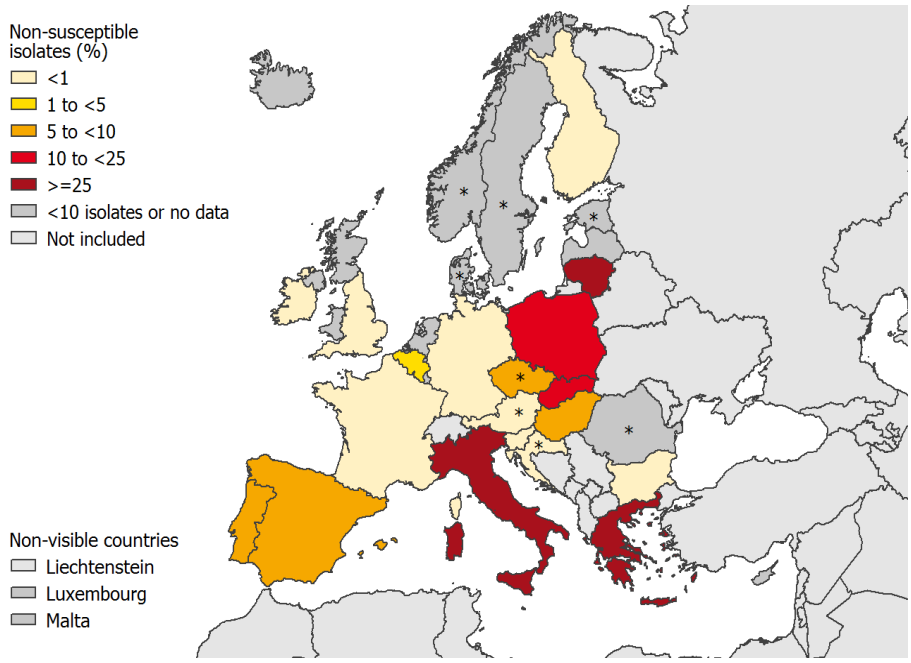
Figure 47. Percentage of Enterobacteriaceae isolates from HAIs non-susceptible to carbapenems, by country (n=2787 isolates), ECDC PPS 2011–2012



Countries with <10 isolates with known antimicrobial susceptibility results not shown. The Netherlands: only resistant isolates reported (n of carbapenem-R isolates: 0/142 Enterobacteriaceae isolates); Lithuania was excluded because no carbapenem susceptibility data provided for Enterobacteriaceae other than K. pneumoniae*.*
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Nine of 19 countries reported no carbapenem resistance among *Klebsiella* spp. isolates (Figure 48). Non-susceptibility to carbapenems in *K. pneumoniae* was higher than 50% in Italy (51.7%), Greece (66.7%) and Lithuania (66.7%).

Figure 48. Percentage of *Klebsiella* spp. isolates from HAIs non-susceptible to carbapenems, by country (n=726 isolates), ECDC PPS 2011–2012

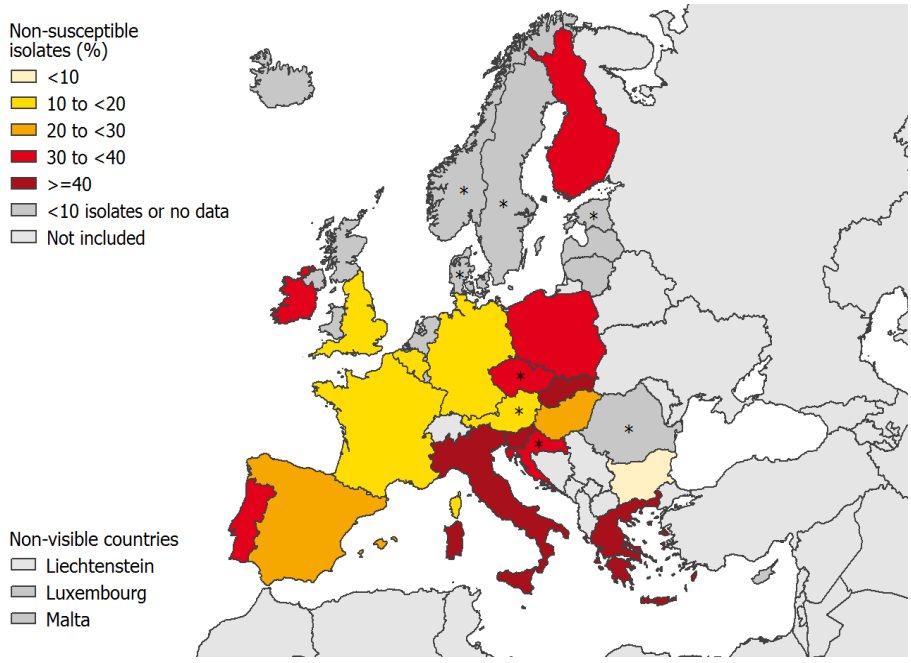


Countries with <10 isolates with known antimicrobial susceptibility results not shown. The Netherlands: only resistant isolates reported (n of carbapenem-R isolates: 0/33 Klebsiella *spp. isolates, of which 24* K. pneumoniae).
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Gram-negative non-fermenting bacteria

Carbapenem AST data for at least 10 *P. aeruginosa* isolates were reported by 18 countries. The percentage of non-susceptible isolates varied from 6.3% in Bulgaria to almost 49.4%% in Greece (Figure 49).

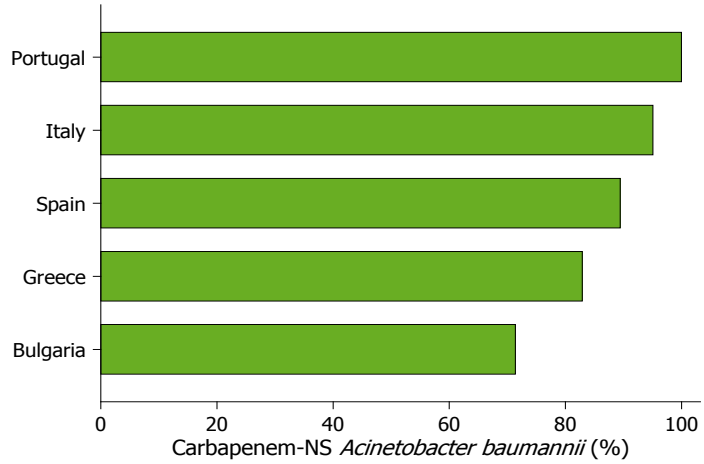
Figure 49. Percentage of *P. aeruginosa* isolates in HAIs non-susceptible to carbapenems, by country (n=756 isolates), ECDC PPS 2011–2012



Countries with <10 isolates with known antimicrobial susceptibility results not shown.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Only five countries reported resistance data for at least ten isolates of *Acinetobacter baumannii* from HAIs. In these countries, resistance to carbapenems ranged from 71.4% in Bulgaria to 100% in Portugal (Figure 50).

Figure 50. Percentage of *Acinetobacter baumannii* isolates from HAIs non-susceptible to carbapenems, by country (n=292 isolates), ECDC PPS 2011–2012

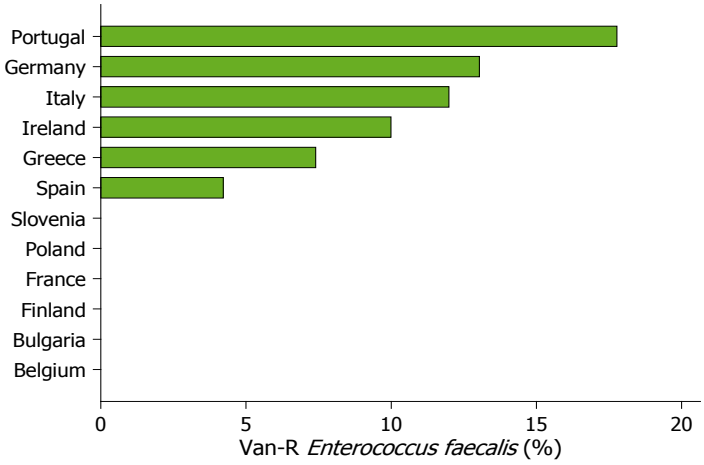


Countries with <10 isolates with known antimicrobial susceptibility results not shown.

Enterococci

Glycopeptide-resistant *E. faecalis* was reported by six countries with more than 10 isolates of *E. faecalis* from HAIs and varied from 4.2% in Spain to 17.8% in Portugal. In another six countries no resistant isolates were reported (Figure 51).

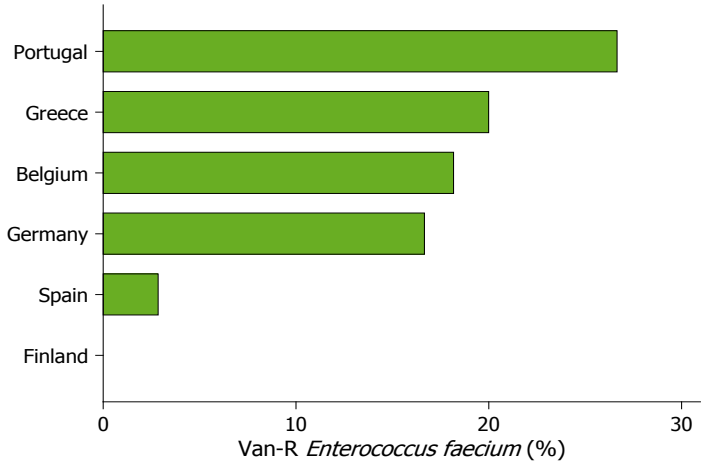
Figure 51. Percentage of glycopeptide-resistant *E. faecalis* isolates from HAIs, by country (n=455 isolates), ECDC PPS 2011–2012



Countries with <10 isolates with known antimicrobial susceptibility results not shown.

Glycopeptide-resistant isolates of *E. faecium* were reported by five countries ranging from 2.9% in Spain to 26.7% in Portugal (Figure 52).

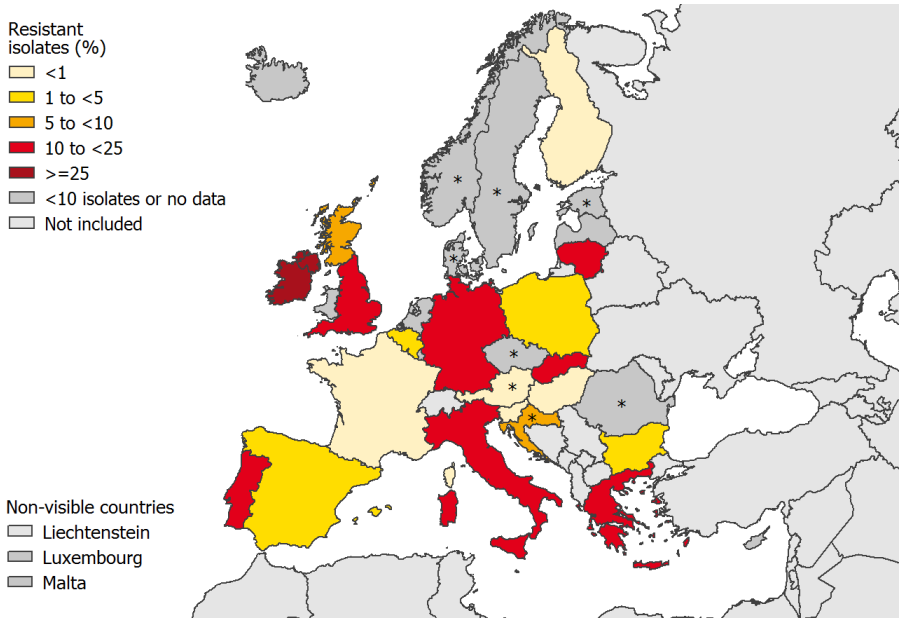
Figure 52. Percentage of glycopeptide-resistant *E. faecium* isolates from HAIs, by country (n=205 isolates), ECDC PPS 2011–2012



Countries with <10 isolates with known antimicrobial susceptibility results not shown.

When all *Enterococcus* species were combined, resistance data for at least 10 enterococci isolates were available for 20 countries. The percentage of glycopeptide resistance (VRE) varied from 0% in five countries and 3.6% in Belgium to 31.0% in Ireland.

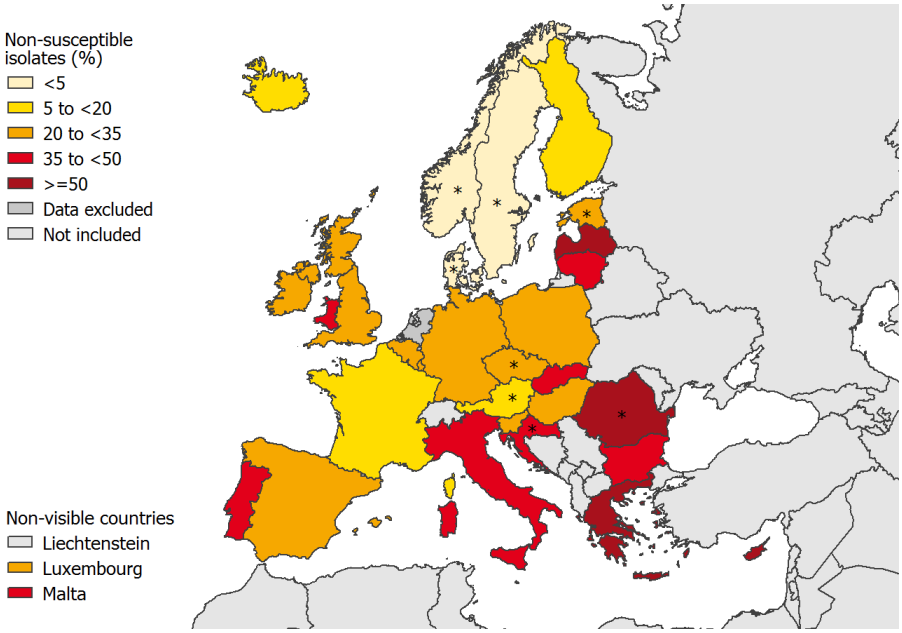
Figure 53. Percentage of glycopeptide-resistant *Enterococcus* spp. (VRE) isolated from HAIs, by country (n=755 isolates), ECDC PPS 2011–2012



Countries with <10 isolates with known antimicrobial susceptibility results not shown.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Out of a total of 5725 isolates for which AST results were provided, 1948 isolates (all species combined), or 34.0%, were non-susceptible to the antimicrobial resistance marker included in the PPS protocol (first-line marker, or third-generation cephalosporins for Enterobacteriaceae). This percentage varied between 0% in Denmark and Sweden and 81.8% in Romania.

Figure 54. Composite index: percentage of isolates non-susceptible to first-level antimicrobial resistance markers from HAIs, by country (n=5725 isolates), ECDC PPS 2011–2012



First-level antimicrobial resistance markers in PPS: MRSA, VRE, Enterobacteriaceae non-susceptible to third-generation cephalosporins, Pseudomonas aeruginosa *and* Acinetobacter baumannii *non-susceptible to carbapenems. Data from the Netherlands were excluded for reasons explained above.*
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Antimicrobial use

Main results

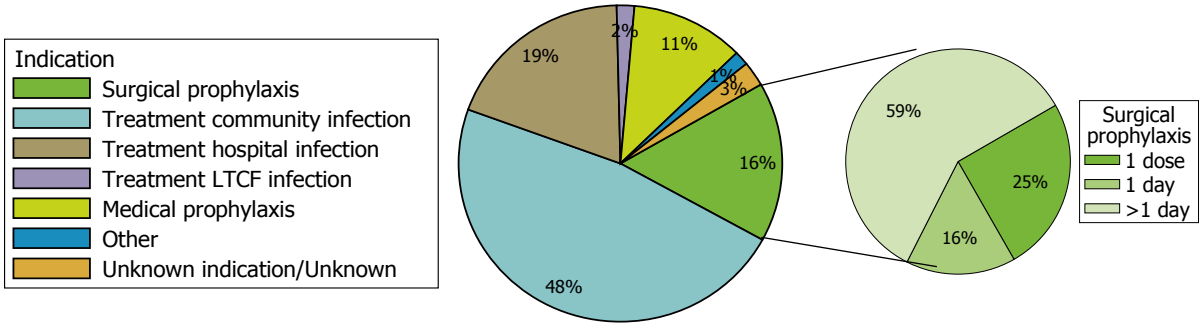
Prevalence of antimicrobial use and indication

Of a total of 231 459 patients in the database, 80 951 patients (35.0%) received at least one antimicrobial agent. A total of 110 151 antimicrobial agents were reported, which is an average 1.36 antimicrobials per patient receiving antimicrobials. Of 80 951 patients, 70.9% received one antimicrobial agent, 23.4% received two and 5.7% received three or more antimicrobial agents (up to a maximum of eight antimicrobials for two patients).

Antimicrobials were administered parenterally in 70.6% of cases. The reason for antimicrobial use was documented in the patient's medical records for 79.4% of prescriptions.

Antimicrobials were most frequently prescribed for treatment of an infection (68.4%): a community-acquired infection (47.6%), a hospital infection (19.1%) or an infection acquired in a long-term care facility (1.8%). Surgical prophylaxis was the indication for 16.3% of prescriptions: 59.2% for more than one day, 15.8% for one day and only 25.0% for less than one day (Figure 55). Overall, 53 742 of 231 459 patients (23.2%) were receiving treatment for an infection. The prevalence of patients receiving treatment for a hospital infection was 6.4%. The prevalence of patients receiving surgical prophylaxis was 6.5% (Table 19).

Figure 55. Indications for antimicrobial use in European acute care hospitals, ECDC PPS 2011-2012



LTCF: Long-term care facility.

Table 19. Indication for antimicrobial use, route of administration and documentation of the reason for antimicrobial use in the patient notes, ECDC PPS 2011–2012

	Number of patients	Prevalence %	N of antimicrobials	Relative frequency %
Total	**80951**	**35.0**	**110151**	**100.0**
Indication for antimicrobial use				
Treatment	54630	23.6	75332	68.4
Community infection	38977	16.8	52391	47.6
Hospital infection	14733	6.4	21001	19.1
Other healthcare-associated infection	1490	0.6	1953	1.8
Surgical prophylaxis	15056	6.5	17992	16.3
Single dose	3998	1.7	4512	4.1
One day	2619	1.1	2846	2.6
>1 day	8762	3.8	10653	9.7
Medical prophylaxis	9956	4.3	12480	11.3
Other indication	1261	0.5	1606	1.5
Unknown indication, verified	1147	0.5	1383	1.3
Unknown/missing	1133	0.5	1393	1.3
Route of administration				
Parenteral	58359	25.2	77738	70.6
Oral	27131	11.7	31763	28.8
Other/unknown	559	0.2	650	0.6
Reason in notes				
Yes	64397	27.8	87471	79.4
No	15310	6.6	19113	17.4
Unknown	2711	1.2	3567	3.2

A total of 56 890 infections diagnosed by a physician were treated in 53 742 patients, which is an average of 1.06 infections per treated patient. The most common diagnosis site of infection was the respiratory tract (32.8%) with pneumonia and bronchitis accounting for 23.8% and 9.0%, respectively. Respiratory tract infections were more common among community-acquired infections (35.4%) and those acquired in long-term care (37.1%) than among hospital infections (25.8%). Urinary tract infections accounted for 16.1% of diagnoses, with symptomatic lower urinary tract infections accounting for 11.1% and upper urinary tract infections for 4.5%. Systemic infections, including laboratory-confirmed bacteraemia, accounted for 13.5% of diagnoses and were more common among hospital infections than community or long-term care infections (18.9% versus 11.4% and 12.3%, respectively).

Table 20. Site of diagnosis for antimicrobial treatment of infections, ECDC PPS 2011–2012

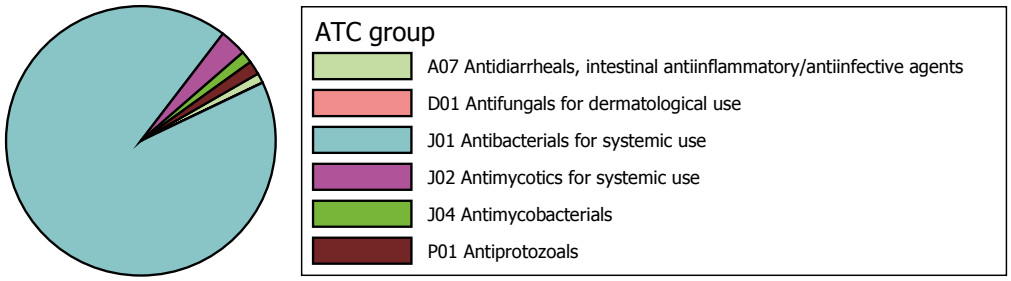
	Total	%	CI	%	HI	%	LI	%
Total number of diagnoses (N of infections)	**56890**	**100.0**	**39749**	**100.0**	**15611**	**100.0**	**1530**	**100.0**
Respiratory tract	18650	32.8	14059	35.4	4024	25.8	567	37.1
PNEU (Pneumonia)	13552	23.8	9751	24.5	3364	21.5	437	28.6
BRON (Acute bronchitis or exacerbations of chronic bronchitis)	5098	9.0	4308	10.8	660	4.2	130	8.5
Urinary tract	9131	16.1	5995	15.1	2767	17.7	369	24.1
CYS (Symptomatic lower urinary tract infections)	6311	11.1	3795	9.5	2243	14.4	273	17.8
PYE (Symptomatic upper urinary tract infections)	2588	4.5	2081	5.2	422	2.7	85	5.6
ASB (Asymptomatic bacteriuria)	232	0.4	119	0.3	102	0.7	11	0.7
Systemic infections	7679	13.5	4537	11.4	2954	18.9	188	12.3
BAC (Laboratory-confirmed bacteraemia)	2031	3.6	819	2.1	1147	7.3	65	4.2
CSEP (Clinical sepsis, excluding FN)	1996	3.5	1045	2.6	896	5.7	55	3.6
FN (Febrile neutropaenia or other infection of immunocompromised)	1027	1.8	621	1.6	390	2.5	16	1.0
SIRS (Systemic inflammatory response with no clear anatomic site)	1008	1.8	745	1.9	248	1.6	15	1.0
UND (Completely undefined, site with no systemic inflammation)	1617	2.8	1307	3.3	273	1.7	37	2.4
Cardiovascular system	726	1.3	465	1.2	246	1.6	15	1.0
Gastro-intestinal system	6915	12.2	5086	12.8	1721	11.0	108	7.1
GI (GI infections (salmonellosis, antibiotic-associated diarrhoea))	2794	4.9	1951	4.9	787	5.0	56	3.7
IA (Intra-abdominal sepsis including hepatobiliary)	4121	7.2	3135	7.9	934	6.0	52	3.4
Skin/soft tissue/bone/joint	8773	15.4	5758	14.5	2815	18.0	200	13.1
SST (Cellulitis, wound, deep soft tissue not involving bone)	7142	12.6	4673	11.8	2311	14.8	158	10.3
BJ (Septic arthritis (including prosthetic joint), osteomyelitis)	1631	2.9	1085	2.7	504	3.2	42	2.7
Central nervous system	724	1.3	549	1.4	165	1.1	10	0.7
Eye/ear/nose/throat	2597	4.6	1979	5.0	588	3.8	30	2.0
EYE (Endophthalmitis)	144	0.3	121	0.3	23	0.1	0	0.0
ENT (Infections of ear, mouth, nose, throat or larynx)	2453	4.3	1858	4.7	565	3.6	30	2.0
Genito-urinary system/obstetrics	943	1.7	782	2.0	148	0.9	13	0.8
OBGY (Obstetric or gynaecological infections, STD in women)	665	1.2	542	1.4	117	0.7	6	0.4
GUM (Prostatitis, epididymoorchitis, STD in men)	278	0.5	240	0.6	31	0.2	7	0.5
Missing/Unknown	752	1.3	539	1.4	183	1.2	30	2.0

CI: community infection; HI: hospital infections; LI: long-term care or other healthcare-associated infections.

Distribution of antimicrobial agents

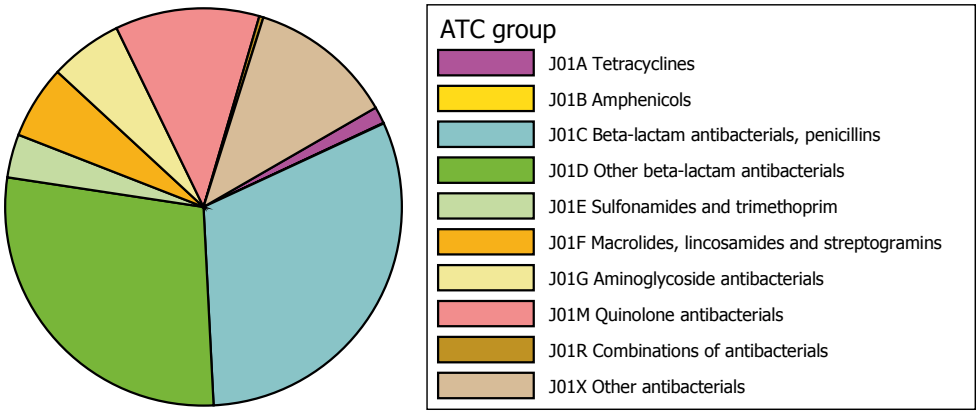
Antibacterials for systemic use (ATC group J01) represented 92.5% of all reported antimicrobials (Figure 56). Antimycotics for systemic use (ATC group J02) accounted for 3.3% overall. Although in the Netherlands antimycotics (ATC groups J02 and D01) were not included in the national protocol, the exclusion of the Netherlands only had a minor influence on these percentages (92.4% J01 antibacterials and 3.3% J02 antimycotics, respectively). Triazole derivates accounted for 81.5% of J02 antimycotics (fluconazole 66.4%, voriconazole 7.0%, itraconazole 4.2% and posaconazole 3.9%), amphotericin B 7.0%, imidazole derivates 2.0% and other antimycotics for systemic use 9.6% (caspofungin 5.9%, anidulafungin 2.0%, micafungin 1.5%). Antimycobacterials (J04) (included in the protocol for other indications than *Mycobacterium tuberculosis* only) made up 1.5% of the total, of which rifampicin accounted for 52.3%, isoniazid for 18.0%, ethambutol for 15.8%, pyrazinamide for 13.5%, and rifabutin for 0.3%. Antiprotozoals (ATC group P01) accounted for 1.7% of all antimicrobials, 98.6% of which were oral or rectal metronidazole. ATC group A07 made up 1.2% of the total, of which nystatin accounted for 45.5%, oral vancomycin for 30.9%, rifaximin for 9.9%, oral colistin for 7.2% and oral amphotericin B for 2.7%. Only 13 (0.01% of total) antifungals for dermatologic use (ATC group D01) were reported.

Figure 56. Distribution of antimicrobial use in acute care hospitals on the day of the survey, by ATC level 2 group (n= 110 151 antimicrobial agents), ECDC PPS 2011–2012



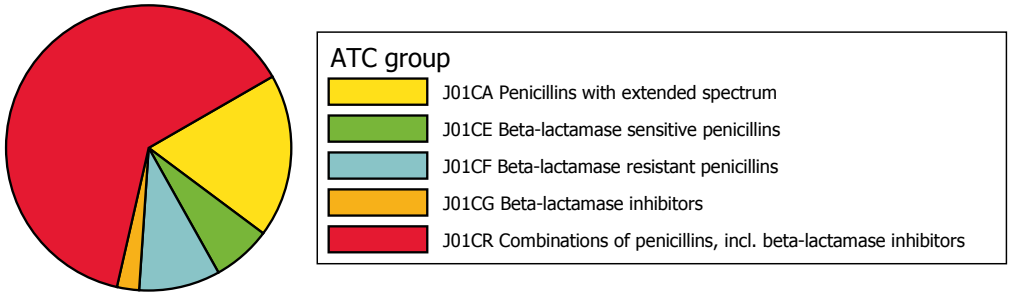
Within the ATC group J01 (antibacterials for systemic use), the most frequently used classes were penicillins (31.1%), other beta-lactam antibacterials (28.2%), quinolones (11.8%) and other antibacterials (11.8%) (Figure 57).

Figure 57. Distribution of use of ATC group J01 (antibacterials for systemic use) in acute care hospitals on the day of the survey (n= 101 866 antimicrobial agents), ECDC PPS 2011–2012



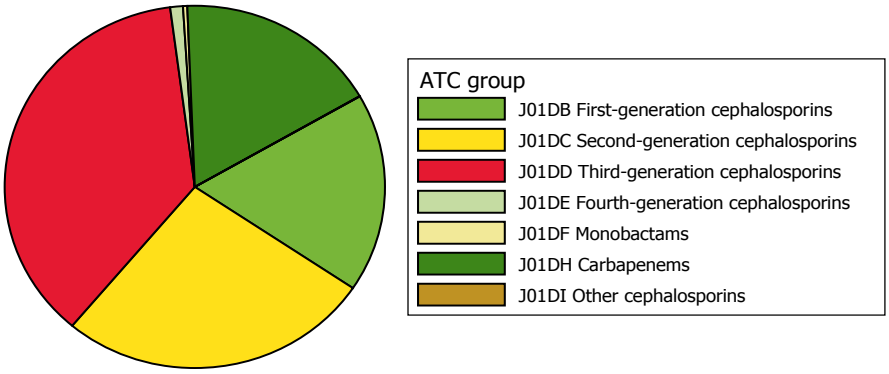
The ATC fourth level group J01CR (combinations of penicillins including beta-lactam inhibitors) accounted for 63.1% of all penicillins (Figure 58), of which J01CR01 (amoxicillin and enzyme inhibitor) accounted for 60.6% and J01CR05 (piperacillin and enzyme inhibitor) for 29.1%. Penicillins with extended spectrum (J01CA) made up 18.5% of all penicillins and included predominantly amoxicillin (56.8%) and ampicillin (26.7%).

Figure 58. Distribution of use of ATC group J01C (beta-lactam antibacterials, penicillins) in acute care hospitals on the day of the survey (n= 31 673 antimicrobial agents), ECDC PPS 2011–2012



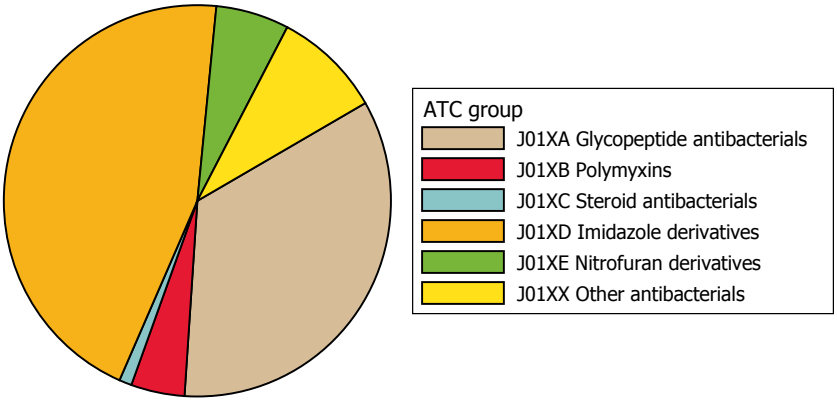
In the ATC third level group J01D (other beta-lactam antibacterials), third-generation cephalosporins were most frequently used (36.8%), followed by second-generation cephalosporins (26.7%), first-generation cephalosporins (17.8%) and carbapenems (17.3%) (Figure 59).

Figure 59. Distribution of use of ATC group J01D (Other beta-lactam antibacterials) in acute care hospitals on the day of the survey (n= 28 717 antimicrobial agents), ECDC PPS 2011–2012



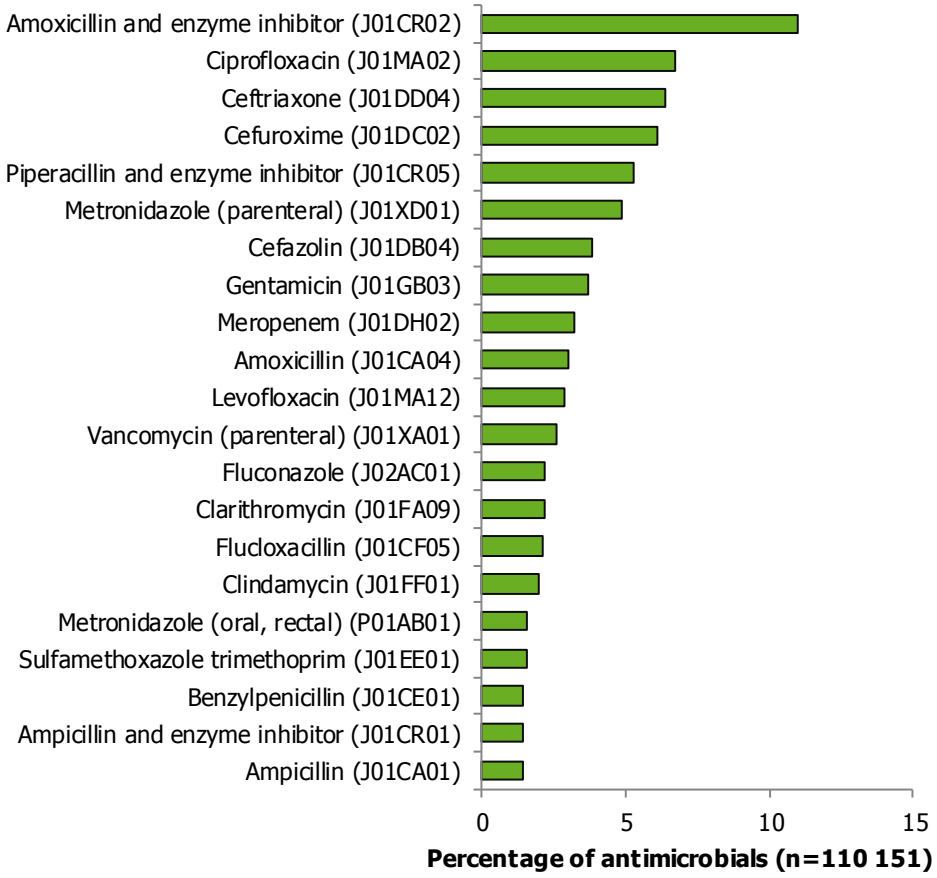
Within the group of other antibacterials (J01X), imidazole derivates (99.3% parenteral metronidazole) accounted for 45.0% of antimicrobial agents, glycopeptide antibacterials 34.4% (68.9% parenteral vancomycin and 31.0% teicoplanin), nitrofuran derivates 6.1%, polymyxins 4.5% (98.3% parenteral colistin), steroid antibacterials (fusidic acid) 1.0% and other antibacterials (ATC fourth level J01XX) 9.0% (linezolid 67.2%, daptomycin 18.7%, fosfomycin 8.2%) (Figure 60).

Figure 60. Distribution of use of ATC group J01X (Other antibacterials) in acute care hospitals on the day of the survey (n= 12 012 antimicrobial agents), ECDC PPS 2011–2012



Out of a total of 222 different antimicrobials reported at the fifth ATC level, 21 (9.5%) accounted for 75% of the total antimicrobial use in European hospitals (Figure 61). The most frequently prescribed antibiotic, amoxicillin with enzyme inhibitor (J01CR02), accounted for 11.0% of all antimicrobial agents and was used in 79.2% of hospitals. Ciprofloxacin accounted for 6.7% of the total, but was used in more (84.3%) hospitals. The median number of different antimicrobials (ATC fifth level) reported, by hospital, was 20 (IQR 12–29).

Figure 61. Antimicrobial agents accounting for 75% of antimicrobial use in European acute care hospitals (DU 75%), ECDC PPS 2011–2012



DU: drug utilisation.

The type of antimicrobials used varied considerably by indication (Table 21 and Table A1.6). Combinations of penicillins, including beta-lactamase inhibitors (ATC group J01CR) were the most common group of antimicrobials in all indications except for surgical prophylaxis. For surgical prophylaxis, first- and second-generation cephalosporins (ATC groups J01DB and J01DC), aminoglycosides (ATC group J01GB) and imidazole derivates – in particular parenteral metronidazole (J01XD01) – were used more often than for other indications ($p<0.001$). Within ATC group J01CR, amoxicillin and enzyme inhibitor (J01CR02) was the most frequently used drug in all indications except for the treatment intention of hospital infections, where it accounted for only 7.7% of all antimicrobials, compared with 11.8% for all other indications combined; while piperacillin and enzyme inhibitor (J01CR05) accounted for 9.0% of treatment for hospital infections compared with 4.4% for other indications ($p<0.001$). Antimicrobial use intended to treat hospital infections was also characterised by higher (significant at $p<0.001$ level) use of intestinal anti-infectives (ATC group A07AA), in particular of oral vancomycin (A07AA09, 1.2% for hospital infection versus 0.2% for other indications combined), tetracyclines (ATC group J01AA), in particular tigecycline (J01AA12, 0.8% versus 0.1%), the beta-lactamase inhibitors sulbactam and tazobactam (ATC group J01CG, 1.0% versus 0.7%), fourth-generation cephalosporins (ATC group J01DE, 0.6% versus 0.2%), carbapenems (ATC group J01DH, 9.4% versus 3.4%), glycopeptide antibacterials (ATC group J01XA, 8.6% versus 2.6%), polymyxins (ATC group J01XB, 1.6% versus 0.2%), other antibacterials (ATC group J01XX, 2.5% versus 0.6%), all antimycotics for systemic use (ATC group J02, 5.8% versus 2.7%) and nitroimidazole derivates (ATC group P01AB), in particular oral metronidazole (P01AB01, 2.4% versus 1.4%). The distribution of antimicrobials in the treatment of infections associated with long-term care showed a profile in between the treatment of community infections and hospital infections, with, for example, a similar use of amoxicillin and enzyme inhibitor as for the treatment of community infections (14.2% versus 13.1%), but a higher use of piperacillin and enzyme inhibitor (9.0% versus 5.6%), oral vancomycin (0.9% versus 0.2%), carbapenems (6.4% versus 4.2%) or polymyxins (0.9% versus 0.2%).

Table 21. Distribution of antimicrobials (fourth ATC level*) as a percentage of the total number of antimicrobials, by indication, ECDC PPS 2011–2012

	CI	HI	LI	SP	MP	Oth	Unk	Total
Number of antimicrobials	**52380**	**20989**	**1953**	**17982**	**12474**	**1604**	**2769**	**110151**
A07AA Intestinal anti-infectives, antibiotics	0.6	2.6	1.3	0.1	2.6	2.4	1.5	1.2
D01BA Antifungals for systemic use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J01AA Tetracyclines	1.6	1.7	1.0	0.3	0.6	2.8	1.9	1.3
J01BA Amphenicols	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0
J01CA Penicillins, extended spectrum without anti-pseudomonal activity	6.7	3.6	3.9	3.0	5.9	6.0	4.8	5.3
J01CE Beta-lactamase sensitive penicillins	2.6	1.2	0.6	0.6	2.3	2.3	1.9	1.9
J01CF Beta-lactamase resistant penicillins	2.9	3.1	2.0	2.7	0.8	1.4	2.7	2.6
J01CG Beta-lactamase inhibitors	0.8	1.0	1.1	0.4	0.4	0.4	0.5	0.7
J01CR Combinations of penicillins, incl. beta-lactamase inhibitors	20.5	17.6	25.0	14.2	13.6	13.2	21.8	18.1
J01DB First-generation cephalosporins	1.5	0.9	0.7	20.1	3.0	1.9	2.4	4.6
J01DC Second-generation cephalosporins	5.4	2.8	3.5	18.9	4.8	5.0	4.9	7.0
J01DD Third-generation cephalosporins	10.9	6.0	10.8	9.7	9.8	8.0	9.1	9.6
J01DE Fourth-generation cephalosporins	0.2	0.6	0.4	0.1	0.3	0.2	0.1	0.3
J01DF Monobactams	0.1	0.2	0.2	0.0	0.0	0.2	0.0	0.1
J01DH Carbapenems	4.2	9.4	6.4	1.1	2.6	4.6	3.6	4.5
J01DI Other cephalosporins and penems	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J01EA Trimethoprim and derivatives	1.2	1.7	1.2	0.3	2.6	1.0	1.8	1.3
J01EB Short-acting sulfonamides	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.1
J01EC Intermediate-acting sulfonamides	0.1	0.1	0.2	0.0	0.2	0.1	0.1	0.1
J01ED Long-acting sulfonamides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J01EE Combinations of sulfonamides and trimethoprim, incl. derivatives	0.9	1.3	1.1	0.6	8.1	0.6	1.9	1.8
J01FA Macrolides	5.1	1.4	4.7	0.4	2.9	13.0	3.1	3.4
J01FF Lincosamides	2.4	1.7	2.1	1.9	1.2	1.5	1.2	2.0
J01FG Streptogramins	0.1	0.1	0.3	0.0	0.0	0.1	0.0	0.1
J01GA Streptomycins	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
J01GB Aminoglycosides	5.0	5.6	3.9	6.8	5.3	6.7	4.4	5.4
J01M1 First-generation quinolones	0.2	0.2	0.3	0.2	0.8	0.5	0.4	0.3
J01M2 Second-generation quinolones	10.7	9.7	12.5	5.8	12.1	10.1	13.6	10.0
J01M3 Third-generation quinolones	1.0	0.5	0.7	0.1	0.3	0.1	0.6	0.6
J01RA Combinations of antibacterials	0.3	0.1	0.2	0.4	0.5	0.6	0.3	0.3
J01XA Glycopeptide antibacterials	2.6	8.6	4.8	2.7	2.1	2.9	2.5	3.8
J01XB Polymyxins	0.2	1.6	0.9	0.0	0.5	0.5	0.4	0.5
J01XC Steroid antibacterials	0.2	0.1	0.1	0.0	0.0	0.2	0.1	0.1
J01XD Imidazole derivatives	4.8	3.8	3.8	7.7	3.4	5.8	5.1	4.9
J01XE Nitrofuran derivatives	0.6	0.9	0.9	0.1	1.4	0.4	0.9	0.7
J01XX Other antibacterials	0.7	2.5	1.0	0.2	0.8	0.6	0.7	1.0
J02AA Antimycotics, antibiotics	0.1	0.4	0.2	0.0	0.7	0.2	0.1	0.2
J02AB Imidazole derivatives	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1
J02AC Triazole derivatives	1.5	4.4	2.2	0.2	8.0	3.1	3.6	2.6
J02AX Other antimycotics for systemic use	0.1	0.9	0.2	0.0	0.4	0.1	0.4	0.3
J04 Antimycobacterials	2.4	1.0	0.7	0.1	0.5	0.6	0.9	1.4
P01AB Nitroimidazole derivatives	1.7	2.4	1.3	0.9	1.0	2.8	2.3	1.6

**Fourth ATC level except for quinolone antibacterials (classified according to reference [39]) and antimycobacterials combined at second ATC level J04.*
CI: treatment intention of community infection, HI: treatment intention of hospital infection, LI: treatment intention of long-term care/other healthcare-associated infection, SP: surgical prophylaxis, MP: medical prophylaxis, Oth: other indications, Unk: Unknown indication and missing data.

Medical prophylaxis was characterised by a higher relative use of intestinal anti-infectives (ATC group A07AA), in particular of nystatin (A07AA02, 1.3% versus 0.5% for other indications) and oral colistin (A07AA02, 0.5% versus 0.04%), trimethoprim including derivates and combinations (ATC groups J01EA and J01EE, 2.6% and 8.1% versus 1.2% and 1.0%, respectively), quinolone antibacterials (ATC group J01M, 13.2% versus 10.6%) and antimycotics

for systemic use (ATC group J02, 9.1% versus 2.5%). Macrolides (ATC group J01FA) were 13.0% of antimicrobial use for 'other' indications, compared with 3.3% of all other indications combined.

Antimicrobial use by hospital type, specialty and patient risk factors

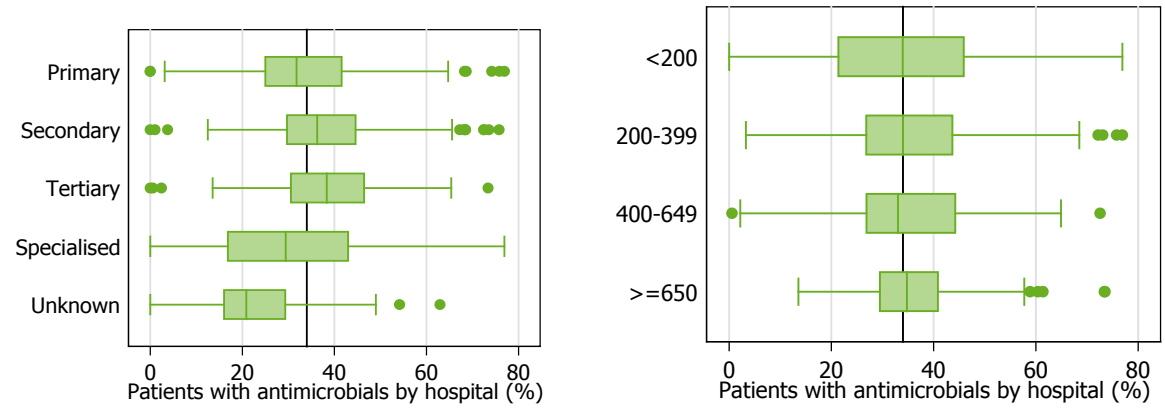
The prevalence of antimicrobial use varied significantly by hospital type ($p<0.001$). Primary hospitals recorded the lowest prevalence of 31.7% (median 31.8%, IQR 25.0–41.7%), in secondary hospitals the prevalence was 35.8% (median 36.3% IQR 29.7–44.6%), in tertiary hospitals it was 37.4% (median 38.4% IQR 30.7–46.6%) and in specialised hospitals it was similar to the prevalence in primary hospitals at 31.9%, but with a larger variation between hospitals (median 29.8%, IQR 16.9–43.1) (Table 21). Prevalence of antimicrobial use did not vary by hospital size (Figure 62).

Table 22. Percentile distribution of the prevalence of antimicrobial use, by hospital type, ECDC PPS 2011–2012

	No of hospitals	No of patients	Pts with AU	Prev AU %	P10	P25	P50	P75	P90
Primary	269	36 399	11 556	31.7	19.6	25.0	31.8	41.7	51.3
Secondary	301	79 964	28 608	35.8	24.7	29.7	36.3	44.6	53.5
Tertiary	204	90 173	33 732	37.4	26.2	30.7	38.4	46.6	54.5
Specialised	113	13 998	4 471	31.9	7.0	16.9	29.8	43.1	53.8
Unknown	60	10 925	2 585	23.7	11.8	16.0	20.9	29.3	41.2
Total	**947**	**231 459**	**80 952**	**35.0**	**19.0**	**26.2**	**34.0**	**44.3**	**52.9**

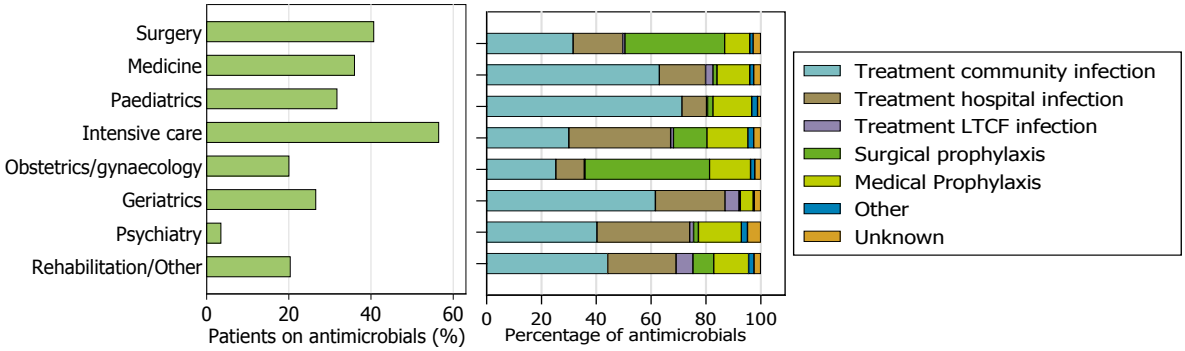
Pts with AU: patients receiving at least one antimicrobial; Prev AU: percentage patients receiving at least one antimicrobial; P: percentile.

Figure 62. Prevalence of antimicrobial use (percentage of patients on antimicrobials), by hospital type (left) and size (right), n=947 hospitals (vertical black line=overall median), ECDC PPS 2011–2012



The prevalence of antimicrobial use was lowest among psychiatric patients (3.5%) and highest among ICU patients (56.5%) (Figure 63). The indications for antimicrobial use varied considerably by patient/consultant specialty with the highest relative use for treatment of community infections in paediatric patients (71.3% of all antimicrobials), the highest use for treatment of hospital infections in ICU patients (37.3%) and for treatment of infections associated with long-term care in rehabilitation and geriatric patients (6.1% and 5.1%, respectively). Surgical prophylaxis was the most common indication in obstetrics and gynaecology (45.4%); the relative frequency of medical prophylaxis varied between 4.7% in geriatrics and 15.6% in psychiatry. The percentage of patients receiving more than one antimicrobial varied between 8.7% in psychiatry and 47.7% in the ICU.

Figure 63. Prevalence of antimicrobial use (percentage of patients on antimicrobials) by patient/consultant specialty (left) and indication for antimicrobial use by patient/consultant specialty (right), ECDC PPS 2011–2012



LTCF=long-term care facility.

The distribution of antibacterials for systemic use by patient/consultant specialty showed the highest relative use of aminoglycosides among paediatric patients and the highest use of other antibacterials among ICU patients (Figure 64).

Figure 64. Distribution of antibacterials for systemic use (ATC group J01) by patient/consultant specialty, ECDC PPS 2011–2012

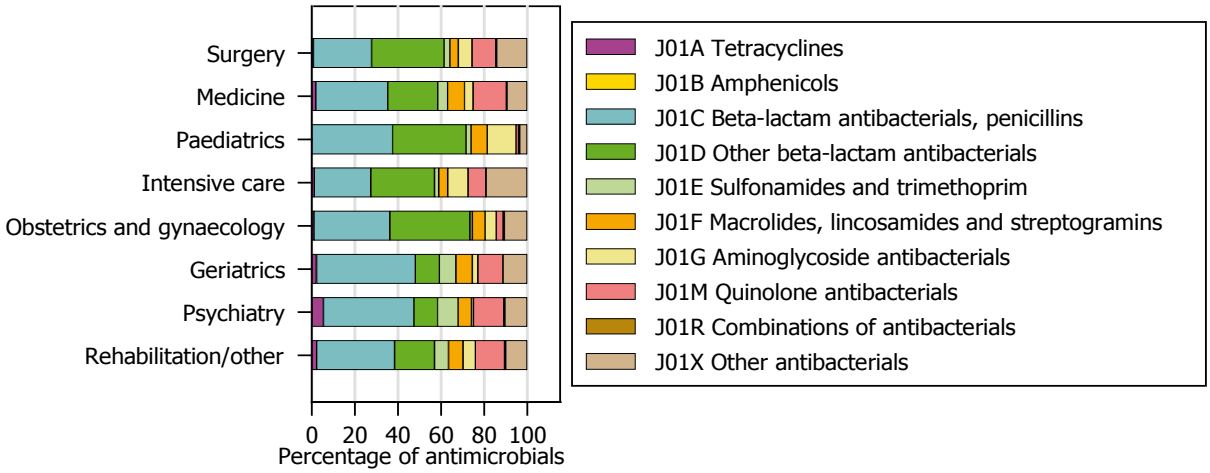


Table 23 shows the prevalence of antimicrobial use by patient risk factors for 215 537 patients in 30 countries that used the standard (patient-based) protocol. In multiple logistic regression, antimicrobial use was independently associated at the $p<0.001$ level with all risk factors and with 54 out of 60 (90%) of the risk factor sublevels. The highest independent risk (adjusted odds ratio ≥2.0) was observed in patients with intubation or urinary catheters and in the patient/consultant specialties urology, plastic and reconstructive surgery, burns care, haematology and bone marrow transplantation, nephrology, pneumology, infectious disease, general paediatrics, surgical intensive care, paediatric intensive care and neonatal intensive care. The lowest independent risk (adjusted odds ratio ≤0.5) was observed in neonates (less than one month old) and in the patient/consultant specialties neurology, psychiatry, obstetrics and maternity, and rehabilitation and other specialties. Central and peripheral vascular catheters were not included in the model because of the association with parenteral antimicrobial use. The discriminatory power of the model as measured by the area under the ROC curve was 0.7264 for the model development sample (two thirds of the data) and 0.7278 for the validation (other) third of the data. The model goodness-of-fit tested on subsamples of the data was good with non-significant Hosmer–Lemeshow Chi Square tests for six out of eight tested random subsamples.

Table 23. Patient risk factors for antimicrobial use with crude and adjusted odds ratios from multiple logistic regression model, n=215 537 patients in 30 countries, standard protocol data only, ECDC PPS 2011–2012

	N of patients	% of total	N of pts with AU	Pts with AU %	Crude OR (95%CI)			Adj. OR* (95%CI)		
All patients (standard protocol)	**215 537**	**100.0**	**76 186**	**35.3**						
Age										
5-45 years (ref.)	42 825	19.9	13 460	31.4	ref.			ref.		
<1 month	7 592	3.5	1 151	15.2	0.4	(0.4 -	0.4)	0.4	(0.4 -	0.5)
1–11 months	5 135	2.4	1 844	35.9	1.2	(1.2 -	1.3)	0.9	(0.8 -	1.0)
1–<5 years	4 275	2.0	2 109	49.3	2.1	(2.0 -	2.3)	1.3	(1.2 -	1.4)
45–74 years	88 726	41.2	32 681	36.8	1.3	(1.2 -	1.3)	0.9	(0.8 -	0.9)
75–84 years	43 665	20.3	16 509	37.8	1.3	(1.3 -	1.4)	0.9	(0.8 -	0.9)
≥85 years	23 319	10.8	8 432	36.2	1.2	(1.2 -	1.3)	0.9	(0.8 -	0.9)
Male Gender	101 137	46.9	39 400	39.0	1.3	(1.3 -	1.4)	1.2	(1.1 -	1.2)
Length of stay (days) (1)										
1–3 days	70 705	32.8	21 251	30.1	ref.			ref.		
4–7 days	57 159	26.5	22 349	39.1	1.5	(1.5 -	1.5)	1.5	(1.4 -	1.5)
8–14 days	42 008	19.5	16 722	39.8	1.5	(1.5 -	1.6)	1.4	(1.4 -	1.5)
≥15 days	44 617	20.7	15 578	34.9	1.2	(1.2 -	1.3)	1.1	(1.1 -	1.1)
Unknown	1 048	0.5	286	27.3	0.9	(0.8 -	1.0)	1.0	(0.8 -	1.2)
McCabe score										
Non-fatal	142 925	66.3	46 514	32.5	ref.			ref.		
Ultimately fatal	34 780	16.1	15 445	44.4	1.7	(1.6 -	1.7)	1.3	(1.2 -	1.3)
Rapidly fatal	11 275	5.2	5 321	47.2	1.9	(1.8 -	1.9)	1.3	(1.2 -	1.3)
Unknown	26 557	12.3	8 906	33.5	1.0	(1.0 -	1.1)	1.0	(0.9 -	1.0)
Surgery since admission										
No surgery	155 733	72.3	48 937	31.4	ref.			ref.		
NHSN surgery	43 456	20.2	19 989	46.0	1.9	(1.8 -	1.9)	1.7	(1.7 -	1.8)
Minimal/non-NSHN surgery	13 882	6.4	6 400	46.1	1.9	(1.8 -	1.9)	1.8	(1.7 -	1.8)
Unknown	2 466	1.1	860	34.9	1.2	(1.1 -	1.3)	1.2	(1.1 -	1.4)
Presence of invasive devices										
Intubation [a]	4 906	2.3	3 558	72.5	5.0	(4.7 -	5.3)	2.1	(1.9 -	2.3)
Urinary catheter [a]	36 907	17.1	21 605	58.5	3.2	(3.1 -	3.3)	2.5	(2.4 -	2.6)
Central vascular catheter [b]	16 086	7.5	10 687	66.4	-			-		
Peripheral vascular catheter [b]	99 867	46.3	52 003	52.1	-			-		
Patient/Consultant specialty										
All other specialties (ref.)	22 621	10.5	5 798	25.6	ref.			ref.		
General surgery	16 527	7.7	7 199	43.6	2.2	(2.1 -	2.3)	1.6	(1.5 -	1.7)
Digestive tract surgery	4 384	2.0	1 856	42.3	2.1	(2.0 -	2.3)	1.4	(1.3 -	1.6)
Orthopaedics and traumatology	19 388	9.0	7 016	36.2	1.6	(1.6 -	1.7)	1.1	(1.0 -	1.2)
Vascular surgery	5 018	2.3	1 977	39.4	1.9	(1.8 -	2.0)	1.3	(1.2 -	1.4)
Neurosurgery	3 636	1.7	1 087	29.9	1.2	(1.1 -	1.3)	0.7	(0.7 -	0.8)
Paediatric general surgery	1 298	0.6	544	41.9	2.1	(1.9 -	2.3)	1.6	(1.4 -	1.9)
Transplant/cancer surgery	1 157	0.5	522	45.1	2.4	(2.1 -	2.7)	1.4	(1.2 -	1.7)
Ear/Nose/Throat surgery	2 963	1.4	1 276	43.1	2.2	(2.0 -	2.4)	1.8	(1.7 -	2.0)
Ophthalmology	1 441	0.7	303	21.0	0.8	(0.7 -	0.9)	0.7	(0.6 -	0.8)

	N of patients	% of total	N of pts with AU	Pts with AU %	Crude OR (95%CI)			Adj. OR* (95%CI)		
Urology	5 656	2.6	3 338	59.0	4.2	(3.9 -	4.4)	2.4	(2.2 -	2.6)
Plastic/reconstructive surgery	1 252	0.6	668	53.4	3.3	(3.0 -	3.7)	2.2	(1.9 -	2.6)
Thoracic surgery	2 536	1.2	1 115	44.0	2.3	(2.1 -	2.5)	1.6	(1.5 -	1.8)
Burns care	184	0.1	97	52.7	3.2	(2.4 -	4.3)	2.0	(1.4 -	2.8)
General medicine	29 061	13.5	11 793	40.6	2.0	(1.9 -	2.1)	1.8	(1.7 -	1.9)
Gastro-enterology	6 317	2.9	2 214	35.0	1.6	(1.5 -	1.7)	1.5	(1.4 -	1.7)
Oncology	5 231	2.4	1 675	32.0	1.4	(1.3 -	1.5)	1.2	(1.1 -	1.3)
Cardiology	12 330	5.7	2 533	20.5	0.8	(0.7 -	0.8)	0.7	(0.7 -	0.7)
Dermatology	1 298	0.6	391	30.1	1.3	(1.1 -	1.4)	1.3	(1.2 -	1.6)
Haematology/BMT	3 547	1.6	2 181	61.5	4.6	(4.3 -	5.0)	4.2	(3.8 -	4.6)
Nephrology	2 988	1.4	1 461	48.9	2.8	(2.6 -	3.0)	2.4	(2.2 -	2.7)
Neurology	9 294	4.3	1 312	14.1	0.5	(0.4 -	0.5)	0.4	(0.4 -	0.5)
Pneumology	8 721	4.0	4 844	55.5	3.6	(3.4 -	3.8)	3.5	(3.2 -	3.7)
Rheumatology	1 487	0.7	240	16.1	0.6	(0.5 -	0.6)	0.7	(0.6 -	0.8)
Infectious diseases	3 144	1.5	2 082	66.2	5.7	(5.3 -	6.2)	6.1	(5.5 -	6.8)
Other medical	2 960	1.4	1 011	34.2	1.5	(1.4 -	1.6)	1.5	(1.4 -	1.7)
Paediatrics general	7 856	3.6	3 220	41.0	2.0	(1.9 -	2.1)	2.1	(2.0 -	2.3)
Surgical ICU	1 973	0.9	1 413	71.6	7.3	(6.6 -	8.1)	2.0	(1.7 -	2.3)
Paediatric ICU	753	0.3	435	57.8	4.0	(3.4 -	4.6)	3.5	(2.9 -	4.3)
Neonatal ICU	2 138	1.0	729	34.1	1.5	(1.4 -	1.6)	2.3	(2.0 -	2.6)
Medical/other ICU	5 640	2.6	3 395	60.2	4.4	(4.1 -	4.7)	1.6	(1.5 -	1.8)
Obstetrics/Maternity	11 444	5.3	1 728	15.1	0.5	(0.5 -	0.5)	0.5	(0.5 -	0.6)
Psychiatry	8 226	3.8	304	3.7	0.1	(0.1 -	0.1)	0.1	(0.1 -	0.2)
Rehabilitation	3 068	1.4	429	14.0	0.5	(0.4 -	0.5)	0.5	(0.4 -	0.6)
Hospital type										
Primary	31 401	14.6	10 332	32.9	ref.			ref.		
Secondary	75 275	34.9	26 859	35.7	1.1	(1.1 -	1.2)	1.2	(1.2 -	1.3)
Tertiary	85 363	39.6	32 320	37.9	1.2	(1.2 -	1.3)	1.3	(1.2 -	1.3)
Specialised	12 573	5.8	4 090	32.5	1.0	(0.9 -	1.0)	0.9	(0.9 -	1.0)
Unknown	10 925	5.1	2 585	23.7	0.6	(0.6 -	0.7)	0.8	(0.7 -	0.8)
Hospital size										
<200 beds	21 039	9.8	7 320	34.8	ref.			ref.		
200–399 beds	49 141	22.8	17 586	35.8	1.0	(1.0 -	1.1)	0.9	(0.9 -	1.0)
400–649 beds	56 311	26.1	20 244	36.0	1.1	(1.0 -	1.1)	0.8	(0.8 -	0.9)
650–899 beds	39 053	18.1	13 778	35.3	1.0	(1.0 -	1.1)	0.8	(0.8 -	0.8)
≥900 beds	49 993	23.2	17 258	34.5	1.0	(1.0 -	1.0)	0.7	(0.7 -	0.8)

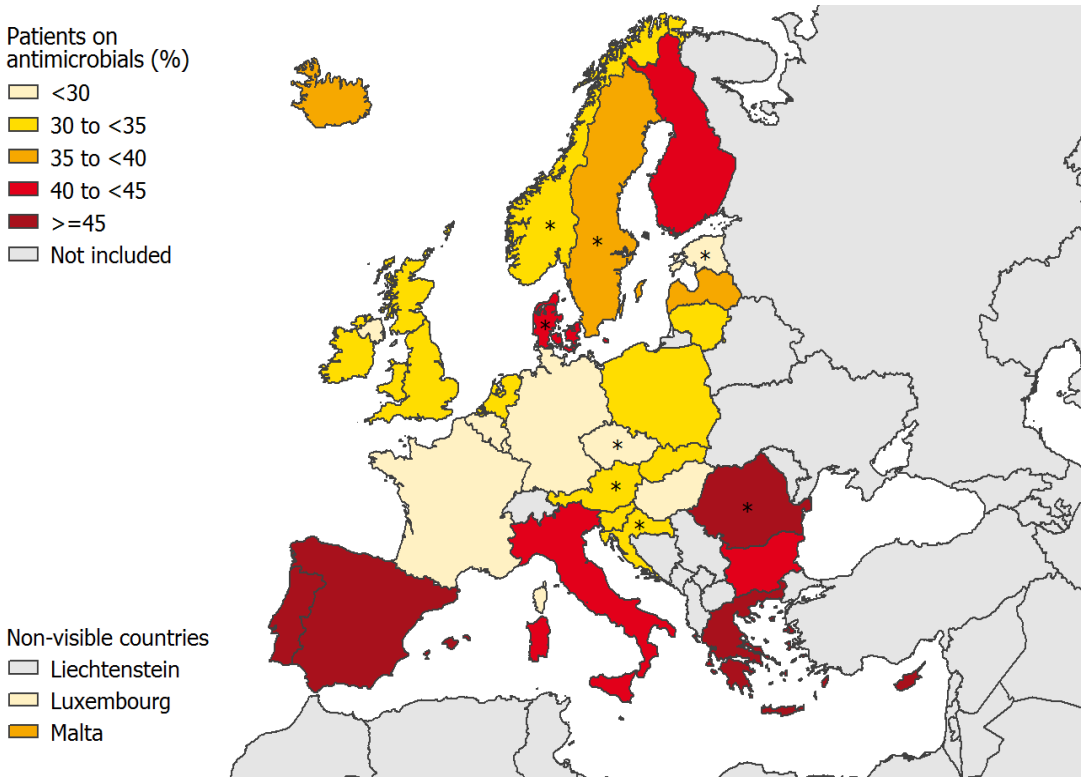
**Adj. OR: Adjusted odds ratio in final multiple logistic regression model; only specialties that were significant in the final model are displayed, see Annex 1, Table A1.5 for %prevalence of antimicrobial use in other specialties.*
(a) Total length of stay (not only before HAI onset as in HAI model), total presence of intubation and urinary catheter (not only before healthcare-associated PN or urinary tract infections as in HAI model).
(b) CVC and PVC: Odds ratios not calculated and variables not included in model because of strong correlation with parenteral antimicrobial treatment.

Results by country[i]

Prevalence of antimicrobial use, observed and predicted

The prevalence of antimicrobial use (percentage of patients receiving at least one antimicrobial agent) in acute care hospitals ranged from 21.4% (95% CI 19.8–23.1%) in France to 54.7% (51.7–57.7%) in Greece (Figures 65 and 66). The weighted prevalence of antimicrobial use in Europe, accounting for the number of occupied acute care beds by country was 32.6%.

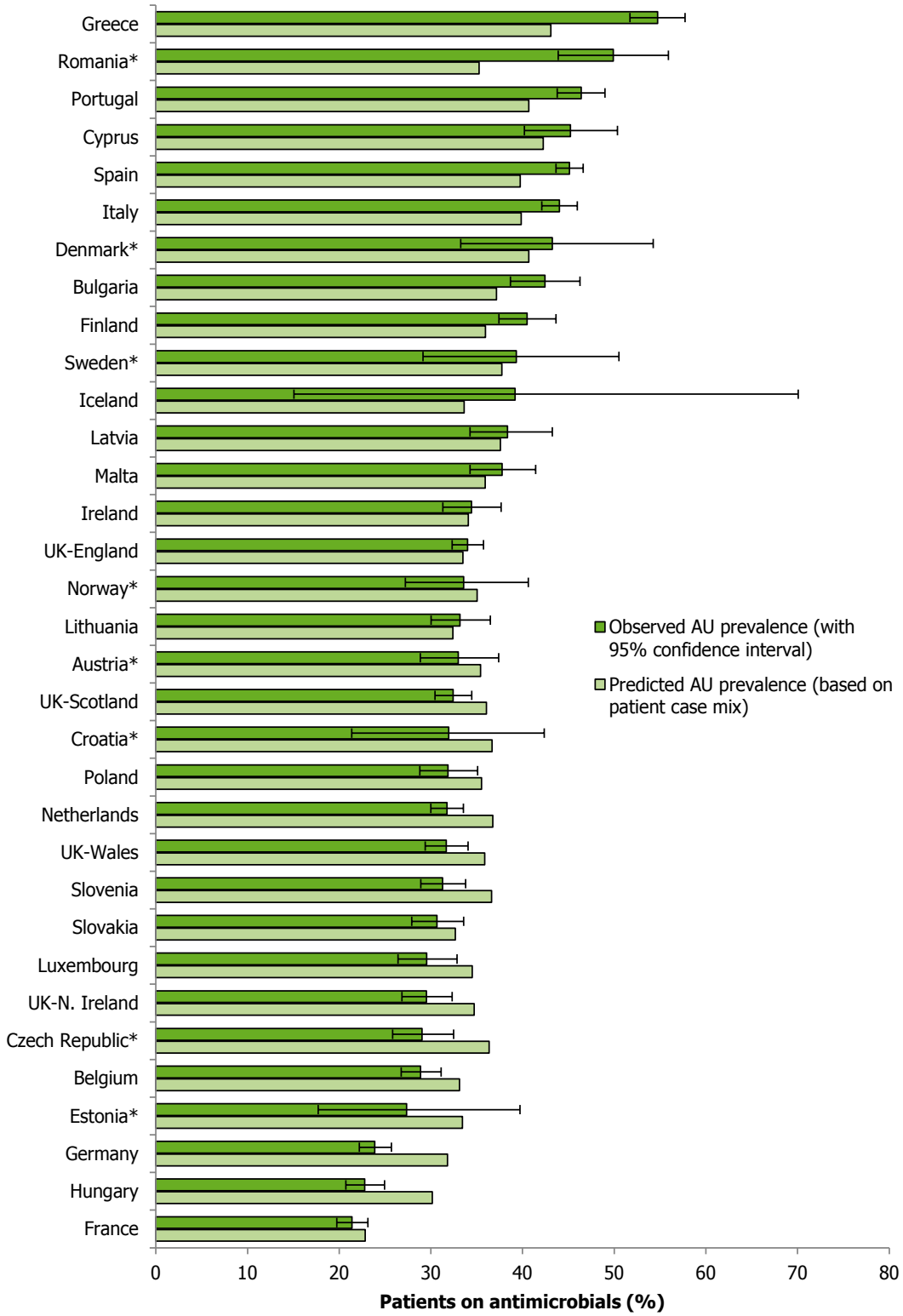
Figure 65. Prevalence of antimicrobial use (percentage of patients receiving antimicrobials) in acute care hospitals, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

[i] Note: representativeness of the PPS data by country was evaluated based on compliance with the recommended sampling methodology of hospitals and sample size. Representativeness was optimal or good in 25 (76%) countries and poor or very poor in 8 (24%) countries. Countries (and number of hospitals) with optimal representativeness were Bulgaria (n=42), Cyprus (n=8), Finland (n=59), France (n=54), Germany (n=46), Hungary (n=29), Ireland (n=50), Italy (n=49), Latvia (n=15), Luxembourg (n=9), Malta (n=3), Portugal (n=57), Slovakia (n=40), Slovenia (n=21), UK-England (n=51), UK-Northern Ireland (n=16), UK-Scotland (n=52); good representativeness was obtained in Belgium (n=52), Greece (n=37), Iceland (n=2), Lithuania (n=44), Netherlands (n=33), Poland (n=35), Spain (n=59), UK-Wales (n=22); low representativeness in Austria (n=9), Czech Republic (n=14), Croatia (n=11), Estonia (n=4), Norway (n=7), Romania (n=10) and very low represenativeness in Denmark (n=3) and Sweden (n=4).

Figure 66. Observed prevalence of antimicrobial use with 95% confidence intervals and predicted prevalence of antimicrobial use based on case mix and hospital characteristics, by country, ECDC PPS 2011–2012



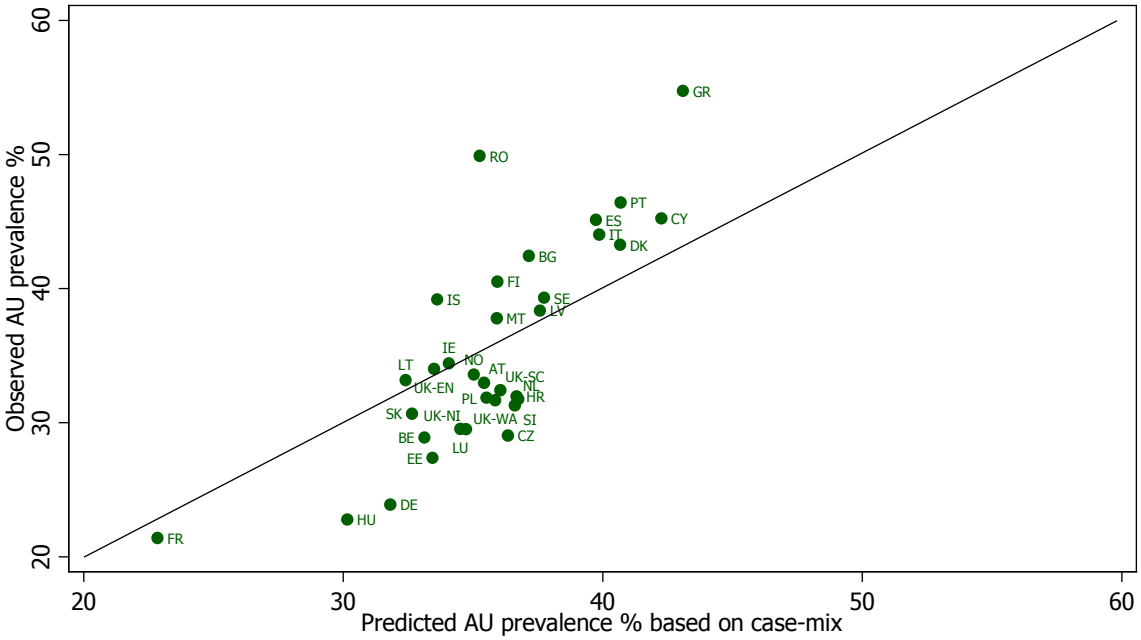
The Netherlands: antimycotics (amounting to 3.3% of antimicrobials overall in other countries) were not included in the protocol.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

The predicted prevalence of antimicrobial use was calculated based on patient case mix and hospital characteristics using the multiple regression model in Table 23. For light protocol data (7% of the patients), a model only including patient/consultant specialty, hospital type and hospital size was used (model not shown).

The correlation between the observed and predicted prevalence by country is shown in Figure 67 (correlation coefficients: Pearson's rho 0.79, p<0.001, R-squared 0.61; Spearman's rho 0.71, p<0.001). In four countries the observed prevalence was almost identical to the predicted prevalence (Ireland, Latvia, Lithuania and UK-England).

The ratio of observed prevalence divided by predicted prevalence (Standardised antimicrobial use ratio, SAUR) varied between 0.75 in Germany and 0.76 in Hungary to 1.27 in Greece and 1.42 in Romania.

Figure 67. Correlation between the observed and predicted prevalence of antimicrobial use (AU) by country, ECDC PPS 2011–2012



Line: observed prevalence = predicted prevalence (Standardised antimicrobial use ratio (SAUR)=1). Countries below the line have a SAUR lower than 1, countries above the line have a SAUR higher than 1. The smaller the distance between the dot and the line, the closer the observed prevalence comes to the predicted prevalence based on case mix.

Validation of national antimicrobial use data

In the four countries that validated their PPS data, the sensitivity of the primary PPS data collectors for detecting and reporting a patient receiving antimicrobials was on average 95.0% and varied between 93.1% in Bulgaria to 96.8% in Spain (Table 24). The specificity for detecting and reporting a patient receiving antimicrobials was high in all countries and 99.4% on average, being lowest in Hungary (98.8%) and highest in Spain (100%). When applying the validation sensitivity and specificity to the (primary) antimicrobial use prevalence results in these countries, the estimated 'true' prevalence of antimicrobial use was on average to 37.8% compared with an average observed prevalence of 36.3% patients with at least one antimicrobial.

Table 24. Results of national PPS validation surveys in four countries: prevalence of antimicrobial use (AU)

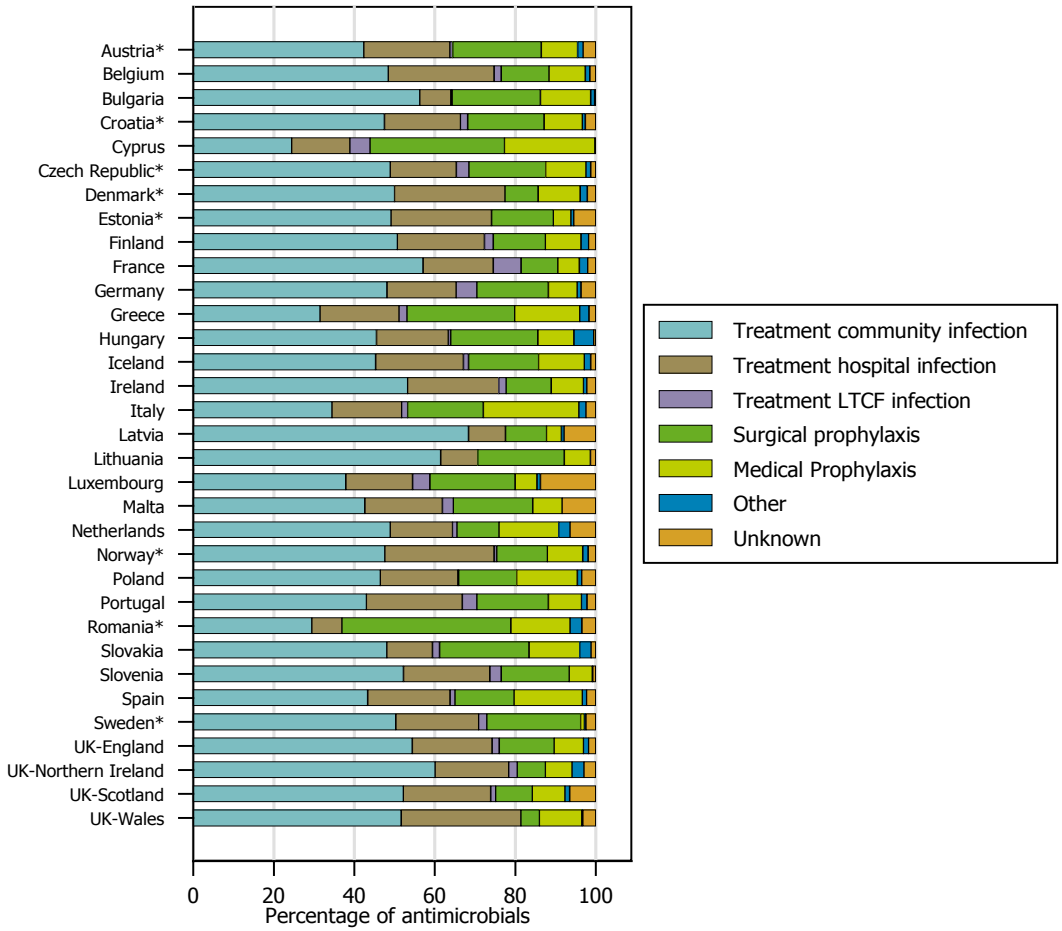
Country	N of hosp.	N of pts	Se % (95%CI)	Sp % (95%CI)	pPPS AU% (95%CI)	True AU% (95%CI)
Bulgaria	30	1280	93.1 (89.3-96.0%)	99.6 (99.1-99.9%)	42.4 (38.7-46.3%)	45.3 (43.7-47.4%)
Hungary	5	274	96.6 (87.9-99.6%)	98.8 (96.7-99.8%)	22.8 (20.7-24.9%)	22.6 (20.3-25.3%)
Ireland	10	342	93.5 (87.2-97.3%)	99.3 (97.4-99.9%)	34.4 (31.3-37.7%)	36.3 (33.7-39.2%)
Spain	5	239	96.8 (92.1-99.1%)	100.0 (96.6-100.0%)	45.4 (44.4-46.4%)	46.9 (44.0-49.1%)
Mean			**95.0**	**99.4**	**36.3**	**37.8**

Se: sensitivity; Sp: specificity; pPPS AU%: AU prevalence (% of patients receiving at least one antimicrobial) of the primary national PPS; True AU%: estimated true AU prevalence after adjustment for sensitivity and specificity found in the validation survey.

Indications for antimicrobial use

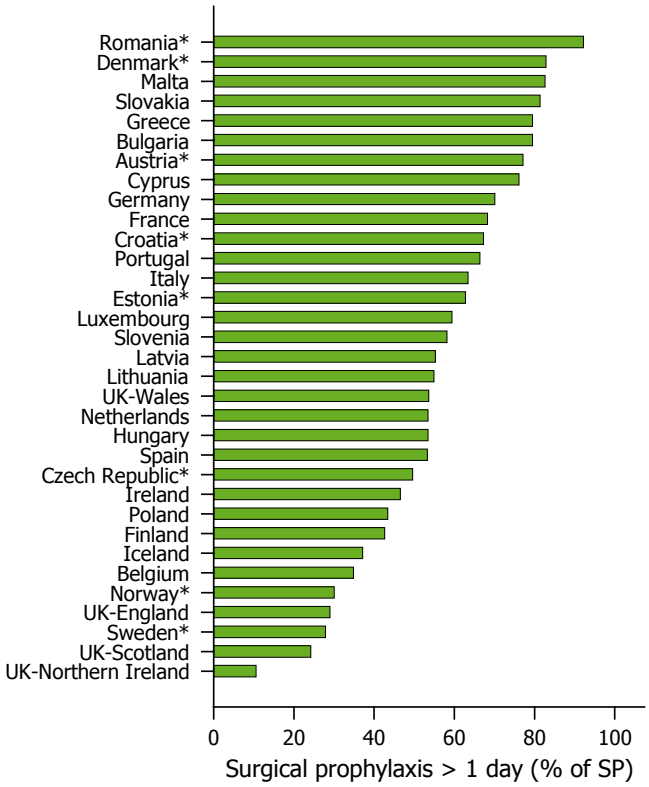
Indications for antimicrobial use varied considerably by country (Figure 68). The percentage of antimicrobials prescribed for treatment of a community infection was lowest in Cyprus (24.6%) and highest in Latvia (68.4%). Treatment of a hospital infection was closely correlated with the prevalence of HAIs as per case definition (see Figure 28), with a relative frequency varying from 7.4% of antimicrobials in Romania to 29.7% of antimicrobials in UK-Wales. The percentage of antimicrobials prescribed for treatment of an infection associated with long-term care varied from 0.0% in Denmark, Estonia, Lithuania, Romania and UK-Wales to 5.0% in Cyprus, 5.2% in Germany and 6.9% in France. Surgical prophylaxis accounted for less than 10% of antimicrobials in UK-Wales (4.6%), UK-Northern Ireland (7.0%), Denmark (8.2%), UK-Scotland (9.0%) and France (9.1%) but for more than 30% of antimicrobials in Cyprus (33.1%) and Romania (42.0%). The percentage of surgical prophylaxis prescribed for more than one day was lowest in UK-Northern Ireland (10.7%) and highest in Romania (92.3%) (Figure 69). Medical prophylaxis accounted for less than 5% of antimicrobials in Sweden (1.0%), Latvia (3.8%) and Estonia (4.4%), but for more than 20% in Cyprus (22.4%) and Italy (23.8%) (Figure 70). Other indications for antimicrobial use were most common in Hungary (4.9% of all antimicrobials). The percentage of antimicrobials for which the indication was unknown varied between 0.0% in Cyprus and 13.7% in Luxembourg.

Figure 68. Indications for antimicrobial use by country, ECDC PPS 2011–2012



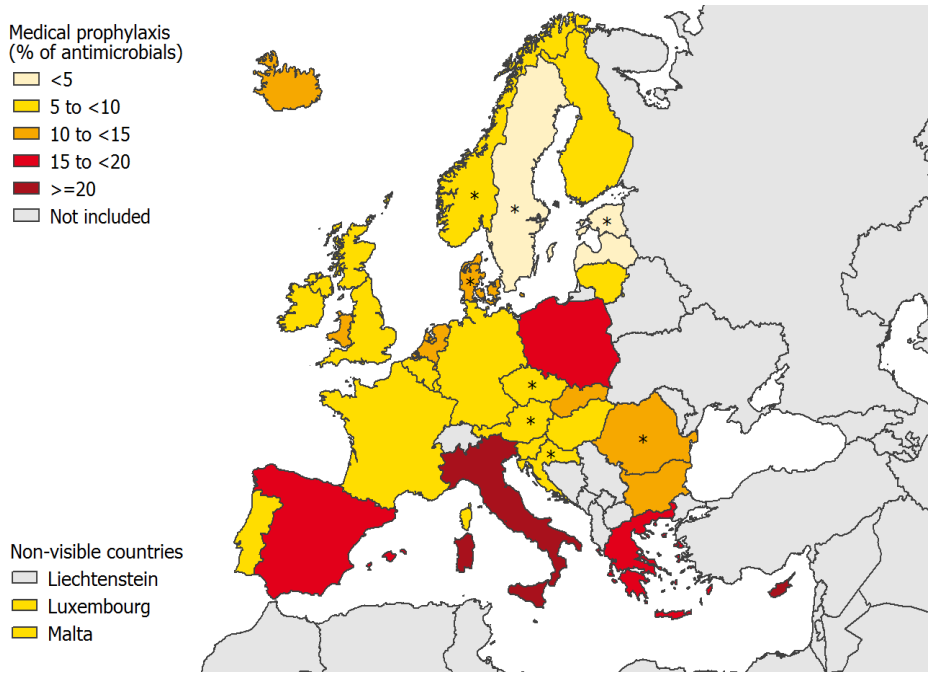
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Figure 69. Surgical prophylaxis given for more than one day as a percentage of the total antimicrobials prescribed for surgical prophylaxis, by country, ECDC PPS 2011–2012



SP=surgical prophylaxis.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Figure 70. Percentage of antimicrobials prescribed for medical prophylaxis, ECDC PPS 2011–2012

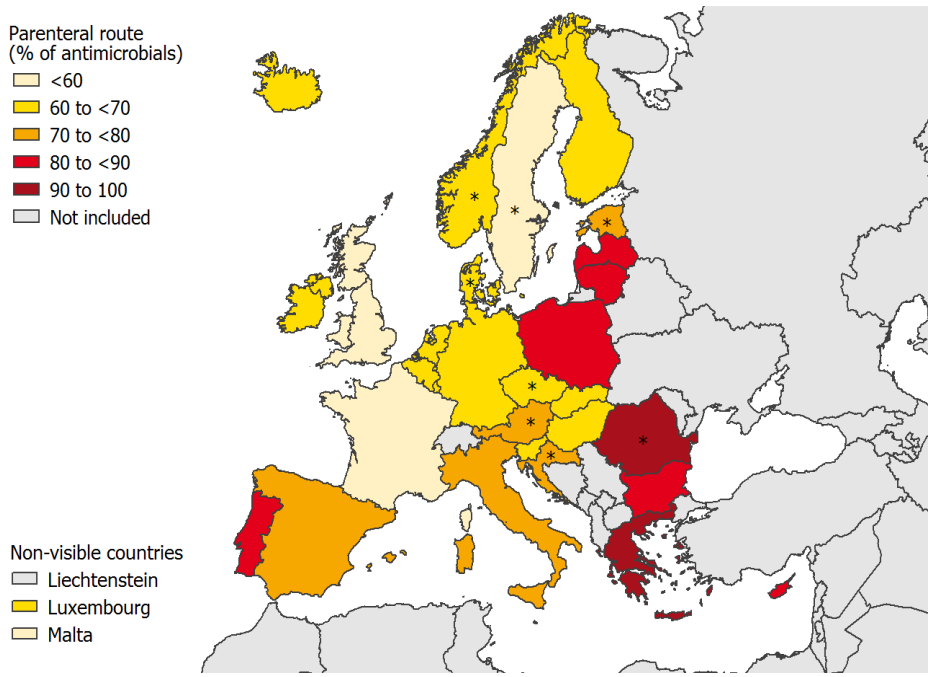


**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Route of administration and documentation of the reason for antimicrobial use

The route of administration of antimicrobials was parenteral in 70.9% of cases (country median 69.9%) and varied from less than 50% in UK-Wales, Sweden and UK-Scotland to more than 90% in Greece and Romania.

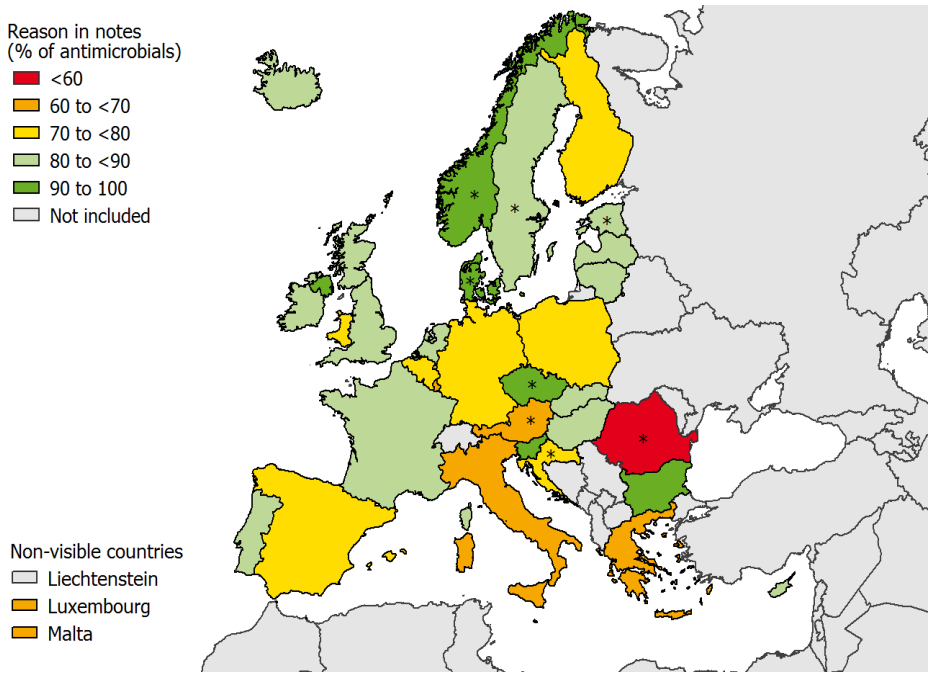
Figure 71. Percentage of antimicrobials for which the route of administration was parenteral, ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

The reason for antimicrobial use was documented in the patient's medical records for 79.4% of prescriptions (country median 80.6%) and ranged from 49.5% in Romania to 98.0% in Bulgaria (Figure 72).

Figure 72. Percentage of antimicrobials for which the reason for use was documented in the patient's records, ECDC PPS 2011–2012

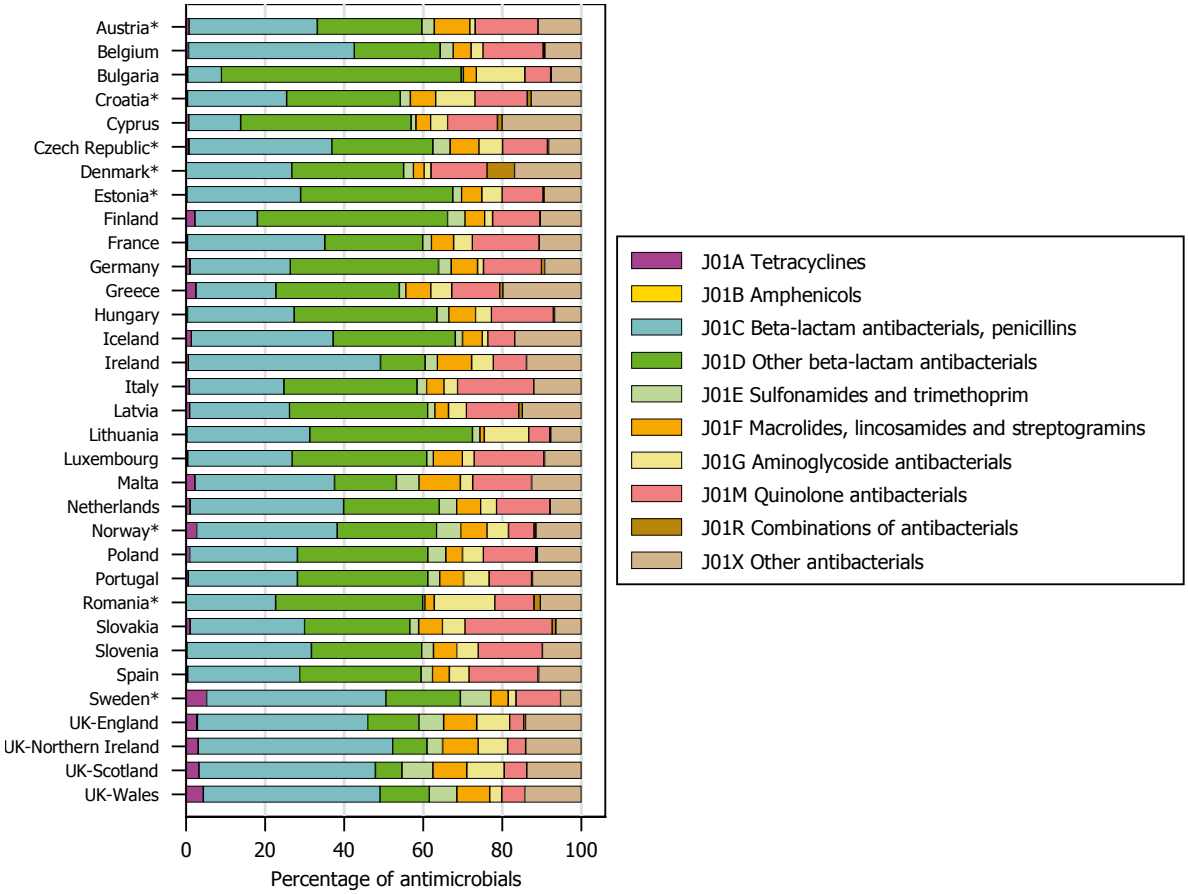


**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Distribution of antimicrobial agents

Within ATC group J01 (antibacterials for systemic use), the percentage of penicillins (ATC group J01C) varied between 8.5% in Bulgaria and 49.2% in UK-Northern Ireland (Figure 73). Other beta-lactam antibacterials (ATC Group J01D) varied between 6.7% in UK-Scotland and 60.7% in Bulgaria. The percentage of ATC group J01E (sulfonamides and trimethoprim) within ATC group J01 ranged from 0.5% in Bulgaria and Romania to 7.8% in UK-Scotland. The percentage of ATC group J01F (macrolides, lincosamides and streptogramins) ranged from 1.1% in Lithuania to more than 10.4% in Malta, the percentage of aminoglycosides (ATC group J01G) from 1.3% in Austria to 15.2% in Romania, the percentage of quinolone antibacterials (ATC group J01M) from 3.5% in UK-England to 22.0% in Slovakia and the percentage of other antibacterials (ATC group J01X) from 5.2% in Sweden to 19.8% in Greece and 20.0% in Cyprus.

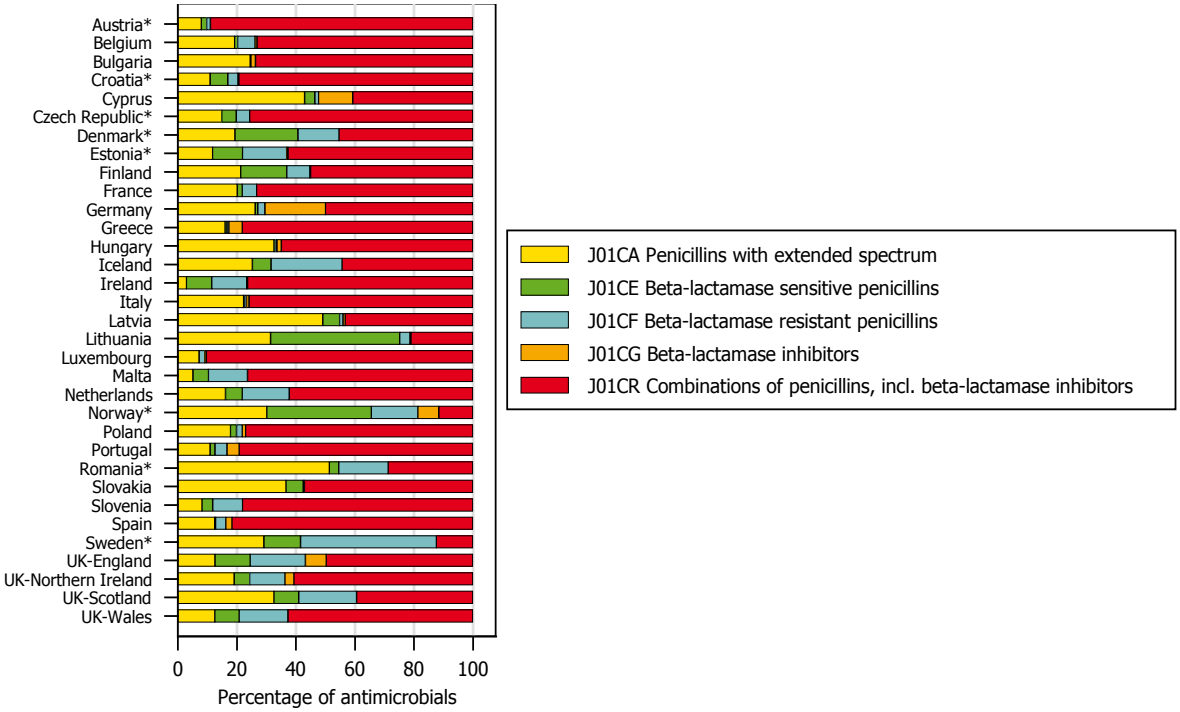
Figure 73. Distribution of antimicrobial groups by ATC third level and by country, (J01 antibacterials for systemic use), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Within ATC group J01C (penicillins), the percentage of penicillins with extended spectrum (ATC group J01CA) varied between 3.0% in Ireland and 51.3% in Romania (Figure 74). Beta-lactamase-sensitive penicillins (ATC group J01CE) accounted for 0.0% of penicillins in Luxembourg and 43.7% in Lithuania. Beta-lactamase-resistant penicillins (ATC group J01CF) accounted for 0.0% of penicillins in Bulgaria and Slovakia and more than 20% in Iceland (24.1%) and Sweden (46.0%). ATC group J01CR (combinations of penicillins, including beta-lactamase inhibitors) were the most frequently used penicillins in all countries except Cyprus, Latvia, Lithuania, Norway, Romania and Sweden.

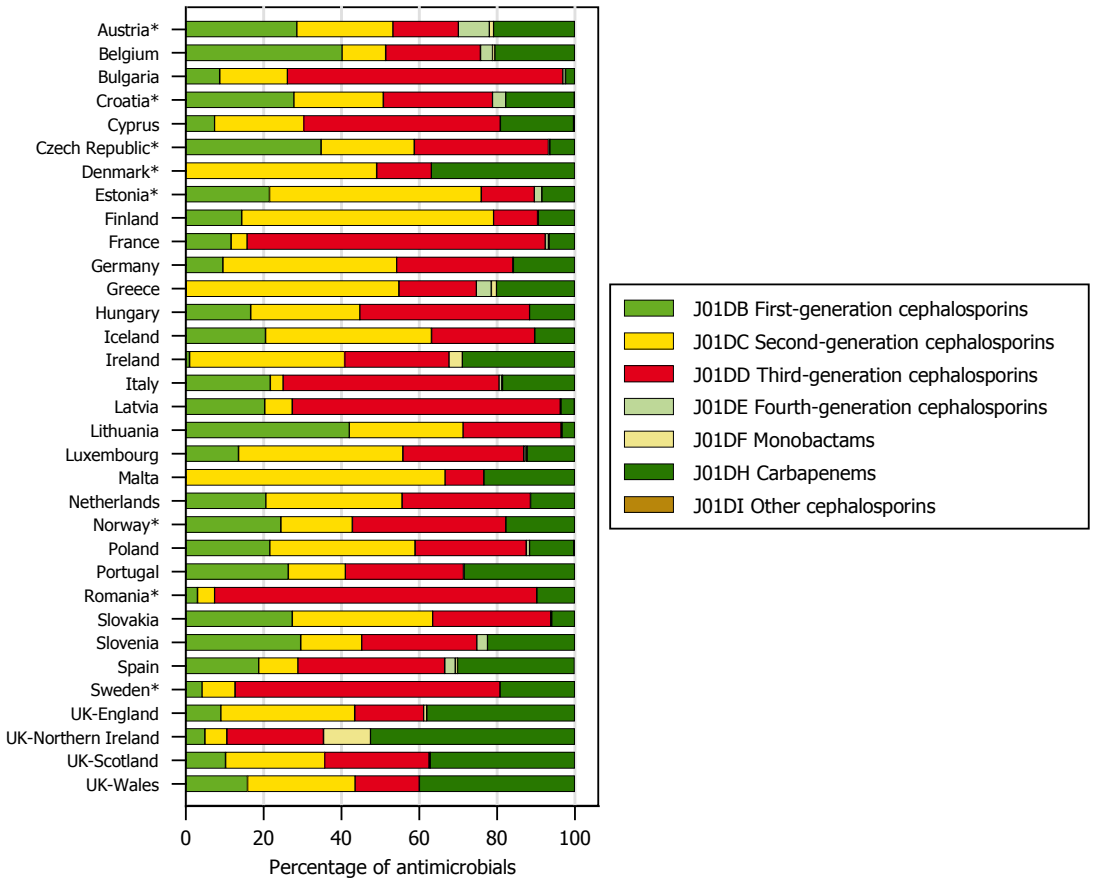
Figure 74. Distribution of antimicrobial use by country, ATC group J01C (Beta-lactam antibacterials, penicillins), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

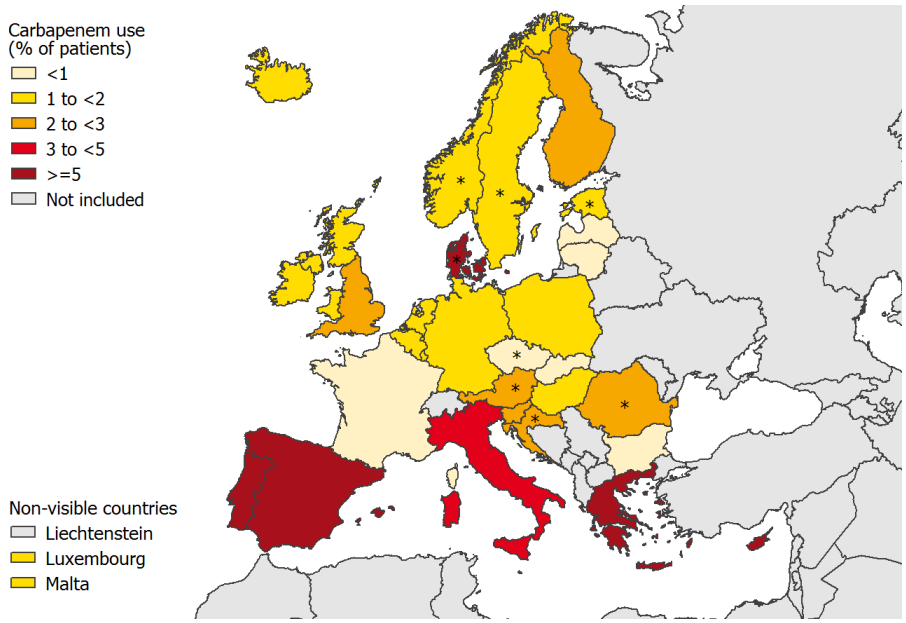
The percentage of first-generation cephalosporins within ATC group J01D (other beta-lactam antibacterials) varied from 0.0% in Denmark and Malta to more than 40% in Belgium (40.2%) and Lithuania (42.1%) (Figure 75). Second-generation cephalosporins accounted for more than half of J01D use in Estonia (54.4%), Greece (54.7%), Finland (64.7%) and Malta (66.7%). The percentage of third-generation cephalosporins within ATC group J01D varied from 10% in Malta to more than 70% in Bulgaria (70.8%), France (76.6%) and Romania (82.8%), and the percentage of fourth-generation cephalosporins ranged from 0.0% in 14 countries to 7.9% in Austria. Use of monobactams was only reported in 13 (39.4%) countries, highest in UK-Northern Ireland (12.1% of ATC group J01D). The percentage of carbapenems within ATC group J01D ranged from less than 5% in Bulgaria, Lithuania and Latvia to more than 30% in Spain, Denmark and the four countries of the United Kingdom. The prevalence of carbapenem use (percentage of patients receiving carbapenems) ranged from less than 1% of hospitalised patients in six countries to more than 5% in Cyprus, Denmark, Greece, Portugal and Spain (Figure 76).

Figure 75. Distribution of antimicrobial use by country, ATC group J01D (Other beta-lactam antibacterials), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

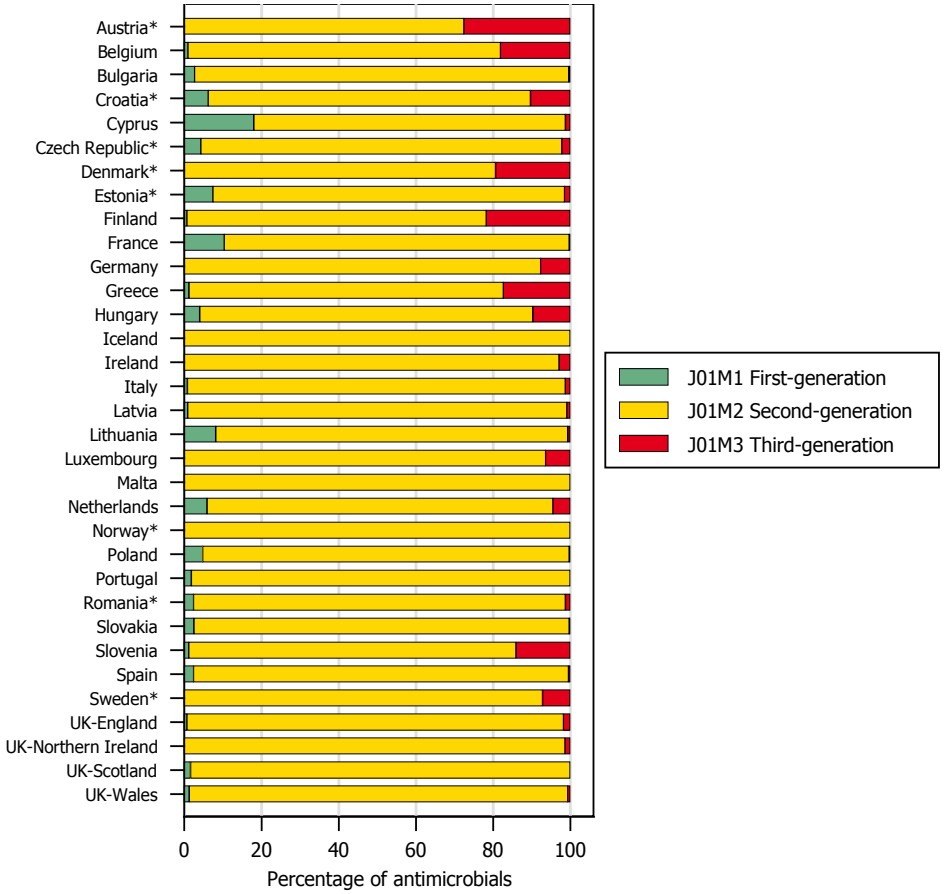
Figure 76. Prevalence of carbapenem (J01DH) use (percentage of hospitalised patients receiving carbapenems), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

The large majority (91.7%) of quinolone antibacterials (ATC group J01M) used in European hospitals were second-generation quinolones. No first-generation quinolones were reported by 10 countries but accounted for more than 10% of ATC group J01M in France (10.8%) and Cyprus (18.1%). No third-generation quinolones were reported by five countries but represented more than 10% of ATC group J01M in Finland (21.8%) and Austria (27.5%).

Figure 77. Distribution of antimicrobial use by country, ATC group J01M (Quinolone antibacterials), ECDC PPS 2011–2012



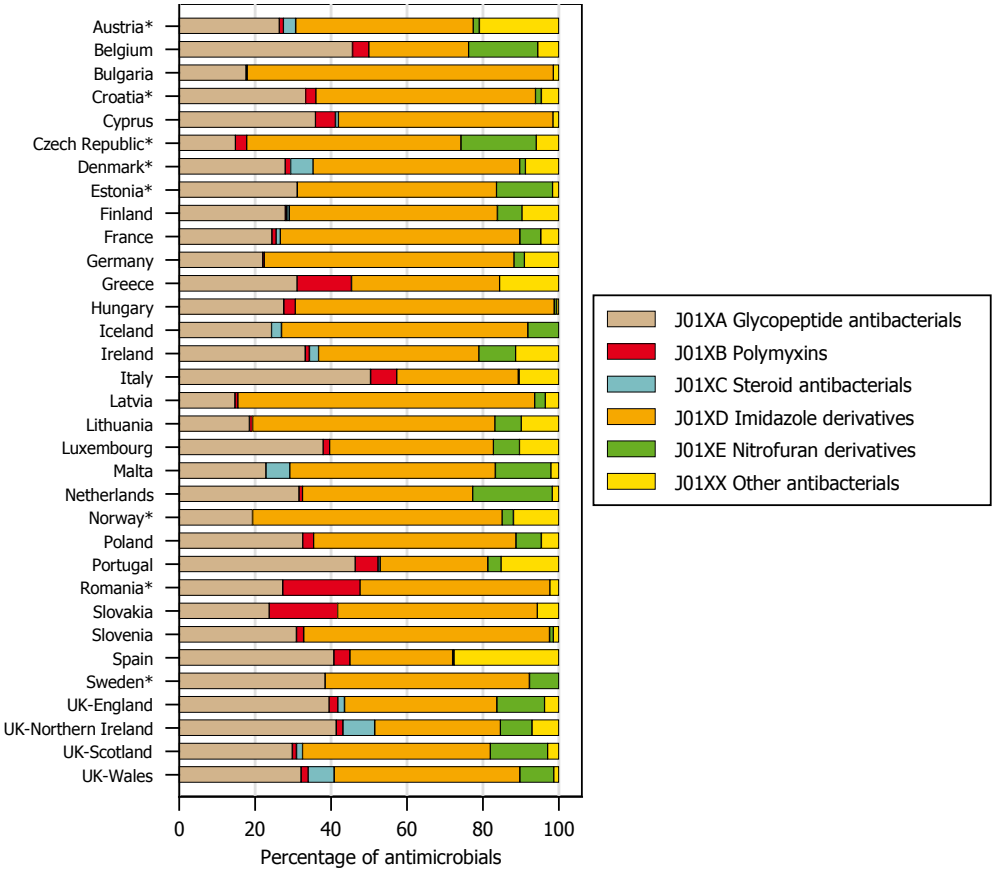
Quinolone antibacterials (ATC group J01M) were classified according to reference [39] as in ESAC-Net [40].
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Within ATC group J01X (other antibacterials), the most frequently used antibacterials were imidazole derivates (ATC group J01XD), representing from 26.2% of J01X antibacterials in Belgium to 80.6% in Bulgaria (Figure 78).

The second most important group within ATC group J01X were glycopeptide antibacterials (ATC group J01XA), lowest in Latvia (14.7%) and highest in Italy (50.5%). The prevalence of glycopeptide use (percentage of hospitalised patients receiving glycopeptides) ranged from less than 0.5% of patients in Czech Republic and Hungary to more than 3% in Portugal (3.3%), Italy (3.3%), Cyprus (4.4%) and Greece (4.9%) (Figure 79). At country level, the prevalence of glycopeptide use was associated with the percentage meticillin resistance in *S. aureus* (MRSA) from HAIs (Pearson's rho 0.61, $p<0.001$; Spearman's rho 0.59, $p<0.01$).

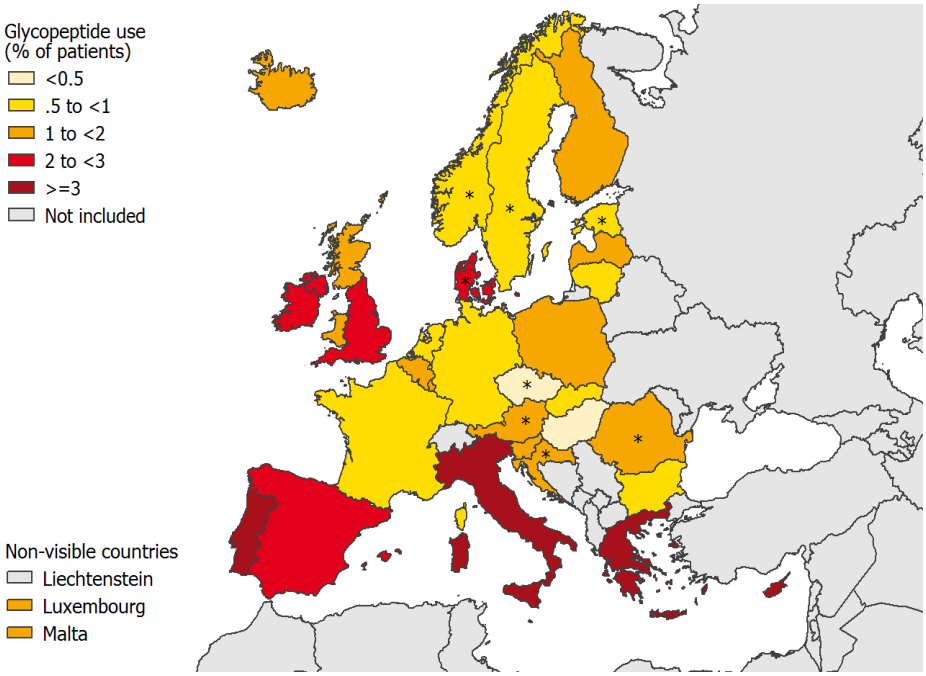
Polymyxins (ATC group J01XB) represented less than 1% of ATC group J01X in 11 countries but more than 10% in Greece (14.3%), Slovakia (18.0%) and Romania (20.3%). No steroid antibacterials (ATC group J01XC) were reported by 19 countries and accounted for 8.4% of ATC group J01X in UK-Northern Ireland (8.4%). Nitrofuran derivates (ATC group J01XE) accounted for less than 1% of ATC group J01X in nine countries and ranged up to 20.9% in the Netherlands. ATC group J01XX (other antibacterials including linezolid, daptomycin and fosfomycin) represented less than 1% of ATC group J01X in Hungary, Iceland and Sweden and more than 15% in Portugal (15.2%), Greece (15.6%), Austria (20.9%) and Spain (27.5%).

Figure 78. Distribution of antimicrobial classes by ATC fourth level and by country, J01X (Other antibacterials), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

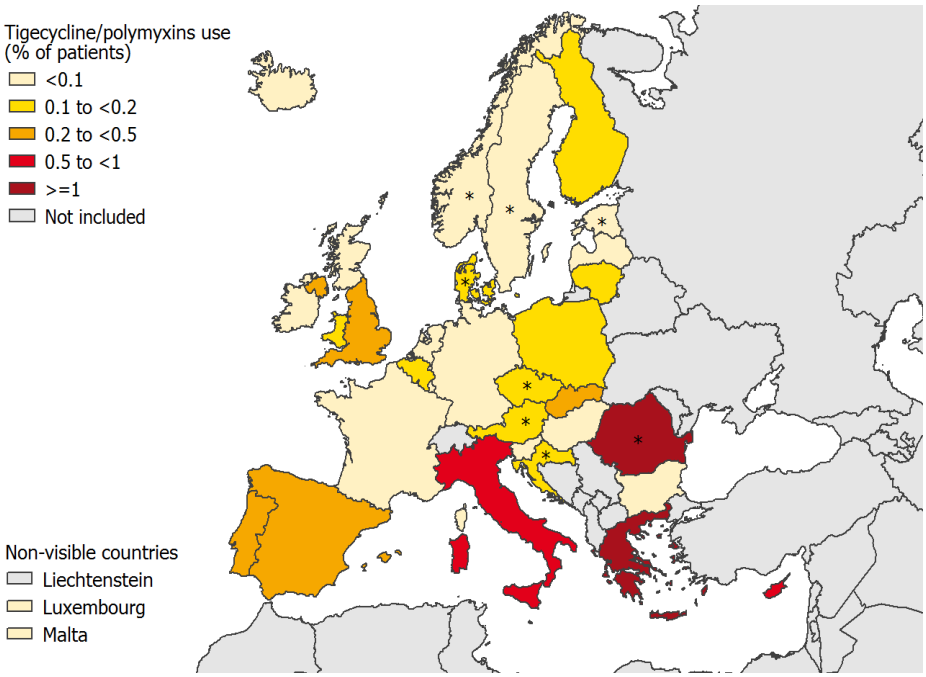
Figure 79. Prevalence of glycopeptide (J01XA) use (percentage of hospitalised patients receiving glycopeptide antibacterials), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

The 10 most commonly used antimicrobials at the fifth ATC level are given for each country in the country summary sheets in Annex 2. The prevalence of the use of polymyxins (ATC group J01XB) and/or tigecycline (ATC J01AA12) as an indicator of empirical or documented treatment of infections with carbapenem-resistant gram-negatives [41] varied from less than 1 per 1000 patients (0.1%) in 15 countries to 1.0% of patients in Cyprus, 1.4% of patients in Romania and 3.2% of all hospitalised patients in Greece (Figure 80). The indicator was strongly associated with the percentage of Enterobacteriaceae non-susceptible to carbapenems reported for HAIs ($p<0.001$).

Figure 80. Prevalence of use of polymyxins (ATC group J01XB) and/or tigecycline (percentage of hospitalised patients receiving any of these antibacterials), ECDC PPS 2011–2012

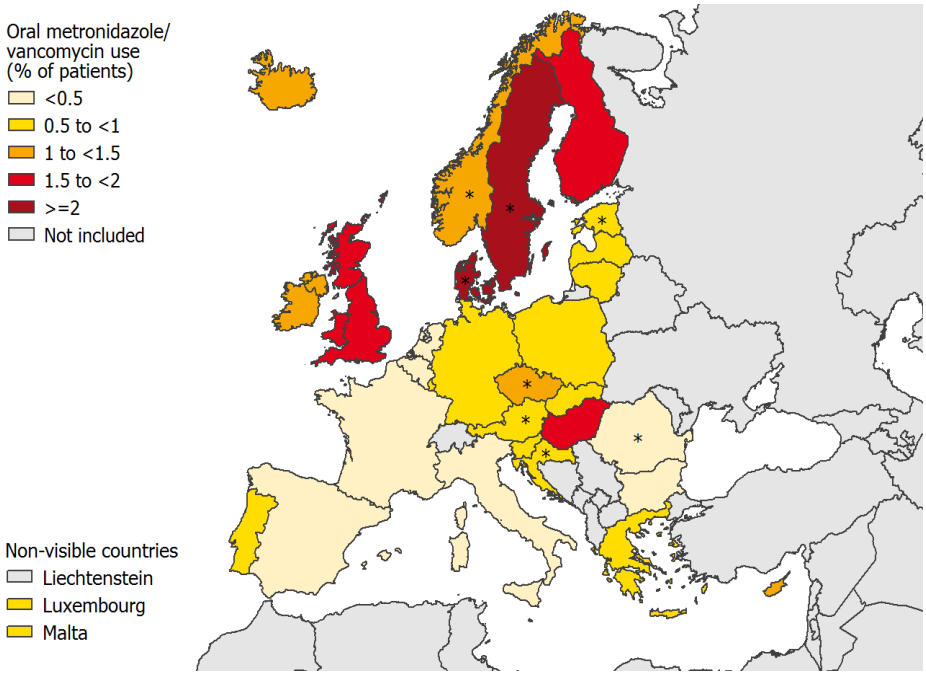


**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

The prevalence of the use of oral metronidazole (P01AB01) and/or oral vancomycin (A07AA09) as indicator of the oral treatment of *C. difficile* infections, varied from less than 0.2% of patients in Bulgaria and France to 2.1% of patients in Denmark and Sweden (Figure 81). The indicator was strongly correlated with the relative frequency of *C. difficile* infections ($p<0.01$) and with the relative frequency of healthcare-associated gastro-intestinal infections ($p<0.001$, spearman correlation coefficient 0.58).

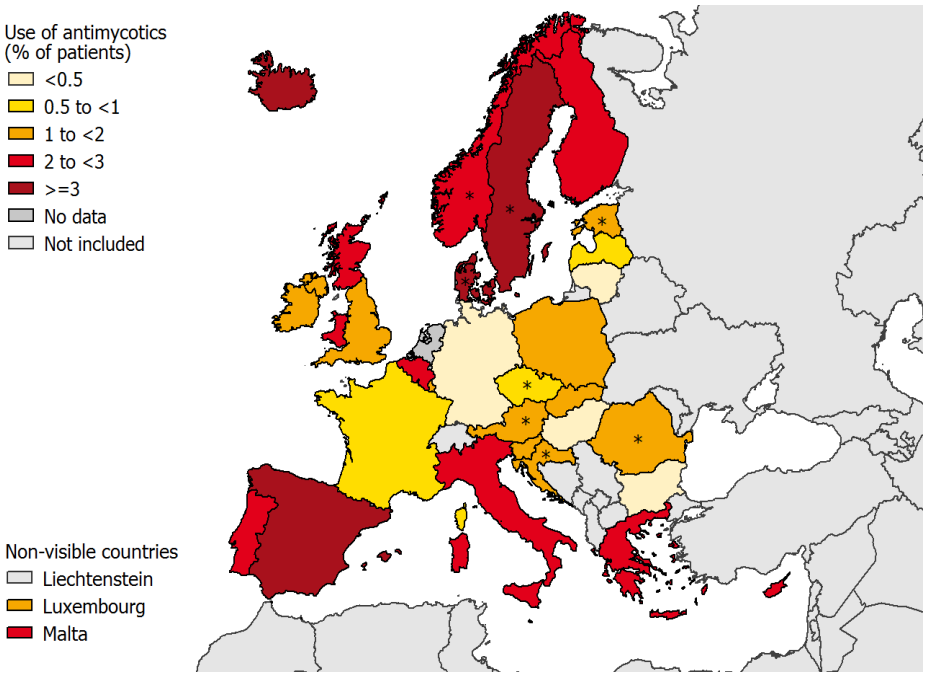
Finally, an important variation between countries was also observed for the prevalence of the use of antimycotics, including antimycotics for systemic use (ATC group J02) and nystatin (A07AA02), which together accounted for 3.8% of all antimicrobials, varying from less than 1% in Bulgaria (0.9%) and Lithuania (0.7%) to 8.6% in Sweden, 8.9% in Iceland and 14.7% in Denmark. Nystatin accounted for 14.5% within this group overall, varying between 0.0% in nine countries to 72.0% in Sweden. The prevalence of antimycotics ranged from 0.3% in Lithuania to 4.5% of patients in Iceland and 10.0% of patients in Denmark (Figure 82). In the Netherlands, antimycotics were not included in the national PPS protocol.

Figure 81. Prevalence of use of oral metronidazole (P01AB01) and/or oral vancomycin (A07AA09) (percentage of hospitalised patients receiving any of these antimicrobials), ECDC PPS 2011–2012



**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Figure 82. Prevalence of use of antimycotics (ATC group J02 and nystatin) (percentage of hospitalised patients receiving any antimycotic for systemic use), ECDC PPS 2011–2012



The Netherlands: antimycotics were not registered in national protocol.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

Burden estimates

Prevalence burden estimates: number of patients with an HAI or antimicrobials on any given day

The number of patients with at least one HAI on any given day in acute care hospitals in European Member States and Croatia was estimated at 81 089 patients with a 95% confidence interval ranging from 64 624 to 105 898 patients. The number of patients receiving antimicrobials in acute care hospitals on any given day was estimated at 466 226 patients (95% CI 419 284–515 690). After applying the country-specific prevalence percentages to the number of occupied acute care hospital beds per country, the weighted prevalence of patients with HAIs in Europe was 5.7% (95% CI 4.5–7.4%). The weighted prevalence of patients receiving antimicrobials in Europe was 32.7% (95% CI 29.4–36.2%).

Table 25. Estimation of the number of patients with at least one HAI and the number of patients receiving at least one antimicrobial (AU) on any day in acute care hospitals, ECDC PPS 2011–2012

	Mean N of occupied beds per day	Pts with HAI %	(95%CI)	N of pts with HAI	(95%CI)	Pts with AU %	(95% CI)	N of pts with AU	(95%CI)
Austria*	49 152	6.2	(4.2-9.1)	3 047	(2 045-4 493)	33.0	(28.9-37.4)	16 210	(14 180-18 378)
Belgium	35 192	7.1	(6.1-8.3)	2 506	(2 154-2 914)	28.9	(26.8-31.1)	10 167	(9 414-10 948)
Bulgaria	22 737	3.7	(2.8-5.0)	844	(628-1 130)	42.4	(38.7-46.3)	9 650	(8 797-10 521)
Croatia*	13 703	5.7	(4.7-7.0)	782	(639-955)	32.0	(26.3-38.3)	4 378	(3 597-5 242)
Cyprus	1 199	6.5	(4.8-8.6)	77	(58-104)	45.2	(40.2-50.4)	542	(482- 604)
Czech Republic*	35 515	4.6	(3.4-6.3)	1 648	(1 204-2 241)	29.0	(25.8-32.5)	10 314	(9 177-11 532)
Denmark*	11 861	9.8	(1.0-52.7)	1 165	(125-6 253)	43.3	(18.8-71.6)	5 131	(2 225-8 487)
Estonia*	3 209	5.7	(4.5-7.1)	182	(146-228)	27.4	(17.7-39.7)	878	(568-1 275)
Finland	9 167	7.4	(6.3-8.6)	676	(582-784)	40.5	(37.4-43.7)	3 713	(3 431-4 002)
France	166 752	4.9	(4.3-5.6)	8 188	(7 170-9 355)	21.4	(19.8-23.1)	35 685	(32 933-38 586)
Germany	350 137	5.0	(3.8-6.7)	17 647	(13 235-23 389)	23.9	(21.2-26.8)	83 648	(74 124-93 977)
Greece	25 512	9.1	(7.6-10.8)	2 309	(1 929-2 753)	54.7	(51.7-57.7)	13 965	(13 192-14 726)
Hungary	33 753	4.5	(4.0-5.2)	1 532	(1 343-1 745)	22.8	(20.7-25.0)	7 686	(6 997-8 421)
Iceland	738	10.2	(5.6-17.9)	75	(41-132)	39.2	(15.1-70.1)	289	(111- 517)
Ireland	9 554	5.2	(4.3-6.3)	494	(406-601)	34.4	(31.3-37.7)	3 289	(2 991-3 599)
Italy	136 088	6.3	(5.4-7.4)	8 628	(7 390-10 071)	44.0	(42.1-46.0)	59 920	(57 280-62 573)
Latvia	5 374	2.3	(1.5-3.6)	125	(81-192)	38.3	(34.7-42.1)	2 059	(1 865-2 261)
Lithuania	11 763	3.3	(2.1-5.1)	387	(248-598)	33.2	(30.0-36.5)	3 902	(3 530-4 291)
Luxembourg	1 724	5.4	(3.6-8.0)	93	(62-139)	29.5	(26.4-32.9)	509	(455- 566)
Malta	840	4.4	(3.0-6.3)	37	(25- 53)	37.8	(34.3-41.4)	317	(288- 348)
Netherlands	24 932	7.4	(6.2-8.8)	1 835	(1 533-2 191)	31.8	(30.0-33.6)	7 916	(7 479-8 367)
Norway*	9 568	7.8	(5.3-11.5)	751	(507-1 097)	33.6	(27.2-40.6)	3 213	(2 604-3 887)
Poland	106 871	6.4	(5.0-8.2)	6 861	(5 333-8 795)	31.9	(28.8-35.1)	34 049	(30 768-37 512)
Portugal	19 035	10.8	(9.5-12.3)	2 062	(1 805-2 349)	46.4	(43.8-49.0)	8 834	(8 345-9 327)
Romania*	88 578	2.8	(2.0-3.9)	2 489	(1 772-3 481)	49.9	(38.9-60.9)	44 200	(34 457-53 944)
Slovakia	15 657	3.5	(2.7-4.6)	556	(424-726)	30.7	(27.9-33.6)	4 802	(4 370-5 256)
Slovenia	5 381	6.4	(5.0-8.1)	342	(269-435)	31.3	(28.9-33.8)	1 684	(1 555-1 818)
Spain	88 823	8.3	(7.5-9.1)	7 328	(6 626-8 083)	45.1	(43.7-46.6)	40 086	(38 780-41 392)
Sweden*	16 164	7.3	(3.9-13.4)	1 186	(632-2 161)	39.3	(29.1-50.5)	6 354	(4 709-8 166)
UK-England	103 598	5.9	(5.2-6.9)	6 164	(5 335-7 128)	34.0	(32.3-35.7)	35 223	(33 483-37 015)
UK-N.Ireland	3 485	4.2	(2.8-6.1)	145	(99-211)	29.5	(26.8-32.3)	1 029	(935-1 127)
UK-Scotland	14 013	4.7	(4.2-5.4)	663	(583-754)	32.4	(30.4-34.5)	4 542	(4 266-4 827)
UK-Wales	6 449	4.1	(3.1-5.5)	266	(199-355)	31.7	(29.4-34.1)	2 042	(1 894-2 196)
Europe	**1 426 526**	**5.7**	**(4.5-7.4)**	**81 089**	**(64 624-105 895)**	**32.7**	**(29.4-36.2)**	**466 226**	**(419 284-515 690)**

Mean number of occupied beds: number of beds in acute care hospitals x occupancy rate; Occupancy rate=number of patient-days/(number of beds x 365); Number of beds in acute care hospitals: number of acute care beds if known, total number of beds in acute care hospitals otherwise, for the year preceding the survey; Pts: patients; 95% CI: 95% confidence interval, adjusted for design effect.
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

The country-weighted prevalence and estimated numbers of patients with an HAI, by infection type, is given in Table 26. After correcting for the number of occupied beds in each country, the prevalence of patients with pneumonia and lower respiratory tract infections (1.38% of hospitalised patients) was similar to the prevalence of patients with urinary tract infections (1.36%), mainly due to the higher frequency of urinary tract infections in Germany and France (see Figure 34). The total number of HAIs on any given day in Europe was estimated at 87 539 HAIs, or 1.08 HAIs per infected patient, which is the same ratio as in the aggregated PPS results.

Table 26. Estimated number of (patients with) HAIs on any given day, by HAI type, ECDC PPS 2011–2012

HAI type	Weighted HAI prev. %	(95% CI)	N of HAIs on one day	(95% CI)	% of total HAIs (a)	(95% CI)
Pneumonia/Lower respiratory tract	1.38	(1.01-2.03)	19 691	(14 402-28 898)	22.5	(16.5-33.0)
Urinary tract infections	1.36	(0.97-1.97)	19 399	(13 881-28 155)	22.2	(15.9-32.2)
Surgical site infections	1.22	(0.89-1.86)	17 399	(12 755-26 491)	19.9	(14.6-30.3)
Bloodstream infections	0.61	(0.40-1.31)	8 648	(5 717-18 689)	9.9	(6.5-21.3)
Gastro-intestinal tract infections	0.52	(0.32-0.98)	7 413	(4 582-13 967)	8.5	(5.2-16.0)
Systemic infections	0.30	(0.16-1.19)	4 227	(2 274-16 959)	4.8	(2.6-19.4)
Skin and soft tissue infections	0.21	(0.12-0.42)	2 951	(1 699-6 038)	3.4	(1.9-6.9)
Other HAI types	0.55	(0.35-1.12)	7 811	(4 963-15 921)	8.9	(5.7-18.2)
Total HAIs [(a)]	**-**		**87 539**	**(60 273-155 118)**	**100.0**	

(a) multiple HAIs within one category of the displayed HAI type categories accounted for 0.3% of all HAIs and were excluded from this analysis; the number of patients with a particular HAI type is thus considered equal to the number of HAIs in each category; 95% CI: 95% confidence interval, corrected for design effect in each country – country-specific mid, lower and upper estimates of the numbers of each HAI type were summed up to obtain the total number for Europe, and applied to the total number of occupied beds to obtain the prevalence and confidence intervals by HAI type.

Incidence burden estimates: number of patients per year with an HAI

The incidence of patients acquiring at least one HAI per year in the period 2011-2012 estimated using the Rhame and Sudderth formula (see methods) is given by country in Table 26. The estimated incidence and 95% confidence interval were applied to the annual number of discharges from acute care hospitals to estimate the total number of patients with HAIs per country and per year and summed up to obtain the total number for Europe. Because of the uncertainty inherent to the Rhame and Sudderth formula, two estimates were calculated for each country, one using the country mean number of days from HAI onset until PPS date (LN-INT) and one using the country median time from HAI onset until PPS date. The latter approach was chosen because the median time from admission to PPS date for all patients in the PPS was much more similar to the overall length of stay in participating hospitals than the mean time from admission to PPS date in all patients, which was twice as long as the length of stay (see Figure 12). However, since this relationship is not necessarily true for patients with HAIs, we also used the mean time from HAI onset until PPS date to obtain a lower estimate of the incidence. The point estimate per country was calculated as the mean of the two estimates. The lower 95% confidence interval limit is given as the lower limit of the lowest estimate, the upper 95% confidence interval limit as the upper limit of the highest estimate.

The total annual number of patients with HAI in Europe was estimated to be between 1.9 million and 5.2 million patients, with a point estimate of 3.2 million patients with at least one HAI per year in acute care hospitals. The weighted European HAI incidence estimate was 3.5% (95% CI 2.2-5.8%) (Table 26).

Table 27. Estimation of the annual number of patients acquiring at least one HAI in acute care hospitals, ECDC PPS 2011–2012

	Number of discharges	LOS (LA)	Mean LN-INT	p50 (LN-INT)	Estimated HAI incidence % (95% CI)		Estimated number of patients per year with an HAI (95% CI)	
Austria*	2 678 476	6.0	11.9	7.0	4.2	(2.1-7.8)	113 091	(56 146-210 076)
Belgium	1 771 738	7.6	11.2	7.0	6.3	(4.2-9.0)	111 276	(73 556-159 292)
Bulgaria	1 514 897	5.7	7.4	5.0	3.5	(2.1-5.6)	53 260	(31 851-85 341)
Croatia*	602 731	6.9	9.2	7.0	4.9	(3.5-6.8)	29 709	(20 947-41 197)
Cyprus	113 529	4.6	10.3	9.0	3.1	(2.1-4.4)	3 472	(2 403-4 960)
Czech Republic*	2 086 825	7.0	9.6	7.0	4.0	(2.5-6.3)	83 250	(51 191-131 142)
Denmark*	1 277 608	3.8	8.6	6.0	5.3	(0.5-33.5)	67 731	(5 954-428 320)
Estonia*	243 208	7.1	11.0	8.0	4.4	(2.9-6.3)	10 583	(7 139-15 293)
Finland	975 100	4.3	9.8	7.0	3.9	(2.8-5.3)	38 054	(27 354-51 461)
France	11 915 797	5.8	15.4	8.0	2.7	(1.6-4.1)	324 344	(194 130-487 897)
Germany	17 388 244	6.2	12.6	7.0	3.5	(1.8-5.9)	601 161	(321 321-1 025 716)
Greece	2 344 992	3.9	11.3	8.0	3.7	(2.6-5.2)	87 631	(60 796-122 189)
Hungary	2 379 172	6.9	9.9	6.0	4.2	(2.7-5.9)	99 029	(65 378-140 617)
Iceland	46 595	7.8	10.8	6.0	10.3	(4.0-23.3)	4 793	(1 873-10 837)
Ireland	638 452	5.5	11.8	7.0	3.2	(2.0-4.9)	20 491	(12 516-31 336)
Italy	7 374 765	6.2	13.8	8.0	3.9	(2.4-5.7)	284 100	(178 383-420 098)
Latvia	183 584	6.7	13.3	9.0	1.5	(0.8-2.7)	2 679	(1 401-4 911)
Lithuania	724 228	7.2	13.4	7.0	2.6	(1.1-5.2)	18 644	(8 189-37 858)
Luxembourg	101 694	7.0	12.2	9.0	3.6	(2.0-6.2)	3 688	(2 075-6 341)
Malta	59 443	5.1	10.5	9.0	2.3	(1.4-3.6)	1 357	(857-2 123)
Netherlands	1 720 000	5.2	12.0	7.0	4.3	(2.7-6.5)	74 572	(45 901-112 516)
Norway*	878 000	2.5	10.5	7.5	2.2	(1.3-3.8)	19 716	(11 104-33 586)
Poland	7 419 229	5.3	9.7	7.0	4.2	(2.7-6.2)	308 462	(201 192-459 028)
Portugal	1 104 424	6.9	11.8	8.0	7.9	(5.6-10.7)	86 829	(61 504-117 812)
Romania*	4 238 839	6.4	14.4	12.0	1.4	(0.9-2.1)	58 477	(37 868-89 160)
Slovakia	891 095	6.5	8.9	7.0	3.0	(2.0-4.3)	26 322	(17 734-38 443)
Slovenia	370 243	5.6	10.9	7.0	4.2	(2.6-6.4)	15 367	(9 454-23 737)
Spain	5 124 968	6.6	11.7	8.0	5.7	(4.2-7.5)	292 612	(215 294-382 895)
Sweden*	1 366 712	4.1	6.8	5.0	5.2	(2.4-11.0)	71 619	(32 210-150 771)
UK-England	11 198 966	2.7	9.2	6.0	2.2	(1.5-3.0)	243 746	(167 104-340 451)
UK-N. Ireland	270 904	4.7	11.4	7.0	2.3	(1.2-4.1)	6 097	(3 153-11 011)
UK-Scotland	975 205	5.2	12.7	7.0	2.7	(1.7-4.0)	26 786	(16 720-39 310)
UK-Wales	464 539	5.1	11.8	7.0	2.4	(1.3-4.0)	11 075	(6 162-18 527)
Europe	**90 444 202**	**5.7**	**11.1**	**7.3**	**3.5**	**(2.2-5.8)**	**3 200 021**	**(1 948 862-5 234 253)**

***Number of discharges**: number of discharges for acute care beds if available in national denominator data in TESSy (n=19 countries), number of discharges for all beds in acute care hospitals otherwise (Estonia, Germany, Greece, Hungary, Iceland, Ireland, Latvia, Norway, Portugal, Romania, Slovenia, Spain); UK-Wales: total of hospital data in PPS; Cyprus: estimation based on number of acute care beds in Eurostat multiplied by European average number of discharges per bed per year (41.0). **LOS**: average length of hospital stay from PPS hospital data (=LA in Rhame and Sudderth formula); **LN**= length of stay in patients with HAI; **INT**: number of days from hospital admission to onset of HAI (onset of first HAI if more than one HAI in single patient); **LN-INT**: number of days from onset of HAI until discharge in incidence series (if hospital-wide HAI surveillance had been performed in the same period), approached by PPS survey date – date of HAI onset +1 (see text); for HAI present on admission, the date of onset was replaced by the date of admission; P50=percentile 50 or median; **Estimated HAI incidence % :** percentage of hospitalised patients with at least one HAI per year, estimated using formula by Rhame and Sudderth [43] I=P x LA/(LN-INT), where P is the prevalence of patients with at least one HAI with 95% confidence intervals corrected for the PPS country-specific design effect, LA is the length of stay for all patients and (LN-INT) is the length of stay from onset of infection in patients with an HAI. Two estimates were calculated per country, one based on the mean and one based on the median time from HAI onset to PPS date, see text. **Estimated number of patients per year with an HAI**: number of discharges multiplied by estimated HAI incidence and 95% confidence interval. The HAI incidence and 95% CI for Europe was calculated as the sum of the estimated country-specific numbers of patients with HAI x100 /total number of discharges.*
**PPS data representativeness was poor in Austria, Croatia, Czech Republic, Estonia, Norway and Romania and very poor in Denmark and Sweden.*

The country-weighted estimated incidence and total numbers of patients with HAIs, by infection type and per year, is given in Table 28. The most common HAI type in terms of number of HAIs per year was urinary tract infections with an estimated number of 888 106 HAIs per year, closely followed by pneumonia and lower respiratory tract infections with 860 938 HAIs per year. Both HAI types were estimated to affect about 1% of hospitalised patients per year in Europe and accounted for, respectively, 25.2% and 24.4% of the estimated total of 3.5 million HAIs per year. The 95% confidence interval of the total number of HAIs per year ranged from 1.9 million HAIs to 8.3 million HAIs per year, a wider range than around the estimated total of patients with at least one HAI because of the cumulative uncertainty around each of the site-specific incidence estimates. A comparison between Table 28 and Table 26 shows that the relative frequency of HAI types with a longer length of stay from date of onset until PPS date decreases after applying the formula by Rhame and Sudderth, while the relative frequency of HAI types with a shorter length of stay increases, as can be expected when converting prevalence into incidence.

Table 28. Estimation of the number of HAIs by HAI type per year in acute care hospitals, ECDC PPS 2011–2012

HAI type	LN-INT	P50 (LN-INT)	HAI inc.%	(95% CI)	N HAIs /year	(95% CI)	% of total HAIs	(95% CI)
Pneumonia/LRT	8.9	6.7	0.95	(0.58-1.66)	860 938	(522 771-1 500 038)	24.4	(14.8-42.5)
Urinary tract	8.0	6.3	0.98	(0.58-1.72)	888 106	(527 129-1 554 275)	25.2	(14.9-44.0)
Surgical site	15.0	9.3	0.60	(0.33-1.17)	543 149	(298 167-1 062 673)	15.4	(8.4-30.1)
Bloodstream	11.3	8.7	0.35	(0.19-0.93)	312 822	(171 262-844 423)	8.9	(4.9-23.9)
Gastro-intestinal	13.3	9.3	0.29	(0.14-0.66)	258 327	(127 121-593 452)	7.3	(3.6-16.8)
Systemic	7.5	5.7	0.26	(0.11-1.82)	236 387	(100 646-1 647 657)	6.7	(2.9-46.7)
Skin/soft tissue	12.8	9.0	0.11	(0.05-0.31)	103 146	(43 564-277 627)	2.9	(1.2-7.9)
Other HAI types	13.2	7.9	0.36	(0.17-0.85)	326 903	(151 302-770 238)	9.3	(4.3-21.8)
Total HAIs [(a)]					**3 529 778**	**(1 941 962-8 250 382)**		

*(a) multiple HAIs within one category of the displayed HAI type categories accounted for 0.3% of all HAIs in the PPS and were excluded; the number of patients with a particular HAI type is thus considered to be equal to the number of HAIs in each category; **LN-INT**: number of days from onset of HAI until discharge in incidence series (if hospital-wide HAI surveillance had been performed in the same period), approached by PPS survey date – date of HAI onset +1 (see text); for HAI present on admission, the date of onset was replaced by the date of admission;P50=percentile 50 or median; **Estimated HAI incidence % :** percentage of hospitalised patients with at least one HAI per year, estimated using formula by Rhame and Sudderth [43] I=P x LA/(LN-INT), where P is the prevalence of patients with at least one HAI with 95% confidence intervals corrected for the PPS country-specific design effect. Two estimates were calculated per country, one based on the mean and one based on the median time from HAI onset to PPS date, see text. **Estimated number of patients per year with an HAI**: number of discharges multiplied by estimated HAI incidence and 95% confidence interval. The HAI incidence and 95% CI for Europe was calculated as the sum of the estimated country-specific numbers of patients with HAI x100 /total number of discharges. **LRT**: lower respiratory tract.*

Burden estimates for specific HAI types and microorganisms

The total annual number of patients with ventilator-associated pneumonia in Europe was estimated at 215 352 (107 697–441 969) and patients with catheter-related bloodstream infections at 122 861 (57 028–641 167). The annual number of patients with *C. difficile* infections was estimated at 123 997 (61 018–284 857), the annual number of patients with a healthcare-associated MRSA infection at 178 875 (98 411–418 096) and the annual number of patients with an HAI involving carbapenem-resistant Enterobacteriaceae at 97 111 (53 427–226 984).

Discussion

The ECDC PPS provides the first hospital-wide data on HAIs and antimicrobial use in acute care hospitals for all EU/EEA Member States and Croatia. The final ECDC PPS database included data reported from 947 acute care hospitals in Europe (11.3% of all acute care hospitals in these countries) and included records from 231 459 patients (12.2% of acute care beds). Despite limitations and inherent difficulties arising from the magnitude of the survey and the need for agreement on, and adherence to, uniform definitions, methodology and requirements, the ECDC PPS has:

- estimated the overall burden of HAIs and use of antimicrobials in acute care hospitals in the EU;
- described HAIs and antimicrobial use by type of hospital, patient and by country;
- increased surveillance skills through the training of approximately 2800 healthcare workers across Europe;
- disseminated the results (e.g. through feedback of the results by hospital); and
- provided a standardised tool for hospitals to identify targets for quality improvement.

The latter objective was achieved through the ECDC PPS protocol developed together with experts from all Member States and international projects or organisations and through supporting tools such as free hospital software, hospital reports comparing local results to the national data, standardised training materials and a protocol for PPS data validation.

Healthcare-associated infections

The prevalence of patients with at least one HAI in acute care hospitals in Europe was 6.0% in the PPS sample and was estimated at 5.7% (95% CI 4.5–7.4%) when extrapolated to the average daily number of occupied beds per country. The HAI prevalence point estimate was slightly lower than the 7.1% found in the review of national point prevalence surveys in 2008 [2] and the prevalence of 7.1% found in the pilot PPS in 2010 [3], though the 95% confidence interval in 2011–2012 included the previous percentages. With the exception of UK-Scotland, countries with lower HAI prevalence in the 2008 PPS review also tended to be lower in 2011–2012 ($p<0.01$). This finding suggests that the influence of differences between national PPS protocols before the ECDC PPS may have been less important than previously thought, or that despite the standardisation of the methodology through the ECDC PPS protocol, the national interpretation of the methods and definitions tended to be biased towards the previous national methodology or reporting behaviour. An overall lack of diagnostic testing in lower-resource countries, for example, would result in underascertainment of HAI cases and lower HAI prevalence results, irrespective of the exact methodology used. Direct comparison of HAI prevalence figures between countries should be avoided for several reasons that were addressed in the results section and are further discussed below (see limitations). At least confidence intervals or predicted values based on case mix (preferably both) should be taken into account when interpreting the observed prevalence, as done in Figure 26. Because of the risk of misinterpretation of the HAI prevalence by country presented as a single indicator, ECDC did not publish a map of the observed HAI prevalence and advises against doing so, even though the results by country are given in the report.

The total annual number of patients with at least one HAI in acute care hospitals in the EU/EEA and Croatia was estimated at 3.2 million patients per year with a wide 95% confidence interval of 1.9 to 5.2 million patients per year. The point estimate of 3.2 million was lower than the 2008 estimate of 4.1 million patients per year with HAI in Europe [2], even though the 2008 estimate falls inside the 2011–2012 confidence interval. The main reason for this difference was the lower prevalence in 2011–2012 and the relatively even lower incidence estimate of 3.5% compared with 5.1% in 2008. The 2008 incidence estimate was based on a prevalence-to-incidence conversion using the same method (Rhame and Sudderth formula), but using length-of-stay parameters from literature [44] rather than derived from the data. Because of this, the prevalence-to-incidence ratio was 1.39 in 2008 while it was 1.63 in 2011–2012. The third parameter that varied between the two estimates was the number of hospital discharges per year which was estimated to be 81 million for 27 EU Member States in 2008 (based on available Eurostat data), while in the ECDC PPS the estimated total was 90 million discharges for 29 EU/EEA Member States and Croatia based on the numbers reported by the national PPS coordinating centres. In addition, the estimates for 2011–2012 were first made for each country separately and summed up for Europe, while in 2008 only a total estimate was made. Not surprisingly, the additional number of countries and discharges in 2011–2012 ,compared with 2008, did not compensate for the lower HAI incidence estimate. Finally, the number of HAIs per patient with an HAI (1.1) was similar in 2011–2012 to that in the PPS review in 2008. The estimated total number of HAIs per year was 3.5 million HAIs in 2011–2012, compared with 4.5 million HAIs per year in 2008.

The 95% confidence intervals of the country-specific burden estimates derived from the 2011–2012 data included previously published burden estimates in individual countries, obtained using similar or different methods: the previous point estimate of 125 000 patients per year with an HAI in Belgium [4] fell within the 2011–2012 interval of 73 556 – 159 292, the Finnish point estimate of 45 854 patients per year with an HAI [5] fell within the 2011–2012 interval of 27 354–51 461, the estimated range of 400 000 to 600 000 HAIs per year in Germany [6] fell

within the ECDC PPS interval of 321 321–1 025 716 and the older point estimate by Plowman *et al*. of 320 994 patients per year with an HAI for UK-England [7] was considerably higher than the ECDC PPS point estimate of 243 746 patients with HAI, but also fell within the confidence interval of 167 104–340 451.

The most common infection types in the ECDC PPS sample were pneumonia (19.4%, together with lower respiratory tract infections accounting for 23.5% of HAIs), surgical site infections (19.6%), urinary tract infections (19.0%), and bloodstream infections (10.7%). In the 2008 PPS review, urinary tract infections were the most frequent HAI type accounting for 27%, followed by pneumonia and lower respiratory tract infections (24%), surgical site infections (17%) and bloodstream infections (10.5%). The lower relative frequency of urinary tract infections in the ECDC PPS was probably explained to some extent by the fact that asymptomatic urinary tract infections were excluded from the ECDC PPS while they were included in many of the national surveys in the 2008 PPS review, accounting, on average, for 20.0% of urinary tract infections in the 2008 review in studies that specified the proportion of asymptomatic infections. In the ECDC 2011–2012 PPS, urinary tract infections were also more common in Germany and France, resulting in a higher relative frequency on any given day of 22.2% of urinary tract infections after extrapolation to the total number of occupied beds, while the relative frequency of pneumonia and lower respiratory tract infections decreased to 22.5% (Table 26). When converting site-specific prevalence to incidence per year, the relative frequency of HAI types with a shorter length of stay from date of onset until PPS date logically increased, resulting in urinary tract infections being the most common HAI type (25.2%, Table 28), while the relative frequency of HAI types with a longer length of stay, such as bloodstream infections, decreased. The ECDC PPS confidence interval for the estimated total number of healthcare-associated bloodstream infections per year included a recent estimate of 242 692–414 477 bloodstream infections per year for Europe based on national estimates [8].

The percentage of HAIs with microbiological results (54.1%) was lower than the results of the 2008 PPS review (61.7%). In the ECDC PPS, PPS surveyors were not supposed to revisit files of patients with an HAI after the PPS day to collect microbiological data, while in some of the national protocols included in the review, microbiological data were added when they became available after the PPS day (e.g. in France). Another reason for the overall lower percentage in the ECDC PPS, was that the Netherlands did not report any microbiological data for HAIs on admission due to a methodological discrepancy in their protocol. For these two reasons, the percentage in the ECDC PPS likely underestimates the true percentage of HAIs that are microbiologically documented.

The four microorganisms most frequently isolated from HAIs in the ECDC PPS – *E. coli* (15.9% of microorganisms), *S. aureus* (12.3%), *Enterococcus* spp. (9.6%) and *P. aeruginosa* (8.9%) – were the same as in the 2008 PPS review. *Klebsiella* spp. (8.7%) and *C. difficile* (5.4%) were, however, more common in 2011–2012 than in the 2008 review (based on studies carried out between 1996 and 2007). This observation was consistent with the recent epidemics of ESBL and carbapenemase-producing *K. pneumoniae* [9, 37] and of new virulent PCR ribotypes of *C. difficile* [10, 11]. The distribution of the relative frequency of *Klebsiella* spp. by country (Table 18) was largely determined by the proportion of *K. pneumoniae* (Figure 41). *Clostridium difficile*, which in the 2008 PPS review accounted for less than 2% of all microorganisms found in HAIs in national PPSs performed before the start of the epidemic of PCR ribotype 027, accounted for more than 4% of all microorganisms in 17 countries in 2011–2012 (up to 20.6% in Hungary), indicating an increased incidence of *C. difficile* infections in more than half of the countries. In addition, *C. difficile* infections are most likely underdiagnosed in several countries, as shown by the variability of the percentage of healthcare-associated gastro-intestinal infections that were confirmed as *C. difficile* infections and by the absence of a correlation between the oral treatment of *C. difficile* infection and its prevalence in some countries (e.g. Lithuania).

Antimicrobial resistance data for microorganisms isolated from HAIs were only collected for selected bug–drug combinations. Because of the cross-sectional (single day) study design, the numbers of microorganisms for which antimicrobial susceptibility data were known by country was relatively small, and results should be interpreted with caution. Nevertheless, the countries reporting the highest and the lowest resistance percentages roughly corresponded with the ECDC PPS and the European Antimicrobial Resistance Surveillance Network (EARS-Net). All resistance markers by country were significantly correlated at the $p<0.05$ level between the two databases. The rank order was the most similar for MRSA and resistance of *K. pneumoniae* to third-generation cephalosporins ($p<0.001$), and less so for carbapenem resistance in *P. aeruginosa* ($p=0.04$). Despite the good correlations, resistance percentages by country reported from the ECDC PPS were, with very few exceptions, higher than corresponding figures reported by EARS-Net. The difference was the largest for vancomycin-resistant enterococci (VRE) and third-generation cephalosporin and carbapenem resistance in *E. coli*, and less for MRSA, third-generation cephalosporin resistance in *K. pneumoniae* and carbapenem resistance in *P. aeruginosa*. EARS-Net includes both community- and healthcare-associated infections, and these differences might be a reflection of a larger proportion of community-acquired VRE and *E. coli* infections than MRSA, *K. pneumoniae* and *P. aeruginosa*. In addition, EARS-net only includes invasive isolates which might further explain differences in resistance percentages between that and the ECDC PPS.

The risk model for HAI presented in this report included all HAI types in order to obtain a single summary predicted value and risk score by hospital and country. We also performed a risk analysis for each HAI type separately, and for HAIs with onset during the current hospitalisation only. Not surprisingly, the discriminatory

power of these more specific models were sometimes higher than for the general HAI model. However, presenting these multiple sub-models would be beyond the scope of this report. The methodology for the standardisation was based on multiple logistic regression as frequently used for mortality and for other diseases, including HAIs [45–51].

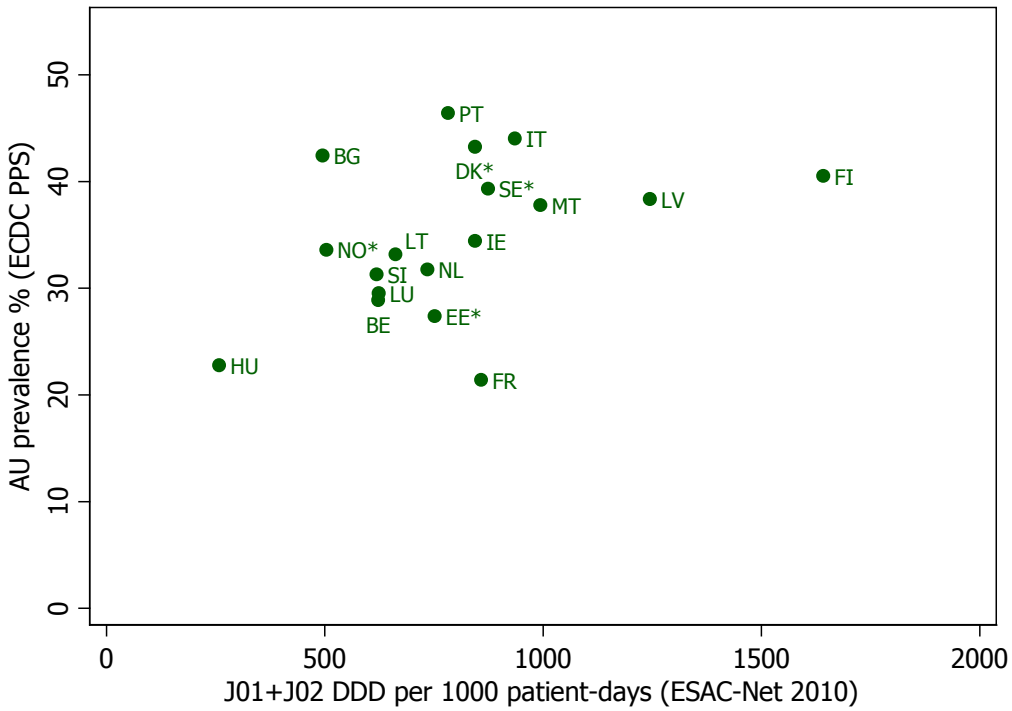
Antimicrobial use

The prevalence of antimicrobial use of 35.0% was similar to the prevalence found in the pilot ECDC PPS (34.6%) and about 5% higher than in previous ESAC PPSs using an identical methodology [19-21]. It should be noted that neither the ESAC hospital PPSs, nor the pilot PPS pursued representativeness at the national or European level, while the ECDC PPS methodology recommended representative sampling and good representativity was obtained by two thirds of the countries. Because of the lower antimicrobial use prevalence in Germany and France, the prevalence extrapolated to the average daily number of occupied beds per country was lower at 32.7%, with a 95% confidence interval including previous point estimates (29.4–36.2).

The ranking of countries according to the prevalence of antimicrobial use was not correlated with the ranking of 18 countries according to 2010 hospital antimicrobial consumption data expressed as DDD for J01 and J02 per 1 000 inhabitants and per day in ESAC-Net [40]. However, when the J01+J02 DDD was expressed per 1000 patient-days using the ECDC PPS national hospital denominator data, there was a moderate correlation, with France as an outlier (p value 0.03 without France and 0.07 with France) and less good correlations for Bulgaria, Portugal and Finland (Figure 83). Evidently, antimicrobial use measured on a single day does not necessarily reflect the total yearly antimicrobial consumption. Nonetheless, one might question why the correlation is good for 14/18 countries reporting yearly hospital consumption data to ESAC-Net, and less good for other countries. For countries with a lower annual consumption than 'predicted' based on the prevalence of antimicrobial use (Bulgaria, Portugal), a possible explanation could be that the national consumption data reported to ESAC-Net were incomplete (e.g. not reported for the entire year, or for a subset of hospitals only). A higher annual consumption than predicted based on the prevalence of antimicrobial use (France, Finland) might be explained by the fact that the patient-days denominator data used do not reflect all patient-days for which annual consumption data were reported to ESAC-Net. For instance, French data were reported for total hospital care and not only for acute care, whereas denominator data were restricted to acute care patient-days. While this may be true for other countries as well, the relative difference between the number of patient-days for all hospital beds and the number of patient-days for acute care beds only was much larger in France than in other countries where both variables were given (see Annex 1, Table A1.7). Similarly, in Finland, antimicrobial consumption data reported to ESAC-Net for the hospital sector include long-term care facilities. Another factor that may influence the correlation between the prevalence of antimicrobial use and the annual antimicrobial consumption data is the effect on DDDs of differences between countries in the dosage of certain antimicrobials (e.g. higher daily dose than the WHO-defined DDD for amoxicillin-clavulanic acid in France).

The fact that there is a correlation between prevalence of antimicrobial use in a hospital and antimicrobial consumption when expressing the latter as DDD per 1 000 patient-days but not when it is expressed as DDD per 1 000 inhabitants per day is likely due to large differences between countries with regard to annual hospitalisation rates and/or average length of hospital stay. Differences in years (2011–2012 for PPS and 2010 for ESAC-Net) are not likely to explain much of the variation because consumption data within one country are strongly correlated from one year to another.

Figure 83. Scatterplot showing prevalence of antimicrobial use in acute care hospitals (%, ECDC PPS 2011–2012) and antimicrobial consumption of ATC groups J01 and J02 in the hospital sector (re-calculated as DDD per 1 000 patient-days, numerator data from ESAC-Net, 2010[(a)]; denominator data from ECDC PPS 2011–2012)



(a) 18 countries reporting 2010 hospital antimicrobial consumption (ESAC-Net) data to TESSy [40]; J01=ATC group J01, antibacterials for systemic use, J02=ATC group J02, antimycotics for systemic use; DDD=defined daily dose; patient-days as reported in ECDC PPS national denominator data (year preceding PPS in 2011–2012): acute care beds in acute hospitals if available, total beds in acute hospitals otherwise (Estonia, Hungary, Ireland, Latvia, Norway, Portugal, Slovenia); linear regression without data points of Bulgaria, Finland, France and Portugal and countries with poor reresentativenss (marked with asterisk: Denmark, Estonia, Norway and Sweden): Annual antimicrobial consumption (J01+J02) in DDD per 1 000 patient-days = 23.2 x antimicrobial use prevalence (Correllation coefficient rho, 0.86, p=0.001).

Case mix contributed in large part to the variation of the antimicrobial use prevalence per country and explained 59.3% of the variation between countries (Figure 67). Varying proportions of patient groups with a lower or higher prevalence of antimicrobial use in a given country (such as for instance more rehabilitation and fewer ICU patients in France) may result in a lower or higher predicted prevalence of antimicrobial use based on case mix. The countries with the lowest and highest standardised antimicrobial use ratio were Germany and Romania, respectively. However, for both these countries, one has to bear in mind that the predicted values were based on consultant/patient specialty and hospital characteristics only (light data) and were therefore less precise than in countries with patient-based data. In addition, the patient-based risk model has several limitations: 1) for many of the factors in the model the time relationship to the start of the antimicrobial could not be determined since the start date of the antimicrobial was not collected in the PPS, 2) only one model was used in the current report (all indications for antimicrobial use combined) while separate models per indication could have been more precise but would have led us beyond the scope of this report (see 'Limitations', below) and 3) the predictions are also subject to statistical uncertainty (95% confidence intervals, not shown in the figures) and to cross-country variability in the interpretation of risk factor definitions.

The most used antimicrobials in the ECDC PPS were in line with previous ESAC hospital PPSs and with the pilot ECDC PPS, with the various beta-lactams (penicillins, cephalosporins and carbapenems) accounting for more than half of all antimicrobials used. The pattern of antimicrobial use differed greatly between treatment of hospital infection versus treatment of community infection and was consistent with the type of infections and microbiological data reported in the HAI part of the PPS. The prevalence of the use of glycopeptides and the prevalence of the use of polymyxins/tigecycline was correlated with the percentage of MRSA and carbapenem-non-susceptible Enterobacteriaceae respectively. This observation further supported the validity of the antimicrobial resistance data collected in the PPS, even though the percentages were often based on small numbers of isolates. The high use of polymyxins/tigecycline in Romania suggests an important clinical problem with carbapenem-resistant Enterobacteriaceae despite the low number of reported HAIs in general and therefore also low numbers of Enterobacteriaceae with known antimicrobial susceptibility results. Also in Cyprus, the absence of carbapenem-reported resistant Enterobacteriaceae was in contrast to polymyxins/tigecycline use (10 of 719 antimicrobials) and

to EARS-Net data for Cyprus. This was most likely also due to the low number of Enterobacteriaceae isolates with known susceptibility results in the PPS (n=12) despite otherwise good representativeness of the data in the country. The high use of carbapenems and glycopeptides in Denmark was unexpected in the context of the known microbiological ecology in that country and was possibly related to the very poor representativeness of the PPS sample (only three hospitals).

Oral treatment of *C. difficile* infections was better correlated with gastro-intestinal HAIs as a whole than with the percentage of *C. difficile* infection alone. This observation may support the hypothesis that *C. difficile* remains underdiagnosed microbiologically, even though clinicians treat patients for it For example, in Lithuania, oral metronidazole or vancomycin accounted for 1.3% of all antimicrobials used, but none of the gastro-intestinal HAIs was reported as a *C. difficile* infection. In comparison, in Latvia, oral metronidazole or vancomycin also accounted for 1.3% of all antimicrobials, but 71.4% of gastro-intestinal infections were reported as *C. difficile* infections, for a similar relative frequency of gastro-intestinal infections (Figure 35). Indeed, the national PPS coordinating centre in Lithuania reported that Lithuanian laboratories do not perform routine testing for *C. difficile*, because there is no written policy nor standardised methodology at national level. In addition (or by consequence), doctors do not send stool samples for *C. difficile* detection. There are only a few sporadic cases of laboratory-confirmed *C. difficile* infections in some Lithuanian hospitals.

The most common indication for antimicrobial use was treatment of a community-acquired infection, accounting for 48% of the presriptions, a value in between the 41% found in the pilot ECDC PPS and 52% found in the 2009 ESAC hospital PPS. Treatment of an HAI was the indication for 21% of antimicrobials, lower than the 25% in the pilot PPS and 27% in the ESAC hospital PPS of 2009. As in the pilot PPS, the prevalence of patients receiving antimicrobials for the treatment of a hospital infection (6.4%) was similar (slightly higher) than the HAI prevalence (6.0%) found in the survey.

Surgical prophylaxis accounted for 16% of antimicrobials used, and was excessively prolonged for more than one day in 59% of the cases, similar to the 61% found in the pilot PPS and 54% in the ESAC 2009 PPS. Surgical prophylaxis should cover the peri-operative period only and a single dose is usually enough unless there is extensive blood loss or the procedure is prolonged. One has to bear in mind that the percentage of prolonged surgical prophylaxis is overestimated in the PPS, because a different recall period is used for surgical prophylaxis (24 hours before 8 am on the survey day) and a treatment given for more than one day has a higher probability of being captured in the PPS study than a treatment given for one day only. Nonetheless, comparing this indicator between hospitals (and countries) using the same methodology is valid, and countries with a high percentage of prolonged surgical prophylaxis (Figure 69) may consider specific measures in this area.

Medical prophylaxis accounted for 11% of antimicrobial use (versus 13% in the pilot PPS and 7% in the ESAC 2009 PPS). Further details regarding medical prophylaxis are scarce in the PPS data because information regarding the infection site for which prophylaxis was given was not collected in the ECDC PPS protocol. The type of antimicrobials used suggested that a considerable proportion of medical prophylaxis was prescribed for the prevention of urinary tract infections and prevention of fungal infections.

The percentage of antimicrobials administered parenterally (71%) was higher than in the ESAC 2009 PPS (66%) and similar to the 72% in the pilot PPS. Promoting earlier change of parenteral to oral administration of antimicrobials seems to be a priority in several eastern European countries and Portugal (Figure 71). The reason for prescribing the antimicrobial was, on average, well documented though it was low in certain countries, particularly in Romania (Figure 72).

Structure and process indicators

The ECDC PPS also provided data for the first time on infection control structure and process indicators at the hospital level for all participating Member States: alcohol-based hand rub consumption as a proxy indicator of hand hygiene, the percentage of single-room beds as a proxy indicator for isolation capacity of patients carrying microorganisms requiring enhanced infection prevention and control measures, and full-time equivalents of specialised infection prevention and control staff.

The median hand rub consumption was 18.7 litres per 1000 patient-days but with a large variation from 6.0 litres per 1000 patient-days in Hungary to 70.1 litres per 1000 patient-days in Sweden. In countries with a national surveillance system in place for alcohol-based hand rub consumption in hospitals, the median value compared well with national reports: in Ireland, the PPS figure (2012) was 20.7 litres per 1000 patient-days whereas the national median in 2010 was 20.3 litres per 1000 patient-days [52]; in Germany, the hospital-wide 2012 PPS median of 19.5 litres per 1000 patient-days was similar to the national median of 21 litres per 1000 patient-days in non-ICU departments of 504 hospitals participating in the HAND-KISS surveillance module in 2011 [53, 54]. Alcohol hand rub consumption data are, however, subject to many limitations (which are further explained below). In particular, if they are based on purchased volumes rather than actually dispensed volumes. For example, the lower consumption in hospitals that provided hand rub data only for wards that were included in the PPS possibly indicated that these data are based on actually dispensed volumes while data for the entire hospital is likely to

comprise a mixture of dispensed and purchased volumes. The heterogeneity of what alcohol hand rub consumption data exactly represent also seemed to be illustrated by the fact that the observed consumption levels in the PPS did not reflect the efforts made in several countries through the organisation of hand hygiene campaigns [55].

The median percentage of single-room beds in the ECDC PPS hospitals was 9.9%, with very low percentages in most eastern countries and Portugal (Figure 18) and 30 times more single beds in the highest ranking country (France) than in the lowest (Hungary). The largest hospital-based European survey before the ECDC PPS looking at infection control indicators – carried out by the EU-funded ARPAC project in 169 acute hospitals from 32 European countries in 2001 – also found that an insufficient number of isolation rooms was a permanent problem for most hospitals in central-eastern Europe, although the percentage of single-room beds was not measured in that study [54]. Isolation of patients with MRSA in single rooms was shown to be associated with lower MRSA percentages and acquisition, particularly if combined with rapid MRSA detection and contact precautions [56, 57].

Infection prevention and control nurses (IPCN) were present in 86% of hospitals and infection prevention and control doctors (IPCD) in 26% of hospitals. The median staffing levels were 0.94 IPCN FTEs per 250 or 3.74 per 1000 hospital beds, and 0.36 IPCD FTEs per 250 or 1.43 per 1000 hospital beds. The SENIC standard of 1 FTE IPCN per 250 beds – although lower than more recent standards for IPCN staffing recommended in scientific literature [58] – was reached by 47% of hospitals. The ARPAC study found lower median staffing levels (2.33 IPCN per 1000 beds and 0.94 IPCD per 1000 beds), but a similar percentage of hospitals with IPCN (80%) and a much higher percentage of hospitals with presence of an IPCD of 74% [54]. However, the ARPAC study sample was biased towards large academic centres with a median of 659 beds, compared with 300 beds in the ECDC PPS, which may explain the higher presence of IPCD and the lower staffing level of IPCN, since the IPCN FTEs per 250 beds was higher in smaller hospitals in the ECDC PPS (Table 7). Nevertheless, even in the largest hospital category (≥650 beds) IPCN staffing levels in the ECDC PPS were still higher at 2.98 per 1000 beds, suggesting that IPCN levels in European hospitals may have increased over the past 10 years. Similar to the findings of the ARPAC study and as for the percentage of single-room beds, east-European countries tended to have lower infection prevention and control staffing levels. IPCN staffing levels reported by hospitals in the ECDC PPS were in line with national recommendations or legal requirements in nine of the 17 countries having such requirements in place [59]. In three countries (Germany, Lithuania and Portugal), the reported median IPCN staffing levels were below 50% of the ratio recommended at national level. Results of IPCN staffing levels collected in the ECDC PPS, however, need to be interpreted with caution because of possible misunderstanding of these variables in some countries (e.g. Lithuania) and because selection bias occurred in other countries (see limitations).

Limitations

Data representativeness

For all results presented in this report, one has to keep in mind that the representativeness of the PPS sample was poor or very poor for eight (24%) countries (Table 1). Results for these countries, especially in Denmark and Sweden, could be heavily biased as a result of the very low number of participating hospitals and low sample size. Low sample size also results in large confidence intervals and in a lack of sufficient numbers to calculate certain indicators, e.g. the antimicrobial resistance markers, for which a minimum of 10 isolates with known antimicrobial susceptibility results was required. Also in some countries with a sufficiently large sample size, the representativeness was less than optimal because hospitals participated on a voluntary basis rather than based on a systematic sampling process as recommended in the protocol. However, when the number of participating hospitals is sufficiently large, even voluntary participation often tends to result in fairly representative samples, as shown in many national HAI surveillance systems. In addition, risk adjustment compensated for differences in case mix, including those resulting from less representative samples. Finally, the average length of stay and size of the hospitals in the ECDC PPS were very similar to the overall national averages in most countries, which also supported good overall representativeness of the data.

Data validity

The indicator that is by far the most difficult to interpret is the main result of the ECDC PPS: the prevalence of HAIs. Validation studies carried out in four countries during the national PPS showed that the sensitivity of the national PPS teams tended to be rather low (72% on average), resulting in underestimation of the true HAI prevalence, particularly in countries with lower national HAI prevalence and/or for which the observed HAI prevalence was lower than predicted based on the case mix. In Spain, where the HAI prevalence was higher than had been predicted, the sensitivity was high and the number of false-positive HAIs was larger. The number of countries that performed validation was, however, too small to give an overall estimate of the sensitivity and specificity of the HAI prevalence in the ECDC PPS. More (10) countries participated in the pilot PPS validation study in November 2011 (with two hospitals per country), prior to the 'full' validation of national PPSs in 2012. The overall sensitivity in that study was higher (83%); however, the conditions of the pilot validation study were very different and may not apply to the actual ECDC PPS.

Low sensitivity (false negatives, or underreporting) of HAIs is a frequently encountered problem in national HAI surveillance systems [60–63]. Low specificity (false positives, or overreporting) is usually less of a problem, and was indeed not a big issue in the ECDC PPS validation studies. Both low sensitivity and low specificity may be related to one or more of following factors:

- Difficulty in confirming the case definition of an infection if signs and symptoms were not well documented in the patient's records or if diagnostic tests included in the case definition of a particular HAI type were not done (e.g. because of lack of resources and/or because of a national tendency to rely more on clinical signs and symptoms to diagnose an infection). If possible sources of information were not all verified during the primary PPS data collection, certain elements of a case definition may have been missed, which would result in false negatives if these sources were verified by the validation teams. If certain symptoms are assumed to be present even though they were not documented in any data source, this might result in false positives. Failure to systematically check criteria for all case definitions included in the protocol may also result in incomplete case ascertainment and therefore in false negatives. For example, oral cavity infections were frequently reported in Sweden (20% of all HAIs), Iceland and UK-Scotland, whereas no such infections were reported in Estonia, Latvia, Lithuania or Romania. Such a difference may be influenced by failure to check for signs and symptoms of less severe infection types. Finally, lack of diagnostic testing and/or failure to document any signs and symptoms of infections in the patient records may result in low numbers of HAIs, but with high sensitivity and specificity (see below).
- Non-respect of the definition of the key term 'healthcare-associated': even if the case definition of an infection is matched, hospital PPS staff may decide not to report the infection as 'healthcare-associated' even though it should according to the definition in the protocol. For example, failure to report an infection with a typical community pathogen that starts after Day 2 of the current hospitalisation as an HAI. The recognition of an infection as healthcare-associated still has a negative connotation in many countries, because an HAI is perceived as a medical error. Cultural differences between European countries may result in different reporting behaviour, particularly for the recognition of an infection as healthcare-associated. Such reporting behaviour is possibly influenced by historical or still existing punitive consequences of reporting HAIs (e.g. to health authorities) or by the fear of a negative financial impact of the (public) disclosure of an existing HAI problem.

The fact that the reported prevalence of HAIs was very well correlated with the prevalence of antimicrobial use for what prescribers call a 'hospital infection' (Figure 28) shed some light on the previous two hypotheses. In four countries, the HAI definition was frequently not confirmed in patients that were treated for a hospital infection. This was likely due to the fact that certain elements of the case definition were not documented in the patient records or diagnostic tests included in the case definition were not done, while the clinician considered that a hospital infection was present and treated the patient accordingly. However, if diagnostic tests were not performed at all on a patient with an infection, antimicrobial use would also not be recognised as treatment of a hospital infection by the prescriber and, if an antimicrobial was prescribed at all, it is likely that it would rather have been reported as treatment intention of a community infection, medical prophylaxis or as antimicrobial use for an unknown indication. The latter case could both explain a lower HAI prevalence and low use of antimicrobials for treatment of hospital infections, and if no signs and symptoms of infections were documented at all after Day 2 of the hospital stay, these false-negative HAI cases due to a lack of case ascertainment would not be captured in a validity study either. Lack of diagnostic testing was frequently mentioned as a problem during the PPS and supporting diagnostic capacity in Europe continues to be a priority. The ECDC PPS did unfortunately not collect (a) proxy indicator(s) of the frequency of diagnostic testing, which would have enabled a better interpretation of the HAI prevalence results.

The excellent correlation between HAI prevalence and the percentage of patients treated for a clinically diagnosed hospital infection in the majority of countries (and hospitals) also suggests that PPS staff often seem to have followed the prescribers' subjective opinion to classify an infection as healthcare-associated rather than strictly applying the criteria of the key term 'healthcare-associated' in the ECDC PPS protocol for each case-definition-confirmed infection. The prescriber's willingness to report an infection for which he/she prescribes antimicrobial treatment as healthcare-associated is likely to be strongly influenced by the earlier mentioned cultural factors that affect the reporting of HAIs in the clinical ward under his/her responsibility.

While differences in data validity (sensitivity and specificity) and case ascertainment most likely had a major impact on the prevalence of patients with HAIs, per country, the European average prevalence is likely to be more valid because it is based on a mixture of countries and hospitals with varying sensitivity and specificity, underreporting but also overreporting. In addition, the validity of the other HAI data (e.g. isolated microorganisms, types of HAIs, antimicrobial resistance markers, origin of HAIs) is also less affected (as supported by the results of the validation surveys). Therefore, indicators such as relative frequencies and percentage resistance are more valid even though they are based on smaller numbers (large confidence intervals) and the frequency of some infection types or microorganisms may be influenced by a specific lack of diagnostic testing or case ascertainment.

Data validity was less of a problem for antimicrobial use prevalence because sensitivity and specificity of the prevalence of patients with antimicrobial use were high in the four national PPS validation surveys and in the pilot PPS

validation study. However, the ECDC PPS results showed that the indication for antimicrobial use, in particular the intention to treat a hospital-acquired infection, was strongly correlated with HAI prevalence. Therefore, the prevalence and relative frequency of this indication is subject to the same validity issues as for the prevalence of HAIs.

The validity, or rather reproducibility or inter-rater reliability, was also verified for collected patient risk factors. As expected, the reproducibility was the lowest for the McCabe score, in particular for classifying the patient's underlying illness as non-fatal or ultimately fatal. Nonetheless, the McCabe score was strongly correlated with the prevalence of both HAIs and antimicrobial use and is therefore an important variable when adjusting results for differences in case mix.

Adjustment for case mix

Differences in HAI and antimicrobial use prevalence may also be explained to a large extent by differences in case mix and types of hospitals and healthcare between countries. The ECDC PPS protocol was designed to be adjustable for many of these differences by including the most important known risk factors for HAIs and antimicrobial use in the protocol. We estimated the number of predicted infections in each hospital and country based on logistic regression models developed on two thirds of the total ECDC PPS database and validated on the remaining third. Standardised infection and antimicrobial use ratios (SIR and SAUR) were calculated as the number of observed over the number of predicted patients with an HAI or on antimicrobials, respectively.

An important limitation of this method of standardisation is that the prediction is made using the database of the ECDC PPS itself as the reference. The risk applied for each of the factors is the average (adjusted) risk for all countries together, i.e. it was not based on a model that assumes all possible infection prevention and antimicrobial stewardship measures were fully implemented. The predicted values should therefore in no case be interpreted as good practice targets.

Another limitation of applying the European average risk coefficients to each patient in every country is that we assume that each of the risk factors means the same thing across countries. This assumption is probably true for factors such as the presence of invasive devices, but for factors such as the medical specialty, the type of hospitals or even the McCabe score, country-specific differences in the definitions or in the interpretation of the definitions cannot be excluded. In addition, the same risk factor does not necessarily give rise to the same risk in each country. For the factor age for instance, it is well known that large inter-country or genetic differences exist with regard to life expectancy and health status in older age groups.

We built a single model for HAIs and another for antimicrobial use. Prediction could be more precise with prediction models for specific HAI types or antimicrobial use indications. This would, however, be beyond the scope of the current report. Another important limitation of the antimicrobial use model is that the presence of many risk factors could not be ascertained before the start of the antimicrobial treatment because the start date was not collected. Prolonged length of stay, for instance, may also be the consequence of the reason for prescribing the antimicrobials (e.g. an infection), therefore the antimicrobial use model is conceptually less robust than the HAI model. In the HAI model, however, the length of stay was calculated as being until onset of infection, the presence of intubation and urinary catheters was only included if present before onset of pneumonia or urinary tract infection, respectively, and the protocol specified that the McCabe score had to be estimated without (before) the influence of an HAI, if one was present. For both models, we excluded the presence of a central and peripheral vascular catheter because of the correlation with parenteral antimicrobial treatment.

The predicted prevalence of HAIs based on case mix ranged from 4.7% in Hungary to 7.7% in Greece, or a highest/lowest ratio of 1.6, while the observed HAI prevalence ranged from 2.3% in Latvia to 10.8% in Portugal, giving a highest/lowest ratio of 4.7. For antimicrobial use the ranges for the predicted and observed prevalence were much closer, with a highest/lowest ratio of 1.9 for the predicted prevalence and 2.6 for the observed prevalence. The larger differences between observed and predicted prevalences for HAIs than for antimicrobial use are likely related to more important data validity issues for HAIs than for antimicrobial use. There are, however, some other factors that need to be considered. While the model assisted in predicting the overall HAI prevalence, there are likely to be a number of other factors that explain HAI prevalence in each country, that were not captured by the protocol and hence by the model. A particular example may be the method of care delivery, including the organisation and provision of community medical care, the role of palliative care and long-term care services. For example, in some eastern countries, patients with an expected longer length of stay (such as patients with an HAI) are transferred to long-term care wards in the hospital. These wards were, however, excluded from the PPS in accordance with the inclusion criteria (with differences in interpretation of what long-term care wards actually are), thereby generating a selection bias. An illustration of this is that in the 2010 national PPS in Lithuania, including long-term care wards, the HAI prevalence was indeed 7.1% compared with 4.2% in acute care wards.

Burden estimates

Point prevalence surveys are generally accepted as a cost-effective way of gathering hospital-wide information on all types of HAI. Hospital-wide surveillance of HAIs is very resource-intensive and the United States Centers for Disease Control and Prevention (US CDC) National Nosocomial Infections Surveillance system (NNIS) discontinued

its hospital-wide surveillance component in 1999 partly because too few hospitals had sufficient resources to perform hospital-wide surveillance using NNIS methods [64,65]. Since then, the US CDC and other national HAI surveillance systems have used only targeted surveillance protocols, most frequently for infections acquired in ICUs and targeted surveillance of surgical site infections, or for specific microorganisms [2].

Prevalence surveys only allow a direct estimate of the total number of patients with an HAI or on antimicrobials on a given day. There is, however, a mathematical relationship between prevalence and incidence which theoretically enables a conversion from prevalence into incidence and vice versa, taking into account the length of hospital stay of infected and non-infected patients as well as the time from admission to HAI onset [43,66]. In order to estimate the total annual number of patients with HAIs in Europe, we used the Rhame and Sudderth formula as previously done in several studies [4,5,44,67-69]. A major problem with this method is that the formula is based on length-of-stay data of the 'incidence series', which would only be known if hospital-wide surveillance had been performed during the same period. In a study by Gastmeier, et al. that combined the two approaches (simultaneous surveillance and nested PPS) to validate the relationship of incidence and prevalence, the Rhame and Sudderth formula performed well, even though the authors did not recommend its use on a routine basis because repeated PPSs are indeed inferior to continuous surveillance as a tool for HAI prevention, in particular for targeted surveillance. For the ECDC PPS, length of stay for all patients was collected at the hospital level for the year preceding the survey, which was used as a proxy for the length of stay in the year of the survey. To approximate the length of stay for patients with an HAI, we used the observation that the hospital length of stay from the previous year was well correlated with the median length of stay until survey date (Figure 12). This observation clearly showed that the distribution of patients in a PPS sample is very much skewed towards patients with a longer length of stay as compared to the 'incidence series', with severe underrepresentation of patients staying only a few days in the hospital (e.g. one or two days). We therefore used the median length of stay from HAI onset until PPS date as the denominator in the Rhame and Sudderth formula. We validated this approach using PPS simulations on European ICU surveillance data with various simulations of patients staying one or two days to obtain a comparable length of stay in the incidence series and the ECDC PPS hospitals. These simulations confirmed that the Rhame and Sudderth formula performs well using this method. However, since results of the latter simulation study are not yet published, we also performed a second estimation using the average time from HAI onset until survey date as denominator to obtain a second (lower) HAI incidence estimate, and calculated the point estimate of the incidence as the average with a wide 95% confidence interval encompassing confidence intervals of both estimates and which expresses the high degree of uncertainty inherent in the incidence and burden estimates. Another limitation with the burden estimations was the fact that national denominator data in acute care hospitals were available for acute care beds in some countries while in other countries, denominator data were only available for the total number of beds in acute care hospitals (see Annex 1, Table A1.7). In 18 countries providing both denominators, the number of acute care bed discharges accounted for 86% of the total number of acute care hospital discharges. This difference of 14% is small compared with the uncertainty related to the prevalence-to-incidence conversion and is therefore less important. Imprecisions in the national denominator data, particularly for the number of beds and patient-days in acute care hospitals (number of occupied beds on any given day), have relatively more impact on the prevalence burden estimate because the confidence interval of the European prevalence is only determined by the confidence intervals of the country-specific prevalence estimates.

Limitations of structure and process indicators

The infection control structure and process indicators collected at the hospital level in the ECDC PPS need to be interpreted with caution because they may, in some cases, not necessarily reflect what they are supposed to measure. The way the number of litres of alcohol hand rub is collected varies between hospitals and countries and may be based on volumes dispensed by the hospital pharmacy or volumes purchased (or otherwise obtained) in the given year, but not necessarily dispensed or used by the healthcare workers in the same year. In addition, the indicator does not take into account the consumption of other hand hygiene agents (e.g. medicated liquid soap), the wastage of hand rub (e.g. replacement of hand rub dispensers before they are empty), hand rub usage for other purposes than hand hygiene and does not distinguish between usage by visitors, patients and healthcare workers. Finally, alcohol hand rub consumption measured at one point in time should be interpreted with caution, especially in relation to other indicators (e.g. percentage antimicrobial resistance) measured at the same time, because the observed level of use could equally precede or be the consequence of the other indicator ('chicken or egg' problem). For example, the high alcohol hand rub consumption in Greek hospitals may be the reflection of increased efforts to control antimicrobial resistance (unless it is explained by one of the factors listed above). In Scandinavian countries, however, it would seem plausible that the high use of alcohol hand rub may have contributed to the low levels of observed antimicrobial resistance (in the PPS and in surveillance systems for antimicrobial resistance such as EARS-Net).

Single rooms may be primarily used for private patients (against supplemental fees, thus generating additional income for the hospital) or for purposes other than the isolation of patients with 'alert' microorganisms.

Finally, one FTE of specialised infection control staff does not necessarily mean that 100% of that person's time is used for infection control/hospital hygiene-related tasks, nor does it reflect the quality of the specialised training

that this person had prior to taking up his/her function as an infection control nurse or doctor in the hospital. In addition, Lithuania reported that the question of the infection control FTEs may have been misunderstood in Lithuanian hospitals, and that only full-time IPC staff were reported in the Lithuanian PPS, not part-time IPC staff. Indeed, 32 of the 44 hospitals in Lithuania reported no IPCN FTEs, while none reported FTEs between 0 and 1, nor between 1 and 2. Even though no other countries reported problems with the interpretation of the definition of the IPC FTE variables, it can't be excluded that a similar misinterpretation occurred in the same way in other hospitals or countries. Another bias, in the opposite direction, occurred in at least two countries (Czech Republic and Estonia). In these countries, the presence of infection control staff was a condition to be included in the survey, because no other staff were available to collect PPS data. As mentioned earlier, in the Czech Republic a new law prevented external epidemiologists from accessing patient information in the hospitals. This new law therefore unfortunately affected the representativeness of the PPS data in the Czech Republic and moreover made it impossible to carry out any kind of validation of PPS data by external validation teams.

The difficulties encountered with the structure and process indicator variables emphasise that more attention should be given to clarifying the methodology for these variables in the PPS both in the protocol as in the training materials.

Conclusions

The 2011–2012 ECDC PPS was the first EU-wide point prevalence survey to collect data on healthcare-associated infections in a total of more than 1000 hospitals from 29 EU/EEA Member States and Croatia. It was also the largest European point prevalence study of antimicrobial use in acute care hospitals performed to-date. All countries used the same standardised protocol developed during a two year collaborative effort involving more than 100 Member States and international experts and several support projects outsourced by ECDC to test the methodology, to develop standardised training materials and deliver train-the-trainer courses for national PPS coordinating staff, to develop free hospital software to collect PPS data and to develop and test a PPS validation methodology. An estimated 2800 healthcare workers from 1200 hospitals across Europe were trained by national PPS coordinating staff to implement the standardised PPS methodology.

The ECDC PPS confirmed that healthcare-associated infections are a major public health problem in Europe with a prevalence of 5.7% (4.5–7.4%) or 81 089 (64 624–105 895) patients with an HAI on any given day in European acute care hospitals. Based on findings from the PPS, the estimated total annual number of patients with an HAI in European acute care hospitals in 2011–2012 was 3.2 million, albeit with a wide confidence interval of 1.9 million to 5.2 million patients.

The survey also made possible a comprehensive description of the epidemiology of healthcare-associated infections by type of patient, hospital and country. ICU patients, haematology/bone marrow transplantation and burns care patients were at highest risk of an HAI. The five most common HAI types were urinary tract infections, pneumonia, surgical site infections, bloodstream infections and gastro-intestinal infections. The rising epidemic of carbapenem-resistant gram-negative bacteria in several countries and the major contribution of other well-known hospital pathogens such as MRSA and *C. difficile* were confirmed by the ECDC PPS results. Observations such as the large variations in the percentage of gastro-intestinal HAIs that were reported as *C. difficile* infections showed important differences between countries with regard to diagnostic testing for HAIs, possibly related to the lack of financial resources and/or the lack of diagnostic guidelines in some countries or institutions.

While a first major step has been made in increasing the HAI surveillance skills and awareness of healthcare workers across Europe, considerable training to harmonise the interpretation of case definitions as well as additional validation efforts are still needed before reliable comparisons of – even risk-adjusted – prevalence figures for HAIs between countries can be made. Direct comparison of HAI prevalence percentages between countries were not an objective of the ECDC PPS and these cannot be made without taking case mix, confidence intervals and data validity into account.

Data validity was much less a problem for the prevalence of antimicrobial use in the ECDC PPS. The overall prevalence of antimicrobial use extrapolated to the total number of occupied beds was 32.7% (29.4–36.2%) and 466 226 (419 284–515 690) patients were estimated to receive at least one antimicrobial on any given day in European acute care hospitals in 2011–2012. Germany and Hungary recorded the lowest standardised antimicrobial use ratio (adjusted for case mix) and Greece and Romania the highest.

Finally, for the first time, the ECDC PPS collected EU-wide data on three infection control structure and process indicators. Inter-country differences in the consumption of alcohol hand rub were difficult to interpret because of the large variability in the data sources and other possible limitations that were not captured in the ECDC PPS. Nevertheless, it provides useful European reference data for future surveys or surveillance systems. The large differences in the number of single rooms and staffing levels of infection prevention and control nurses demonstrate the difficulties of lower-resourced countries, in particular, in matching the levels obtained by higher-resourced Member States or in meeting what are accepted as international standards.

In order to maximise the prevention of HAIs and antimicrobial resistance in European healthcare institutions, the continued implementation of Council Recommendation 2009/C 151/01 on Patient Safety, including the Prevention and Control of Healthcare Associated Infections is crucial (see Recommendations chapter). Specific recommendations from the findings of the ECDC PPS include continued support for laboratory capacity to improve diagnostic testing for HAIs, ensuring sufficient isolation capacity for patients with alert microorganisms, improvement of HAI surveillance systems by integrating regular validation studies, implementation of standardised surveillance for consumption of alcohol hand rub and *C. difficile* infections and development of guidance for the prevention and control of HAIs with carbapenem-resistant gram-negative bacteria.

The ECDC PPS used the previous ESAC hospital PPS methodology, allowing the identification of select areas for the improvement of antimicrobial use in several European countries including: excessive use of broad-spectrum antimicrobials, excessive prolongation of surgical prophylaxis, high use of medical prophylaxis, frequent parenteral administration of antibiotics and low (in some countries) documentation of the reason for antimicrobial prescribing in the patient's records.

ECDC is supporting the prevention of HAIs and the prudent use of antimicrobials in healthcare institutions through different outsourced projects. Some of the outcomes of these projects are already available, others projects are still ongoing or outputs are under development.

- Evidence-based guidance on the prevention of *Clostridium difficile* infections [70]
- Evidence-based guidance on organisation of hospital infection control programmes [71]
- Guidance on cost-effective interventions to prevent and control HAIs [72]
- Support to national infection control training programmes [73, 74]
- Systematic review and evidence-based guidance on peri-operative antibiotic prophylaxis [75]
- Diagnostic capacity building for *C. difficile* infections and carbapenemase-producing bacteria [76, 77]
- Prevalence surveys of healthcare-associated infections and antimicrobial use in European long-term care facilities, in accordance with the special emphasis given to this type of facilities in the implementation report of Council Recommendation (2009/C 151/01) [78]

Recommendations

At least 20% of HAIs are estimated to be preventable by sustained and multifaceted infection prevention and control programmes, including surveillance of HAIs [12,42]. The proportion preventable by employing current evidence-based strategies is highest for device-associated infections and surgical site infections [13].

In order to maximise the prevention of HAIs and antimicrobial resistance in European healthcare institutions, the continued implementation of the Council Recommendation (2009/C 151/01) on Patient Safety, including the Prevention and Control of Healthcare Associated Infections is crucial. The main components of the Council Recommendation with regard to HAI prevention and control are reiterated below, together with the specific action points that were identified in the first implementation report of the Council Recommendation [15].

- Have infection prevention and control programmes in place at national and hospital level, including recommendations on organisational and structural arrangements, diagnostic and therapeutic procedures (for example antimicrobial stewardship), resource requirements, surveillance objectives, training and information to patients.
- Continue the development of guidance on the prevention and control of HAIs and antimicrobial resistance at EU level and have guidelines available at national and hospital level.
- Improve surveillance by:
  - repeating national point prevalence surveys of HAIs as a means to monitor the burden of HAIs in all types of healthcare institutions, to identify priorities and targets for intervention, to evaluate the impact of interventions and to raise awareness,
  - ensuring that surveillance of targeted infection types is in place, e.g. surveillance of HAIs in ICU and surveillance of surgical site infections,
  - implementing surveillance systems for the timely detection and reporting of alert healthcare-associated organisms and strengthening the ability to respond to the spread (including across borders) of such organisms and prevent their introduction into healthcare settings,
  - developing an evaluation system with a set of indicators in Member States to assess the implementation of the strategy/action plan and its success in improving the prevention and control of HAIs.
- Enhance infection prevention and control staffing and training by:
  - ensuring adequate numbers of specialised infection control staff with time set aside for this task in hospitals and other healthcare institutions,
  - improving the training of specialised infection control staff and better aligning qualifications between Member States.
- Improve information for patients and strengthen their involvement in compliance with infection prevention and control measures.
- Develop research at EU level in the area of the prevention and control of HAIs, including studies on cost-effectiveness of prevention and control measures.

Regarding recommendations for the improvement of antimicrobial prescribing in hospitals, it is important to bear in mind the principles of the Council Recommendation of 15 November 2001 on the prudent use of antimicrobial agents in human medicine (2002/77/EC) [16].

Based on ECDC PPS results, additional or specific recommendations can be proposed in the area of prevention and control of HAIs, antimicrobial resistance and antimicrobial use in acute care hospitals. These suggestions include the following:

- Continued support for laboratory capacity to improve diagnostic testing for HAIs.
- Prioritise ensuring sufficient isolation capacity for patients with alert microorganisms in acute care hospitals when rebuilding hospitals.

- Implement EU-standardised surveillance of alcohol hand rub consumption, complemented if possible by hand hygiene compliance monitoring.
- Implement standardised surveillance of *C. difficile* infections at local, national and EU level.
- Develop guidance for the prevention and control of HAIs with carbapenem-resistant gram-negative bacteria.
- Enhance EU surveillance of HAIs with carbapenem-resistant gram-negative bacteria, e.g. by improving the EARS-Net surveillance of antimicrobial resistance with regard to the origin of the infection (community- or healthcare-associated) and coverage of other infection types and antimicrobial resistance markers.
- Support the timely detection of new epidemics with alert microorganisms and support the implementation of appropriate prevention and control measures accordingly, e.g. by promoting the use by Member States of the ECDC epidemic intelligence system (EPIS) for antimicrobial resistance.
- Develop or improve antimicrobial stewardship programmes to improve antimicrobial prescribing in acute care hospitals, in particular:
  - rationalise the use of broad-spectrum antimicrobials (e.g. carbapenems),
  - limit the excessive prolongation of surgical prophylaxis,
  - rationalise the use of antimicrobials for medical prophylaxis,
  - promote the practice of changing the route of administration of antimicrobials from parenteral to oral when possible,
  - improve the documentation of the reason for antimicrobial prescribing in the clinical notes.
- Report hospital antimicrobial consumption to ESAC-Net in defined daily dose per number of patient-days rather than per number of inhabitants.

In addition to the recommendations for the prevention of HAIs and the improvement of antimicrobial prescribing in acute care hospitals, the experience of the ECDC PPS suggests the following recommendations for future repeated PPSs in Europe:

- EU-wide PPS initiatives can increase surveillance skills in Member States as well as enable countries to execute studies using a common protocol. However, considerable additional training of healthcare workers is needed to harmonise the interpretation of HAI case definitions and other key terms in the ECDC PPS protocol.
- National PPSs should be repeated at least once every five years. ECDC will organise a second coordinated PPS in all Member States in 2016–2017, but will also support the organisation, data collection, validation and analysis of national PPSs in 2013–2015. In particular, countries with poor sample representativeness in the 2011–2012 ECDC PPS are encouraged to perform a second PPS during the intermediate period in the recommended number of hospitals in accordance with the ECDC PPS protocol.
- National PPS coordinating centres should perform validation studies during the national PPSs, and perform at least one national PPS with simultaneous validation before the end of 2017. International validation should be considered.
- The ECDC PPS protocol should be evaluated and adjusted where needed. Particular emphasis should be given to the inclusion of long-term-care wards in acute care hospitals, the inclusion of HAIs present on admission from other types of healthcare institutions, revision of certain case definitions, discussion on the possibility of adding certain variables to improve usefulness of data (e.g. date of start antimicrobial in hospital, acquisition of HAI in the ICU, site for antimicrobial and medical prohylaxis, type of surgery), consideration of further refining/improving infection control indicators and adding (a) proxy indicator(s) for the frequency of diagnostic testing.

References

1. European Centre for Disease Prevention and Control (ECDC). Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. Protocol version 4.3. Full scale survey and codebook. Stockholm: ECDC: 2012. Available from: http://www.ecdc.europa.eu/en/activities/surveillance/HAI/about_HAI-Net/Pages/PPS.aspx
2. European Centre for Disease Prevention and Control (ECDC). Annual epidemiological report on communicable diseases in Europe 2008. Stockholm: ECDC; 2008. Available from: http://ecdc.europa.eu/en/publications/Publications/0812_SUR_Annual_Epidemiological_Report_2008.pdf
3. Zarb P, Coignard B, Griskeviciene J, Muller A, Vankerckhoven V, Weist K, et al; National Contact Points for the ECDC pilot point prevalence survey; Hospital Contact Points for the ECDC pilot point prevalence survey. The European Centre for Disease Prevention and Control (ECDC) pilot point prevalence survey of healthcare-associated infections and antimicrobial use. Euro Surveill. 2012;17(46):pii=20316
4. Vrijens F, Hulstaert F, Devriese S, van de Sande S. Hospital-acquired infections in Belgian acute-care hospitals: an estimation of their global impact on mortality, length of stay and healthcare costs. Epidemiol Infect. 2012 Jan;140(1):126-36.
5. Kanerva M, Ollgren J, Virtanen MJ, Lyytikäinen O; Prevalence Survey Study Group. Estimating the annual burden of health care-associated infections in Finnish adult acute care hospitals. Am J Infect Control. 2009 Apr;37(3):227-30.
6. Gastmeier P, Geffers C. [Nosocomial infections in Germany. What are the numbers, based on the estimates for 2006?]. Dtsch Med Wochenschr. 2008 May;133(21):1111-5. doi: 10.1055/s-2008-1077224. German.
7. Plowman R, Graves N, Griffin MA, Roberts JA, Swan AV, Cookson B, Taylor L. The rate and cost of hospital-acquired infections occurring in patients admitted to selected specialties of a district general hospital in England and the national burden imposed. J Hosp Infect. 2001 Mar;47(3):198-209.
8. Goto M, Al-Hasan MN. Overall burden of bloodstream infection and nosocomial bloodstream infection in North America and Europe. Clin Microbiol Infect. 2013 Feb 26.
9. Magiorakos AP, Suetens C, Monnet DL, Gagliotti C, Heuer OE. The rise of carbapenem resistance in Europe: just the tip of the iceberg? Antimicrob Resist Infect Control. 2013 Feb 14;2(1):6.
10. Kuijper EJ, Coignard B, Tüll P; ESCMID Study Group for Clostridium difficile; EU Member States; European Centre for Disease Prevention and Control. Emergence of Clostridium difficile-associated disease in North America and Europe. Clin Microbiol Infect. 2006 Oct;12 Suppl 6:2-18. Review.
11. Bauer MP, Notermans DW, van Benthem BH, Brazier JS, Wilcox MH, Rupnik M, Monnet DL, van Dissel JT, Kuijper EJ; ECDIS Study Group. Clostridium difficile infection in Europe: a hospital-based survey. Lancet. 2011 Jan 1;377(9759):63-73.
12. Harbarth S, Sax H, Gastmeier P. The preventable proportion of nosocomial infections: an overview of published reports. J Hosp Infect. 2003 Aug;54(4):258-66
13. Umscheid CA, Mitchell MD, Doshi JA, Agarwal R, Williams K, Brennan PJ. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. Infect Control Hosp Epidemiol. 2011 Feb;32(2):101-14.
14. Council of the European Union. Council Recommendation of 9 June 2009 on patient safety, including the prevention and control of healthcare associated infections (2009/C 151/01). Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:151:0001:0006:EN:PDF
15. Report from the Commission to the Council on the Basis of the Member States' Reports on the Implementation of The Council Recommendation (2009/C 151/01) on Patient Safety, including the Prevention and Control of Healthcare Associated Infections. Com(2012) 658. Available from http://ec.europa.eu/health/patient_safety/policy/index_en.htm
16. Council of the European Union. Council Recommendation of 15 November 2001 on the prudent use of antimicrobial agents in human medicine (2002/77/EC). Available from: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:034:0013:0016:EN:PDF
17. Suetens C, Ammon A, Weist K, Sodano L, Monnet DL. Review of methods of national prevalence surveys of healthcare-associated infections in 17 European countries. European Congress of Clinical Microbiology and Infectious Diseases (ECCMID); 16-19 May 2009; Helsinki, Finland. Clin Microbiol Infect. 2009;15(s4):P.624.
18. Improving Patient Safety in Europe (IPSE). The IPSE report 2005-2008. Lyon: Université Claude Bernard Lyon1; November 2009]. Available from http://www.ecdc.europa.eu/en/activities/surveillance/HAI/Documents/0811_IPSE_Technical_Implementation_Report
19. Ansari F, Erntell M, Goossens H, Davey P. The European surveillance of antimicrobial consumption (ESAC) point-prevalence survey of antibacterial use in 20 European hospitals in 2006. Clin Infect Dis. 2009;49(10):1496-504.
20. Amadeo B, Zarb P, Muller A, Drapier N, Vankerckhoven V, Rogues A, et al. European surveillance of antibiotic consumption (ESAC) point prevalence survey 2008: Paediatric antimicrobial prescribing in 32 hospitals of 21 European countries. J Antimicrob Chemother. 2010;6(10)5:2247-52.

21. Zarb P, Amadeo B, Muller A, Drapier N, Vankerckhoven V, Davey P, et al. Identification of targets for quality improvement in antimicrobial prescribing: The web-based ESAC point prevalence survey 2009. J Antimicrob Chemother. 2011;66(2):443-9.
22. Zarb P, Goossens H. European surveillance of antimicrobial consumption (ESAC): Value of a point-prevalence survey of antimicrobial use across Europe. Drugs. 2011;71(6):745-55.
23. Hansen S, Sohr D, Geffers C, Astagneau P, Blacky A, Koller W, et al. Concordance between European and US case definitions of healthcare-associated infections. Antimicrob Resist Infect Control. 2012 Aug 2;1(1):28. doi: 10.1186/2047-2994-1-28.
24. Goossens H. Expert-proposed European strategies to monitor and control infection, antibiotic use, and resistance in health-care facilities. Lancet Infect Dis. 2011;11(5):338-40.
25. McCabe WR, Jackson GG. Gram-negative bacteremia: I. Etiology and ecology. Arch Intern Med. 1962;110:847-53.
26. Eurostat: Health care resources (non-expenditure data). Reference Metadata in Euro SDMX Metadata Structure (ESMS). Available from http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/hlth_res_esms.htm
27. Hospital in Europe Link for Infection Control through Surveillance (HELICS). Surveillance of surgical site infections. Protocol version 9.1. Lyon: HELICS; Sept 2004. Available from: http://www.ecdc.europa.eu/en/activities/surveillance/HAI/Documents/0409_IPSE_SSI_protocol.pdf
28. Kuijper EJ, Coignard B, Tüll P, ESCMID Study Group for Clostridium difficile; EU Member States; European Centre for Disease Prevention and Control. Emergence of Clostridium difficile-associated disease in North America and Europe. Clin Microbiol Infect. 2006;12(Suppl 6): 2-18.
29. Nosocomial infection surveillance system for preterm infants on neonatology departments and intensive care units (Neo-KISS). Protokoll.
Surveillance nosokomialer Infektionen bei Frühgeborenen mit einem Geburtsgewicht <1.500g. [Protocol. Surveillance of nosocomial infections in preterm infants with a birth weight <1,500 g]. Berlin: Institut für Hygiene und Umweltmedizin, Charité; Dec 2009. German. Available from: http://www.nrz-hygiene.de/fileadmin/nrz/download/NEOKISSProtokoll221209.pdf
30. Hospital in Europe Link for Infection Control through Surveillance (HELICS). Surveillance of nosocomial infections in intensive care units. Protocol version 6.1. Lyon: HELICS; Sept 2004. Available from: http://www.ecdc.europa.eu/en/activities/surveillance/HAI/Documents/0409_IPSE_ICU_protocol.pdf
31. Geffers C, Baerwolff S, Schwab F, Gastmeier P. Incidence of healthcare-associated infections in high-risk neonates: results from the German surveillance system for very-low-birthweight infants. J Hosp Infect. 2008;68(3):214-21.
32. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. Am J Infect Control. 2008;36(5):309-32.
33. Commission Implementing Decision 2012/506/EU of 8 August 2012 amending Decision 2002/253/EC laying down case definitions for reporting communicable diseases to the Community network under Decision No 2119/98/EC of the European Parliament and of the Council OJ L 262/1; 27.9.2012 available from http://ec.europa.eu/health/communicable_diseases/early_warning/comm_legislation_en.htm
34. World Health Organization (WHO) Collaborating Centre for Drug Statistics Methodology. The ATC/DDD system: International language for drug utilization research. Oslo: WHO Collaborating Centre for Drug Statistics Methodology; Oct 2007. Available from: http://www.fhi.no/dav/a0fb3024e7.pdf
35. PPS Hospital Software HELICSWin.Net. Download page and user manual. http://ecdc.europa.eu/en/activities/surveillance/HAI/about_HAI-Net/Pages/HELICSWinNet-download-page-HWN.aspx
36. http://www.nrz-hygiene.de/surveillance/kiss/cdad-kiss/
37. European Centre for Disease Prevention and Control. Antimicrobial resistance surveillance in Europe 2011. Annual Report of the European Antimicrobial Resistance Surveillance Network (EARS-Net). Stockholm: ECDC; 2012.
38. Zarb P, Ansari F, Muller A, Vankerckhoven V, Davey PG, Goossens H. Drug utilization 75% (DU75%) in 17 European hospitals (2000-2005): results from the ESAC-2 Hospital Care Sub Project. Curr Clin Pharmacol. 2011 Feb;6(1):62-70.
39. Adriaenssens N, Coenen S, Versporten A, Muller A, Minalu G, Faes C, et al. European Surveillance of Antimicrobial Consumption (ESAC): outpatient quinolone use in Europe (1997-2009). J Antimicrob Chemother. 2011 Dec;66 Suppl 6:vi47-56.
40. European Centre for Disease Prevention and Control. Surveillance of antimicrobial consumption in Europe, 2010. Stockholm: ECDC; 2013.
41. Huttner B, Jones M, Rubin MA, Neuhauser MM, Gundlapalli A, Samore M. Drugs of last resort? The use of polymyxins and tigecycline at US Veterans Affairs medical centers, 2005-2010. PLoS One. 2012;7(5):e36649. doi:10.1371/journal.pone.0036649. Epub 2012 May 16.
42. Haley RW, Culver DH, White JW, Morgan WM, Emori TG, Munn VP, Hooton TM. The efficacy of infection surveillance and control programs in preventing nosocomial infections in US hospitals. Am J Epidemiol. 1985;121:182–205

43. Rhame FS, Sudderth WD. Incidence and prevalence as used in the analysis of the occurrence of nosocomial infections. Am J Epidemiol. 1981 Jan;113(1):1-11.

44. Gastmeier P, Bräuer H, Sohr D, Geffers C, Forster DH, Daschner F, Rüden H. Converting incidence and prevalence data of nosocomial infections: results from eight hospitals. Infect Control Hosp Epidemiol. 2001 Jan;22(1):31-4.

45. Le Gall JR, Lemeshow S, Saulnier F. A new Simplified Acute Physiology Score (SAPS II) based on a European/North American multicenter study. JAMA. 1993 Dec 22-29;270(24):2957-63.

46. Rioux C, Grandbastien B, Astagneau P. The standardized incidence ratio as a reliable tool for surgical site infection surveillance. Infect Control Hosp Epidemiol. 2006 Aug;27(8):817-24. Epub 2006 Jul 24.

47. Kritsotakis EI, Dimitriadis I, Roumbelaki M, Vounou E, Kontou M, Papakyriakou P, Koliou-Mazeri M, Varthalitis I, Vrouchos G, Troulakis G, Gikas A. Case-mix adjustment approach to benchmarking prevalence rates of nosocomial infection in hospitals in Cyprus and Greece. Infect Control Hosp Epidemiol. 2008 Aug;29(8):685-92.

48. Kanerva M, Ollgren J, Lyytikäinen O; Finnish Prevalence Survey Study Group. Interhospital differences and case-mix in a nationwide prevalence survey. J Hosp Infect. 2010 Oct;76(2):135-8.

49. Kanerva M, Ollgren J, Lyytikäinen O; Finnish Prevalence Survey Study Group. Benchmarking antibiotic use in Finnish acute care hospitals using patient case-mix adjustment. J Antimicrob Chemother. 2011 Nov;66(11):2651-4.

50. Malpiedi PJ, Peterson KD, Soe MM, Edwards JR, Scott RD, Wise ME, Baggs J, Yi SH, Dudeck MA, Arnold KE, Weiner LM, Rebmann CA, Srinivasan A, Fridkin SK, McDonald LC. 2011 National and State Healthcare-Associated Infection Standardized Infection Ratio Report. Published February 11, 2013. Available at http://www.cdc.gov/hai/national-annual-sir/index.html

51. European Centre for Disease Prevention and Control. Surveillance of healthcare-associated infections in Europe, 2007. Stockholm: ECDC; 2012. Available from http://www.ecdc.europa.eu/en/publications/Publications/120215_SUR_HAI_2007.pdf

52. Health Protection Surveillance Centre. Alcohol Hand Rub Consumption Surveillance. Alcohol hand rub consumtion in Irish acute hospitals, 2006 to Q4 2010. Available from http://www.hpsc.ie/hpsc/A-Z/Gastroenteric/Handwashing/AlcoholHandRubConsumptionSurveillance/

53. Behnke M, Gastmeier P, Geffers C, Mönch N, Reichardt C. Establishment of a national surveillance system for alcohol-based hand rub consumption and change in consumption over 4 years. Infect Control Hosp Epidemiol. 2012 Jun;33(6):618-20.

54. Nationales Referenzzentrum für Surveillance von nosokomialen Infektionen. HAND-KISS (Alcohol-based handrub consumption surveillance). Referenzdaten. Available from http://www.nrz-hygiene.de/surveillance/kiss/hand-kiss/

55. Magiorakos AP, Suetens C, Boyd L, Costa C, Cunney R, Drouvot V, et al. National hand hygiene campaigns in Europe, 2000-2009. Euro Surveill. 2009 Apr 30;14(17).

56. MacKenzie FM, Bruce J, Struelens MJ, Goossens H, Mollison J, Gould IM; ARPAC Steering Group. Antimicrobial drug use and infection control practices associated with the prevalence of methicillin-resistant Staphylococcus aureus in European hospitals. Clin Microbiol Infect. 2007 Mar;13(3):269-76.

57. Marshall C, Richards M, McBryde E. Do active surveillance and contact precautions reduce MRSA acquisition? A prospective interrupted time series. PLoS One. 2013;8(3):e58112.

58. Wright SB, Ostrowsky B, Fishman N, Deloney VM, Mermel L, Perl TM. Expanding roles of healthcare epidemiology and infection control in spite of limited resources and compensation. Infect Control Hosp Epidemiol. 2010 Feb;31(2):127-32.

59. European Commission. Detailed analysis of countries' reports on the implementation of the Council Recommendation (2009/C 151/01) on patient safety, including the prevention and control of healthcare associated infections. Commission Staff Working Document SWD(2012) 366, Nov 2012. *Accompanying the document* Report from the Commission to the Council on the Basis of the Member States' Reports on the Implementation of The Council Recommendation (2009/C 151/01) on Patient Safety, including the Prevention and Control of Healthcare Associated Infections. Com(2012) 658. Available from http://ec.europa.eu/health/patient_safety/policy/index_en.htm

60. Fabry J, Morales I, Metzger M, Russell I, Gastmeier P. Quality of information: a European challenge. J Hosp Infect 2007;65(2):155-158.

61. Haley RW, Schaberg DR, McClish DK, Quade D, Crossley KB, Culver DH, et al. The accuracy of retrospective chart review in measuring nosocomial infection rates: results of validation studies in pilot hospitals. *Am J Epidemiol.* 1980;111:516-533.

62. Emori TG, Edwards JR, Culver DH, Sartor C, Stroud LA, Gaunt EE, et al. Accuracy of reporting nosocomial infections in intensive-care-unit patients to the National Nosocomial Infections Surveillance System: a pilot study. Infect Control Hosp Epidemiol. 1998;19:308-316.

63. Hajdu A, Eriksen HM, Sorknes NK, Hauge SH, Loewer HL, Iversen BG, Aavitsland P. Evaluation of the national surveillance system for point-prevalence of healthcare-associated infections in hospitals and in long-term care facilities for elderly in Norway, 2002-2008. BMC Public Health. 2011 Dec 13;11:923.

64. CDC. National Nosocomial Infections Surveillance (NNIS) System Report, Data Summary from January 1992-June 2001, issued August 2001. Am J Infect Control. 2001;29:404-421.

65. Brossette SE, Hacek DM, Gavin PJ, Kamdar MA, Gadbois KD, Fisher AG, Peterson LR. A Laboratory-Based, Hospital-Wide, Electronic Marker for Nosocomial Infection: The Future of Infection Control Surveillance? Am J Clin Pathol. 2006 Jan;125(1):34-9.

66. Freeman J, Hutchison GB. Prevalence, incidence and duration. Am J Epidemiol 1980;112(5):707-723.

67. Graves N, Nicholls TM, Wong CG, Morris AJ. The prevalence and estimates of the cumulative incidence of hospital-acquired infections among patients admitted to Auckland District Health Board Hospitals in New Zealand. Infect Control Hosp Epidemiol 2003;24(1):56-61.

68. Rossello-Urgell J, Rodriguez-Pla A. Behavior of cross-sectional surveys in the hospital setting: a simulation model. Infect Control Hosp Epidemiol 2005;26(4):362-368.

69. Reilly J, Stewart S, Allardice G, Noone A, Robertson C, Walker A, Coubrough S. NHS Scotland national HAI prevalence survey. Final Report 2007, Health Protection Scotland. Available from http://www.documents.hps.scot.nhs.uk/hai/sshaip/publications/national-prevalence-study/report/full-report.pdf

70. Vonberg RP, Kuijper EJ, Wilcox MH, Barbut F, Tüll P, Gastmeier P; European C difficile-Infection Control Group; European Centre for Disease Prevention and Control (ECDC), van den Broek PJ, Colville A, Coignard B, Daha T, Debast S, Duerden BI, van den Hof S, van der Kooi T, Maarleveld HJ, Nagy E, Notermans DW, O'Driscoll J, Patel B, Stone S, Wiuff C. Infection control measures to limit the spread of Clostridium difficile. Clin Microbiol Infect. 2008 May;14 Suppl 5:2-20.

71. Systematic review and evidence-based guidance on organisation of hospital infection control programmes. Ref.: OJ/2010/07/23-PROC/2010/038

72. Systematic literature review on cost-effectiveness interventions to prevent and control healthcare associated infections (HCAI). Ref.: OJ/15/02/2012-PROC/2012/014

73. Implementation of a training strategy for infection control training in the European Union. Ref.: OJ/10/08/2012-PROC/2012/051

74. European Centre for Disease Prevention and Control. Core competencies for infection control and hospital hygiene professionals in the European Union. Stockholm: ECDC; 2013. Available from http://ecdc.europa.eu/en/publications/Publications/infection-control-core-competencies.pdf

75. European Centre for Disease Prevention and Control. Systematic review and evidence-based guidance on perioperative antibiotic prophylaxis. Stockholm: ECDC;2013. Available from http://www.ecdc.europa.eu/en/publications/Publications/Forms/ECDC_DispForm.aspx?ID=1150&MasterPage=1

76. Supporting capacity building for surveillance of *Clostridium difficile* infections at European level. Ref.: OJ/2010/07/09-PROC/2010/035

77. European survey on carbapenemase-producing bacteria. Ref.: OJ/25/04/2012-PROC/2012/036

78. Prevalence surveys of healthcare-associated infections and antimicrobial use in European long-term care facilities. Ref.: OJ/20/06/2011-PROC/2011/058

Acknowledgements

First and foremost, ECDC would like to thank all participating hospitals, in particular the hospital staff that collected, validated and entered the data during the ECDC PPS and transferred these data to the respective national PPS coordinating centres. Thanks to their efforts, we were able to provide the most comprehensive picture of the epidemiology and burden of healthcare-associated infections and antimicrobial use in acute care hospitals in Europe to date. The identity of the hospitals participating in the EU-wide PPS were not collected for reasons of confidentiality and are therefore not listed.

Secondly, ECDC is very much indebted to the national PPS coordination teams who did a tremendous job in preparing the national PPS tools including translating the ECDC PPS protocol and tools, developing national software, recruiting participating hospitals, preparing and providing training to hospital PPS staff, providing continuous support to hospitals during the data collection process with regard to methodological and technical questions, participating in the data collection process in some countries, carrying out data management, preparing the national database, providing feedback to participating hospitals and uploading the national database into ECDC's TESSy system. The composition of the national PPS coordination teams was as follows:

Austria: Alexander Blacky, Luigi Segnani (Medical University Vienna), Gabriela El Belazi (Ministry Of Health, Vienna)

Belgium: Mathijs-Michiel Goossens, Sofie Vaerenberg (Scientific Institute of Public Health, Brussels), Evelyne Van Gastel, Norbert Eggermont (Federal Public Service Health, Food Chain and Environment, Brussels), Herman Goossens (University of Antwerp)

Bulgaria: Rossitza Vatcheva -Dobrevska, Ivan Ivanov, Elina Dobreva (National Centre of Infectious and Parasitic Diseases, Sofia)

Cyprus: Avgi Hadjiloukas, Olga Kalakouta-Poyiadji, Anna Demetriou, Chrystalla Hadjianastassiou (Ministry Of Health, Nicosia)

Croatia: Ana Budimir, Zrinka Bošnjak (University Hospital Centre, Zagreb)

Czech Republic: Jana Prattingerová (Ministry of Health, Prague & Regional Public Health Authority Liberec), Helena Šebestová (National Institute of Public Health, Prague), Hana Tkadlecová (Regional Public Health Authority Zlín)

Denmark: Christian Stab Jensen, Brian Kristensen (Statens Serum Institut, Copenhagen)

Estonia: Pille Märtin (West-Tallinn Central Hospital, Tallinn), Annika Lemetsar (Health Board, Tallinn), Mait Altmets (North Estonia Medical Centre)

Finland: Outi Lyytikäinen, Tommi Kärki (National Institute for Health and Welfare, Helsinki)

France: Bruno Coignard, Jean-Michel Thiolet, Sophie Vaux, S. Georges, L. Léon (Institut de veille sanitaire, Paris), L. Simon (CClin Est), Pascal Jarno (CClin Ouest), D. Verjat-Trannoy, K. Miliani, B. Migueres (CClin Nord), M. Giard, C. Bernet (CClin Sud-Est), C. Gautier (CClin Sud-Ouest), O. Bajolet (CHU Reims), S. Alfandari (CH Tourcoing)

Germany: Petra Gastmeier, Brar Piening, Michael Behnke, Luis Peña Diaz, Sonja Hansen, R. Leistner, A. Gropmann, P. Svarovsky (Institute of Hygiene and Environmental Medicine, Charité - University Medicine Berlin, Berlin), Martin Mielke (Robert Koch Institute, Berlin)

Greece: Achilleas Gikas, Evangelos Kritsotakis, Eirini Astrinaki (University Hospital of Heraklion, Heraklion), Elenh Maltezou, Flora Kontopidou (Hellenic Center for Disease Control and Prevention, Athens)

Hungary: Karolina Böröcz, Andrea Kurcz, Ágnes Hajdu, Andrásné Szonyi, Rita Szabó, István Veress, Emília Süvegesné Gulyás, Márta Melles (National Center for Epidemiology, Budapest), Emese Szilágyi (Office of the Chief Medical Officer, Budapest)

Iceland: Ása Steinunn Atladóttir, Guðrún Sigmundsdóttir (Centre for Health Security and Communicable Disease Control, Directorate of Health)

Ireland: Karen Burns, Margaret Foley, Sheila Donlon, Siobhan Dowling, Stephen Murchan, Myles Houlden, Margaret Nadin (Health Protection Surveillance Centre, Dublin)

Italy: Maria Luisa Moro, Enrico Ricchizzi (Agenzia Sanitaria e Sociale regionale Emilia – Romagna, Bologna)

Latvia: Uga Dumpis, Elina Dimina, Agita Melbarde Kelmere, Anastasija Bahol (Pauls Stradins Clinical University Hospital, Riga), Marite Kula (Liepaja Regional Hospital)

Lithuania: Jolanta Asembergiene, Greta Gailiene (Institute of Hygiene, Vilnius)

Luxembourg: Elisabeth Heisbourg (Ministry of Health, Luxembourg), Anne-Marie Ternes, Jean-Claude Schmit (Centre de Recherche Public de la Santé, Luxembourg), M-Thérèse Staub (Centre Hospitalier de Luxembourg)

Malta: Michael Borg, Elizabeth Scicluna, Peter Zarb (Infection Control Unit, Mater Dei Hospital)

Netherlands: Emma Smid, Mayke Koek, Sabine de Greeff, Titia Hopmans, Janneke Blok, Jan Wille, Kati Halonen, Wilma Dedecker, Birgit Van Benthem (National Institute for Public Health and the Environment, Bilthoven)

Norway: Thale Berg, Nina Sorknes (Norwegian Institute of Public Health)

Poland: Aleksander Deptula (Nicolas Copernicus University, Ludwik Rydygier Collegium Medicum in Bydgoszcz), , Ewa Trejnowska (Provincial Medical Centre, Opole), Waleria Hryniewicz (National Medicines Institute, Warsaw)

Portugal: Elaine Pina, Paulo Jorge Nogueira, José Artur Paiva, Goreti Silva (General Directorate of Health/Direcção Geral da Saúde, Lisbon)

Romania: Serban Roxana, Gratiana Chicin, Angela Romaniuc, Maria Rosca, Rodica Radu, Lavinia Zota, Alina Zaharia, Ionel Iosif, Andreea Niculcea (National Center for Comunicable Diseases, Bucharest)

Slovakia: Mária Štefkovicová, Slavka Litvová, Eva Kopšíková (Regional Public Health Authority, Trencín), Dana Rošková (Regional Public Health Authority, Martin), Jana Námešná (Regional Public Health Authority, Banská Bystrica)

Slovenia: Irena Klavs, Jana Kolman, Aleš Korošec (National Institute of Public Health), Tatjana Lejko Zupanc (University Medical Centre Ljubljana), Božena Kotnik Kevorkijan (University Medical Centre Maribor)

Spain: Josep Vaqué i Rafart, Juan José Otal Entraigas, José Ángel Rodrigo Pendás (Hospital Universitari Vall d'Hebron), Ángel Asensio (Spanish Society of Preventive Medicine, Hospital Puerta de Hierro, Madrid), Berta Uriel Latorre (Complejo Hospitalario de Ourense)

Sweden: Johan Struwe, Tomas Söderblom, Jenny Hellman (Swedish Institute for Communicable Disease Control, Stockholm)

United Kingdom-England: Susan Hopkins, Karen Shaw, Anthony Kessel (Health Protection Agency, London)

United Kingdom-Northern Ireland: Lourda Geoghegan, Gerard McIlvenny, Mark McConaghy, Rachel Spiers, Caroline McGeary, Hilda Crookshanks, Kevin Dunbar (Public Health Agency, Health and Social Care Northern Ireland, Belfast)

United Kingdom-Scotland: Jacqui Reilly, Shona Cairns, Samantha Fleming, Andrew Moyes, Sally Stewart, Greg Allan (Health Protection Scotland, Glasgow)

United Kingdom-Wales: Dafydd Williams, Maggie Heginbotham, Victoria McClure, Mari Morgan, Wendy Harrison, John Twiddy, Neil Wiggleswort (Public Health Wales, Welsh Healthcare Associated Infection Programme, Cardiff)

We are especially grateful to the members of ECDC PPS coordination expert team who participated in regular teleconferences held before, during and after the ECDC PPS. This group was instrumental in providing answers to methodological questions asked by national contact points, providing advice regarding organisational decisions and planning and commenting on and contributing to the writing of this report at various stages of its production. The members of the ECDC PPS coordination expert team include: Bruno Coignard (Institut de Veille Sanitaire, France), Susan Hopkins (Health Protection Agency, United Kingdom), Jana Kolman (National Institute of Public Health, Slovenia), Outi Lyytikäinen (National Institute for Health and Welfare, Finland), Maria-Luisa Moro (Regional Agency for Health and Social Care of Emilia-Romagna, Italy), Arno Muller (ESAC-Net consultant, France), Jacqueline Reilly (Health Protection Scotland, United Kingdom), Peter Zarb (Mater Dei hospital, Malta), and Jolanta Griskeviciene, Klaus Weist and Carl Suetens (ECDC).

We would like to reiterate our gratitude to the more than 100 experts in the countries, and international organisations that participated in the ECDC PPS protocol meetings (please see list of names in reference [1]).

ECDC would also like to acknowledge the coordinators and participants in the following projects that were outsourced in support of the point prevalence survey.

1. Contract ECD.2172 following a call for tender entitled 'Support to the pilot point prevalence survey of healthcare-associated infections and antimicrobial use in European acute-care hospitals'.

The support to the pilot PPS was outsourced to a consortium under coordination of the University of Antwerp, Belgium, in collaboration with the National Institute for Public Health Surveillance (InVS) in Paris, France, and the Scientific Institute of Public Health in Brussels, Belgium. The helpdesk team during the pilot PPS discussed methodological issues during regular teleconferences and was composed of Herman Goossens (Team leader), Arno Muller, Peter Zarb, Bruno Coignard, Boudewijn Catry, Sofie Vaerenberg, Mat Goossens, Susan Hopkins, Klaus Weist, Jolanta Griškevičienė and Carl Suetens (ECDC PPS project manager). During the pilot PPS project, the ESAC web-PPS software for hospitals was adapted to the ECDC protocol.

The following persons participated in the pilot PPS at the hospital level and tested V3.3 of the PPS protocol:

Angel Asensio, Serge Alfandari, Anastasia Antoniadou, Andrea Kurcz, Angelo Pan, Anne-Marie Van Den Abeele, Audra Žygelienė, Benedicte Delaere, Christine Laurent, Carlos Palos, Domagoj Drenjancevic, Elizabeth Scicluna, Andrea Kološova, Emmelia Vounou, Achilleas Gikas, Grazia Tura, Robert Hemmer, Hilde Jansens, Henrieta Hudečková, Ioannis Demetriades, Jolanta Falkovska, Josep Vaqué, Katia Verhamme, Maria Kontou, Bozena Kotnik Kevorkijan, Margarita Viciola Garcia, Mari Kanerva, Etelvina Ferreira, Mārīte Kūla, Ghita Camelia, Nadine Mönch, Nieves López Fresneña, Philippe Vanhems, Pille Märtin, Piret Mitt, Rossitza Vatcheva-Dobrevska, Viljaras Reigas, Reinoud Cartuyvels, Bruno Grandbastien, José Sánchez Payá , Shona Cairns, Soraya Cherifi, Sylvie Arias Lopez, Emese Szilagyi, Tatjana Lejko Zupanc, Tomasz Ozorowski, Uga Dumpis, Zrinka Bosnjak, Ladislava Matějíčková, Jana Prattingerova, Liana Signorini.

2. Contract ECD.1842 following a call for tender entitled 'Curriculum for course on epidemiology and analysis of point prevalence studies of healthcare-associated infections' and Contract ECDC/10/017 following a call for tender entitled 'Courses for point prevalence study of healthcare-associated infections and antimicrobial use in acute care hospitals in Europe.

The development of PPS courses and teaching materials was outsourced to the Health Protection Agency, London (Susan Hopkins (coordinator), Barry Cookson, Berit Muller-Pebody, Gareth Hughes, Naomi Boxall) with collaboration of Health Protection Scotland (Jacqueline Reilly, Shona Cairns). Some material developed by the training curriculum team was integrated in the protocol. A 3-day train-the-trainer course was delivered to two participants from each Member State in London, March 2011.

3. Contract ECD.2218 following a request for an offer on 'HELICSwin Hospital Software Support' was made with the Belgian Scientific Institute of Public Health to develop a standalone software package for PPS data entry, export and analysis (HELICSwin.Net).

4. Contract ECD.2218 following a call for tender entitled 'Pilot validation study of the ECDC point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals' was made with the Caledonian University Glasgow.

5. Four contracts with individual PPS coordinating centres (Bulgaria, Hungary, Romania, Spain) for the project 'Validation of the national point prevalence survey on HAI and antimicrobial use is acute care hospitals'.

The authors would also like to thank all ECDC colleagues who contributed to one or more of the various aspects of the ECDC PPS project and report, in particular Jolanta Griskeviciene (PPS helpdesk, follow-up of development of PPS metadata and validation reports in TESSy, data quality checks, training), and further – in alphabetical order, and not exhaustively – Lennart Adell Kind, Barbara Albiger, Catalin Albu, Andrew Amato-Gauci, Andrea Ammon, Bruno Ciancio, Denis Coulombier, Brenna Deckert, Lorenzo De Simone, Liselotte Diaz-Högberg, Daniel Faensen, Johan Giesecke, Gaetan Guyodo, Ewa Hellberg, Ole Heuer, Elmira Khazeeva, Piotr Kramarz, Valentina Lazdina, Eva Liljestedt, Anna-Pelagia Magiorakos, Silja Marma, Oana Mereuta-Buzatu, Guia Miniotti, Dominique L Monnet, Luciana Muresan, Sorin Ostafiev, Alberto Pedrini, Anastasia Pharris, Diamantis Plachouras, Vladimir Prikazsky, Chantal Quinten, Per Rolfhamre, Silvia Sarbu, Luisa Sodano, Pernille Sokoni, Gianfranco Spiteri, Marc Struelens, Boyana Todorova, Nicolas Van Lamsweerde, Klaus Weist, Zaib-un-Nisa, Phillip Zucs, the current and former ECDC Directors (Marc Sprenger and Zsuzsanna Jakab) and the ECDC Advisory Forum Members (especially Jean-Claude Desenclos who recommended that ECDC to organise a European PPS of HAI in 2007) for their support and advice throughout the project.

Annex 1. Tables

Table A1.1. Distribution of patient risk factors by country, patient-based data only

Country	N of patients	Median age (yrs)	Age category						Sex ratio M:F	Median length of stay until PPS day (days)	% Surgery since admission	McCabe score				Invasive device use			
			% < 1 month	% 1–11months	% 1–17 years	% 18–64 years	% 65–84 years	% 85+ years				% Non-fatal	% Ultimately fatal	% Rapidly fatal	% Missing	% CVC	% PVC	% Urinary catheter	% Intubation
Austria	4 321	64	0.0	3.5	3.9	43.4	38.7	10.4	0.87:1	7	33.0	69.4	21.1	5.7	3.8	12.7	48.7	17.4	2.1
Belgium	13 758	64	3.9	2.6	4.8	39.4	36.7	12.7	0.79:1	7	29.1	62.7	15.3	5.8	16.2	13.6	34.4	13.1	2.2
Bulgaria	8 952	58	2.8	5.0	9.6	45.8	34.3	2.5	0.92:1	4	24.5	81.8	10.3	3.0	4.9	3.0	62.8	12.4	2.0
Croatia	2 378	59	3.7	1.7	6.6	48.4	36.2	3.3	0.95:1	6	24.7	75.1	18.4	4.5	1.9	5.2	40.8	15.4	2.9
Cyprus	1 037	59	5.5	3.3	7.7	42.0	35.3	6.2	1.02:1	5	33.0	61.9	8.4	5.7	24.0	6.6	64.6	26.9	3.3
Czech Republic	3 774	63	3.9	0.8	5.0	44.0	39.0	7.3	0.97:1	6	32.5	80.1	9.1	3.2	7.6	6.9	46.8	20.3	2.7
Estonia	2 076	59	1.8	0.8	5.3	52.0	36.0	4.1	0.87:1	7	29.3	72.8	18.1	5.1	4.0	7.7	42.4	11.5	3.0
Finland	9 712	62	6.3	1.2	4.8	43.3	35.5	9.0	0.89:1	4	29.1	60.3	26.9	5.8	6.9	5.4	50.6	18.2	1.8
France	9 670	67	5.0	0.7	2.4	39.0	35.1	17.8	0.83:1	7	23.1	59.8	18.5	9.3	12.4	7.1	30.6	10.2	1.3
Greece	8 247	63	2.1	3.3	7.2	39.0	40.2	8.1	1.19:1	5	28.2	71.5	20.8	6.0	1.6	10.3	70.6	30.7	4.5
Hungary	10 180	61	2.4	3.2	6.8	45.3	36.8	5.4	0.76:1	5	27.5	63.0	8.6	4.3	24.2	4.2	33.2	12.2	1.9
Iceland	462	63	3.2	2.6	4.3	42.2	35.5	12.1	0.88:1	7	26.8	66.5	16.7	5.4	11.5	9.5	43.1	13.3	2.2
Ireland	9 030	63	5.8	2.0	5.0	39.2	37.0	10.9	0.86:1	6	17.6	73.9	21.7	3.4	1.0	6.0	40.7	12.4	1.4
Italy	14 784	64	3.1	3.0	4.9	39.4	39.7	9.8	0.99:1	6	31.9	73.6	13.7	8.5	4.2	12.2	56.4	24.9	3.0
Latvia	2 832	52	3.5	3.7	15.7	43.0	30.6	3.5	0.92:1	5	24.9	88.8	7.7	0.7	2.8	4.4	49.9	8.5	1.3
Lithuania	7 761	62	1.9	1.3	8.5	41.9	39.8	6.6	0.80:1	5	24.6	79.9	4.2	1.6	14.2	3.8	38.4	6.4	1.6
Luxembourg	1 744	66	3.0	1.0	3.7	40.0	41.1	11.2	0.85:1	8	31.8	68.8	20.7	7.3	3.2	9.4	36.5	12.3	2.6
Malta	757	65	4.5	0.9	5.8	38.0	40.7	10.1	0.94:1	6	24.6	65.9	19.3	3.8	11.0	5.8	44.8	16.2	1.6
Netherlands	7 540	65	3.7	3.2	3.1	39.0	41.0	9.9	0.91:1	5	33.7	56.6	9.2	2.9	31.3	6.8	47.8	20.2	1.8
Norway	1 465	63	5.3	1.0	5.1	40.8	39.6	8.2	0.90:1	4	25.3	0.0	0.0	0.3	99.7	10.0	50.2	15.5	2.0
Poland	8 067	57	4.1	4.1	13.4	42.3	31.3	4.9	0.96:1	5	27.8	76.5	12.5	4.2	6.8	7.9	55.5	14.8	3.2
Portugal	10 359	66	3.6	1.4	3.5	39.5	41.8	10.2	1.01:1	7	31.2	67.1	23.0	7.0	2.9	9.5	66.8	24.0	4.0
Slovakia	8 397	57	4.8	3.2	8.2	46.2	32.9	4.6	0.82:1	5	21.9	84.2	11.1	2.0	2.8	3.4	40.8	14.1	2.1
Slovenia	5 628	60	4.7	1.3	6.5	45.0	36.0	6.5	0.92:1	6	30.5	78.1	16.4	5.1	0.5	7.3	46.8	16.2	3.0
Spain	13 520	66	1.3	3.7	3.9	39.6	41.3	10.3	1.13:1	6	29.0	71.6	20.3	7.6	0.5	13.5	66.5	19.7	2.8
Sweden	613	75	1.0	0.0	0.2	26.8	48.1	24.0	0.88:1	4	22.7	77.0	17.1	4.2	1.6	5.1	63.5	22.5	0.5
UK-England	25 727	70	3.7	2.3	3.1	33.3	38.5	19.0	0.82:1	6	25.7	47.8	16.5	4.0	31.7	5.7	39.5	18.6	1.6
UK-Northern Ireland	3 992	66	4.7	0.0	5.6	38.0	37.8	14.0	0.84:1	6	16.8	69.9	21.1	2.7	6.2	5.0	43.4	17.1	2.4
UK-Scotland	11 902	70	3.6	1.2	2.5	34.6	42.8	15.4	0.77:1	7	22.9	65.2	24.1	9.0	1.7	4.3	31.7	18.9	1.5
UK-Wales	6 852	71	2.3	1.3	3.0	31.5	41.8	20.0	0.84:1	8	23.5	43.0	10.7	4.2	42.2	4.9	33.6	18.5	2.4
Europe																			
All countries	215 537	64	3.5	2.4	5.3	39.9	38.1	10.8	0.89:1	6	26.9	66.3	16.1	5.2	12.3	7.5	46.7	17.2	2.3
Country P25	2 492	60	2.5	1.1	3.8	39.0	35.6	6.3	0.84:1	5	24.5	62.7	10.4	3.2	2.8	5.0	39.8	12.6	1.7
Country P50	7 651	63	3.7	1.9	5.0	40.4	38.2	9.9	0.89:1	6	27.1	69.6	16.6	4.4	5.5	6.7	45.8	16.2	2.1
Country P75	9 702	66	4.6	3.2	6.8	43.4	40.5	11.9	0.95:1	7	30.2	76.1	20.6	5.8	13.8	9.5	54.3	19.5	2.8

CVC: central vascular catheter; PVC: peripheral vascular catheter

Table A1.2. Distribution of patient/consultant specialty by country

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
N of patients, all specialties	4321	13758	8952	4923	1037	3774	682	2076	9712	9670	9604	8247	10180	462	9030	14784	3447	7761	1744	757	7540	1465	8067	10418	2417	8397	5628	13520	613	25727	3992	11902	6852	231459
Surgery	36.7	25.1	30.6	27.7	35.5	35.4	37.8	30.0	32.4	22.3	32.8	36.5	28.4	19.7	24.8	32.5	36.5	29.2	25.8	37.5	32.6	32.8	31.9	36.8	44.2	25.1	37.4	32.7	32.6	29.8	26.1	27.8	30.5	30.6
General surgery	7.5	1.8	8.5	0.1	10.3	12.5	7.5	5.6	1.5	6.7	7.8	12.2	6.6	7.6	8.8	8.4	10.5	6.2	8.2	12.7	9.6	1.1	6.5	13.3	14.2	9.6	3.9	8.0	20.2	7.8	9.9	10.9	5.7	7.7
Digestive tract surgery	0.3	3.4	1.7	4.6	0.0	0.0	6.7	1.7	8.5	3.0	2.1	0.0	0.3	0.2	1.5	0.6	0.0	2.7	0.7	0.0	5.2	8.3	1.1	0.2	0.0	0.5	5.3	2.7	0.0	1.8	0.7	0.0	3.1	2.1
Orthopaedics and surgical traumatology	10.5	8.6	5.5	6.2	10.4	6.5	15.1	6.9	9.7	8.1	12.8	8.1	9.6	4.8	6.6	7.4	10.2	4.9	8.7	8.9	7.6	8.9	8.1	10.1	7.4	7.7	14.0	9.6	12.2	12.2	7.4	8.8	12.6	9.1
Cardiovascular surgery	4.3	2.4	2.8	3.2	1.7	3.2	0.0	3.5	2.5	0.9	3.1	2.2	2.0	2.6	2.0	2.9	4.4	3.2	0.6	5.3	1.8	2.9	2.8	2.1	3.4	0.4	2.1	3.1	0.2	1.8	2.4	2.4	2.8	2.4
Thoracic surgery	0.4	0.3	0.4	1.0	0.4	0.3	1.2	0.6	0.5	0.0	0.3	0.3	0.7	0.6	0.1	0.9	0.5	0.7	0.1	0.0	0.6	0.0	0.5	0.6	0.1	0.8	0.5	0.5	0.0	0.3	0.5	0.3	0.5	0.5
Neurosurgery	1.4	2.1	1.9	1.9	2.3	3.4	0.0	2.1	1.5	0.1	0.6	2.9	1.6	0.6	0.8	2.7	4.0	2.8	2.5	2.1	1.6	1.4	1.9	2.6	4.1	0.9	1.3	2.2	0.0	1.0	1.0	1.2	0.5	1.7
Paediatric surgery	1.2	0.2	0.6	0.5	1.0	1.0	0.0	0.7	0.7	0.1	0.3	1.0	0.7	0.0	0.4	0.6	1.3	1.9	0.5	1.5	0.3	0.0	2.2	0.5	3.6	0.3	0.6	0.3	0.0	0.3	0.4	0.5	0.4	0.6
Transplantation surgery	0.0	0.4	0.0	0.1	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.1	0.4	0.3	0.4	0.0	0.0	0.0	0.0	0.6	0.3	0.0	0.1	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.2
Surgery for cancer	0.4	0.9	0.7	1.6	0.0	0.0	0.0	2.8	0.8	0.3	0.0	0.1	0.1	0.2	0.1	0.6	0.1	0.3	0.1	0.0	0.1	3.4	0.9	0.1	0.0	0.0	0.6	0.1	0.0	0.2	0.0	0.0	0.0	0.4
ENT	3.1	0.5	2.0	2.4	2.2	2.7	1.8	1.3	1.4	0.7	0.8	2.9	2.5	0.6	1.3	1.6	1.0	1.5	0.6	1.5	0.2	1.8	2.3	1.4	1.6	0.9	2.4	1.2	0.0	0.7	1.0	0.8	1.1	1.4
Ophthalmology	1.9	0.3	1.4	2.3	2.0	1.1	0.0	0.2	0.4	0.4	0.4	1.5	1.3	0.2	0.3	0.8	1.1	0.7	0.5	0.7	0.2	0.8	1.9	0.6	0.7	0.4	1.4	0.3	0.0	0.2	0.1	0.2	0.1	0.7
Maxillo-facial surgery	1.4	0.2	0.3	0.6	0.3	0.1	0.3	0.3	0.1	0.0	0.2	0.3	0.3	0.0	0.2	0.5	0.0	0.4	0.3	0.0	1.1	0.1	0.1	0.4	0.7	0.5	0.7	0.4	0.0	0.1	0.2	0.1	0.4	0.3
Stomatology/ Dentistry	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Burns care	0.0	0.1	0.1	0.1	0.3	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.2	0.2	0.1	0.2	0.1	0.0	0.1	0.2	0.0	0.1	0.1
Urology	3.3	2.5	3.8	2.2	3.6	3.2	4.4	2.6	2.6	1.1	3.5	4.2	2.2	1.1	1.7	3.1	2.1	2.3	1.8	4.8	3.6	2.0	3.0	3.4	2.6	2.1	3.1	3.4	0.0	2.2	1.6	2.0	2.3	2.7
Plastic and reconstructive surgery	0.8	0.9	0.4	0.8	0.7	1.1	0.9	0.0	1.4	0.0	0.5	0.6	0.2	1.1	0.5	0.5	0.1	0.2	0.7	0.3	0.6	0.7	0.0	1.2	2.7	0.5	1.3	0.7	0.0	0.5	0.5	0.7	0.3	0.6
Other surgery	0.1	0.6	0.4	0.0	0.1	0.1	0.0	1.0	0.3	0.7	0.4	0.0	0.0	0.0	0.2	1.3	0.8	0.9	0.5	0.0	0.2	0.8	0.0	0.1	2.8	0.3	0.0	0.1	0.0	0.5	0.2	0.0	0.6	0.4
Medicine	40.4	33.4	44.7	39.9	33.7	38.1	48.7	41.9	38.4	34.7	40.2	41.5	45.7	45.0	44.9	39.8	44.0	50.8	38.6	41.5	46.7	46.7	44.8	40.4	25.0	36.6	35.9	45.1	50.4	41.6	44.5	36.2	42.9	40.9
General medicine	8.3	2.4	1.1	0.3	17.6	15.3	2.9	5.9	7.8	8.8	13.2	17.3	10.1	3.9	22.9	14.2	7.1	16.6	7.5	4.9	12.3	4.3	8.6	25.6	5.0	16.8	4.6	17.0	50.4	18.4	23.7	16.7	16.9	13.2
Gastro-enterology	2.1	5.6	4.9	4.1	0.1	0.4	3.1	1.0	1.1	2.8	5.3	1.0	3.8	3.7	2.4	1.9	2.6	2.3	2.6	4.0	3.7	2.5	1.5	1.3	5.5	0.5	4.1	4.5	0.0	3.8	1.4	3.1	4.8	3.1
Hepatology	0.1	0.3	0.0	0.7	0.0	0.4	0.0	0.0	0.1	0.0	0.0	0.2	0.1	0.9	0.3	0.2	0.7	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.0	0.3	0.6	0.0	0.3	0.2
Endocrinology	0.9	1.2	2.7	1.8	0.1	0.0	2.1	0.6	0.4	1.6	0.2	0.2	0.5	0.2	2.1	0.9	1.2	1.2	1.3	3.8	0.0	0.7	1.1	0.3	0.0	0.1	1.3	0.2	0.0	1.8	0.6	1.2	2.3	1.0
Nephrology	1.5	1.6	3.5	2.1	2.4	0.0	4.3	2.4	1.1	0.8	0.8	1.6	0.8	2.2	1.5	1.9	2.1	1.5	3.2	6.7	0.0	1.3	2.1	1.2	0.5	0.2	1.8	1.4	0.0	1.2	0.3	1.3	1.8	1.4
Cardiology	5.9	5.8	8.4	7.0	6.5	5.3	7.8	7.0	6.3	5.6	7.4	7.8	8.2	7.6	3.7	4.7	6.2	7.6	4.8	5.9	10.3	6.6	9.9	2.8	5.3	1.1	6.5	5.4	0.0	4.6	6.0	3.8	5.3	5.8
Dermatology	3.5	0.1	1.2	1.1	0.0	2.3	0.0	1.0	0.7	0.3	0.3	0.5	1.0	1.5	0.1	0.4	0.7	0.8	0.1	0.0	0.3	0.9	1.7	0.4	1.1	1.3	1.0	0.1	0.0	0.1	0.3	0.4	0.1	0.6
Haematology / BMT	1.1	1.4	2.8	3.0	1.8	0.1	7.2	2.3	2.5	0.7	0.9	3.4	1.3	2.6	1.4	2.0	0.4	1.3	1.1	2.2	2.1	2.7	1.6	1.3	1.1	0.4	1.2	2.5	0.0	1.4	2.3	1.4	1.2	1.6
Oncology	5.0	3.9	0.8	2.4	3.6	1.9	3.1	4.7	2.5	2.3	2.3	1.8	4.3	3.9	3.5	1.9	1.4	2.3	5.2	0.1	1.8	10.2	2.6	1.1	0.2	2.8	1.2	3.3	0.0	1.7	1.7	1.9	1.3	2.4
Neurology	5.0	4.7	9.4	5.3	0.1	7.2	9.1	5.2	6.5	2.6	5.0	2.7	6.9	5.6	1.2	3.4	6.9	11.2	5.3	2.9	7.1	4.7	5.7	2.8	2.5	9.6	4.6	3.7	0.0	1.4	1.5	0.8	0.9	4.4
Pneumology	3.0	4.9	5.0	5.7	1.3	2.8	7.6	7.3	4.9	2.9	1.9	4.1	2.4	7.4	3.8	2.9	5.5	1.3	3.2	5.3	8.1	6.3	5.3	2.0	0.4	2.4	5.3	4.7	0.0	4.1	4.3	4.4	5.6	4.0

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
Rheumatology	1.0	0.6	1.3	0.8	0.0	0.7	0.0	0.1	0.3	0.6	0.6	0.2	4.6	3.7	1.4	0.5	0.4	1.0	0.1	3.7	0.2	1.4	0.4	0.2	0.9	0.0	1.0	0.3	0.0	0.3	0.3	0.2	0.0	0.7
Infectious diseases	0.7	0.6	2.8	4.7	0.3	1.8	1.6	2.3	3.2	1.2	0.1	0.5	1.2	1.9	0.3	3.1	7.5	1.7	1.0	1.8	0.0	4.6	1.4	1.1	0.0	1.3	2.7	1.4	0.0	0.2	0.2	1.0	0.3	1.4
Medical traumatology	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	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Other Medical	2.2	0.2	0.8	0.9	0.0	0.0	0.0	2.1	1.0	4.6	2.3	0.2	0.6	0.0	0.4	1.9	1.3	1.9	3.3	0.0	0.7	0.4	2.8	0.0	2.5	0.0	0.4	0.3	0.0	2.4	1.3	0.0	2.0	1.3
Paediatrics	2.1	5.4	11.4	6.2	6.0	6.5	4.4	3.8	2.3	3.4	1.8	5.7	6.6	5.4	6.1	5.3	8.1	5.6	2.0	5.9	4.5	6.2	8.3	4.5	14.4	10.9	10.0	5.2	0.0	4.5	3.3	4.0	4.3	5.5
Neonatology	1.1	1.0	3.9	1.4	2.0	2.8	0.0	1.6	0.9	1.2	0.4	0.6	2.0	1.7	2.4	2.8	2.3	0.8	0.2	3.2	0.4	2.6	3.2	1.2	9.6	3.9	3.2	2.6	0.0	1.8	1.2	2.4	0.7	1.9
Paediatrics	1.0	4.4	7.5	4.8	4.0	3.7	4.4	2.2	1.4	2.2	1.5	5.2	4.5	3.7	3.8	2.5	5.7	4.8	1.8	2.8	4.1	3.6	5.1	3.3	4.8	7.0	6.8	2.6	0.0	2.7	2.1	1.6	3.7	3.6
Intensive Care Medicine (ICU)	5.4	5.8	5.5	7.7	10.3	8.7	2.6	4.3	3.7	2.3	5.3	7.2	3.8	5.2	4.9	7.1	3.5	3.5	7.3	4.8	6.9	5.2	4.1	5.8	9.1	6.5	3.7	5.5	1.3	3.8	3.5	3.0	3.1	5.0
Medical ICU	1.2	0.8	0.9	0.9	0.8	2.1	0.0	0.3	0.2	0.1	0.8	0.1	0.1	0.0	0.0	0.5	0.6	1.3	0.3	0.0	1.4	2.3	0.6	0.4	1.0	1.6	1.0	0.5	1.3	0.1	0.0	0.2	0.1	0.6
Surgical ICU	1.7	0.7	0.8	1.1	0.5	2.2	0.0	0.4	0.1	0.2	1.1	0.1	0.1	0.0	0.1	0.2	0.1	0.1	0.0	0.0	0.8	0.9	0.1	0.4	1.4	0.9	1.8	0.7	0.0	0.1	0.0	0.2	0.0	0.5
Paediatric ICU	0.5	0.2	1.2	0.8	0.4	0.5	0.0	0.3	0.4	0.0	0.1	0.1	0.4	0.0	0.2	0.4	0.2	0.4	0.1	0.0	0.5	0.0	0.7	0.2	0.0	0.6	0.3	0.3	0.0	0.2	0.3	0.3	0.0	0.3
Neonatal ICU	1.0	0.9	0.2	1.5	3.9	0.9	0.0	0.0	1.1	0.3	0.6	2.2	1.0	3.5	1.4	1.7	0.3	0.2	1.0	1.8	1.4	1.6	0.5	1.2	1.6	1.1	0.1	0.7	0.0	1.1	0.8	1.3	0.8	1.0
Mixed/polyvalent ICU	0.5	2.4	1.9	0.6	3.1	1.6	2.6	2.5	1.7	1.4	2.5	2.9	1.8	1.7	1.7	2.2	1.9	1.0	4.9	2.9	2.4	0.3	1.5	2.3	3.1	1.3	0.2	2.9	0.0	1.9	2.4	0.9	1.6	1.9
Specialized ICU	0.4	0.7	0.5	2.8	1.7	1.4	0.0	0.4	0.2	0.2	0.1	1.7	0.2	0.0	0.2	2.1	0.3	0.5	1.0	0.0	0.0	0.0	0.4	1.2	1.7	0.9	0.3	0.4	0.0	0.3	0.1	0.2	0.3	0.6
Other ICU	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.1	0.0	0.0	0.2	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.1
Obstetrics and gynaecology	7.9	7.7	6.4	10.0	13.4	6.0	3.1	3.4	12.1	11.2	5.5	5.5	8.5	5.4	9.8	7.8	7.2	5.2	8.1	8.7	6.8	8.3	7.6	5.5	5.5	9.7	9.1	7.1	2.8	7.7	9.6	4.9	5.3	7.6
Obstetrics / Maternity	4.0	5.5	3.2	4.6	10.1	2.0	2.1	2.0	10.4	10.3	2.2	4.8	5.2	3.5	8.2	5.5	3.3	2.5	4.2	5.9	4.8	6.7	4.2	3.9	4.7	4.5	3.8	5.0	2.0	5.9	7.7	3.5	3.3	5.1
Gynaecology (incl. surgery)	3.9	2.2	3.3	5.4	3.3	4.1	1.0	1.4	1.7	0.9	3.3	0.6	3.3	1.9	1.6	2.3	3.9	2.8	4.0	2.8	1.9	1.6	3.5	1.6	0.8	5.2	5.3	2.1	0.8	1.8	1.9	1.4	2.0	2.4
Geriatrics	0.0	14.9	0.0	0.0	0.1	0.0	0.0	0.0	0.2	3.9	1.6	0.0	0.3	4.5	4.1	2.3	0.0	0.0	6.4	0.0	2.5	0.0	0.9	0.0	0.0	3.3	0.0	0.6	8.6	9.2	7.9	16.1	5.8	3.9
Geriatrics, care for the elderly	0.0	14.9	0.0	0.0	0.1	0.0	0.0	0.0	0.2	3.9	1.6	0.0	0.3	4.5	4.1	2.3	0.0	0.0	6.4	0.0	2.5	0.0	0.9	0.0	0.0	3.3	0.0	0.6	8.6	9.2	7.9	16.1	5.8	3.9
Psychiatry	3.4	6.9	1.1	5.3	1.1	1.7	0.0	15.1	7.1	6.9	9.2	3.6	5.7	14.7	5.1	2.6	0.8	2.9	11.0	1.6	0.0	0.0	1.4	6.1	0.0	6.6	2.5	3.4	0.0	0.0	5.0	4.2	4.2	4.0
Psychiatry	3.4	6.9	1.1	5.3	1.1	1.7	0.0	15.1	7.1	6.9	9.2	3.6	5.7	14.7	5.1	2.6	0.8	2.9	11.0	1.6	0.0	0.0	1.4	6.1	0.0	6.6	2.5	3.4	0.0	0.0	5.0	4.2	4.2	4.0
Other	2.5	0.7	0.3	3.2	0.0	3.2	3.4	1.5	2.6	15.3	2.5	0.0	1.0	0.0	0.3	2.0	0.0	2.0	0.7	0.0	0.0	0.1	0.7	0.8	1.5	0.7	1.4	0.4	1.8	2.2	0.2	3.9	3.5	2.1
Rehabilitation	0.0	0.4	0.3	2.3	0.0	3.2	3.4	1.4	0.8	15.3	0.4	0.0	0.0	0.0	0.2	1.4	0.0	0.0	0.7	0.0	0.0	0.0	0.1	0.4	0.0	0.5	0.0	0.2	0.0	1.7	0.0	1.8	2.9	1.4
Others not listed	2.5	0.4	0.0	0.8	0.0	0.0	0.0	0.1	1.8	0.0	1.8	0.0	1.0	0.0	0.1	0.6	0.0	2.0	0.0	0.0	0.0	0.1	0.5	0.4	1.5	0.2	1.4	0.2	1.8	0.3	0.1	1.2	0.5	0.6
Unknown	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	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	0.0	0.2	0.0	0.9	0.0	0.1
Mixed	1.6	0.1	0.0	0.0	0.0	0.4	0.0	0.0	1.0	0.0	1.1	0.0	0.0	0.0	0.0	0.7	0.0	0.7	0.0	0.0	0.0	0.8	0.3	0.1	0.4	0.6	0.0	0.0	2.4	1.1	0.0	0.0	0.4	0.4
Combination of specialties	1.6	0.1	0.0	0.0	0.0	0.4	0.0	0.0	1.0	0.0	1.1	0.0	0.0	0.0	0.0	0.7	0.0	0.7	0.0	0.0	0.0	0.8	0.3	0.1	0.4	0.6	0.0	0.0	2.4	1.1	0.0	0.0	0.4	0.4

Table A1.3. Distribution of HAI types by country

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
Number of HAI	287	1086	352	317	79	192	73	128	771	498	516	820	498	51	501	1068	82	270	102	35	360	121	548	1231	77	324	396	1257	50	1602	169	601	300	14762
Pneumonia	20.6	18.8	18.2	17.7	10.1	13.5	17.8	24.2	18.2	20.7	16.5	22.9	18.1	33.3	17.4	21.6	23.2	32.6	16.7	28.6	20.8	24.0	22.1	23.2	19.5	16.4	18.9	13.9	12.0	22.0	24.3	17.1	13.0	19.7
PN1 Pneumonia, pos. quantitative culture, minimally contaminated LRT specimen	2.1	1.1	1.1	1.6	1.3	3.6	1.4	1.6	0.1	3.4	1.6	3.2	0.6	2.0	0.8	3.8	1.2	1.5	0.0	0.0	0.0	0.0	1.6	1.6	5.2	2.2	0.0	1.4	4.0	0.5	0.6	0.5	1.7	1.5
PN2 Pneumonia, pos. quantitative culture, possibly contaminated LRT specimen	0.7	0.5	1.1	6.9	0.0	1.0	4.1	1.6	0.3	2.4	0.8	2.4	2.2	0.0	0.8	1.9	1.2	1.5	2.0	0.0	0.0	0.8	0.5	0.4	1.3	1.5	0.3	1.0	0.0	0.4	0.0	0.8	1.3	1.1
PN3 Pneumonia, microbiological diagnosis by alternative microbiology methods	1.7	2.1	0.6	1.3	2.5	0.5	1.4	0.8	0.8	0.2	1.2	0.5	0.8	2.0	0.2	1.3	0.0	0.0	2.0	2.9	5.6	0.0	0.2	0.9	0.0	0.3	0.0	0.7	0.0	0.4	0.0	0.3	0.7	0.9
PN4 Pneumonia, pos. sputum culture or non-quantitative culture, LRT specimen	2.4	5.3	5.4	0.3	1.3	4.2	0.0	8.6	0.9	1.4	2.1	3.2	1.4	9.8	1.8	4.4	4.9	10.7	5.9	0.0	7.8	1.7	3.8	6.8	7.8	5.6	10.6	2.8	0.0	2.6	7.1	1.7	1.7	3.8
PN5 Pneumonia - Clinical signs of pneumonia without positive microbiology	11.5	9.0	7.4	6.3	5.1	3.6	11.0	10.9	15.6	13.3	7.4	12.8	13.1	17.6	13.6	10.0	13.4	17.8	5.9	25.7	6.9	19.0	10.2	13.2	1.3	6.8	7.8	7.9	8.0	17.3	16.6	13.8	7.0	11.5
NEO-PNEU Pneumonia in neonates	0.0	0.5	2.3	0.0	0.0	0.0	0.0	0.8	0.1	0.0	0.0	0.0	0.0	2.0	0.2	0.2	2.4	1.1	0.0	0.0	0.6	0.8	4.9	0.0	0.0	0.0	0.3	0.1	0.0	0.4	0.0	0.0	0.7	0.4
PN-Nos Pneumonia, not specified	2.1	0.3	0.3	1.3	0.0	0.5	0.0	0.0	0.4	0.0	3.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.7	0.7	0.3	3.9	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.4
Other lower respiratory tract inf.	0.7	5.4	6.3	3.8	6.3	3.1	0.0	3.9	2.1	3.4	3.3	3.8	6.0	2.0	1.4	2.4	1.2	3.7	15.7	0.0	0.8	2.5	5.3	5.6	1.3	5.6	5.3	6.0	0.0	4.2	3.6	2.8	5.0	4.1
LRI-BRON Bronchitis, tracheobronchitis, etc. without evidence of pneumonia	0.3	4.4	6.0	3.5	3.8	3.1	0.0	3.1	1.0	2.4	2.1	1.8	5.8	2.0	1.0	1.6	0.0	3.0	4.9	0.0	0.6	0.0	4.9	4.1	1.3	4.6	4.0	3.5	0.0	2.3	0.6	1.7	3.0	2.8
LRI-LUNG Other infections of the lower respiratory tract	0.0	0.9	0.0	0.0	2.5	0.0	0.0	0.8	1.0	1.0	0.8	1.3	0.2	0.0	0.4	0.8	1.2	0.7	10.8	0.0	0.3	2.5	0.4	1.4	0.0	0.9	1.3	2.5	0.0	1.6	3.0	1.2	2.0	1.2
LRI-Nos Lower respiratory tract infection, other than pneumonia,not specified	0.3	0.1	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1
Surgical site infections	17.4	17.6	24.4	18.9	24.1	21.9	27.4	32.0	23.9	13.5	21.5	10.9	22.5	23.5	18.2	16.2	23.2	22.2	8.8	25.7	23.1	22.3	20.1	15.7	23.4	15.7	16.7	29.0	18.0	15.2	18.9	18.6	23.7	19.1
SSI-S Surgical site infection, Superficial incisional	5.2	4.3	7.1	7.9	7.6	4.2	4.1	3.9	4.8	2.8	7.2	3.5	9.0	15.7	8.0	5.0	7.3	4.8	1.0	14.3	8.9	5.8	5.8	3.9	11.7	7.1	5.1	5.9	4.0	6.2	5.9	9.0	12.0	5.9
SSI-D Surgical site infection, Deep incisional	7.0	7.6	12.2	6.0	11.4	8.3	12.3	14.1	8.4	5.2	6.6	2.7	8.6	5.9	5.0	5.4	8.5	13.0	7.8	2.9	9.7	11.6	9.3	4.5	6.5	6.2	6.3	11.2	8.0	5.2	8.3	5.8	5.7	7.1
SSI-O Surgical site infection, Organ/Space	3.8	5.7	5.1	5.0	5.1	8.9	11.0	14.1	10.6	5.4	5.8	4.5	4.8	2.0	5.2	5.8	7.3	4.4	0.0	8.6	4.4	5.0	4.9	7.1	5.2	2.5	5.3	11.9	6.0	3.6	4.7	3.7	6.0	6.0
SSI-Nos Surgical site infection, not specified	1.4	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	1.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.1
Urinary tract infections	21.3	18.0	19.0	23.3	10.1	27.1	15.1	13.3	12.5	30.7	30.0	17.0	15.1	17.6	15.0	20.8	11.0	13.3	22.5	14.3	20.8	12.4	17.3	23.2	18.2	26.2	19.4	14.4	18.0	20.4	11.8	22.0	16.7	19.3
UTI-A Urinary tract infection, microbiologically confirmed	10.1	14.7	16.5	16.4	3.8	19.8	12.3	9.4	10.6	28.9	14.7	10.6	6.0	15.7	8.2	13.0	6.1	9.3	13.7	11.4	16.4	5.0	8.2	17.4	15.6	18.2	12.6	10.7	14.0	9.7	6.5	12.6	9.7	12.7
UTI-B Urinary tract infection, not microbiologically confirmed	9.4	2.2	2.3	6.3	6.3	7.3	2.7	3.9	1.7	1.8	8.3	5.9	9.0	2.0	6.8	7.5	2.4	4.1	8.8	2.9	3.3	7.4	8.9	5.7	2.6	7.1	6.8	3.7	4.0	10.2	5.3	9.3	7.0	6.0
UTI-Nos Urinary tract infection, not specified	1.7	1.0	0.3	0.6	0.0	0.0	0.0	0.0	0.1	0.0	7.0	0.5	0.0	0.0	0.0	0.3	2.4	0.0	0.0	0.0	1.1	0.0	0.2	0.2	0.0	0.9	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.6
Bloodstream infections (a)	7.7	14.0	6.0	8.2	19.0	12.0	13.7	5.5	9.5	10.6	5.0	18.9	6.8	2.0	13.6	15.8	4.9	5.2	8.8	5.7	16.1	5.8	9.5	7.6	11.7	9.9	8.8	13.2	8.0	7.5	8.9	11.8	12.7	10.7
BSI Bloodstream infection (laboratory-confirmed) , other than CRI3	5.9	9.8	3.7	5.7	13.9	9.4	8.2	3.9	6.4	6.6	4.5	13.2	3.6	2.0	8.8	8.4	3.7	4.8	8.8	2.9	12.2	5.0	7.5	5.5	10.4	7.7	6.6	8.8	8.0	6.2	7.7	10.0	11.0	7.6
CRI3-CVC Microbiologically confirmed CVC-related bloodstream infection	1.0	3.5	1.4	1.9	3.8	1.6	4.1	1.6	2.2	3.4	0.6	3.8	1.6	0.0	3.8	6.6	0.0	0.0	0.0	0.0	2.2	0.8	1.1	1.9	1.3	1.2	2.0	2.9	0.0	0.9	1.2	1.2	1.7	2.3

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
CRI3-PVC Microbiologically confirmed PVC-related bloodstream infection	0.7	0.3	0.9	0.3	0.0	1.0	1.4	0.0	0.3	0.4	0.0	0.5	0.6	0.0	0.6	0.6	0.0	0.4	0.0	2.9	0.0	0.0	0.4	0.0	0.0	0.6	0.0	0.8	0.0	0.2	0.0	0.2	0.0	0.4
NEO-LCBI Laboratory-confirmed bloodstream infection in neonates, non-CNS	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.2	0.0	0.9	0.4	0.0	0.4	0.1	1.2	0.0	0.0	0.0	1.1	0.0	0.5	0.1	0.0	0.3	0.3	0.3	0.0	0.2	0.0	0.3	0.0	0.3
NEO-CNSB Laboratory-confirmed BSI with CNS in neonates	0.0	0.1	0.0	0.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.1	0.0	0.2	0.0	0.2
Catheter-related infections w/o BSI	6.3	1.7	2.8	1.9	2.5	2.1	0.0	0.8	0.9	2.2	1.0	3.3	1.8	0.0	1.0	1.0	1.2	3.0	0.0	0.0	1.7	1.7	1.1	1.5	3.9	1.9	0.8	1.5	0.0	0.8	1.2	1.3	1.0	1.6
CRI1-CVC Local CVC-related infection	1.4	0.6	0.0	0.9	1.3	0.5	0.0	0.0	0.1	0.6	0.0	1.2	0.0	0.0	0.0	0.5	1.2	1.1	0.0	0.0	0.0	0.8	0.4	0.3	1.3	0.3	0.3	0.4	0.0	0.2	0.0	0.2	0.0	0.4
CRI2-CVC General CVC-related infection	2.8	1.0	0.6	0.3	0.0	0.5	0.0	0.0	0.1	0.4	0.2	1.5	1.0	0.0	0.6	0.5	0.0	0.7	0.0	0.0	1.7	0.0	0.7	0.6	2.6	0.6	0.3	0.6	0.0	0.3	1.2	0.2	0.0	0.6
CRI1-PVC Local PVC-related infection	1.7	0.0	2.3	0.6	1.3	1.0	0.0	0.0	0.6	0.8	0.6	0.5	0.8	0.0	0.4	0.1	0.0	0.7	0.0	0.0	0.0	0.8	0.0	0.6	0.0	0.6	0.0	0.3	0.0	0.2	0.0	0.8	1.0	0.5
CRI2-PVC General PVC-related infection	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.2	0.0	0.1	0.0	0.2	0.0	0.1
Cardiovascular system infections	0.3	1.7	8.2	0.6	0.0	3.1	1.4	1.6	0.5	1.0	0.6	1.3	1.8	2.0	0.4	2.6	2.4	1.1	1.0	2.9	1.1	0.8	1.3	1.5	2.6	1.9	0.8	1.7	2.0	0.6	0.6	0.2	0.3	1.4
CVS-VASC Arterial or venous infection	0.3	0.7	7.7	0.3	0.0	2.1	0.0	1.6	0.4	0.6	0.4	0.7	1.8	2.0	0.2	1.9	0.0	0.0	1.0	2.9	0.6	0.0	0.4	0.7	0.0	1.9	0.5	1.0	2.0	0.2	0.6	0.0	0.0	0.9
CVS-ENDO Endocarditis	0.0	0.4	0.0	0.3	0.0	1.0	0.0	0.0	0.0	0.2	0.2	0.5	0.0	0.0	0.2	0.3	1.2	0.0	0.0	0.0	0.6	0.0	0.5	0.6	1.3	0.0	0.3	0.4	0.0	0.3	0.0	0.2	0.3	0.3
CVS-CARD Myocarditis or pericarditis	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	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	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVS-MED Mediastinitis	0.0	0.5	0.6	0.0	0.0	0.0	1.4	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.5	0.0	1.1	0.0	0.0	0.0	0.8	0.0	0.0	1.3	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.2
CVS-Nos Cardiovasular system infection, not specified	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	0.0	1.2	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	0.0	0.0	0.0	0.0
Gastro-intestinal system infections	10.5	8.1	3.1	6.0	8.9	11.5	6.8	3.1	10.8	3.8	13.4	4.3	17.9	0.0	10.0	6.6	8.5	8.1	13.7	2.9	3.9	9.1	9.3	6.1	7.8	3.4	5.6	4.5	14.0	8.9	8.9	7.2	11.7	7.7
GI-CDI Clostridium difficile infection	5.9	3.4	0.0	2.2	2.5	6.8	1.4	1.6	5.2	1.4	7.0	0.7	10.6	0.0	5.8	2.8	6.1	0.0	10.8	2.9	1.4	3.3	4.6	2.3	2.6	1.2	0.5	0.7	4.0	5.6	4.7	5.2	11.3	3.7
GI-GE Gastroenteritis (excluding CDI)	1.4	0.4	1.1	1.3	0.0	2.1	0.0	0.0	1.0	0.4	0.8	0.9	4.6	0.0	0.2	0.9	1.2	1.1	0.0	0.0	0.8	0.0	2.2	0.6	3.9	0.9	1.0	0.6	4.0	0.3	0.0	0.2	0.0	0.9
GI-GIT Gastrointestinal tract , excl. GE, CDI	0.7	1.6	0.0	0.3	1.3	1.6	0.0	0.0	2.6	0.8	1.7	1.0	1.8	0.0	1.8	0.9	0.0	1.9	2.0	0.0	0.0	2.5	0.5	1.2	0.0	0.6	0.8	0.4	2.0	0.7	0.6	0.2	0.0	1.0
GI-HEP Hepatitis	0.3	0.2	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	0.1	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	0.1	0.0	0.2	0.0	0.0
GI-IAB Intraabdominal infection, not specified elsewhere	1.7	2.2	1.1	1.9	5.1	1.0	4.1	1.6	1.8	1.2	1.4	1.7	0.6	0.0	2.0	1.8	0.0	5.2	1.0	0.0	1.4	3.3	1.6	2.0	0.0	0.6	3.3	2.6	4.0	2.1	3.6	1.0	0.3	1.9
NEO-NEC Necrotising enterocolitis	0.3	0.4	0.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.2	0.0	1.2	0.0	0.0	0.0	0.3	0.0	0.2	0.0	1.3	0.0	0.0	0.2	0.0	0.1	0.0	0.5	0.0	0.1
GI-Nos Gastro-intesinal system infection, not specified	0.0	0.0	0.0	0.3	0.0	0.0	1.4	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Number of HAIs	287	1086	352	317	79	192	73	128	771	498	516	820	498	51	501	1068	82	270	102	35	360	121	548	1231	77	324	396	1257	50	1602	169	601	300	14762
Skin and soft tissue infections	3.8	3.2	3.1	3.2	2.5	2.6	1.4	7.0	3.5	5.0	1.4	6.1	3.6	5.9	3.2	3.2	1.2	3.0	2.0	5.7	5.3	5.8	3.6	5.0	5.2	5.2	3.5	3.2	0.0	5.2	5.9	4.0	7.3	4.1
SST-SKIN Skin infection	1.7	1.5	0.0	0.3	1.3	0.5	0.0	2.3	1.4	2.4	0.0	0.5	0.8	5.9	2.2	1.0	1.2	0.4	0.0	0.0	4.2	2.5	2.0	1.4	0.0	2.2	1.5	1.0	0.0	2.8	3.6	0.7	6.0	1.6
SST-ST Soft tissue	0.7	1.1	2.0	1.3	1.3	1.0	0.0	2.3	1.0	1.0	0.2	2.6	2.0	0.0	1.0	1.1	0.0	0.7	1.0	5.7	0.0	1.7	0.7	2.2	1.3	0.9	1.0	1.3	0.0	1.4	1.8	2.0	0.7	1.3
SST-DECU Decubitus ulcer	0.7	0.6	0.9	1.6	0.0	1.0	1.4	0.8	0.5	1.6	0.4	2.4	0.8	0.0	0.0	0.8	0.0	0.7	1.0	0.0	0.6	0.0	0.7	0.9	1.3	1.5	0.5	0.7	0.0	0.5	0.0	1.2	0.7	0.8
SST-BURN Burn	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.3	0.0	0.0	0.4	0.0	0.0	0.0	0.2	0.0	1.1	0.0	0.0	0.0	1.7	0.2	0.2	1.3	0.0	0.3	0.2	0.0	0.1	0.0	0.2	0.0	0.2
SST-BRST Breast abscess or mastitis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.6	0.3	0.1	0.0	0.0	0.6	0.0	0.0	0.1
SST-Nos Skin and soft tissue infections, not specified	0.7	0.1	0.3	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2	1.3	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1
Bone and joint infections	1.0	1.7	0.9	2.5	3.8	1.6	0.0	0.0	1.0	2.8	1.9	0.7	0.4	0.0	3.8	1.6	12.2	0.7	2.9	5.7	0.3	0.8	1.5	2.4	1.3	1.2	3.8	1.4	2.0	1.7	1.2	0.3	0.7	1.7
BJ-BONE Osteomyelitis	0.3	0.6	0.6	0.9	2.5	1.0	0.0	0.0	0.5	1.4	0.8	0.2	0.2	0.0	1.2	0.8	6.1	0.7	1.0	5.7	0.0	0.0	0.5	1.5	1.3	0.9	1.8	0.2	0.0	0.6	0.0	0.2	0.0	0.7
BJ-JNT Joint or bursa	0.7	1.0	0.3	0.6	1.3	0.5	0.0	0.0	0.5	1.2	0.6	0.2	0.2	0.0	1.6	0.6	4.9	0.0	0.0	0.0	0.3	0.8	0.9	0.9	0.0	0.3	1.8	1.2	2.0	0.7	0.6	0.0	0.7	0.7

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
BJ-DISC Disc space infection	0.0	0.1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.0	1.0	0.2	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.6	0.2	0.0	0.1
BJ-Nos Bone and joint infection, not specified	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0	1.2	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1
Central nervous system infections	0.0	0.4	0.9	2.8	0.0	0.0	0.0	0.8	1.2	0.0	0.0	1.2	0.8	0.0	0.6	0.1	3.7	1.5	0.0	0.0	0.6	0.0	0.4	0.9	1.3	0.3	0.0	1.2	0.0	0.3	1.8	0.8	0.3	0.7
CNS-IC Intracranial infection	0.0	0.2	0.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.7	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.3	0.0	0.0	1.2	0.0	0.3	0.1
CNS-MEN Meningitis or ventriculitis	0.0	0.2	0.6	2.2	0.0	0.0	0.0	0.8	1.0	0.0	0.0	0.9	0.8	0.0	0.4	0.1	1.2	0.0	0.0	0.0	0.6	0.0	0.2	0.7	1.3	0.0	0.0	0.6	0.0	0.2	0.6	0.7	0.0	0.4
CNS-SA Spinal abscess without meningitis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.1	0.0	0.2	0.0	0.1
CNS-Nos Central nervous system infection, not specified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eye, Ear, Nose or Mouth infection	1.0	1.9	4.0	0.6	1.3	0.5	2.7	0.0	3.2	3.0	1.7	1.0	2.8	11.8	4.6	3.3	0.0	1.9	4.9	2.9	3.3	2.5	3.6	2.1	1.3	8.3	1.8	3.9	22.0	2.4	1.2	9.5	3.7	3.1
EENT-CONJ Conjunctivitis	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.2	0.5	0.0	2.2	0.0	0.1	0.0	0.2	0.0	0.2	1.3	0.3
EENT-EYE Eye, other than conjunctivitis	0.0	0.3	0.6	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.1	0.2	2.0	0.0	0.2	0.0	0.4	0.0	0.0	0.3	0.0	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.5	0.7	0.2
EENT-EAR Ear mastoid	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.4	0.2	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.8	0.0	0.4	0.2	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.3	0.0	0.2
EENT-ORAL Oral cavity (mouth, tongue, or gums)	1.0	1.2	0.3	0.6	1.3	0.5	2.7	0.0	1.7	2.4	0.2	0.4	0.2	7.8	4.2	2.1	0.0	0.0	3.9	2.9	1.1	2.5	0.5	1.1	0.0	3.1	0.8	2.9	20.0	1.7	1.2	7.5	1.7	1.8
EENT-SINU Sinusitis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0	1.0	0.0	0.3	0.0	0.2	0.1	0.0	0.0	0.0	0.2	2.0	0.0	0.0	0.0	0.0	0.1
EENT-UR Upper respiratory tract, pharyngitis, laryngitis, epiglottitis	0.0	0.3	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.8	0.0	1.4	0.0	0.2	0.7	0.0	1.5	0.0	0.0	0.3	0.0	1.5	0.2	1.3	3.1	0.8	0.6	0.0	0.2	0.0	1.0	0.0	0.5
EENT-Nos Eye, Ear, Nose or Mouth infection, not specified	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
Reproductive tract infections	0.3	0.7	0.3	0.6	0.0	0.0	1.4	0.0	0.6	0.8	1.0	0.2	0.4	0.0	1.4	0.6	1.2	2.2	0.0	0.0	0.3	0.8	0.0	0.4	1.3	0.9	0.8	0.3	0.0	0.7	0.0	0.5	1.0	0.6
REPR-EMET Endometritis	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.2	0.7	0.1
REPR-EPIS Episiotomy	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REPR-VCUF Vaginal cuff	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
REPR-OREP Other infections of the male or female reproductive tract	0.0	0.6	0.3	0.0	0.0	0.0	1.4	0.0	0.4	0.6	0.4	0.2	0.4	0.0	1.4	0.6	0.0	0.7	0.0	0.0	0.3	0.0	0.0	0.2	1.3	0.9	0.3	0.1	0.0	0.7	0.0	0.3	0.3	0.4
REPR-Nos Reproductive tract infections, not specified	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.8	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 infections	9.1	6.8	2.8	9.8	11.4	1.0	12.3	7.8	12.2	2.4	2.7	8.4	2.0	2.0	9.6	4.2	6.1	1.5	2.9	5.7	1.9	11.6	4.9	4.7	1.3	3.1	13.9	5.8	4.0	9.9	11.8	3.8	3.0	6.3
SYS-DI Disseminated infection	1.4	0.5	0.0	1.9	0.0	0.0	0.0	0.0	1.3	0.2	1.4	0.5	0.2	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.3	1.0	0.0	0.1	0.0	0.2	0.7	0.4
SYS-CSEP Clinical sepsis in adults and children	6.3	5.1	0.9	2.5	5.1	0.5	12.3	4.7	8.9	2.0	0.2	3.9	0.8	2.0	7.4	3.3	1.2	1.1	1.0	5.7	1.7	8.3	2.7	3.8	0.0	1.2	11.4	4.1	4.0	8.1	11.8	3.2	2.0	4.4
NEO-CSEP Clinical sepsis in neonates	0.3	0.7	2.0	1.6	6.3	0.5	0.0	3.1	1.9	0.2	0.0	1.7	1.0	0.0	2.0	0.7	4.9	0.4	2.0	0.0	0.3	2.5	1.8	0.4	0.0	0.3	2.3	0.7	0.0	1.4	0.0	0.5	0.3	1.0
SYS-Nos Systemic infections, not specified	1.0	0.6	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.2	0.2	1.3	1.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4

(a) Bloodstream infections: the origin of bloodstream infections (catheter-related, secondary to another infection or unknown origin) was recorded in a separate variable and is not given in this table. Catheter-related bloodstream infections reported under Figure 1 in the country summary sheets (Annex 2) include bloodstream infections (BSI, NEO-CNBC and NEO-LCBI) with origin C-CVC and C-PVC and microbiologically confirmed catheter-related bloodstream infections (CRI3-CVC and CRI3-PVC).

The Netherlands: not including HAIs present on admission (N=238 HAIs). In the Netherlands HAIs present on admission were registered based on the diagnosis of the physician at admission and not based on the definitions of HAIs in the ECDC PPS protocol. The HAI type for HAIs present on admission was only reported for surgical site infections (N=117) and was not specified for other HAI types (N=121).

Table A1.4. Microorganisms isolated in HAI, by country

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
Number of microorganism codes, incl. negative	328	1287	398	369	90	223	78	145	874	558	604	935	549	61	550	1257	92	321	118	49	650	136	604	1348	89	397	488	1485	56	1683	190	634	316	16962
Number of HAI	287	1086	352	317	79	192	73	128	771	498	516	820	498	51	501	1068	82	270	102	35	598	121	548	1231	77	324	396	1257	50	1602	169	601	300	15000
% of HAI with microorganisms	47.0	64.7	60.2	55.2	50.6	76.0	42.5	47.7	47.7	68.7	54.5	54.8	41.4	52.9	52.1	61.0	45.1	48.1	58.8	57.1	46.3	43.0	48.9	53.5	80.5	66.0	55.6	63.3	46.0	40.2	46.2	53.6	54.7	8114
Number of isolates	176	904	258	227	51	177	36	78	471	402	369	564	257	37	310	841	47	181	76	34	329	67	324	775	74	287	312	1024	29	725	99	355	180	10076
Gram-positive cocci	33.0	30.3	31.4	30.0	33.3	33.3	52.8	37.2	41.6	36.6	35.0	19.5	32.3	40.5	36.8	27.0	40.4	37.0	30.3	41.2	36.8	43.3	31.2	34.2	31.1	26.8	28.2	35.0	51.7	29.5	35.4	44.2	35.6	3296
Staphylococcus aureus	8.5	10.7	9.7	12.8	21.6	18.6	8.3	14.1	13.2	14.2	13.3	3.0	12.8	5.4	14.8	8.3	12.8	16.0	10.5	26.5	14.3	20.9	8.3	17.0	18.9	7.7	7.7	10.5	6.9	15.0	14.1	23.9	18.3	1243
Staphylococcus epidermidis	4.5	5.2	3.5	1.8	5.9	4.0	8.3	3.8	5.3	4.0	2.4	3.5	1.9	0.0	1.6	6.3	2.1	2.2	3.9	2.9	4.0	7.5	5.9	3.1	0.0	3.5	3.8	4.9	0.0	1.2	2.0	3.1	1.1	383
Staphylococcus haemolyticus	2.3	0.3	0.4	0.0	0.0	0.6	2.8	0.0	0.6	1.5	0.5	1.1	0.4	0.0	0.3	1.1	2.1	0.6	3.9	0.0	0.0	0.0	1.2	0.1	0.0	0.7	0.6	0.5	0.0	0.3	1.0	0.3	0.0	61
Coagulase-negative stafylococci, not specified	2.8	2.1	3.1	5.7	0.0	2.3	2.8	0.0	3.2	0.2	1.4	0.0	4.3	13.5	4.8	1.0	4.3	5.0	0.0	0.0	0.0	4.5	2.2	0.1	2.7	1.0	1.0	2.1	13.8	4.0	3.0	4.2	5.0	222
Other coagulase-negative stafylococci (cns)	0.6	1.0	0.4	0.0	0.0	0.0	2.8	0.0	0.4	2.2	0.8	0.4	0.4	0.0	0.3	1.0	6.4	0.0	1.3	0.0	1.2	0.0	0.3	0.9	0.0	1.7	1.0	1.6	3.4	0.3	1.0	0.8	0.6	86
Staphylococcus sp., not specified	0.0	0.4	0.0	0.0	0.0	0.6	2.8	1.3	1.1	0.0	0.3	1.2	0.0	0.0	0.0	0.6	0.0	0.6	0.0	0.0	2.7	0.0	0.6	0.3	1.4	1.4	1.0	0.4	0.0	0.6	0.0	0.6	0.0	57
Streptococcus pneumoniae	0.0	0.8	0.0	0.0	0.0	0.6	0.0	2.6	0.0	1.2	0.0	0.0	0.4	0.0	0.3	0.2	0.0	1.1	0.0	0.0	1.2	0.0	0.3	0.1	0.0	0.7	0.0	0.5	0.0	0.3	0.0	0.3	0.0	37
Streptococcus agalactiae (b)	0.0	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.6	1.5	0.3	0.2	0.4	0.0	1.0	0.5	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	1.4	0.6	0.1	0.0	0.7	0.0	1.1	0.6	43
Streptococcus pyogenes (a)	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.3	0.2	0.2	0.3	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.1	0.0	1.0	0.0	0.0	0.0	0.3	1.0	0.0	0.0	16
Other haemol. streptococcae (c, g)	0.0	0.4	0.4	1.3	0.0	0.0	2.8	1.3	1.3	0.2	0.0	0.2	0.8	2.7	1.0	0.2	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.3	0.0	1.4	0.0	0.0	0.0	0.6	0.0	0.8	0.0	40
Streptococcus sp., other	0.6	0.8	0.4	1.3	2.0	1.1	0.0	1.3	1.1	0.5	0.8	0.7	1.2	0.0	1.6	0.5	2.1	0.0	1.3	0.0	0.9	4.5	0.9	0.5	0.0	0.3	0.6	1.0	0.0	0.7	1.0	1.1	0.6	81
Streptococcus sp., not specified	0.6	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	1.4	0.0	0.0	1.3	0.0	0.1	0.0	0.6	1.1	29
Enterococcus faecalis	6.3	4.8	8.5	4.8	2.0	4.0	8.3	9.0	9.1	6.5	7.6	5.0	4.3	8.1	3.2	6.8	0.0	4.4	6.6	11.8	6.4	1.5	5.9	6.5	1.4	3.1	8.0	7.3	6.9	1.4	5.1	3.4	0.6	559
Enterococcus faecium	5.7	1.4	3.5	2.2	2.0	0.6	13.9	2.6	3.2	2.2	4.1	2.7	1.6	2.7	3.2	0.1	0.0	5.0	1.3	0.0	5.5	0.0	3.4	4.0	1.4	1.0	1.9	3.6	10.3	1.1	4.0	1.1	0.6	253
Enterococcus sp., other	0.6	0.3	0.8	0.0	0.0	0.0	0.0	0.0	0.2	0.7	1.6	0.4	0.0	2.7	0.6	0.2	6.4	1.1	0.0	0.0	0.0	0.0	0.6	0.3	1.4	0.0	0.3	0.2	6.9	0.7	0.0	0.0	0.6	44
Enterococcus sp., not specified	0.6	1.3	0.4	0.0	0.0	0.0	0.0	0.0	0.6	0.7	1.4	0.9	3.1	2.7	3.9	0.0	2.1	1.1	0.0	0.0	0.3	3.0	0.3	0.5	2.7	1.7	1.0	0.5	3.4	2.2	3.0	2.3	4.4	113
Gram-positive cocci, not specified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	2.7	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	0.4	0.0	0.1	0.0	0.3	2.2	14
Other gram-positive cocci	0.0	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.4	0.5	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.3	0.0	15
Gram-negative cocci	0.6	0.7	0.0	0.4	2.0	0.0	0.0	0.0	0.4	0.5	0.0	0.2	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0	0.6	1.5	0.0	0.0	0.0	0.7	0.6	0.2	0.0	0.7	2.0	1.4	1.7	41
Moraxella catharralis	0.0	0.7	0.0	0.4	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.7	0.0	0.1	0.0	0.1	2.0	0.6	0.0	21

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
Moraxella sp., other	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	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	2
Moraxella sp., not specified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	3
Neisseria meningitidis	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	2
Neisseria sp., other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Neisseria sp., not specified	0.6	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	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	0.0	0.0	0.0	0.0	0.0	3
Gram-negative cocci, not specified	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	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	0.0	0.6	1.7	5
Gram-negative cocci, other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	4
Gram-positive bacilli	0.0	0.4	0.8	0.0	0.0	0.0	2.8	2.6	1.1	0.7	1.9	0.5	0.0	0.0	0.0	1.4	0.0	2.2	0.0	0.0	1.2	1.5	0.3	0.0	0.0	0.0	1.3	0.6	0.0	1.0	4.0	1.4	1.7	78
Corynebacterium species	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.8	0.5	0.0	0.0	0.0	1.3	0.0	2.2	0.0	0.0	0.6	1.5	0.3	0.0	0.0	0.0	0.3	0.3	0.0	0.1	1.0	0.3	0.0	39
Bacillus species	0.0	0.1	0.4	0.0	0.0	0.0	2.8	2.6	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.0	0.0	0.0	1.1	0.0	17
Lactobacillus species	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
Listeria monocytogenes	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	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2
Gram-positive bacilli, not specified	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	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.7	2.0	0.0	1.7	12
Other gram-positive bacilli	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	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	0.0	0.0	0.3	0.0	0.0	0.1	1.0	0.0	0.0	6
Number of isolates	176	904	258	227	51	177	36	78	471	402	369	564	257	37	310	841	47	181	76	34	329	67	324	775	74	287	312	1024	29	725	99	355	180	10076
Enterobacteriaceae	33.5	42.8	39.1	38.8	29.4	41.2	13.9	42.3	27.8	43.5	39.0	37.2	23.3	37.8	35.2	37.6	36.2	35.4	36.8	35.3	43.8	25.4	40.1	33.8	35.1	42.9	43.3	34.5	31.0	32.1	27.3	30.7	21.1	3647
Citrobacter freundii	1.1	0.7	0.8	0.4	0.0	0.0	2.8	1.3	0.4	1.0	1.1	0.0	0.0	2.7	0.0	0.8	0.0	0.0	2.6	0.0	0.6	0.0	0.3	0.4	0.0	0.3	0.0	0.7	0.0	0.1	1.0	0.3	0.0	50
Citrobacter koseri (ex. diversus)	0.6	0.4	0.0	0.0	2.0	0.0	0.0	0.0	0.0	1.0	1.1	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.0	24
Citrobacter sp., other	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.1	0.0	0.0	1.0	0.0	0.0	10
Citrobacter sp., not specified	0.0	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0	7
Enterobacter cloacae	3.4	4.4	3.5	1.8	0.0	0.6	0.0	5.1	3.2	3.0	2.7	2.0	1.2	2.7	1.0	2.5	4.3	0.6	2.6	0.0	6.1	0.0	5.6	2.7	0.0	1.4	5.8	2.8	3.4	3.0	2.0	1.1	0.0	284
Enterobacter aerogenes	1.1	1.7	0.8	0.0	2.0	0.0	0.0	2.6	0.4	1.5	0.5	0.4	0.0	0.0	1.6	1.1	0.0	0.0	0.0	5.9	1.2	0.0	1.2	1.2	0.0	1.0	1.0	0.9	0.0	0.1	0.0	0.0	0.0	83
Enterobacter agglomerans	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	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3
Enterobacter sakazakii	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	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	0.0	0.0	0.0	0.0	0.0	1
Enterobacter sp., other	0.0	0.0	0.4	0.0	0.0	0.6	0.0	0.0	0.0	0.2	0.8	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	10
Enterobacter sp., not specified	0.0	0.0	0.0	1.3	0.0	3.4	0.0	1.3	0.2	0.0	0.3	0.9	1.6	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	2.4	0.3	0.3	0.0	0.4	0.0	0.3	0.6	41

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
Escherichia coli	14.8	19.6	17.1	15.4	3.9	16.4	5.6	17.9	13.0	26.6	17.6	8.3	10.5	21.6	19.7	12.7	12.8	13.8	18.4	14.7	20.1	11.9	14.8	14.1	6.8	15.0	17.0	16.8	20.7	17.0	8.1	20.3	14.4	1601
Klebsiella pneumoniae	4.5	5.1	8.5	11.9	11.8	10.7	5.6	6.4	4.2	3.0	5.4	16.7	4.3	0.0	4.8	11.1	17.0	9.4	3.9	2.9	7.3	1.5	9.9	8.3	8.1	6.6	9.3	5.6	0.0	1.8	2.0	3.1	1.1	689
Klebsiella oxytoca	2.3	2.4	1.2	0.0	0.0	0.0	0.0	1.3	1.3	1.0	2.4	0.0	0.8	0.0	1.6	1.0	0.0	0.6	2.6	2.9	1.8	0.0	1.5	0.8	0.0	1.4	1.9	1.0	0.0	1.0	1.0	0.6	0.6	116
Klebsiella sp., other	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.5	0.0	0.0	0.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	21
Klebsiella sp., not specified	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.2	0.0	0.0	0.4	1.6	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	6.0	0.6	0.1	5.4	3.8	0.0	0.0	0.0	0.7	0.0	0.6	0.6	46
Proteus mirabilis	2.3	4.9	4.3	4.4	5.9	4.5	0.0	2.6	0.8	4.5	3.5	4.3	0.8	2.7	2.6	3.8	0.0	4.4	3.9	0.0	3.0	0.0	3.7	3.2	4.1	7.7	3.5	2.5	6.9	1.1	4.0	1.1	0.6	323
Proteus vulgaris	0.6	0.2	0.4	0.4	0.0	0.0	0.0	1.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.6	0.0	0.0	0.3	0.0	0.3	0.1	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0	0.0	15
Proteus sp., other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	1.0	0.0	0.0	10
Proteus sp., not specified	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.2	0.4	2.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.3	0.0	0.2	0.0	1.7	5.1	1.1	1.1	32
Serratia marcescens	1.1	0.8	1.6	0.4	0.0	0.6	0.0	0.0	0.8	0.0	1.1	1.1	1.2	0.0	1.3	1.0	0.0	3.3	2.6	0.0	0.9	3.0	1.2	0.9	2.7	0.3	1.9	0.8	0.0	0.7	1.0	0.8	0.6	95
Serratia liquefaciens	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	7
Serratia sp., other	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	5
Serratia sp., not specified	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.5	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	1.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8
Hafnia species	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	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	3
Morganella species	0.6	1.3	0.0	0.9	3.9	1.1	0.0	1.3	1.3	0.2	1.1	0.9	1.2	0.0	0.0	1.2	0.0	0.6	0.0	2.9	0.6	0.0	0.0	1.0	0.0	0.7	0.6	1.4	0.0	0.0	0.0	0.0	0.6	80
Providencia species	0.0	0.6	0.0	0.0	0.0	1.1	0.0	0.0	0.2	0.2	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.3	2.7	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	22
Salmonella sp., not specified	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	0.0	0.0	0.0	0.0	2.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
Shigella species	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Yersinia species	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	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	0.0	0.3	0.0	1
Other enterobacteriaceae	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.3	0.4	0.0	0.0	0.3	0.1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	12
Enterobacteriaceae, not specified	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	2.7	1.3	0.0	0.0	0.0	0.0	0.0	0.3	1.5	0.0	0.0	0.0	0.3	0.0	0.0	0.0	4.0	1.0	0.6	1.1	45
Gram-neg., non-enterobacteriaceae	13.6	12.7	24.4	22.5	23.5	11.3	2.8	11.5	9.8	11.9	7.6	36.2	16.0	2.7	8.4	18.5	12.8	15.5	9.2	8.8	10.9	9.0	15.1	21.4	23.0	18.8	15.4	16.4	0.0	14.2	13.1	6.8	11.1	1593
Acinetobacter baumannii	0.0	0.1	12.0	4.4	7.8	0.0	0.0	2.6	0.4	1.7	0.0	16.0	3.9	0.0	0.6	5.6	10.6	2.2	0.0	0.0	0.3	1.5	2.8	6.2	9.5	1.4	1.6	2.0	0.0	0.8	0.0	0.3	0.0	317
Acinetobacter calcoaceticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
Acinetobacter haemolyticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3
Acinetobacter lwoffi	0.0	0.1	0.4	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
Acinetobacter sp., other	0.0	0.3	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9
Acinetobacter sp., not specified	0.6	0.1	1.2	0.0	0.0	0.0	0.0	0.0	1.1	0.2	0.0	0.0	0.4	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.3	0.0	0.0	0.1	2.7	0.7	0.0	0.2	0.0	0.0	0.0	0.6	0.0	27
Pseudomonas aeruginosa	11.4	9.5	7.8	14.5	13.7	8.5	2.8	5.1	6.2	7.0	4.6	16.8	7.0	0.0	3.5	10.7	0.0	6.6	6.6	2.9	7.0	1.5	10.5	13.3	8.1	10.8	10.6	10.4	0.0	7.3	4.0	2.0	3.9	901
Stenotrophomonas maltophilia	0.6	1.1	0.8	3.1	2.0	0.6	0.0	1.3	0.8	0.2	1.1	1.1	1.6	0.0	1.0	1.0	0.0	0.0	2.6	2.9	0.9	3.0	1.5	0.5	0.0	1.0	1.6	1.1	0.0	1.0	1.0	0.6	0.6	100
Burkholderia cepacia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	3
Pseudomonadaceae family, other	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	0.7	0.4	0.0	0.3	0.2	2.1	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	1.0	0.0	0.3	0.0	28
Pseudomonadaceae family, not specified	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	2.3	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.7	0.0	0.4	0.0	1.9	4.0	0.8	2.8	51
Haemophilus influenzae	0.6	0.3	0.0	0.0	0.0	1.7	0.0	1.3	0.6	0.0	0.0	0.0	0.0	2.7	0.6	0.5	0.0	0.6	0.0	0.0	1.5	3.0	0.0	0.6	0.0	0.7	1.0	1.1	0.0	0.4	1.0	2.0	0.0	58
Haemophilus parainfluenzae	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	6
Haemophilus sp., other	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	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Haemophilus sp., not specified	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	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	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	7
Legionella species	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.0	3
Achromobacter species	0.0	0.0	0.4	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	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.1	0.0	0.0	0.0	9
Aeromonas species	0.0	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	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	0.0	0.0	0.0	0.0	0.0	2
Alcaligenes species	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	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2
Campylobacter species	0.6	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
Flavobacterium species	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	0.0	0.0	0.6	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	1
Helicobacter pylori	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	4
Pasteurella species	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	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	0.0	0.0	0.0	0.0	0.0	1
G-bac, non-enterobacteriaceae, not spec.	0.0	0.6	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.4	0.0	0.0	0.4	0.0	1.5	3.0	0.0	3.3	37
Other gram-bacilli, non-enterobacteriaciaea	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.1	1.4	0.0	0.3	0.0	0.0	0.0	0.0	0.3	0.6	11
Number of isolates	176	904	258	227	51	177	36	78	471	402	369	564	257	37	310	841	47	181	76	34	329	67	324	775	74	287	312	1024	29	725	99	355	180	10076
Anaerobic bacilli	10.2	5.0	0.4	3.1	5.9	8.5	2.8	2.6	10.8	3.2	10.3	1.8	21.4	2.7	11.6	4.5	10.6	3.9	14.5	5.9	2.7	10.4	7.7	3.9	2.7	2.1	1.3	2.4	6.9	14.2	10.1	10.4	21.7	658
Bacteroides fragilis	0.6	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.8	0.7	0.0	0.4	0.0	0.0	0.3	0.4	0.0	1.1	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.0	0.3	0.0	31
Bacteroides sp., other	0.0	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.2	0.3	0.2	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0	0.0	13
Bacteroides sp., not specified	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	0.0	0.0	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	0.0	0.0	2

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
Clostridium difficile	9.7	4.2	0.0	3.1	5.9	7.3	2.8	2.6	8.5	1.7	10.0	1.1	20.6	0.0	9.4	3.8	10.6	0.0	14.5	2.9	1.5	6.0	7.7	3.7	2.7	1.7	0.6	0.9	6.9	12.4	8.1	8.7	18.9	548
Clostridium species, other	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	10
Propionibacterium species	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	9
Prevotella species	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.4	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	1.0	0.0	0.0	10
Anaerobes, not specified	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	2.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.1	1.0	1.1	1.7	20
Other anaerobes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.3	0.1	0.0	1.1	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.3	0.0	0.3	1.1	15
Other bacteria	0.6	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.2	0.0	0.5	0.0	0.4	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.6	0.0	0.8	1.7	23
Mycobacterium, atypical	0.6	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	3
Mycoplasma species	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3
Actinomyces species	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	0.0	2
Nocardia species	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	0.0	3
Other bacteria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	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	0.0	0.4	0.0	0.3	1.1	9
Other bacteria, not specified	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	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	0.0	0.6	0.6	3
Fungi	8.5	7.4	3.9	5.3	5.9	4.0	25.0	3.8	6.2	3.0	4.9	4.6	5.8	13.5	7.1	10.3	0.0	5.0	9.2	8.8	3.3	9.0	2.8	6.7	4.1	8.0	9.0	9.8	10.3	7.4	8.1	4.2	5.6	681
Candida albicans	6.3	3.1	2.3	2.6	3.9	4.0	2.8	2.6	4.0	1.7	3.3	1.6	3.5	10.8	3.2	6.3	0.0	4.4	2.6	5.9	2.1	7.5	1.2	4.5	2.7	3.8	5.1	5.6	6.9	4.3	3.0	1.7	0.6	378
Candida glabrata	0.6	1.0	0.0	0.4	0.0	0.0	11.1	0.0	0.2	0.0	0.5	0.2	0.0	0.0	1.0	0.7	0.0	0.0	2.6	0.0	0.3	0.0	0.3	0.6	1.4	1.0	1.6	0.8	0.0	0.4	0.0	1.1	0.6	62
Candida krusei	0.6	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.4	0.0	0.3	0.4	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.3	0.2	0.0	0.0	1.0	0.3	0.0	19
Candida parapsilosis	0.6	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.7	0.4	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.3	0.0	0.5	0.0	0.1	0.0	0.0	0.6	28
Candida tropicalis	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.3	0.1	0.0	0.0	1.3	2.9	0.0	0.0	0.0	0.3	0.0	0.3	0.3	0.2	0.0	0.1	1.0	0.0	0.0	16
Candida sp., other	0.0	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.7	0.3	0.0	1.6	0.0	0.3	0.4	0.0	0.0	1.3	0.0	0.0	0.0	0.6	0.0	0.0	1.0	0.0	0.4	0.0	0.3	0.0	0.0	0.0	26
Candida sp., not specified	0.0	1.0	0.4	1.8	2.0	0.0	5.6	1.3	0.0	0.0	0.5	1.1	0.0	0.0	1.9	0.8	0.0	0.6	0.0	0.0	0.9	0.0	0.6	0.3	0.0	0.3	0.6	1.1	3.4	1.2	2.0	0.6	3.3	81
Aspergillus fumigatus	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.5	0.0	0.4	0.0	0.0	0.6	25
Aspergillus niger	0.0	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	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	0.0	0.0	0.0	0.0	1
Aspergillus sp., other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.0	4
Aspergillus sp., not specified	0.0	0.2	0.0	0.0	0.0	0.0	2.8	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	12
Other yeasts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.0	0.0	0.3	1.0	0.6	0.0	12

	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovakia	Slovenia	Spain	Sweden	UK-England	UK-Northern Ireland	UK-Scotland	UK-Wales	Europe
Fungi other	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.4	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.0	0.1	0.0	0.0	0.0	12
Filaments other	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	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	0.0	0.0	0.0	0.0	0.0	1
Other parasites	0.6	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	4
Virus	0.0	0.4	0.0	0.0	0.0	1.1	0.0	0.0	2.1	0.5	0.8	0.0	0.8	2.7	0.3	0.2	0.0	0.6	0.0	0.0	0.6	0.0	2.5	0.0	4.1	0.7	1.0	1.1	0.0	0.3	0.0	0.0	0.0	59
Adenovirus	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	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Cytomegalovirus (CMV)	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.2	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.5	0.0	0.0	0.0	0.0	0.0	18
Hepatitis c virus	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	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	0.0	0.0	0.0	0.0	0.0	1
Herpes simplex virus	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	2.7	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	0.2	0.0	0.0	0.0	0.0	0.0	8
Human immunodeficiency virus (HIV)	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	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	2
Norovirus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	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	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	3
Parainfluenzavirus	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	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	0.1	0.0	0.0	0.0	1
Respiratory syncytial virus (RSV)	0.0	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	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	0.0	0.0	0.0	0.0	1
Rotavirus	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.2	0.0	0.0	0.8	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17
Varicella-zoster virus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	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	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
Virus, not specified	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	0.0	0.0	0.6	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	1
Other virus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	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	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	4
Negative codes	53.0	35.3	39.8	44.8	49.4	24.0	57.5	52.3	52.3	31.3	45.5	45.2	58.6	47.1	47.9	39.0	54.9	51.9	41.2	42.9	53.7	57.0	51.1	46.5	19.5	34.0	44.4	36.7	54.0	59.8	53.8	46.4	45.3	6886
Micro-organism not identified	43.9	4.6	0.6	0.0	2.5	10.4	43.8	2.3	0.4	4.2	30.2	0.0	2.6	15.7	11.2	3.1	4.9	1.9	35.3	0.0	41.3	24.0	44.3	24.3	15.6	5.2	0.5	2.8	54.0	5.2	8.3	20.1	3.7	3022
Examination not done	8.4	3.3	6.8	2.2	2.5	6.3	0.0	7.0	2.3	23.9	5.8	18.0	40.4	19.6	15.0	3.5	9.8	30.7	2.9	34.3	8.9	13.2	2.4	10.0	0.0	12.7	22.2	14.3	0.0	8.7	10.1	14.6	4.0	1629
Sterile examination	0.7	1.7	2.8	3.8	0.0	0.0	0.0	6.3	0.6	3.2	1.9	8.0	3.4	2.0	6.6	0.6	1.2	9.3	1.0	8.6	3.5	10.7	0.4	3.7	0.0	1.5	8.3	6.8	0.0	3.9	3.0	2.7	1.0	524
Result not (yet) available or missing	0.0	25.7	29.5	38.8	44.3	7.3	13.7	36.7	48.9	0.0	7.6	19.1	12.2	9.8	15.2	31.8	39.0	10.0	2.0	0.0	0.0	9.1	4.0	8.6	3.9	14.5	13.4	12.8	0.0	41.9	32.5	9.0	36.7	3022

In the Netherlands, microorganisms were not registered for 238 HAIs present on admission.

Table A1.5. Prevalence of HAIs and antimicrobial use by patient specialty

	Number of patients	% of total	N pts HAI	HAI%	N pts AU	AU%
All specialties	231459	100.0	13829	6.0	80952	35.0
Surgical (SUR)	70848	30.6	4767	6.7	28834	40.7
General surgery	17783	7.7	1232	6.9	7673	43.1
Digestive tract surgery	4750	2.1	479	10.1	1976	41.6
Orthopaedics and surgical traumatology	21022	9.1	1298	6.2	7414	35.3
Cardiovascular surgery	5535	2.4	531	9.6	2148	38.8
Thoracic surgery	1054	0.5	66	6.3	421	39.9
Neurosurgery	3892	1.7	342	8.8	1155	29.7
Paediatric surgery	1437	0.6	49	3.4	608	42.3
Transplantation surgery	376	0.2	61	16.2	234	62.2
Surgery for cancer	816	0.4	79	9.7	292	35.8
ENT	3152	1.4	86	2.7	1323	42.0
Ophthalmology	1563	0.7	12	0.8	311	19.9
Maxillo-facial surgery	711	0.3	21	3.0	395	55.6
Stomatology/ Dentistry	93	0.0	0	0.0	54	58.1
Burns care	190	0.1	42	22.1	97	51.1
Urology	6167	2.7	332	5.4	3616	58.6
Plastic and reconstructive surgery	1399	0.6	90	6.4	756	54.0
Other surgery	908	0.4	47	5.2	361	39.8
Medical (MED)	94770	40.9	5293	5.6	34139	36.0
General medicine	30525	13.2	1665	5.5	12268	40.2
Gastro-enterology	7089	3.1	371	5.2	2468	34.8
Hepatology	387	0.2	24	6.2	151	39.0
Endocrinology	2381	1.0	87	3.7	673	28.3
Nephrology	3188	1.4	251	7.9	1545	48.5
Cardiology	13464	5.8	582	4.3	2751	20.4
Dermatology	1385	0.6	18	1.3	414	29.9
Haematology / BMT	3775	1.6	612	16.2	2317	61.4
Oncology	5556	2.4	364	6.6	1754	31.6
Neurology	10092	4.4	500	5.0	1446	14.3
Pneumology	9199	4.0	405	4.4	5044	54.8
Rheumatology	1579	0.7	39	2.5	254	16.1
Infectious diseases	3180	1.4	264	8.3	2108	66.3
Medical traumatology	70	0.0	4	5.7	25	35.7
Other Medical	2900	1.3	107	3.7	921	31.8
Paediatrics (PED)	12765	5.5	311	2.4	4052	31.7
Neonatology	4467	1.9	158	3.5	656	14.7
Paediatrics	8298	3.6	153	1.8	3396	40.9
Intensive Care Medicine (ICU)	11516	5.0	2264	19.7	6504	56.5
Medical ICU	2655	1.1	447	16.8	1485	55.9

	Number of patients	% of total	N pts HAI	HAI%	N pts AU	AU%
Surgical ICU	2158	0.9	528	24.5	1518	70.3
Paediatric ICU	788	0.3	122	15.5	442	56.1
Neonatal ICU	2283	1.0	244	10.7	782	34.3
Mixed/polyvalent ICU	2614	1.1	753	28.8	1768	67.6
Specialized ICU	855	0.4	155	18.1	429	50.2
Other ICU	163	0.1	15	9.2	80	49.1
Gynaecology/obstetrics (GO)	17515	7.6	274	1.6	3513	20.1
Obstetrics / Maternity	11880	5.1	125	1.1	1822	15.3
Gynaecology (incl. surgery)	5635	2.4	149	2.6	1691	30.0
Geriatrics (GER)	9133	3.9	514	5.6	2428	26.6
Geriatrics, care for the elderly	9133	3.9	514	5.6	2428	26.6
Psychiatrics (PSY)	9227	4.0	89	1.0	323	3.5
Psychiatrics	9227	4.0	89	1.0	323	3.5
Other (OTH)	4787	2.1	271	5.7	847	17.7
Rehabilitation	3181	1.4	209	6.6	444	14.0
Others not listed	1413	0.6	59	4.2	343	24.3
Unknown	193	0.1	3	1.6	60	31.1
Mixed (MIX)	898	0.4	46	5.1	312	34.7
Combination of specialties	898	0.4	46	5.1	312	34.7

Table A1.6. Antimicrobial agents (ATC level 4 and 5) by indication

	Total	%	Treatment (%)	Surgical prophyl-axis (%)	Medical prophyl-axis (%)
Total number of antimicrobial agents	110370	100.0	75497	18011	12480
A07AA (Intestinal antiinfectives, antibiotics)	1276	1.2	1.1	0.1	2.5
A07AA01 (Neomycin (oral))	16	0.0	0.0	0.0	0.0
A07AA02 (Nystatin)	551	0.5	0.5	0.0	1.2
A07AA03 (Natamycin)	3	0.0	0.0	0.0	0.0
A07AA04 (Streptomycin (oral))	5	0.0	0.0	0.0	0.0
A07AA05 (Polymyxin B)	3	0.0	0.0	0.0	0.0
A07AA06 (Paromomycin)	16	0.0	0.0	0.0	0.0
A07AA07 (Amphotericin B (oral))	36	0.0	0.0	0.0	0.1
A07AA08 (Kanamycin)	1	0.0	0.0	0.0	0.0
A07AA09 (Vancomycin (oral))	411	0.4	0.5	0.0	0.1
A07AA10 (Colistin (oral))	96	0.1	0.0	0.0	0.5
A07AA11 (Rifaximin)	132	0.1	0.1	0.0	0.5
A07AA51 (Neomycin, combinations (oral))	3	0.0	0.0	0.0	0.0
A07AA54 (Streptomycin, combinations)	3	0.0	0.0	0.0	0.0
D01BA (Antifungals for systemic use)	13	0.0	0.0	0.0	0.0
D01BA01 (Griseofulvin)	3	0.0	0.0	0.0	0.0
D01BA02 (Terbinafine)	10	0.0	0.0	0.0	0.0
J01AA (Tetracyclines)	1414	1.3	1.6	0.3	0.6
J01AA01 (Demeclocycline)	12	0.0	0.0	0.0	0.0
J01AA02 (Doxycycline)	1019	0.9	1.2	0.2	0.3
J01AA04 (Lymecycline)	18	0.0	0.0	0.0	0.1
J01AA05 (Metacycline)	1	0.0	0.0	0.0	0.0
J01AA06 (Oxytetracycline)	10	0.0	0.0	0.0	0.0
J01AA07 (Tetracycline)	16	0.0	0.0	0.0	0.0
J01AA08 (Minocycline)	39	0.0	0.0	0.0	0.1
J01AA10 (Penimepicycline)	1	0.0	0.0	0.0	0.0
J01AA11 (Clomocycline)	2	0.0	0.0	0.0	0.0
J01AA12 (Tigecycline)	296	0.3	0.3	0.1	0.1
J01BA (Amphenicols)	48	0.0	0.0	0.1	0.0
J01BA01 (Chloramphenicol)	47	0.0	0.0	0.1	0.0
J01BA02 (Thiamphenicol)	1	0.0	0.0	0.0	0.0
J01CA (Penicillins, extended spectrum without anti-pseudomonal activity)	5891	5.3	5.8	3.0	6.0
J01CA (Not specified)	5	0.0	0.0	0.0	0.0
J01CA01 (Ampicillin)	1572	1.4	1.3	1.2	2.8
J01CA02 (Pivampicillin)	9	0.0	0.0	0.0	0.0
J01CA04 (Amoxicillin)	3342	3.0	3.6	1.4	2.1
J01CA08 (Pivmecillinam)	129	0.1	0.2	0.0	0.0
J01CA09 (Azlocillin)	1	0.0	0.0	0.0	0.0
J01CA10 (Mezlocillin)	10	0.0	0.0	0.0	0.0
J01CA11 (Mecillinam)	17	0.0	0.0	0.0	0.0
J01CA12 (Piperacillin)	521	0.5	0.5	0.2	0.8
J01CA13 (Ticarcillin)	6	0.0	0.0	0.0	0.0
J01CA14 (Metampicillin)	2	0.0	0.0	0.0	0.0
J01CA15 (Talampicillin)	1	0.0	0.0	0.0	0.0
J01CA17 (Temocillin)	65	0.1	0.1	0.0	0.0
J01CA20 (Combinations of penicillins with extended spectrum)	9	0.0	0.0	0.0	0.0
J01CA21 (Not specified)	1	0.0	0.0	0.0	0.0
J01CA51 (Ampicillin, combinations)	201	0.2	0.2	0.2	0.2
J01CE (Beta-lactamase sensitive penicillins)	2127	1.9	2.2	0.6	2.3
J01CE (Not specified)	1	0.0	0.0	0.0	0.0
J01CE01 (Benzylpenicillin)	1600	1.4	1.7	0.5	1.3
J01CE02 (Phenoxymethylpenicillin)	299	0.3	0.2	0.1	0.9

	Total	%	Treatment (%)	Surgical prophyl-axis (%)	Medical prophyl-axis (%)
J01CE04 (Azidocillin)	1	0.0	0.0	0.0	0.0
J01CE05 (Pheneticillin)	1	0.0	0.0	0.0	0.0
J01CE06 (Penamecillin)	7	0.0	0.0	0.0	0.0
J01CE07 (Clometocillin)	1	0.0	0.0	0.0	0.0
J01CE08 (Benzathine benzylpenicillin)	46	0.0	0.0	0.0	0.1
J01CE09 (Procaine benzylpenicillin)	27	0.0	0.0	0.0	0.0
J01CE10 (Benzathine phenoxymethylpenicillin)	36	0.0	0.0	0.0	0.0
J01CE30 (Combinations of beta-lactamase sensitive penicillins)	108	0.1	0.1	0.1	0.0
J01CF (Beta-lactamase resistant penicillins)	2917	2.6	3.0	2.7	0.8
J01CF01 (Dicloxacillin)	38	0.0	0.0	0.0	0.0
J01CF02 (Cloxacillin)	320	0.3	0.3	0.3	0.0
J01CF03 (Meticillin)	3	0.0	0.0	0.0	0.0
J01CF04 (Oxacillin)	188	0.2	0.1	0.3	0.1
J01CF05 (Flucloxacillin)	2368	2.1	2.4	2.1	0.6
J01CG (Beta-lactamase inhibitors)	798	0.7	0.9	0.4	0.4
J01CG (Not specified)	1	0.0	0.0	0.0	0.0
J01CG01 (Sulbactam)	102	0.1	0.1	0.1	0.1
J01CG02 (Tazobactam)	695	0.6	0.8	0.2	0.4
J01CR (Combinations of penicillins, incl. beta-lactamase inhibitors)	20030	18.1	19.8	14.2	13.6
J01CR01 (Ampicillin and enzyme inhibitor)	1578	1.4	1.2	2.1	1.8
J01CR02 (Amoxicillin and enzyme inhibitor)	12142	11.0	11.6	10.1	8.4
J01CR03 (Ticarcillin and enzyme inhibitor)	25	0.0	0.0	0.0	0.0
J01CR04 (Sultamicillin)	280	0.3	0.2	0.4	0.3
J01CR05 (Piperacillin and enzyme inhibitor)	5837	5.3	6.6	1.4	3.1
J01CR50 (Combinations of penicillins)	168	0.2	0.2	0.1	0.1
J01DB (First-generation cephalosporins)	5102	4.6	1.3	20.1	3.0
J01DB (Not specified)	1	0.0	0.0	0.0	0.0
J01DB01 (Cefalexin)	660	0.6	0.5	0.7	0.9
J01DB03 (Cefalotin)	75	0.1	0.0	0.3	0.0
J01DB04 (Cefazolin)	4254	3.9	0.8	18.9	1.9
J01DB05 (Cefadroxil)	28	0.0	0.0	0.1	0.0
J01DB06 (Cefazedone)	7	0.0	0.0	0.0	0.0
J01DB07 (Cefatrizine)	11	0.0	0.0	0.0	0.0
J01DB08 (Cefapirin)	2	0.0	0.0	0.0	0.0
J01DB09 (Cefradine)	59	0.1	0.0	0.2	0.1
J01DB10 (Cefacetrile)	2	0.0	0.0	0.0	0.0
J01DB11 (Cefroxadine)	3	0.0	0.0	0.0	0.0
J01DC (Second-generation cephalosporins)	7697	7.0	4.6	18.9	4.8
J01DC (Not specified)	8	0.0	0.0	0.0	0.0
J01DC01 (Cefoxitin)	642	0.6	0.1	2.5	0.6
J01DC02 (Cefuroxime)	6721	6.1	4.4	15.2	3.8
J01DC03 (Cefamandole)	31	0.0	0.0	0.1	0.1
J01DC04 (Cefaclor)	73	0.1	0.0	0.1	0.1
J01DC06 (Cefonicide)	64	0.1	0.0	0.3	0.0
J01DC07 (Cefotiam)	2	0.0	0.0	0.0	0.0
J01DC09 (Cefmetazole)	1	0.0	0.0	0.0	0.0
J01DC10 (Cefprozil)	13	0.0	0.0	0.0	0.0
J01DC11 (Ceforanide)	142	0.1	0.0	0.5	0.2
J01DD (Third-generation cephalosporins)	10569	9.6	9.6	9.7	9.9
J01DD01 (Cefotaxime)	1488	1.3	1.3	1.4	1.5
J01DD02 (Ceftazidime)	1412	1.3	1.3	1.2	1.2
J01DD03 (Cefsulodin)	2	0.0	0.0	0.0	0.0
J01DD04 (Ceftriaxone)	7026	6.4	6.4	6.3	6.6
J01DD05 (Cefmenoxime)	9	0.0	0.0	0.0	0.0
J01DD06 (Latamoxef)	1	0.0	0.0	0.0	0.0

	Total	%	Treatment (%)	Surgical prophyl-axis (%)	Medical prophyl-axis (%)
J01DD07 (Ceftizoxime)	48	0.0	0.0	0.1	0.0
J01DD08 (Cefixime)	113	0.1	0.1	0.1	0.1
J01DD09 (Cefodizime)	11	0.0	0.0	0.0	0.0
J01DD12 (Cefoperazone)	177	0.2	0.2	0.2	0.2
J01DD13 (Cefpodoxime)	10	0.0	0.0	0.0	0.0
J01DD14 (Ceftibuten)	13	0.0	0.0	0.0	0.0
J01DD16 (Cefditoren)	3	0.0	0.0	0.0	0.0
J01DD54 (Ceftriaxone, combinations)	102	0.1	0.1	0.2	0.1
J01DD62 (Cefoperazone, combinations)	154	0.1	0.1	0.2	0.1
J01DE (Fourth-generation cephalosporins)	316	0.3	0.3	0.1	0.3
J01DE01 (Cefepime)	309	0.3	0.3	0.1	0.2
J01DE02 (Cefpirome)	6	0.0	0.0	0.0	0.0
J01DE03 (Cefozopran)	1	0.0	0.0	0.0	0.0
J01DF (Monobactams)	106	0.1	0.1	0.0	0.0
J01DF01 (Aztreonam)	106	0.1	0.1	0.0	0.0
J01DH (Carbapenems)	4974	4.5	5.7	1.1	2.6
J01DH02 (Meropenem)	3521	3.2	4.1	0.6	1.7
J01DH03 (Ertapenem)	401	0.4	0.4	0.2	0.2
J01DH04 (Doripenem)	15	0.0	0.0	0.0	0.0
J01DH51 (Imipenem and enzyme inhibitor)	1037	0.9	1.2	0.3	0.7
J01DI (Other cephalosporins and penems)	6	0.0	0.0	0.0	0.0
J01DI01 (Ceftobiprole medocaril)	3	0.0	0.0	0.0	0.0
J01DI02 (Ceftaroline fosamil)	3	0.0	0.0	0.0	0.0
J01EA (Trimethoprim and derivatives)	1462	1.3	1.4	0.3	2.6
J01EA (Not specified)	21	0.0	0.0	0.0	0.1
J01EA01 (Trimethoprim)	1441	1.3	1.3	0.3	2.5
J01EB (Short-acting sulfonamides)	62	0.1	0.0	0.0	0.4
J01EB01 (Sulfaisodimidine)	1	0.0	0.0	0.0	0.0
J01EB02 (Sulfamethizole)	3	0.0	0.0	0.0	0.0
J01EB05 (Sulfafurazole)	1	0.0	0.0	0.0	0.0
J01EB06 (Sulfanilamide)	3	0.0	0.0	0.0	0.0
J01EB20 (Combinations of short-acting sulfonamides)	54	0.0	0.0	0.0	0.4
J01EC (Intermediate-acting sulfonamides)	89	0.1	0.1	0.0	0.2
J01EC01 (Sulfamethoxazole)	66	0.1	0.1	0.0	0.2
J01EC02 (Sulfadiazine)	14	0.0	0.0	0.0	0.0
J01EC03 (Sulfamoxole)	2	0.0	0.0	0.0	0.0
J01EC20 (Combinations of intermediate-acting sulfonamides)	7	0.0	0.0	0.0	0.0
J01ED (Long-acting sulfonamides)	19	0.0	0.0	0.0	0.0
J01ED01 (Sulfadimethoxine)	3	0.0	0.0	0.0	0.0
J01ED05 (Sulfamethoxypyridazine)	5	0.0	0.0	0.0	0.0
J01ED06 (Sulfaperin)	2	0.0	0.0	0.0	0.0
J01ED08 (Sulfaphenazole)	3	0.0	0.0	0.0	0.0
J01ED20 (Combinations of long-acting sulfonamides)	6	0.0	0.0	0.0	0.0
J01EE (Combinations of sulfonamides and trimethoprim, incl. derivatives)	1974	1.8	1.0	0.6	8.1
J01EE01 (Sulfamethoxazole and trimethoprim)	1729	1.6	0.9	0.6	7.0
J01EE02 (Sulfadiazine and trimethoprim)	129	0.1	0.1	0.0	0.7
J01EE03 (Sulfametrole and trimethoprim)	35	0.0	0.0	0.0	0.1
J01EE04 (Sulfamoxole and trimethoprim)	42	0.0	0.0	0.0	0.2
J01EE05 (Sulfadimidine and trimethoprim)	19	0.0	0.0	0.0	0.1
J01EE06 (Sulfadiazine and tetroxoprim)	5	0.0	0.0	0.0	0.0
J01EE07 (Sulfamerazine and trimethoprim)	15	0.0	0.0	0.0	0.1
J01FA (Macrolides)	3793	3.4	4.1	0.4	2.9
J01FA01 (Erythromycin)	434	0.4	0.2	0.1	0.6
J01FA02 (Spiramycin)	24	0.0	0.0	0.0	0.0

	Total	%	Treatment (%)	Surgical prophyl-axis (%)	Medical prophyl-axis (%)
J01FA03 (Midecamycin)	8	0.0	0.0	0.0	0.0
J01FA06 (Roxithromycin)	94	0.1	0.1	0.0	0.0
J01FA07 (Josamycin)	6	0.0	0.0	0.0	0.0
J01FA08 (Troleandomycin)	1	0.0	0.0	0.0	0.0
J01FA09 (Clarithromycin)	2371	2.1	2.9	0.2	0.6
J01FA10 (Azithromycin)	851	0.8	0.8	0.1	1.6
J01FA11 (Miocamycin)	3	0.0	0.0	0.0	0.0
J01FA15 (Telithromycin)	1	0.0	0.0	0.0	0.0
J01FF (Lincosamides)	2210	2.0	2.2	1.9	1.2
J01FF01 (Clindamycin)	2147	1.9	2.1	1.8	1.1
J01FF02 (Lincomycin)	63	0.1	0.1	0.1	0.0
J01FG (Streptogramins)	61	0.1	0.1	0.0	0.0
J01FG01 (Pristinamycin)	61	0.1	0.1	0.0	0.0
J01GA (Streptomycins)	27	0.0	0.0	0.0	0.0
J01GA (Not specified)	1	0.0	0.0	0.0	0.0
J01GA01 (Streptomycin (parenteral))	26	0.0	0.0	0.0	0.0
J01GB (Aminoglycosides)	6008	5.4	5.1	6.8	5.3
J01GB01 (Tobramycin)	496	0.4	0.4	0.3	0.9
J01GB03 (Gentamicin)	4116	3.7	3.4	5.4	3.2
J01GB04 (Kanamycin)	3	0.0	0.0	0.0	0.0
J01GB05 (Neomycin (injection, infusion))	1	0.0	0.0	0.0	0.0
J01GB06 (Amikacin)	1267	1.1	1.2	0.9	1.1
J01GB07 (Netilmicin)	117	0.1	0.1	0.2	0.1
J01GB08 (Sisomicin)	1	0.0	0.0	0.0	0.0
J01GB10 (Ribostamycin)	1	0.0	0.0	0.0	0.0
J01GB11 (Isepamicin)	5	0.0	0.0	0.0	0.0
J01GB12 (Arbekacin)	1	0.0	0.0	0.0	0.0
J01MA (Fluoroquinolones)	11951	10.8	11.5	6.0	13.1
J01MA01 (Ofloxacin)	316	0.3	0.3	0.2	0.2
J01MA02 (Ciprofloxacin)	7427	6.7	7.0	4.4	7.9
J01MA03 (Pefloxacin)	55	0.0	0.1	0.1	0.0
J01MA06 (Norfloxacin)	255	0.2	0.2	0.1	0.7
J01MA07 (Lomefloxacin)	1	0.0	0.0	0.0	0.0
J01MA08 (Fleroxacin)	1	0.0	0.0	0.0	0.0
J01MA11 (Grepafloxacin)	1	0.0	0.0	0.0	0.0
J01MA12 (Levofloxacin)	3190	2.9	3.1	1.1	3.9
J01MA13 (Trovafloxacin)	1	0.0	0.0	0.0	0.0
J01MA14 (Moxifloxacin)	700	0.6	0.8	0.1	0.3
J01MA15 (Gemifloxacin)	2	0.0	0.0	0.0	0.0
J01MA17 (Prulifloxacin)	2	0.0	0.0	0.0	0.0
J01MB (Other quinolones)	31	0.0	0.0	0.0	0.1
J01MB02 (Nalidixic acid)	5	0.0	0.0	0.0	0.0
J01MB03 (Piromidic acid)	3	0.0	0.0	0.0	0.0
J01MB04 (Pipemidic acid)	16	0.0	0.0	0.0	0.0
J01MB06 (Cinoxacin)	7	0.0	0.0	0.0	0.0
J01RA (Combinations of antibacterials)	352	0.3	0.3	0.4	0.5
J01RA (Not specified)	3	0.0	0.0	0.0	0.0
J01RA01 (Penicillins, combinations with other antibacterials)	164	0.1	0.1	0.1	0.3
J01RA02 (Sulfonamides, combinations with other antibacterials (excl. trimethoprim))	31	0.0	0.0	0.0	0.1
J01RA03 (Cefuroxime, combinations with other antibacterials)	151	0.1	0.1	0.3	0.1
J01RA04 (Spiramycin, combinations with other antibacterials)	3	0.0	0.0	0.0	0.0
J01XA (Glycopeptide antibacterials)	4149	3.8	4.3	2.7	2.1
J01XA01 (Vancomycin (parenteral))	2859	2.6	3.2	1.2	1.0
J01XA02 (Teicoplanin)	1288	1.2	1.1	1.5	1.1

	Total	%	Treatment (%)	Surgical prophyl-axis (%)	Medical prophyl-axis (%)
J01XA03 (Telavancin)	1	0.0	0.0	0.0	0.0
J01XA04 (Dalbavancin)	1	0.0	0.0	0.0	0.0
J01XB (Polymyxins)	539	0.5	0.6	0.0	0.5
J01XB01 (Colistin (injection, infusion))	530	0.5	0.6	0.0	0.5
J01XB02 (Polymyxin B)	9	0.0	0.0	0.0	0.0
J01XC (Steroid antibacterials)	125	0.1	0.1	0.0	0.0
J01XC01 (Fusidic acid)	125	0.1	0.1	0.0	0.0
J01XD (Imidazole derivatives)	5412	4.9	4.5	7.7	3.4
J01XD01 (Metronidazole (parenteral))	5375	4.9	4.4	7.6	3.4
J01XD02 (Tinidazole (parenteral))	1	0.0	0.0	0.0	0.0
J01XD03 (Ornidazole (parenteral))	36	0.0	0.0	0.0	0.0
J01XE (Nitrofuran derivatives)	734	0.7	0.7	0.1	1.4
J01XE01 (Nitrofurantoin)	698	0.6	0.7	0.1	1.3
J01XE02 (Nifurtoinol)	36	0.0	0.0	0.0	0.1
J01XX (Other antibacterials)	1085	1.0	1.2	0.2	0.8
J01XX (Not specified)	15	0.0	0.0	0.0	0.0
J01XX01 (Fosfomycin)	88	0.1	0.1	0.0	0.1
J01XX02 (Xibornol)	1	0.0	0.0	0.0	0.0
J01XX03 (Clofoctol)	4	0.0	0.0	0.0	0.0
J01XX04 (Spectinomycin)	1	0.0	0.0	0.0	0.0
J01XX05 (Methenamine)	33	0.0	0.0	0.0	0.2
J01XX07 (Nitroxoline)	21	0.0	0.0	0.0	0.0
J01XX08 (Linezolid)	719	0.7	0.8	0.1	0.3
J01XX09 (Daptomycin)	200	0.2	0.2	0.1	0.1
J01XX10 (Bacitracin)	3	0.0	0.0	0.0	0.0
J02AA (Antimycotics, antibiotics)	250	0.2	0.2	0.0	0.7
J02AA01 (Amphotericin B (parenteral))	250	0.2	0.2	0.0	0.7
J02AB (Imidazole derivatives)	70	0.1	0.1	0.0	0.1
J02AB01 (Miconazole)	23	0.0	0.0	0.0	0.0
J02AB02 (Ketoconazole)	47	0.0	0.0	0.0	0.1
J02AC (Triazole derivatives)	2921	2.6	2.3	0.2	7.9
J02AC01 (Fluconazole)	2380	2.2	2.0	0.2	5.5
J02AC02 (Itraconazole)	151	0.1	0.0	0.0	0.9
J02AC03 (Voriconazole)	252	0.2	0.2	0.0	0.7
J02AC04 (Posaconazole)	138	0.1	0.0	0.0	0.9
J02AX (Other antimycotics for systemic use)	399	0.4	0.4	0.0	0.6
J02AX01 (Flucytosine)	5	0.0	0.0	0.0	0.0
J02AX04 (Caspofungin)	211	0.2	0.2	0.0	0.2
J02AX05 (Micafungin)	55	0.0	0.0	0.0	0.1
J02AX06 (Anidulafungin)	73	0.1	0.1	0.0	0.1
J02AX10 (Not specified)	55	0.0	0.0	0.0	0.1
J04AB (Antimycobacterials, antibiotics)	825	0.7	1.0	0.0	0.2
J04AB02 (Rifampicin)	812	0.7	1.0	0.0	0.2
J04AB03 (Not specified)	8	0.0	0.0	0.0	0.0
J04AB04 (Rifabutin)	5	0.0	0.0	0.0	0.0
J04AC (Hydrazides)	282	0.3	0.3	0.0	0.2
J04AC01 (Isoniazid)	280	0.3	0.3	0.0	0.2
J04AC51 (Not specified)	2	0.0	0.0	0.0	0.0
J04AK (Other drugs for treatment of tuberculosis)	456	0.4	0.6	0.0	0.1
J04AK01 (Pyrazinamide)	210	0.2	0.3	0.0	0.1
J04AK02 (Ethambutol)	246	0.2	0.3	0.0	0.1
J04AM (Combinations of drugs for treatment of tuberculosis)	17	0.0	0.0	0.0	0.0
J04AM02 (Not specified)	2	0.0	0.0	0.0	0.0
J04AM03 (Not specified)	3	0.0	0.0	0.0	0.0
J04AM05 (Not specified)	11	0.0	0.0	0.0	0.0

	Total	%	Treatment (%)	Surgical prophyl-axis (%)	Medical prophyl-axis (%)
J04AM06 (Not specified)	1	0.0	0.0	0.0	0.0
P01AB (Nitroimidazole derivatives)	1783	1.6	1.8	0.9	1.0
P01AB01 (Metronidazole (oral, rectal))	1758	1.6	1.8	0.9	1.0
P01AB02 (Tinidazole (oral, rectal))	5	0.0	0.0	0.0	0.0
P01AB03 (Ornidazole (oral))	18	0.0	0.0	0.0	0.0
P01AB06 (Nimorazole)	1	0.0	0.0	0.0	0.0
P01AB07 (Secnidazole)	1	0.0	0.0	0.0	0.0

Table A1.7. National denominator data

Country	N of acute care hospitals	PPS national denominator data (TESSy)						Eurostat			
		All beds in acute care hospitals			Acute care beds only						
		N of hospital beds	N of discharges / year	N of patient days / year	N of hospital beds	N of discharges / year	N of patient-days / year	N of hospital beds, all	N of hospital beds, curative	N of discharges / year	N of patient-days / year
Austria	189	53 371	2 811 142	17 940 512	-	2 678 476	14 223 715	64 008	46 029	2 328 867	20 395 292
Belgium	194	51 798	1 799 836	14 776 653	44 274	1 771 738	12 845 100	70 170	44 871	1 841 652	12 832 663
Bulgaria	241	44 164	1 632 089	9 243 390	33 420	1 514 897	8 299 120	50 041	38 506	1 917 199	11 662 298
Croatia	60	15 640	602 731	5 001 746	15 640	602 731	5 001 746	24 831	15 546	762 560	7 466 240
Cyprus	8	-	-	-	-	-	-	2 958	2 769	-	-
Czech Republic	158	57 756	2 117 555	14 458 747	52 879	2 086 825	12 963 031	73 746	51 216	2 015 884	14 333 292
Denmark	52	13 779	1 277 608	4 329 146	13 779	1 277 608	4 329 146	19 405	15 895	950 213	4 900 763
Estonia	40	4 685	243 208	1 171 434	-	-	-	7 145	4 647	235 443	1 806 122
Finland	59	-	-	-	-	975 100	3 345 780	31 361	9 601	973 943	11 291 791
France	1558	314 598	13 560 546	123 246 648	223 289	11 915 797	60 864 368	416 710	224 385	10 936 718	61 964 456
Germany	1736	461 022	17 388 244	127 799 952	-	-	-	674 473	462 457	19 621 208	186 799 040
Greece	137	35 120	2 344 992	9 312 024	-	-	-	54 704	45 729	-	-
Hungary	108	69 466	2 379 172	18 351 908	46 634	-	-	71 818	41 421	2 018 659	13 002 051
Iceland	8	1 046	46 595	269 498	-	-	-	1 802	-	45 010	260 870
Ireland	60	12 398	171 996	994 363	-	-	-	14 046	10 226	-	-
Italy	1023	226 095	11 277 742	71 904 064	198 232	7 374 765	49 672 176	213 187	171 376	8 185 552	62 576 104
Latvia	17	6 975	183 584	1 961 514	-	-	-	11 920	7 503	-	-
Lithuania	92	20 867	769 364	5 671 099	16 201	724 228	4 293 377	22 190	16 359	736 013	5 851 404
Luxembourg	9	2 377	102 333	656 225	2 302	101 694	629 164	2 721	2 112	-	-
Malta	3	1 339	64 556	373 502	999	59 443	306 732	1 874	1 119	57 054	425 858
Netherlands	96	-	-	-	46 515	1 720 000	9 100 000	76 980	50 095	1 983 382	11 035 536
Norway	60	16 282	878 000	4 991 102	11 393	-	-	16 117	11 602	856 870	3 828 510
Poland	795	181 077	7 911 536	44 871 400	161 454	7 419 229	39 007 900	251 456	166 646	6 152 077	46 818 472
Portugal	101	24 773	1 104 424	6 947 955	-	-	-	35 601	29 404	1 679 921	5 582 019
Romania	311	111 725	4 238 839	32 330 850	-	-	-	134 736	92 777	4 633 328	34 771 656
Slovakia	112	31 217	989 666	7 656 314	24 229	891 095	5 714 801	34 850	25 693	1 012 831	7 594 373
Slovenia	21	7 826	370 243	2 056 421	7 475	-	-	9 367	7 545	350 966	2 557 323
Spain	550	117 504	5 124 968	32 420 552	-	-	-	145 459	113 123	-	-
Sweden	80	-	1 531 244	7 971 146	21 041	1 366 712	5 900 025	25 566	18 947	1 524 000	9 191 819
UK-England	253	-	11 198 966	37 813 100	100 878	11 198 966	37 813 100	196 103	158 928	-	-
UK-N Ireland	16	4 985	294 538	1 382 797	4 585	270 904	1 272 173	7 276	4 255	-	-
UK-Scotland	52	16 537	975 205	5 114 683	16 537	975 205	5 114 683	24 916	19 025	-	-
UK-Wales	89	-	-	-	-	-	-	12 868	9 952	-	-

-=no data;

Eurostat data from: Health care resources (non-expenditure data). Reference Metadata in Euro SDMX Metadata Structure (ESMS). Available from http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/hlth_res_esms.htm; data are given for the last available year (majority from 2010 or 2011).

Annex 2
Country summary sheets

Austria

PPS data from 25/04/2012 to 19/11/2012

Number of hospitals	9
Standard protocol	9
Light protocol	0
Number of patients	4321

Comments

Data representativeness: poor

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	4	44.4
Secondary	2	22.2
Tertiary	3	33.3
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	450	[172-1106]
Average length of stay (days)*	5.3	[4.9-6.4]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	268
HAI prevalence % (95%CI)	**6.2 (4.2-9.1)**
N of HAIs	287
N of HAIs per infected patient	1.07
N HAIs with microorganism (%)	135 (47.0)
Total N of reported microorg.	176

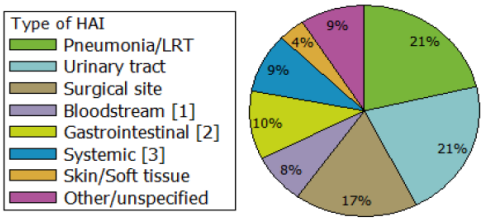
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	35	12.2	33	0.8
Origin of HAI=Same hospital	7	20	6	0.1
Origin of HAI=Other hospital	25	71.4	24	0.6
Origin of HAI=Other/unknown	3	8.6	3	0.1
HAI during current hospitalisation	249	86.8	232	5.4
Missing	3	1		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (3.5%)
[2] incl. *C. difficile* infections (5.9%)
[3] incl. clinical sepsis (6.6%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	1586	36.7	105	6.6
Medicine	1745	40.4	95	5.4
Paediatrics	92	2.1	0	0.0
Intensive care*	234	5.4	49	20.9
Obstetrics and gynaecology	341	7.9	5	1.5
Geriatrics	0	0	0	—
Psychiatry	147	3.4	2	1.4
Rehabilitation/Other	176	4.1	12	6.8
All specialties	4321	100	268	6.2

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

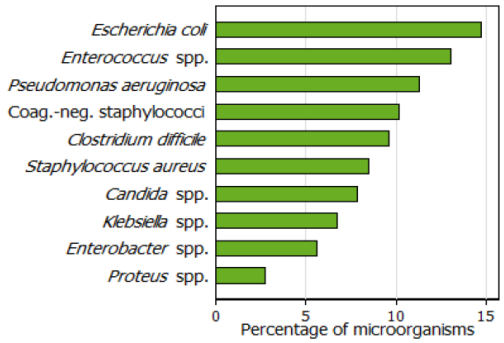


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	15	13	7	53.8
Enterococci / VRE	23	20	0	0.0
Enterococcus faecalis / VAN-R	11	9	0	—
Enterococcus faecium / VAN-R	10	9	0	—
Enterobacteriaceae / 3GC-NS	59	50	11	22.0
Escherichia coli / 3GC-NS	26	23	7	30.4
Klebsiella spp. / 3GC-NS	12	11	2	18.2
Enterobacter spp. / 3GC-NS	10	8	1	—
Enterobacteriaceae / CAR-NS	59	50	2	4.0
Escherichia coli / CAR-NS	26	23	2	8.7
Klebsiella spp. / CAR-NS	12	11	0	0.0
Enterobacter spp. / CAR-NS	10	8	0	—
Pseudomonas aeruginosa / CAR-NS	20	19	2	10.5
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Austria (continued)

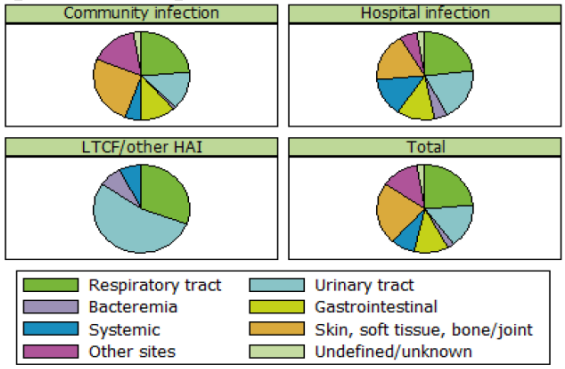
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	1425	
AU prevalence % (95%CI)	33.0 (28.9-37.4)	
N of antimicrobials	1792	
N of antimicrobials per patient	1.26	
	N	Rel%
Reason in patient charts/notes, Yes	1233	68.8
Reason in patient charts/notes, No	541	30.2
Reason in patient charts/notes, Unknown	18	1
Route of administration, Parenteral	1302	72.7
Route of administration, Oral	489	27.3
Route of administration, Other/unknown	1	0.1

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

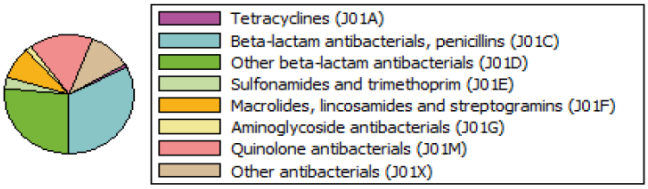


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	1586	36.7	618	39.0
Medicine	1745	40.4	512	29.3
Paediatrics	92	2.1	8	8.7
Intensive care*	234	5.4	159	67.9
Obstetrics and gynaecology	341	7.9	79	23.2
Geriatrics	0	0.0	0	—
Psychiatry	147	3.4	4	2.7
Rehabilitation/Other	176	4.1	45	25.6
All specialties	4321	100	1425	33.0

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty

*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	897	20.8	1157	64.6
Community infection	615	14.2	760	42.4
Hospital infection	278	6.4	384	21.4
Long-term care/other HAI	13	0.3	13	0.7
Surgical prophylaxis	354	8.2	394	22.0
Single dose	53	1.2	61	3.4
One day	28	0.6	29	1.6
>1 day	277	6.4	304	17.0
Medical prophylaxis	138	3.2	162	9.0
Other indication	15	0.3	24	1.3
Unknown	51	1.2	56	3.1

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

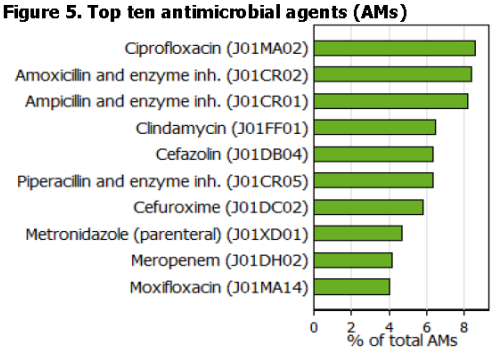


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	2010	46.5	127	6.3	765	38.1
Age, <1 year	152	3.5	5	3.3	33	21.7
Age, 1-44 years	908	21.0	33	3.6	295	32.5
Age, ≥45 years	3261	75.5	230	7.1	1097	33.6
Length of stay, 1-3 days	1316	30.5	24	1.8	354	26.9
Length of stay, 4-7 days	1094	25.3	59	5.4	420	38.4
Length of stay, 8-14 days	934	21.6	73	7.8	329	35.2
Length of stay, ≥15 days	974	22.5	111	11.4	321	33.0
Length of stay, Missing/Unknown	3	0.1	1	33.3	1	33.3
McCabe score, Non-fatal	2997	69.4	100	3.3	872	29.1
McCabe score, Ultimately fatal	913	21.1	113	12.4	370	40.5
McCabe score, Rapidly fatal	246	5.7	35	14.2	112	45.5
McCabe score, Missing/Unknown	165	3.8	20	12.1	71	43.0
Surgery since hospital admission	1414	32.7	138	9.8	604	42.7
Central vascular catheter	548	12.7	114	20.8	336	61.3
Peripheral vascular catheter	2097	48.5	140	6.7	908	43.3
Urinary catheter	749	17.3	106	14.2	458	61.1
Intubation	91	2.1	24	26.4	72	79.1
Total	4321	100.0	268	6.2	1425	33.0

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Belgium

PPS data from 21/09/2011 to 29/12/2011

Number of hospitals	52
Standard protocol	52
Light protocol	0
Number of patients	13758

Comments

Data representativeness: good

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	16	30.8
Secondary	22	42.3
Tertiary	13	25
Specialised	1	1.9
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	275	[199- 525]
Average length of stay (days)*	7.7	[6.7-8.8]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	980
HAI prevalence % (95%CI)	**7.1 (6.1-8.3)**
N of HAIs	1086
N of HAIs per infected patient	1.11
N HAIs with microorganism (%)	703 (64.7)
Total N of reported microorg.	904

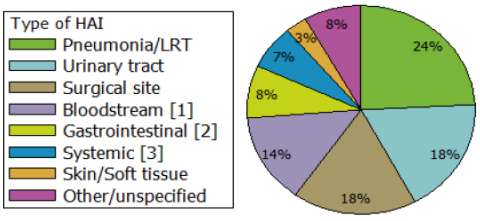
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	151	13.9	136	1
Origin of HAI=Same hospital	98	64.9	87	0.6
Origin of HAI=Other hospital	43	28.5	40	0.3
Origin of HAI=Other/unknown	10	6.6	9	0.1
HAI during current hospitalisation	934	86	843	6.1
Missing	1	0.1		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (4.4%)
[2] incl. *C. difficile* infections (3.4%)
[3] incl. clinical sepsis (5.8%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	3459	25.1	291	8.4
Medicine	4596	33.4	311	6.8
Paediatrics	747	5.4	18	2.4
Intensive care*	797	5.8	162	20.3
Obstetrics and gynaecology	1057	7.7	10	0.9
Geriatrics	2048	14.9	171	8.3
Psychiatry	945	6.9	12	1.3
Rehabilitation/Other	109	0.8	5	4.6
All specialties	13758	100	980	7.1

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

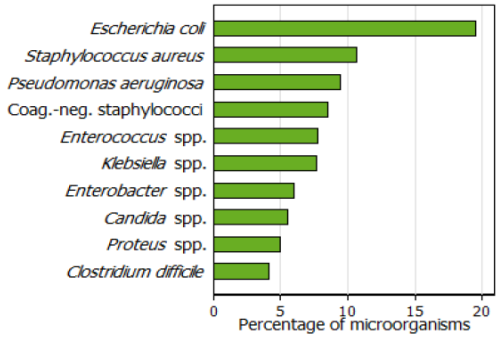


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	97	95	35	36.8
Enterococci / VRE	71	56	2	3.6
Enterococcus faecalis / VAN-R	43	34	0	0.0
Enterococcus faecium / VAN-R	13	11	2	18.2
Enterobacteriaceae / 3GC-NS	382	333	74	22.2
Escherichia coli / 3GC-NS	177	160	22	13.8
Klebsiella spp. / 3GC-NS	70	63	18	28.6
Enterobacter spp. / 3GC-NS	55	51	26	51.0
Enterobacteriaceae / CAR-NS	382	333	4	1.2
Escherichia coli / CAR-NS	177	160	2	1.3
Klebsiella spp. / CAR-NS	70	63	1	1.6
Enterobacter spp. / CAR-NS	55	51	0	0.0
Pseudomonas aeruginosa / CAR-NS	86	76	13	17.1
Acinetobacter baumannii / CAR-NS	1	1	1	.

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Belgium (continued)

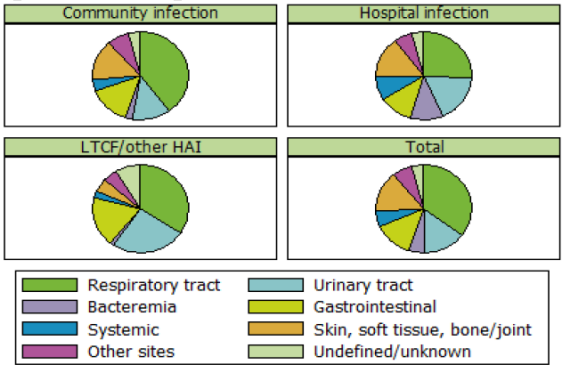
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	3974	
AU prevalence % (95%CI)	28.9 (26.8-31.1)	
N of antimicrobials	4962	
N of antimicrobials per patient	1.25	
	N	Rel%
Reason in patient charts/notes, Yes	3659	73.7
Reason in patient charts/notes, No	1134	22.9
Reason in patient charts/notes, Unknown	169	3.4
Route of administration, Parenteral	3322	66.9
Route of administration, Oral	1618	32.6
Route of administration, Other/unknown	22	0.4

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

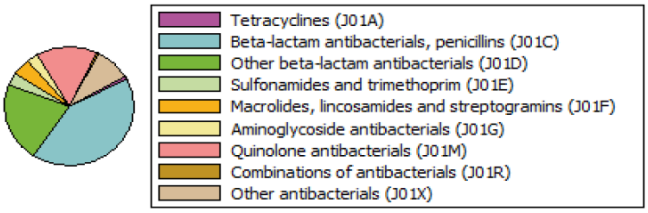


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	3459	25.1	1115	32.2
Medicine	4596	33.4	1558	33.9
Paediatrics	747	5.4	218	29.2
Intensive care*	797	5.8	427	53.6
Obstetrics and gynaecology	1057	7.7	83	7.9
Geriatrics	2048	14.9	522	25.5
Psychiatry	945	6.9	31	3.3
Rehabilitation/Other	109	0.8	20	18.3
All specialties	13758	100	3974	28.9

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty

*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	3079	22.4	3801	76.6
Community infection	2015	14.6	2406	48.5
Hospital infection	1019	7.4	1308	26.4
Long-term care/other HAI	80	0.6	89	1.8
Surgical prophylaxis	553	4.0	586	11.8
Single dose	216	1.6	220	4.4
One day	158	1.1	161	3.2
>1 day	186	1.4	205	4.1
Medical prophylaxis	367	2.7	449	9.0
Other indication	54	0.4	57	1.1
Unknown	61	0.4	70	1.4

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

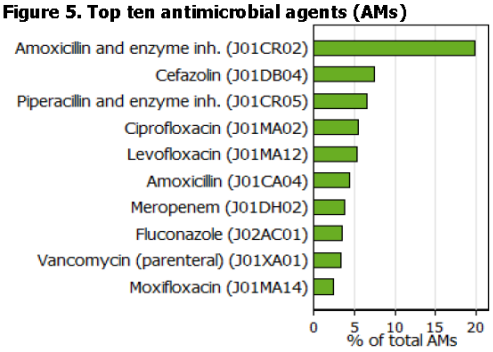


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	6080	44.2	508	8.4	2028	33.4
Age, <1 year	892	6.5	43	4.8	146	16.4
Age, 1-44 years	2877	20.9	105	3.6	774	26.9
Age, ≥45 years	9989	72.6	832	8.3	3054	30.6
Length of stay, 1-3 days	4177	30.4	89	2.1	1051	25.2
Length of stay, 4-7 days	3345	24.3	227	6.8	1066	31.9
Length of stay, 8-14 days	2756	20.0	236	8.6	922	33.5
Length of stay,≥15 days	3430	24.9	423	12.3	920	26.8
Length of stay, Missing/Unknown	50	0.4	5	10.0	15	30.0
McCabe score, Non-fatal	8622	62.7	416	4.8	2212	25.7
McCabe score, Ultimately fatal	2107	15.3	231	11.0	728	34.6
McCabe score, Rapidly fatal	803	5.8	110	13.7	319	39.7
McCabe score, Missing/Unknown	2226	16.2	223	10.0	715	32.1
Surgery since hospital admission	3982	28.9	461	11.6	1419	35.6
Central vascular catheter	1859	13.5	420	22.6	1074	57.8
Peripheral vascular catheter	4712	34.2	388	8.2	2184	46.3
Urinary catheter	1795	13.0	333	18.6	950	52.9
Intubation	302	2.2	108	35.8	225	74.5
Total	13758	100.0	980	7.1	3974	28.9

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Bulgaria

PPS data from 02/05/2012 to 29/06/2012

Number of hospitals	42
Standard protocol	42
Light protocol	0
Number of patients	8952

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	6	14.3
Secondary	21	50
Tertiary	12	28.6
Specialised	3	7.1
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	315	[263-435]
Average length of stay (days)*	5.6	[4.9-6.1]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	332
HAI prevalence % (95%CI)	**3.7 (2.8-5.0)**
N of HAIs	352
N of HAIs per infected patient	1.06
N HAIs with microorganism (%)	212 (60.2)
Total N of reported microorg.	258

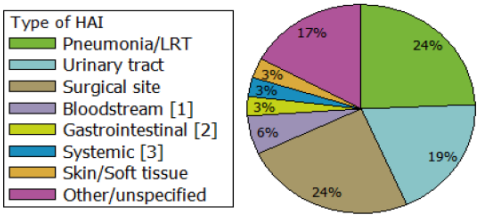
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	36	10.2	35	0.4
Origin of HAI=Same hospital	15	41.7	15	0.2
Origin of HAI=Other hospital	19	52.8	18	0.2
Origin of HAI=Other/unknown	2	5.6	2	0
HAI during current hospitalisation	313	88.9	294	3.3
Missing	3	0.9		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (2.8%)
[2] incl. *C. difficile* infections (0.0%)
[3] incl. clinical sepsis (2.8%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2738	30.6	139	5.1
Medicine	4000	44.7	75	1.9
Paediatrics	1020	11.4	25	2.5
Intensive care*	489	5.5	84	17.2
Obstetrics and gynaecology	577	6.4	8	1.4
Geriatrics	0	0	0	—
Psychiatry	99	1.1	1	1.0
Rehabilitation/Other	29	0.3	0	0.0
All specialties	8952	100	332	3.7

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

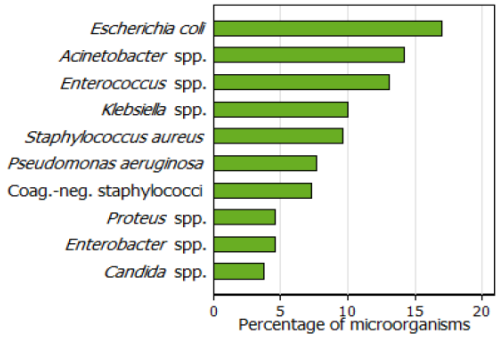


Table 6. Percentage of antimicrobial resistance for selected microorganism-antimicrobial combinations

Microorganism /Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	25	23	4	17.4
Enterococci / VRE	34	24	1	4.2
Enterococcus faecalis / VAN-R	22	17	0	0.0
Enterococcus faecium / VAN-R	9	6	1	—
Enterobacteriaceae / 3GC-NS	101	79	34	43.0
Escherichia coli / 3GC-NS	44	35	13	37.1
Klebsiella spp. / 3GC-NS	26	22	15	68.2
Enterobacter spp. / 3GC-NS	12	7	2	—
Enterobacteriaceae / CAR-NS	101	79	4	5.1
Escherichia coli / CAR-NS	44	35	2	5.7
Klebsiella spp. / CAR-NS	26	22	0	0.0
Enterobacter spp. / CAR-NS	12	7	1	—
Pseudomonas aeruginosa / CAR-NS	20	16	1	6.3
Acinetobacter baumannii / CAR-NS	31	28	20	71.4

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Bulgaria (continued)

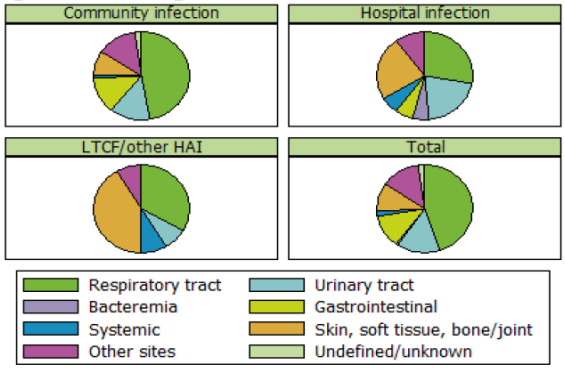
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	3799	
AU prevalence % (95%CI)	42.4 (38.7-46.3)	
N of antimicrobials	4720	
N of antimicrobials per patient	1.24	
	N	Rel%
Reason in patient charts/notes, Yes	4624	98
Reason in patient charts/notes, No	86	1.8
Reason in patient charts/notes, Unknown	10	0.2
Route of administration, Parenteral	4245	89.9
Route of administration, Oral	462	9.8
Route of administration, Other/unknown	13	0.3

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2738	30.6	1402	51.2
Medicine	4000	44.7	1222	30.6
Paediatrics	1020	11.4	634	62.2
Intensive care*	489	5.5	357	73.0
Obstetrics and gynaecology	577	6.4	184	31.9
Geriatrics	0	0.0	0	—
Psychiatry	99	1.1	0	0.0
Rehabilitation/Other	29	0.3	0	0.0
All specialties	8952	100	3799	42.4

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	2419	27.0	3040	64.4
Community infection	2152	24.0	2660	56.4
Hospital infection	265	3.0	367	7.8
Long-term care/other HAI	12	0.1	13	0.3
Surgical prophylaxis	894	10.0	1037	22.0
Single dose	96	1.1	98	2.1
One day	109	1.2	115	2.4
>1 day	692	7.7	824	17.5
Medical prophylaxis	487	5.4	590	12.5
Other indication	36	0.4	41	0.9
Unknown	12	0.1	14	0.3

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

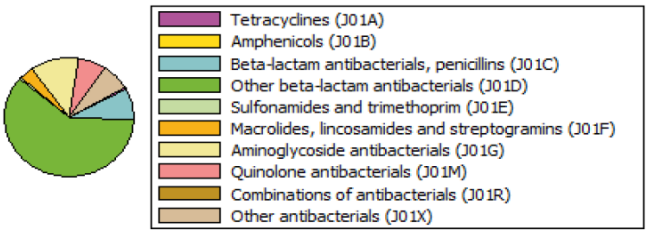


Figure 5. Top ten antimicrobial agents (AMs)

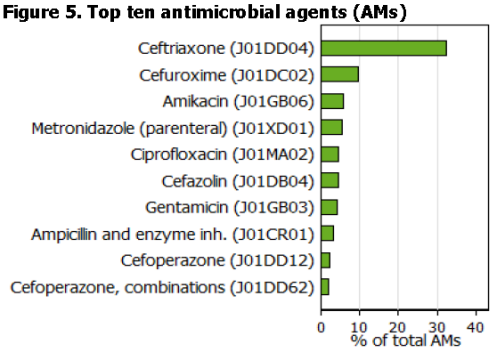


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	4296	48.0	181	4.2	1963	45.7
Age, <1 year	703	7.9	35	5.0	392	55.8
Age, 1-44 years	2388	26.7	48	2.0	1143	47.9
Age, ≥45 years	5861	65.5	249	4.2	2264	38.6
Length of stay, 1-3 days	4047	45.2	68	1.7	1282	31.7
Length of stay, 4-7 days	3039	33.9	136	4.5	1504	49.5
Length of stay, 8-14 days	1392	15.5	74	5.3	761	54.7
Length of stay, ≥15 days	471	5.3	54	11.5	251	53.3
Length of stay, Missing/Unknown	3	0.0	0	0.0	1	33.3
McCabe score, Non-fatal	7319	81.8	164	2.2	3049	41.7
McCabe score, Ultimately fatal	922	10.3	90	9.8	409	44.4
McCabe score, Rapidly fatal	272	3.0	41	15.1	157	57.7
McCabe score, Missing/Unknown	439	4.9	37	8.4	184	41.9
Surgery since hospital admission	2188	24.4	180	8.2	1431	65.4
Central vascular catheter	265	3.0	65	24.5	225	84.9
Peripheral vascular catheter	5612	62.7	268	4.8	3170	56.5
Urinary catheter	1113	12.4	168	15.1	822	73.9
Intubation	176	2.0	50	28.4	157	89.2
Total	8952	100.0	332	3.7	3799	42.4

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Croatia

PPS data from 16/10/2012 to 23/11/2012

Number of hospitals	11
Standard protocol	6
Light protocol	5
Number of patients	4923

Comments

Data representativeness: poor

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	0	0
Secondary	6	54.5
Tertiary	3	27.3
Specialised	2	18.2
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	488	[249-600]
Average length of stay (days)*	6.6	[5.9-8.4]

*Hospital statistics of year preceding PPS

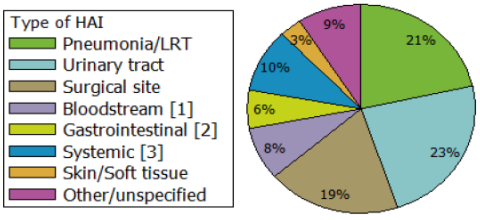
II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	281
HAI prevalence % (95%CI)	**5.7 (4.7-7.0)**
N of HAIs	317
N of HAIs per infected patient	1.13
N HAIs with microorganism (%)	175 (55.2)
Total N of reported microorg.	227

N=number

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (4.1%)
[2] incl. *C. difficile* infections (2.2%)
[3] incl. clinical sepsis (4.1%)
LRT=Lower respiratory tract

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	74	23.3	71	1.4
Origin of HAI=Same hospital	36	48.6	35	0.7
Origin of HAI=Other hospital	33	44.6	31	0.6
Origin of HAI=Other/unknown	5	6.8	5	0.1
HAI during current hospitalisation	242	76.3	209	4.2
Missing	1	0.3		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	1362	27.7	86	6.3
Medicine	1964	39.9	104	5.3
Paediatrics	306	6.2	10	3.3
Intensive care*	379	7.7	74	19.5
Obstetrics and gynaecology	493	10	3	0.6
Geriatrics	0	0	0	—
Psychiatry	263	5.3	0	0.0
Rehabilitation/Other	156	3.2	4	2.6
All specialties	4923	100	281	5.7

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

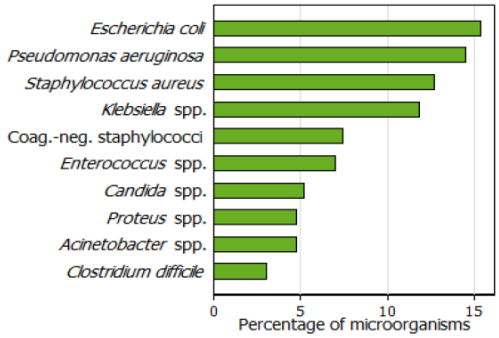


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	29	22	11	50.0
Enterococci / VRE	16	13	1	7.7
Enterococcus faecalis / VAN-R	11	9	1	—
Enterococcus faecium / VAN-R	5	4	0	—
Enterobacteriaceae / 3GC-NS	85	64	25	39.1
Escherichia coli / 3GC-NS	35	24	4	16.7
Klebsiella spp. / 3GC-NS	27	23	15	65.2
Enterobacter spp. / 3GC-NS	7	6	2	—
Enterobacteriaceae / CAR-NS	85	64	0	0.0
Escherichia coli / CAR-NS	35	24	0	0.0
Klebsiella spp. / CAR-NS	27	23	0	0.0
Enterobacter spp. / CAR-NS	7	6	0	—
Pseudomonas aeruginosa / CAR-NS	33	28	11	39.3
Acinetobacter baumannii / CAR-NS	10	9	8	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Croatia (continued)

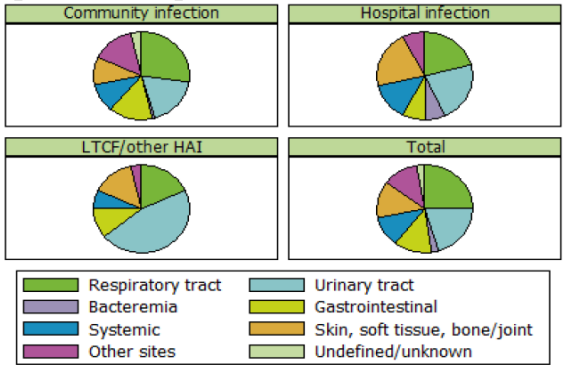
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	1573	
AU prevalence % (95%CI)	32.0 (26.3-38.3)	
N of antimicrobials	2225	
N of antimicrobials per patient	1.41	
	N	Rel%
Reason in patient charts/notes, Yes	1730	77.8
Reason in patient charts/notes, No	400	18
Reason in patient charts/notes, Unknown	95	4.3
Route of administration, Parenteral	1674	75.2
Route of administration, Oral	547	24.6
Route of administration, Other/unknown	4	0.2

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

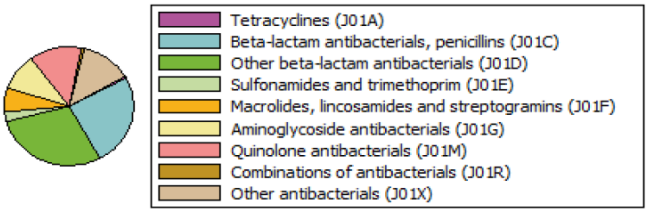


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	1362	27.7	485	35.6
Medicine	1964	39.9	724	36.9
Paediatrics	306	6.2	84	27.5
Intensive care*	379	7.7	182	48.0
Obstetrics and gynaecology	493	10.0	84	17.0
Geriatrics	0	0.0	0	—
Psychiatry	263	5.3	4	1.5
Rehabilitation/Other	156	3.2	10	6.4
All specialties	4923	100	1573	32.0

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1063	21.6	1519	68.3
Community infection	769	15.6	1058	47.6
Hospital infection	282	5.7	419	18.8
Long-term care/other HAI	28	0.6	42	1.9
Surgical prophylaxis	319	6.5	422	19.0
Single dose	71	1.4	79	3.6
One day	50	1.0	59	2.7
>1 day	198	4.0	284	12.8
Medical prophylaxis	169	3.4	211	9.5
Other indication	12	0.2	16	0.7
Unknown	47	1.0	57	2.6

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

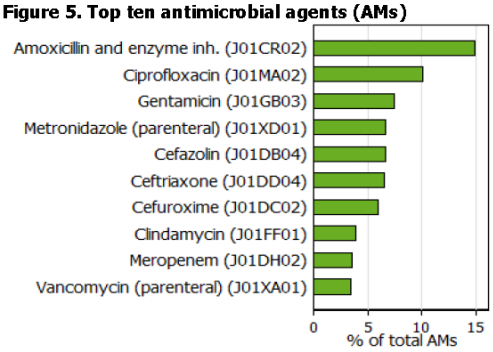


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	1160	48.8	78	6.7	446	38.4
Age, <1 year	129	5.4	10	7.8	32	24.8
Age, 1-44 years	601	25.3	18	3.0	203	33.8
Age, ≥45 years	1648	69.3	115	7.0	624	37.9
Length of stay, 1-3 days	683	28.7	7	1.0	199	29.1
Length of stay, 4-7 days	750	31.5	44	5.9	308	41.1
Length of stay, 8-14 days	590	24.8	47	8.0	218	36.9
Length of stay, ≥15 days	352	14.8	45	12.8	133	37.8
Length of stay, Missing/Unknown	3	0.1	0	0.0	1	33.3
McCabe score, Non fatal	1787	75.1	84	4.7	575	32.2
McCabe score, Ultimately fatal	438	18.4	43	9.8	211	48.2
McCabe score, Rapidly fatal	108	4.5	12	11.1	55	50.9
McCabe score, Missing/Unknown	45	1.9	4	8.9	18	40.0
Surgery since hospital admission	586	24.6	52	8.9	278	47.4
Central vascular catheter	123	5.2	36	29.3	86	69.9
Peripheral vascular catheter	970	40.8	80	8.2	575	59.3
Urinary catheter	364	15.3	68	18.7	237	65.1
Intubation	68	2.9	22	32.4	46	67.6
Total	2378	100.0	143	6.0	859	36.1

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Cyprus

PPS data from 17/10/2011 to 26/10/2011

Number of hospitals	8
Standard protocol	8
Light protocol	0
Number of patients	1037

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	2	25
Secondary	5	62.5
Tertiary	1	12.5
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	169	[56-290]
Average length of stay (days)*	4.9	[2.7-6.4]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	67
HAI prevalence % (95%CI)	**6.5 (4.8-8.6)**
N of HAIs	79
N of HAIs per infected patient	1.18
N HAIs with microorganism (%)	40 (50.6)
Total N of reported microorg.	51

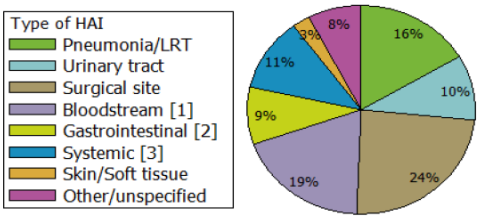
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	12	15.2	11	1.1
Origin of HAI=Same hospital	11	91.7	10	1
Origin of HAI=Other hospital	1	8.3	1	0.1
Origin of HAI=Other/unknown	0	0	0	0
HAI during current hospitalisation	67	84.8	56	5.4
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (16.5%)
[2] incl. *C. difficile* infections (2.5%)
[3] incl. clinical sepsis (11.4%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	368	35.5	26	7.1
Medicine	349	33.7	16	4.6
Paediatrics	62	6	1	1.6
Intensive care*	107	10.3	22	20.6
Obstetrics and gynaecology	139	13.4	2	1.4
Geriatrics	1	0.1	0	0.0
Psychiatry	11	1.1	0	0.0
Rehabilitation/Other	0	0	0	—
All specialties	1037	100	67	6.5

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

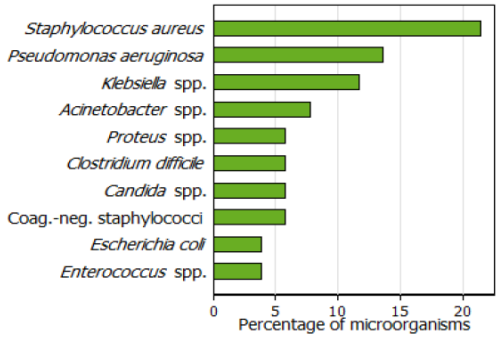


Table 6. Percentage of antimicrobial resistance for selected microorganism-antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	11	11	10	90.9
Enterococci / VRE	2	2	0	—
Enterococcus faecalis / VAN-R	1	1	0	—
Enterococcus faecium / VAN-R	1	1	0	—
Enterobacteriaceae / 3GC-NS	15	12	5	41.7
Escherichia coli / 3GC-NS	2	2	1	—
Klebsiella spp. / 3GC-NS	6	5	3	—
Enterobacter spp. / 3GC-NS	1	1	1	—
Enterobacteriaceae / CAR-NS	15	12	0	0.0
Escherichia coli / CAR-NS	2	2	0	—
Klebsiella spp. / CAR-NS	6	5	0	—
Enterobacter spp. / CAR-NS	1	1	0	—
Pseudomonas aeruginosa / CAR-NS	7	7	5	—
Acinetobacter baumannii / CAR-NS	4	4	3	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Cyprus (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	469	
AU prevalence % (95%CI)	45.2 (40.2-50.4)	
N of antimicrobials	719	
N of antimicrobials per patient	1.53	
	N	Rel%
Reason in patient charts/notes, Yes	639	88.9
Reason in patient charts/notes, No	73	10.2
Reason in patient charts/notes, Unknown	7	1
Route of administration, Parenteral	601	83.6
Route of administration, Oral	116	16.1
Route of administration, Other/unknown	2	0.3

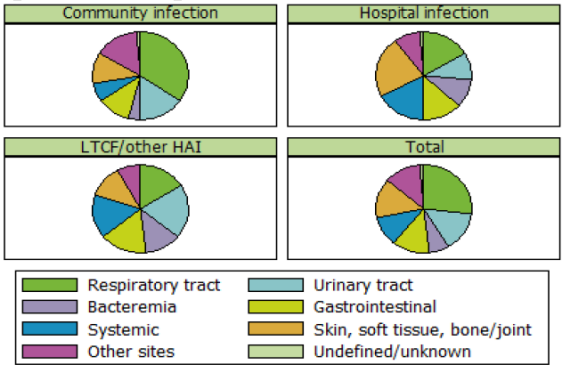
N=Number, Rel%=percentage of total N of antimicrobials

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	368	35.5	196	53.3
Medicine	349	33.7	161	46.1
Paediatrics	62	6.0	20	32.3
Intensive care*	107	10.3	55	51.4
Obstetrics and gynaecology	139	13.4	36	25.9
Geriatrics	1	0.1	1	100.0
Psychiatry	11	1.1	0	0.0
Rehabilitation/Other	0	0.0	0	—
All specialties	1037	100	469	45.2

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	205	19.8	316	43.9
Community infection	129	12.4	176	24.5
Hospital infection	57	5.5	104	14.5
Long-term care/other HAI	22	2.1	36	5.0
Surgical prophylaxis	173	16.7	240	33.4
Single dose	29	2.8	37	5.1
One day	18	1.7	20	2.8
>1 day	128	12.3	183	25.5
Medical prophylaxis	101	9.7	162	22.5
Other indication	1	0.1	1	0.1
Unknown	0	0.0	0	0.0

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

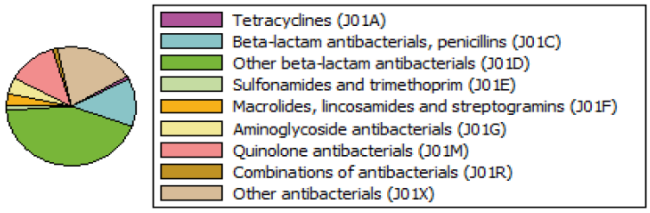


Figure 5. Top ten antimicrobial agents (AMs)

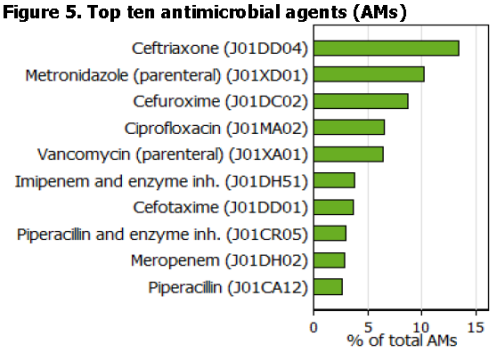


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	523	50.4	38	7.3	269	51.4
Age, <1 year	91	8.8	8	8.8	28	30.8
Age, 1-44 years	288	27.8	12	4.2	122	42.4
Age, ≥45 years	658	63.5	47	7.1	319	48.5
Length of stay, 1-3 days	336	32.4	10	3.0	118	35.1
Length of stay, 4-7 days	357	34.4	13	3.6	165	46.2
Length of stay, 8-14 days	199	19.2	22	11.1	108	54.3
Length of stay, ≥15 days	137	13.2	19	13.9	74	54.0
Length of stay, Missing/Unknown	8	0.8	3	37.5	4	50.0
McCabe score, Non fatal	642	61.9	31	4.8	266	41.4
McCabe score, Ultimately fatal	87	8.4	14	16.1	53	60.9
McCabe score, Rapidly fatal	59	5.7	6	10.2	42	71.2
McCabe score, Missing/Unknown	249	24.0	16	6.4	108	43.4
Surgery since hospital admission	341	32.9	33	9.7	206	60.4
Central vascular catheter	68	6.6	21	30.9	54	79.4
Peripheral vascular catheter	664	64.0	46	6.9	384	57.8
Urinary catheter	279	26.9	36	12.9	193	69.2
Intubation	34	3.3	17	50.0	29	85.3
Total	1037	100.0	67	6.5	469	45.2

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Czech Republic

PPS data from 02/05/2012 to 26/06/2012

Number of hospitals	14
Standard protocol	14
Light protocol	0
Number of patients	3774

Comments

The total number of hospitals included in the representative sample for the Czech Republic (n=28) could not be included because of a recent law (published in April 2012) limiting access to patient files in hospitals by external public health staff.
Data representativeness: poor

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	4	28.6
Secondary	4	28.6
Tertiary	6	42.9
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	364	[300-945]
Average length of stay (days)*	7	[5.6-7.7]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	175
HAI prevalence % (95%CI)	**4.6 (3.4-6.3)**
N of HAIs	192
N of HAIs per infected patient	1.1
N HAIs with microorganism (%)	146 (76.0)
Total N of reported microorg.	177

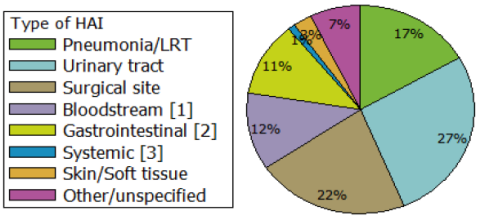
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	35	18.2	32	0.8
Origin of HAI=Same hospital	20	57.1	17	0.5
Origin of HAI=Other hospital	13	37.1	13	0.3
Origin of HAI=Other/unknown	2	5.7	2	0.1
HAI during current hospitalisation	152	79.2	139	3.7
Missing	5	2.6		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (4.7%)
[2] incl. *C. difficile* infections (6.8%)
[3] incl. clinical sepsis (1.0%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	1335	35.4	53	4.0
Medicine	1438	38.1	59	4.1
Paediatrics	244	6.5	2	0.8
Intensive care*	329	8.7	48	14.6
Obstetrics and gynaecology	227	6	3	1.3
Geriatrics	0	0	0	—
Psychiatry	63	1.7	0	0.0
Rehabilitation/Other	138	3.7	10	7.2
All specialties	3774	100	175	4.6

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

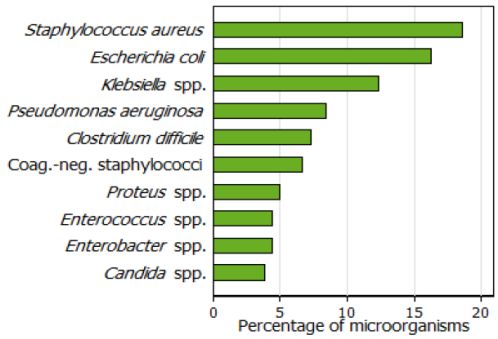


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	33	29	7	24.1
Enterococci / VRE	8	8	0	—
Enterococcus faecalis / VAN-R	7	7	0	—
Enterococcus faecium / VAN-R	1	1	0	—
Enterobacteriaceae / 3GC-NS	71	63	16	25.4
Escherichia coli / 3GC-NS	29	25	3	12.0
Klebsiella spp. / 3GC-NS	22	20	10	50.0
Enterobacter spp. / 3GC-NS	8	8	0	—
Enterobacteriaceae / CAR-NS	71	63	2	3.2
Escherichia coli / CAR-NS	29	25	1	4.0
Klebsiella spp. / CAR-NS	22	20	1	5.0
Enterobacter spp. / CAR-NS	8	8	0	—
Pseudomonas aeruginosa / CAR-NS	15	12	4	33.3
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Czech Republic (continued)

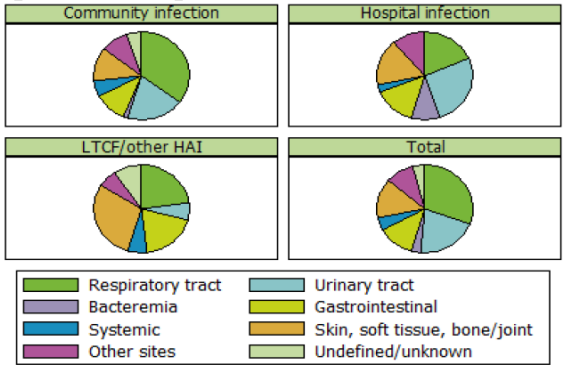
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	1096	
AU prevalence % (95%CI)	29.0 (25.8-32.5)	
N of antimicrobials	1413	
N of antimicrobials per patient	1.29	
	N	Rel%
Reason in patient charts/notes, Yes	1366	96.7
Reason in patient charts/notes, No	43	3
Reason in patient charts/notes, Unknown	4	0.3
Route of administration, Parenteral	888	62.8
Route of administration, Oral	517	36.6
Route of administration, Other/unknown	8	0.6

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	1335	35.4	403	30.2
Medicine	1438	38.1	442	30.7
Paediatrics	244	6.5	31	12.7
Intensive care*	329	8.7	161	48.9
Obstetrics and gynaecology	227	6.0	44	19.4
Geriatrics	0	0.0	0	—
Psychiatry	63	1.7	2	3.2
Rehabilitation/Other	138	3.7	13	9.4
All specialties	3774	100	1096	29.0

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	714	18.9	968	68.5
Community infection	518	13.7	692	49.0
Hospital infection	168	4.5	232	16.4
Long-term care/other HAI	31	0.8	44	3.1
Surgical prophylaxis	237	6.3	270	19.1
Single dose	76	2.0	86	6.1
One day	48	1.3	50	3.5
>1 day	116	3.1	134	9.5
Medical prophylaxis	127	3.4	141	10.0
Other indication	17	0.5	17	1.2
Unknown	13	0.3	17	1.2

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

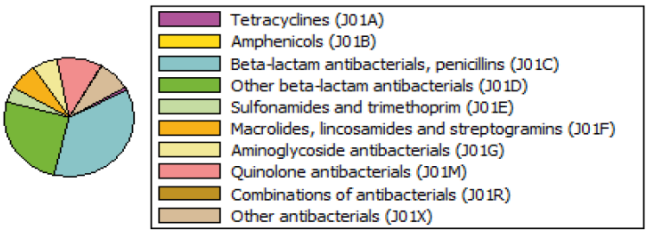


Figure 5. Top ten antimicrobial agents (AMs)

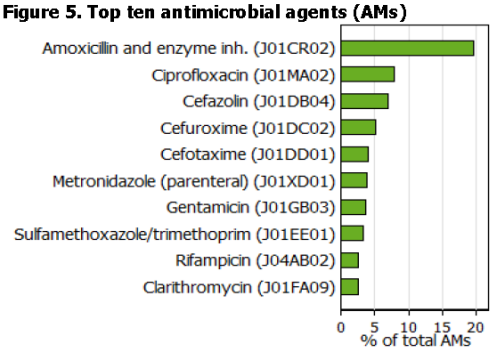


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	1857	49.2	100	5.4	606	32.6
Age, <1 year	176	4.7	2	1.1	18	10.2
Age, 1-44 years	851	22.5	20	2.4	197	23.1
Age, ≥45 years	2747	72.8	153	5.6	881	32.1
Length of stay, 1-3 days	1338	35.5	24	1.8	330	24.7
Length of stay, 4-7 days	1025	27.2	56	5.5	339	33.1
Length of stay, 8-14 days	849	22.5	40	4.7	251	29.6
Length of stay, ≥15 days	559	14.8	55	9.8	176	31.5
Length of stay, Missing/Unknown	3	0.1	0	0.0	0	0.0
McCabe score, Non-fatal	3024	80.1	97	3.2	813	26.9
McCabe score, Ultimately fatal	342	9.1	35	10.2	131	38.3
McCabe score, Rapidly fatal	120	3.2	18	15.0	42	35.0
McCabe score, Missing/Unknown	288	7.6	25	8.7	110	38.2
Surgery since hospital admission	1226	32.5	96	7.8	440	35.9
Central vascular catheter	262	6.9	60	22.9	133	50.8
Peripheral vascular catheter	1763	46.7	87	4.9	690	39.1
Urinary catheter	763	20.2	98	12.8	379	49.7
Intubation	102	2.7	33	32.4	51	50.0
Total	3774	100.0	175	4.6	1096	29.0

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Denmark

PPS data from 25/09/2012 to 11/10/2012

Number of hospitals	3
Standard protocol	0
Light protocol	3
Number of patients	682

Comments

Data representativeness: very poor

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	0	0
Secondary	1	33.3
Tertiary	2	66.7
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	440	[401-1082]
Average length of stay (days)*	3.5	[3.2-4.3]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	67
HAI prevalence % (95%CI)	**9.8 (1.0-52.7)**
N of HAIs	73
N of HAIs per infected patient	1.09
N HAIs with microorganism (%)	31 (42.5)
Total N of reported microorg.	36

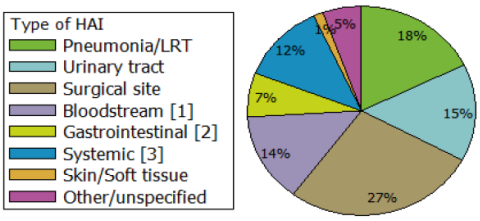
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	0	0	0	0
Origin of HAI=Same hospital	0	.	0	0
Origin of HAI=Other hospital	0	.	0	0
Origin of HAI=Other/unknown	0	.	0	0
HAI during current hospitalisation	73	100	67	9.8
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (5.5%)
[2] incl. *C. difficile* infections (1.4%)
[3] incl. clinical sepsis (12.3%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	258	37.8	29	11.2
Medicine	332	48.7	29	8.7
Paediatrics	30	4.4	1	3.3
Intensive care*	18	2.6	6	33.3
Obstetrics and gynaecology	21	3.1	0	0.0
Geriatrics	0	0	0	—
Psychiatry	0	0	0	—
Rehabilitation/Other	23	3.4	2	8.7
All specialties	682	100	67	9.8

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

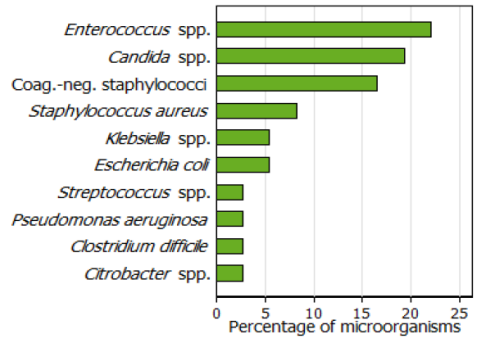


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	3	3	0	—
Enterococci / VRE	8	7	0	—
Enterococcus faecalis / VAN-R	3	2	0	—
Enterococcus faecium / VAN-R	5	5	0	—
Enterobacteriaceae / 3GC-NS	5	3	0	—
Escherichia coli / 3GC-NS	2	1	0	—
Klebsiella spp. / 3GC-NS	2	1	0	—
Enterobacter spp. / 3GC-NS	0	0	0	—
Enterobacteriaceae / CAR-NS	5	3	0	—
Escherichia coli / CAR-NS	2	1	0	—
Klebsiella spp. / CAR-NS	2	1	0	—
Enterobacter spp. / CAR-NS	0	0	0	—
Pseudomonas aeruginosa / CAR-NS	1	1	0	—
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Denmark (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	295	
AU prevalence % (95%CI)	43.3 (18.8-71.6)	
N of antimicrobials	498	
N of antimicrobials per patient	1.69	
	N	Rel%
Reason in patient charts/notes, Yes	478	96
Reason in patient charts/notes, No	14	2.8
Reason in patient charts/notes, Unknown	6	1.2
Route of administration, Parenteral	342	68.7
Route of administration, Oral	151	30.3
Route of administration, Other/unknown	5	1

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment

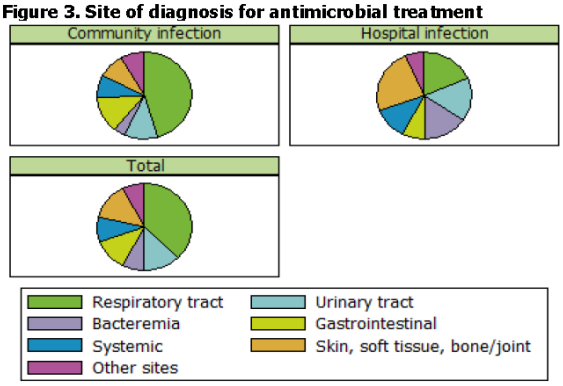


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	258	37.8	98	38.0
Medicine	332	48.7	161	48.5
Paediatrics	30	4.4	9	30.0
Intensive care*	18	2.6	16	88.9
Obstetrics and gynaecology	21	3.1	1	4.8
Geriatrics	0	0.0	0	—
Psychiatry	0	0.0	0	—
Rehabilitation/Other	23	3.4	10	43.5
All specialties	682	100	295	43.3

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	242	35.5	386	77.5
Community infection	174	25.5	249	50.0
Hospital infection	71	10.4	137	27.5
Long-term care/other HAI	0	0.0	0	0.0
Surgical prophylaxis	29	4.3	41	8.2
Single dose	1	0.1	1	0.2
One day	5	0.7	6	1.2
>1 day	23	3.4	34	6.8
Medical prophylaxis	30	4.4	52	10.4
Other indication	6	0.9	9	1.8
Unknown	9	1.3	10	2.0

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

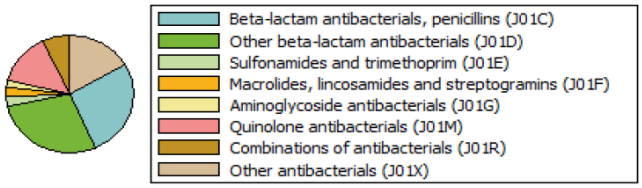


Figure 5. Top ten antimicrobial agents (AMs)

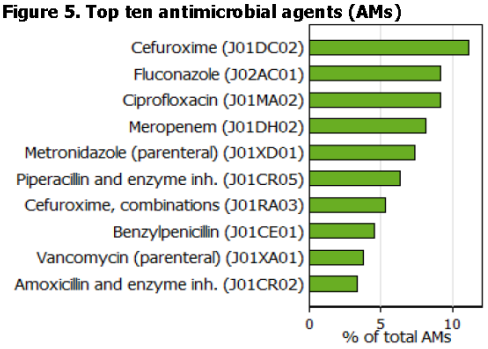


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Light protocol data only

Estonia

PPS data from 11/05/2011 to 07/06/2011

Number of hospitals	4
Standard protocol	4
Light protocol	0
Number of patients	2076

Comments

Data representativeness: poor

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	0	0
Secondary	2	50
Tertiary	2	50
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	694	[368-1064]
Average length of stay (days)*	6.2	[5.4-8.0]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	118
HAI prevalence % (95%CI)	**5.7 (4.5-7.1)**
N of HAIs	128
N of HAIs per infected patient	1.08
N HAIs with microorganism (%)	61 (47.7)
Total N of reported microorg.	78

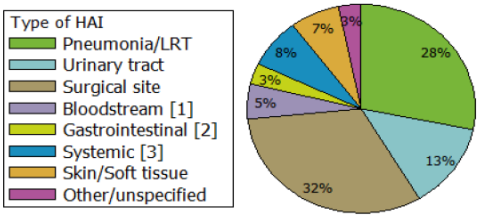
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	22	17.2	21	1
Origin of HAI=Same hospital	15	68.2	14	0.7
Origin of HAI=Other hospital	6	27.3	6	0.3
Origin of HAI=Other/unknown	1	4.5	1	0
HAI during current hospitalisation	106	82.8	97	4.7
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (2.3%)
[2] incl. *C. difficile* infections (1.6%)
[3] incl. clinical sepsis (7.8%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	622	30	46	7.4
Medicine	870	41.9	36	4.1
Paediatrics	78	3.8	6	7.7
Intensive care*	90	4.3	25	27.8
Obstetrics and gynaecology	71	3.4	2	2.8
Geriatrics	0	0	0	—
Psychiatry	314	15.1	3	1.0
Rehabilitation/Other	31	1.5	0	0.0
All specialties	2076	100	118	5.7

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

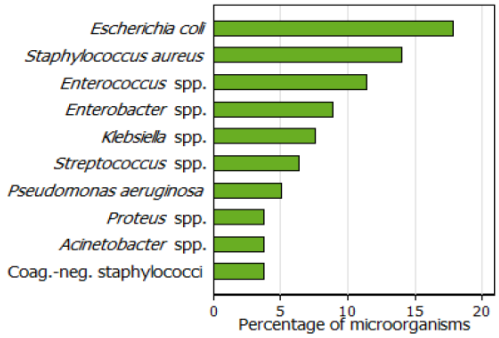


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	11	10	1	10.0
Enterococci / VRE	9	7	0	—
Enterococcus faecalis / VAN-R	7	6	0	—
Enterococcus faecium / VAN-R	2	1	0	—
Enterobacteriaceae / 3GC-NS	33	29	10	34.5
Escherichia coli / 3GC-NS	14	12	4	33.3
Klebsiella spp. / 3GC-NS	6	6	1	—
Enterobacter spp. / 3GC-NS	7	7	4	—
Enterobacteriaceae / CAR-NS	33	29	0	0.0
Escherichia coli / CAR-NS	14	12	0	0.0
Klebsiella spp. / CAR-NS	6	6	0	—
Enterobacter spp. / CAR-NS	7	7	0	—
Pseudomonas aeruginosa / CAR-NS	4	4	1	—
Acinetobacter baumannii / CAR-NS	2	1	1	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Estonia (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	568	
AU prevalence % (95%CI)	27.4 (17.7-39.7)	
N of antimicrobials	685	
N of antimicrobials per patient	1.21	
	N	Rel%
Reason in patient charts/notes, Yes	548	80
Reason in patient charts/notes, No	127	18.5
Reason in patient charts/notes, Unknown	10	1.5
Route of administration, Parenteral	531	77.5
Route of administration, Oral	154	22.5
Route of administration, Other/unknown	0	0

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment

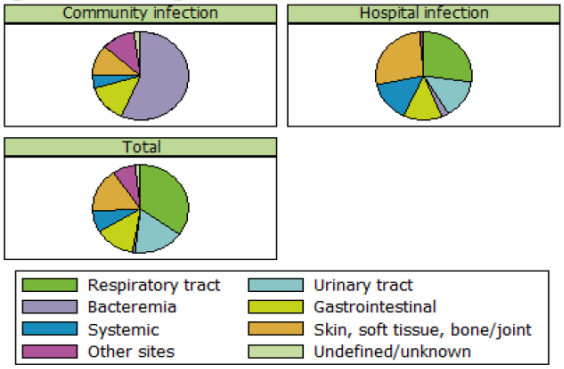


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	622	30.0	232	37.3
Medicine	870	41.9	233	26.8
Paediatrics	78	3.8	23	29.5
Intensive care*	90	4.3	55	61.1
Obstetrics and gynaecology	71	3.4	16	22.5
Geriatrics	0	0.0	0	—
Psychiatry	314	15.1	8	2.5
Rehabilitation/Other	31	1.5	1	3.2
All specialties	2076	100	568	27.4

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	414	19.9	508	74.2
Community infection	287	13.8	337	49.2
Hospital infection	130	6.3	171	25.0
Long-term care/other HAI	0	0.0	0	0.0
Surgical prophylaxis	96	4.6	105	15.3
Single dose	27	1.3	28	4.1
One day	11	0.5	11	1.6
>1 day	59	2.8	66	9.6
Medical prophylaxis	25	1.2	30	4.4
Other indication	5	0.2	5	0.7
Unknown	32	1.5	37	5.4

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

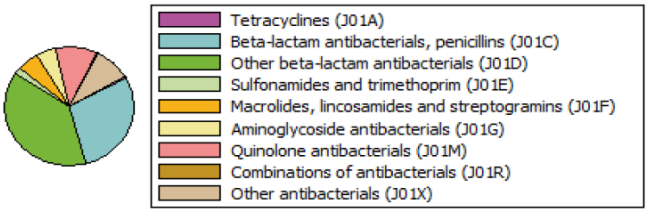


Figure 5. Top ten antimicrobial agents (AMs)

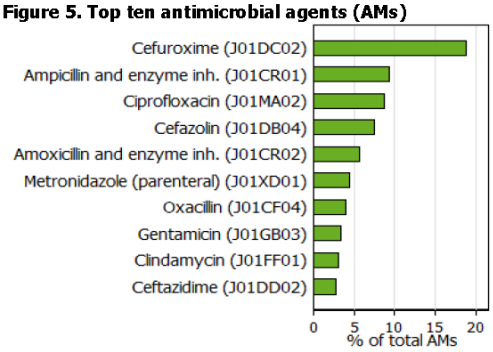


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	965	46.5	68	7.0	291	30.2
Age, <1 year	55	2.6	5	9.1	14	25.5
Age, 1-44 years	541	26.1	15	2.8	121	22.4
Age, ≥45 years	1480	71.3	98	6.6	433	29.3
Length of stay, 1-3 days	626	30.2	14	2.2	159	25.4
Length of stay, 4-7 days	575	27.7	41	7.1	194	33.7
Length of stay, 8-14 days	394	19.0	29	7.4	137	34.8
Length of stay, ≥15 days	476	22.9	34	7.1	78	16.4
Length of stay, Missing/Unknown	5	0.2	0	0.0	0	0.0
McCabe score, Non-fatal	1511	72.8	53	3.5	356	23.6
McCabe score, Ultimately fatal	376	18.1	35	9.3	131	34.8
McCabe score, Rapidly fatal	106	5.1	18	17.0	47	44.3
McCabe score, Missing/Unknown	83	4.0	12	14.5	34	41.0
Surgery since hospital admission	600	28.9	67	11.2	255	42.5
Central vascular catheter	159	7.7	50	31.4	98	61.6
Peripheral vascular catheter	879	42.3	64	7.3	412	46.9
Urinary catheter	239	11.5	40	16.7	149	62.3
Intubation	61	2.9	23	37.7	38	62.3
Total	2076	100.0	118	5.7	568	27.4

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Finland

PPS data from 04/10/2011 to 08/11/2011

Number of hospitals	59
Standard protocol	59
Light protocol	0
Number of patients	9712

Comments

National report: Tommi Kärki, Outi Lyytikäinen. Hoitoon liittyvien infektioiden esiintyvyys Suomessa 2011. Suomenlääkärilehti 2013;68:39-45. Available from http://www.thl.fi/fi_FI/web/infektiotaudit-fi/prevalenssitutkimus-2011.

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	20	33.9
Secondary	18	30.5
Tertiary	14	23.7
Specialised	6	10.2
Unknown	1	1.7

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	149	[73-311]
Average length of stay (days)*	4.4	[3.7-5.9]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	716
HAI prevalence % (95%CI)	**7.4 (6.3-8.6)**
N of HAIs	771
N of HAIs per infected patient	1.08
N HAIs with microorganism (%)	368 (47.7)
Total N of reported microorg.	471

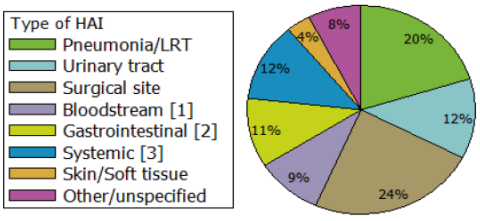
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	315	40.9	298	3.1
Origin of HAI=Same hospital	196	62.2	187	1.9
Origin of HAI=Other hospital	101	32.1	93	1
Origin of HAI=Other/unknown	18	5.7	18	0.2
HAI during current hospitalisation	451	58.5	413	4.3
Missing	5	0.6		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (3.4%)
[2] incl. *C. difficile* infections (5.2%)
[3] incl. clinical sepsis (10.9%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	3151	32.4	259	8.2
Medicine	3734	38.4	326	8.7
Paediatrics	225	2.3	16	7.1
Intensive care*	363	3.7	67	18.5
Obstetrics and gynaecology	1176	12.1	19	1.6
Geriatrics	23	0.2	2	8.7
Psychiatry	689	7.1	5	0.7
Rehabilitation/Other	351	3.6	22	6.3
All specialties	9712	100	716	7.4

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

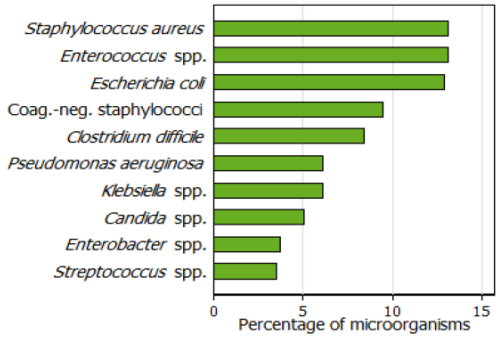


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	62	49	2	4.1
Enterococci / VRE	62	44	0	0.0
Enterococcus faecalis / VAN-R	43	31	0	0.0
Enterococcus faecium / VAN-R	15	10	0	0.0
Enterobacteriaceae / 3GC-NS	128	92	16	17.4
Escherichia coli / 3GC-NS	61	50	5	10.0
Klebsiella spp. / 3GC-NS	29	22	3	13.6
Enterobacter spp. / 3GC-NS	18	13	6	46.2
Enterobacteriaceae / CAR-NS	128	92	1	1.1
Escherichia coli / CAR-NS	61	50	0	0.0
Klebsiella spp. / CAR-NS	29	22	0	0.0
Enterobacter spp. / CAR-NS	18	13	1	7.7
Pseudomonas aeruginosa / CAR-NS	29	22	7	31.8
Acinetobacter baumannii / CAR-NS	2	2	1	–

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Finland (continued)

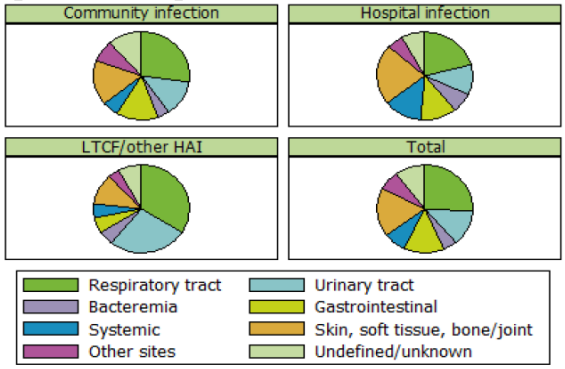
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	3934	
AU prevalence % (95%CI)	40.5 (37.4-43.7)	
N of antimicrobials	5312	
N of antimicrobials per patient	1.35	
	N	Rel%
Reason in patient charts/notes, Yes	4251	80
Reason in patient charts/notes, No	590	11.1
Reason in patient charts/notes, Unknown	471	8.9
Route of administration, Parenteral	3357	63.2
Route of administration, Oral	1938	36.5
Route of administration, Other/unknown	17	0.3

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

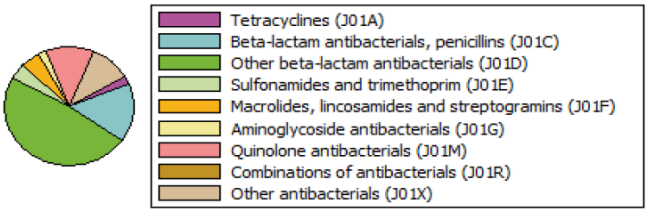


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	3151	32.4	1543	49.0
Medicine	3734	38.4	1882	50.4
Paediatrics	225	2.3	68	30.2
Intensive care*	363	3.7	209	57.6
Obstetrics and gynaecology	1176	12.1	109	9.3
Geriatrics	23	0.2	10	43.5
Psychiatry	689	7.1	28	4.1
Rehabilitation/Other	351	3.6	85	24.2
All specialties	9712	100	3934	40.5

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	2874	29.6	3965	74.6
Community infection	2023	20.8	2696	50.8
Hospital infection	784	8.1	1151	21.7
Long-term care/other HAI	97	1.0	118	2.2
Surgical prophylaxis	597	6.1	685	12.9
Single dose	294	3.0	314	5.9
One day	71	0.7	79	1.5
>1 day	244	2.5	293	5.5
Medical prophylaxis	406	4.2	474	8.9
Other indication	74	0.8	94	1.8
Unknown	79	0.8	95	1.8

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

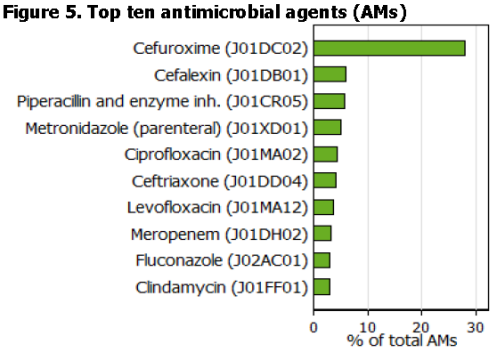


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	4528	46.6	387	8.5	2012	44.4
Age, <1 year	725	7.5	39	5.4	111	15.3
Age, 1-44 years	2275	23.4	95	4.2	685	30.1
Age, ≥45 years	6698	69.0	582	8.7	3132	46.8
Length of stay, 1-3 days	4524	46.6	164	3.6	1555	34.4
Length of stay, 4-7 days	2412	24.8	208	8.6	1162	48.2
Length of stay, 8-14 days	1352	13.9	179	13.2	735	54.4
Length of stay, ≥15 days	1357	14.0	164	12.1	459	33.8
Length of stay, Missing/Unknown	67	0.7	1	1.5	23	34.3
McCabe score, Non fatal	5859	60.3	267	4.6	1965	33.5
McCabe score, Ultimately fatal	2616	26.9	282	10.8	1328	50.8
McCabe score, Rapidly fatal	563	5.8	102	18.1	331	58.8
McCabe score, Missing/Unknown	674	6.9	65	9.6	310	46.0
Surgery since hospital admission	2794	28.8	306	11.0	1413	50.6
Central vascular catheter	525	5.4	171	32.6	411	78.3
Peripheral vascular catheter	4871	50.2	505	10.4	2941	60.4
Urinary catheter	1756	18.1	241	13.7	1157	65.9
Intubation	176	1.8	47	26.7	124	70.5
Total	9712	100.0	716	7.4	3934	40.5

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

France

PPS data from 21/05/2012 to 21/07/2012

Number of hospitals	54
Standard protocol	54
Light protocol	0
Number of patients	9670

Comments

In France, the national PPS in 2012 included a total of 1 938 healthcare institutions and 300 330 patients. A representative sample of 54 hospitals was submitted to ECDC. Please refer to http://www.invs.sante.fr/enp for results based on the complete dataset from the 2012 French PPS.
Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	0	0
Secondary	0	0
Tertiary	0	0
Specialised	0	0
Unknown	54	100

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]	
Size (number of beds)	167	[90-338]	
Average length of stay (days)*	5.9	[4.6-8.0]	

*Hospital statistics of year preceding PPS

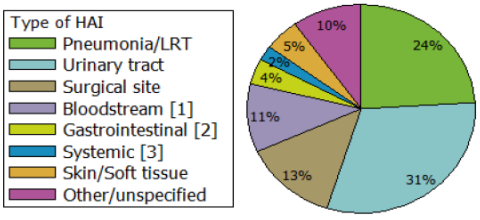
II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	475
HAI prevalence % (95%CI)	**4.9 (4.3-5.6)**
N of HAIs	498
N of HAIs per infected patient	1.05
N HAIs with microorganism (%)	342 (68.7)
Total N of reported microorg.	402

N=number

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (3.8%)
[2] incl. *C. difficile* infections (1.4%)
[3] incl. clinical sepsis (2.2%)
LRT=Lower respiratory tract

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	146	29.3	141	1.5
Origin of HAI=Same hospital	51	34.9	50	0.5
Origin of HAI=Other hospital	52	35.6	50	0.5
Origin of HAI=Other/unknown	43	29.5	41	0.4
HAI during current hospitalisation	308	61.8	295	3.1
Missing	44	8.8		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2153	22.3	96	4.5
Medicine	3357	34.7	179	5.3
Paediatrics	325	3.4	6	1.8
Intensive care*	223	2.3	48	21.5
Obstetrics and gynaecology	1085	11.2	3	0.3
Geriatrics	376	3.9	33	8.8
Psychiatry	671	6.9	5	0.7
Rehabilitation/Other	1480	15.3	105	7.1
All specialties	9670	100	475	4.9

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

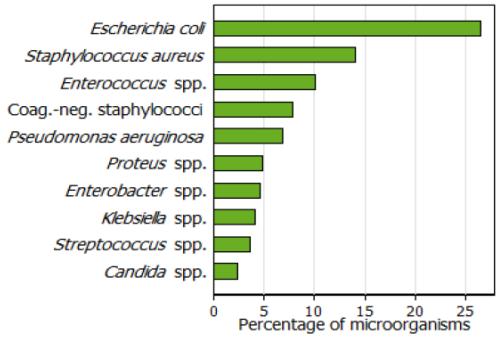


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	57	57	17	29.8
Enterococci / VRE	41	32	0	0.0
Enterococcus faecalis / VAN-R	26	24	0	0.0
Enterococcus faecium / VAN-R	9	8	0	—
Enterobacteriaceae / 3GC-NS	174	161	31	19.3
Escherichia coli / 3GC-NS	107	102	17	16.7
Klebsiella spp. / 3GC-NS	17	16	4	25.0
Enterobacter spp. / 3GC-NS	19	17	7	41.2
Enterobacteriaceae / CAR-NS	174	161	2	1.2
Escherichia coli / CAR-NS	107	102	2	2.0
Klebsiella spp. / CAR-NS	17	16	0	0.0
Enterobacter spp. / CAR-NS	19	17	0	0.0
Pseudomonas aeruginosa / CAR-NS	28	26	3	11.5
Acinetobacter baumannii / CAR-NS	7	6	1	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

France (continued)

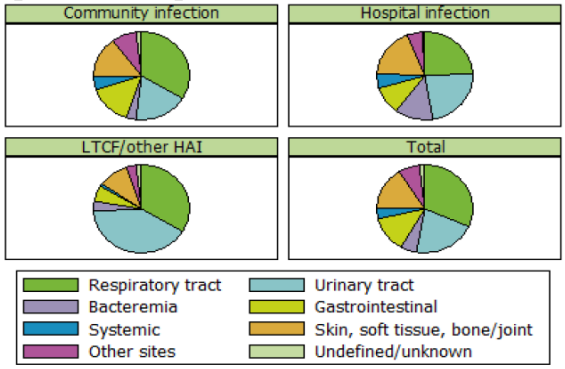
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	2069	
AU prevalence % (95%CI)	21.4 (19.8-23.1)	
N of antimicrobials	2738	
N of antimicrobials per patient	1.32	
	N	Rel%
Reason in patient charts/notes, Yes	2379	86.9
Reason in patient charts/notes, No	346	12.6
Reason in patient charts/notes, Unknown	13	0.5
Route of administration, Parenteral	1575	57.5
Route of administration, Oral	1159	42.3
Route of administration, Other/unknown	4	0.1

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

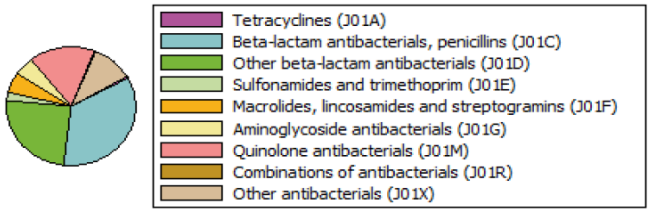


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2153	22.3	525	24.4
Medicine	3357	34.7	973	29.0
Paediatrics	325	3.4	71	21.8
Intensive care*	223	2.3	118	52.9
Obstetrics and gynaecology	1085	11.2	55	5.1
Geriatrics	376	3.9	120	31.9
Psychiatry	671	6.9	15	2.2
Rehabilitation/Other	1480	15.3	192	13.0
All specialties	9670	100	2069	21.4

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1663	17.2	2232	81.5
Community infection	1175	12.2	1565	57.2
Hospital infection	347	3.6	478	17.5
Long-term care/other HAI	152	1.6	189	6.9
Surgical prophylaxis	227	2.3	250	9.1
Single dose	47	0.5	47	1.7
One day	31	0.3	32	1.2
>1 day	149	1.5	171	6.2
Medical prophylaxis	115	1.2	146	5.3
Other indication	47	0.5	56	2.0
Unknown	45	0.5	54	2.0

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

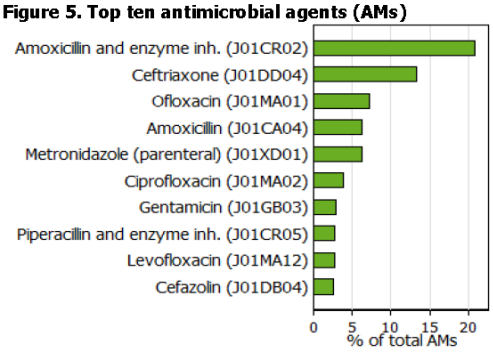


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	4373	45.2	261	6.0	1069	24.4
Age, <1 year	553	5.7	8	1.4	46	8.3
Age, 1-44 years	1928	19.9	31	1.6	262	13.6
Age, ≥45 years	7189	74.3	436	6.1	1761	24.5
Length of stay, 1-3 days	2937	30.4	102	3.5	567	19.3
Length of stay, 4-7 days	2431	25.1	107	4.4	613	25.2
Length of stay, 8-14 days	1700	17.6	99	5.8	458	26.9
Length of stay, ≥15 days	2471	25.6	165	6.7	426	17.2
Length of stay, Missing/Unknown	131	1.4	2	1.5	5	3.8
McCabe score, Non-fatal	5787	59.8	165	2.9	994	17.2
McCabe score, Ultimately fatal	1790	18.5	155	8.7	522	29.2
McCabe score, Rapidly fatal	895	9.3	108	12.1	321	35.9
McCabe score, Missing/Unknown	1198	12.4	47	3.9	232	19.4
Surgery since hospital admission	2236	23.1	130	5.8	513	22.9
Central vascular catheter	691	7.1	120	17.4	318	46.0
Peripheral vascular catheter	2959	30.6	197	6.7	1157	39.1
Urinary catheter	985	10.2	146	14.8	394	40.0
Intubation	130	1.3	36	27.7	73	56.2
Total	9670	100.0	475	4.9	2069	21.4

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Germany

PPS data from 05/09/2011 to 09/01/2012

Number of hospitals	46
Standard protocol	0
Light protocol	46
Number of patients	9604

Comments

In Germany, the national PPS in 2011 included a total of 134 hospitals and 39 699 patients. A representative sample of 46 hospitals was submitted to ECDC (Epidemiologisches Bulletin Nr. 26, July 2012).

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	31	67.4
Secondary	5	10.9
Tertiary	4	8.7
Specialised	6	13
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	225	[150-400]
Average length of stay (days)*	6.4	[5.5-7.3]

*Hospital statistics of year preceding PPS

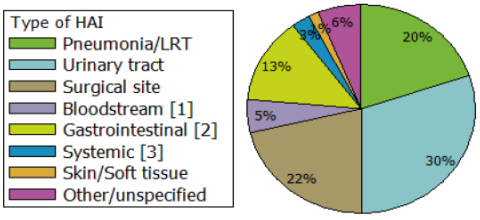
II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	484
HAI prevalence % (95%CI)	**5.0 (3.8-6.7)**
N of HAIs	516
N of HAIs per infected patient	1.07
N HAIs with microorganism (%)	281 (54.5)
Total N of reported microorg.	369

N=number

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (2.1%)
[2] incl. *C. difficile* infections (7.0%)
[3] incl. clinical sepsis (0.2%)
LRT=Lower respiratory tract

Figure 2. Top ten microorganisms isolated in HAIs

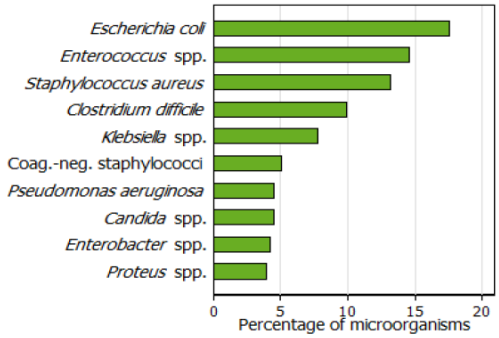


Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	173	33.5	159	1.7
Origin of HAI=Same hospital	49	28.3	45	0.5
Origin of HAI=Other hospital	70	40.5	64	0.7
Origin of HAI=Other/unknown	54	31.2	50	0.5
HAI during current hospitalisation	343	66.5	325	3.4
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	3153	32.8	155	4.9
Medicine	3861	40.2	190	4.9
Paediatrics	177	1.8	0	0.0
Intensive care*	505	5.3	84	16.6
Obstetrics and gynaecology	526	5.5	14	2.7
Geriatrics	151	1.6	15	9.9
Psychiatry	888	9.2	11	1.2
Rehabilitation/Other	343	3.6	15	4.4
All specialties	9604	100	484	5.0

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism /Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	49	46	13	28.3
Enterococci / VRE	54	44	8	18.2
Enterococcus faecalis / VAN-R	28	23	3	13.0
Enterococcus faecium / VAN-R	15	12	2	16.7
Enterobacteriaceae / 3GC-NS	142	111	40	36.0
Escherichia coli / 3GC-NS	65	53	23	43.4
Klebsiella spp. / 3GC-NS	29	22	7	31.8
Enterobacter spp. / 3GC-NS	16	12	6	50.0
Enterobacteriaceae / CAR-NS	142	111	3	2.7
Escherichia coli / CAR-NS	65	53	2	3.8
Klebsiella spp. / CAR-NS	29	22	0	0.0
Enterobacter spp. / CAR-NS	16	12	0	0.0
Pseudomonas aeruginosa / CAR-NS	17	12	2	16.7
Acinetobacter baumannii / CAR-NS	0	0	0	–

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Germany (continued)

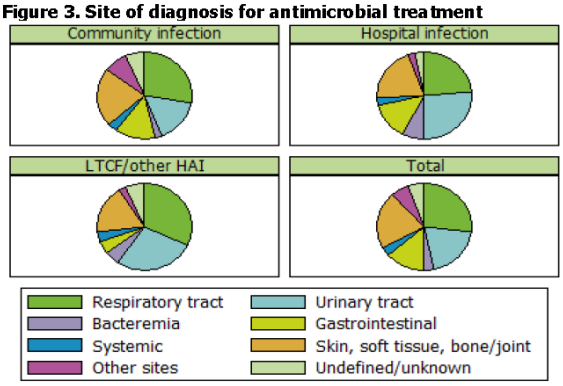
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	2294	
AU prevalence % (95%CI)	23.9 (21.2-26.8)	
N of antimicrobials	2915	
N of antimicrobials per patient	1.27	
	N	Rel%
Reason in patient charts/notes, Yes	2303	79
Reason in patient charts/notes, No	591	20.3
Reason in patient charts/notes, Unknown	21	0.7
Route of administration, Parenteral	1905	65.4
Route of administration, Oral	993	34.1
Route of administration, Other/unknown	17	0.6

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

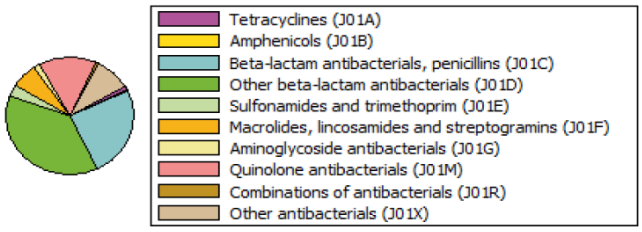


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	3153	32.8	874	27.7
Medicine	3861	40.2	922	23.9
Paediatrics	177	1.8	43	24.3
Intensive care*	505	5.3	234	46.3
Obstetrics and gynaecology	526	5.5	120	22.8
Geriatrics	151	1.6	28	18.5
Psychiatry	888	9.2	18	2.0
Rehabilitation/Other	343	3.6	55	16.0
All specialties	9604	100	2294	23.9

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1600	16.7	2055	70.5
Community infection	1104	11.5	1408	48.3
Hospital infection	393	4.1	502	17.2
Long-term care/other HAI	131	1.4	150	5.1
Surgical prophylaxis	463	4.8	520	17.8
Single dose	111	1.2	115	3.9
One day	34	0.4	40	1.4
>1 day	318	3.3	365	12.5
Medical prophylaxis	146	1.5	208	7.1
Other indication	24	0.2	29	1.0
Unknown	79	0.8	105	3.6

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

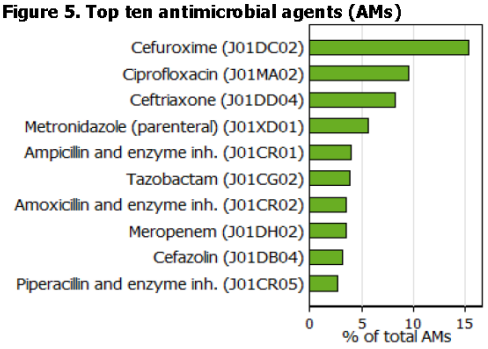


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Light protocol data only

Greece

PPS data from 04/06/2012 to 05/07/2012

Number of hospitals	37
Standard protocol	37
Light protocol	0
Number of patients	8247

Comments

Data representativeness: good

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	2	5.4
Secondary	17	45.9
Tertiary	17	45.9
Specialised	1	2.7
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	428	[270-620]
Average length of stay (days)*	4	[3.2-4.6]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	746
HAI prevalence % (95%CI)	**9.0 (7.6-10.8)**
N of HAIs	820
N of HAIs per infected patient	1.1
N HAIs with microorganism (%)	449 (54.8)
Total N of reported microorg.	564

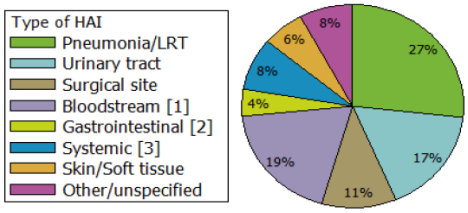
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	222	27.1	206	2.5
Origin of HAI=Same hospital	102	45.9	98	1.2
Origin of HAI=Other hospital	76	34.2	67	0.8
Origin of HAI=Other/unknown	44	19.8	41	0.5
HAI during current hospitalisation	591	72.1	533	6.5
Missing	7	0.9		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (8.3%)
[2] incl. *C. difficile* infections (0.7%)
[3] incl. clinical sepsis (5.6%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	3014	36.5	193	6.4
Medicine	3425	41.5	346	10.1
Paediatrics	472	5.7	9	1.9
Intensive care*	590	7.2	183	31.0
Obstetrics and gynaecology	450	5.5	10	2.2
Geriatrics	0	0	0	–
Psychiatry	293	3.6	5	1.7
Rehabilitation/Other	3	0	0	0.0
All specialties	8247	100	746	9.0

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

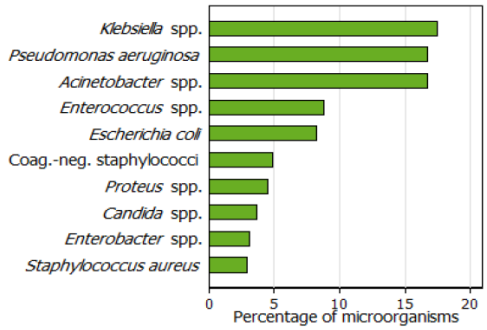


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	17	16	8	50.0
Enterococci / VRE	50	48	6	12.5
Enterococcus faecalis / VAN-R	28	27	2	7.4
Enterococcus faecium / VAN-R	15	15	3	20.0
Enterobacteriaceae / 3GC-NS	205	183	117	63.9
Escherichia coli / 3GC-NS	47	42	21	50.0
Klebsiella spp. / 3GC-NS	99	91	73	80.2
Enterobacter spp. / 3GC-NS	18	17	7	41.2
Enterobacteriaceae / CAR-NS	205	183	73	39.9
Escherichia coli / CAR-NS	47	42	8	19.0
Klebsiella spp. / CAR-NS	99	91	61	67.0
Enterobacter spp. / CAR-NS	18	17	1	5.9
Pseudomonas aeruginosa / CAR-NS	95	89	44	49.4
Acinetobacter baumannii / CAR-NS	90	88	73	83.0

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Greece (continued)

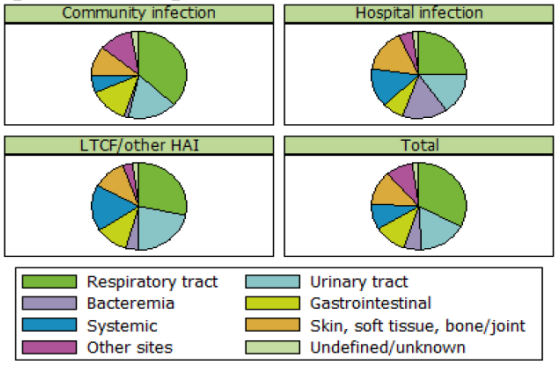
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	4514	
AU prevalence % (95%CI)	54.7 (51.7-57.7)	
N of antimicrobials	7019	
N of antimicrobials per patient	1.55	
	N	Rel%
Reason in patient charts/notes, Yes	4497	64.1
Reason in patient charts/notes, No	2224	31.7
Reason in patient charts/notes, Unknown	298	4.2
Route of administration, Parenteral	6370	90.8
Route of administration, Oral	601	8.6
Route of administration, Other/unknown	48	0.7

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	3014	36.5	1889	62.7
Medicine	3425	41.5	1801	52.6
Paediatrics	472	5.7	199	42.2
Intensive care*	590	7.2	398	67.5
Obstetrics and gynaecology	450	5.5	208	46.2
Geriatrics	0	0.0	0	—
Psychiatry	293	3.6	18	6.1
Rehabilitation/Other	3	0.0	1	33.3
All specialties	8247	100	4514	54.7

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	2244	27.2	3729	53.1
Community infection	1447	17.5	2211	31.5
Hospital infection	738	8.9	1380	19.7
Long-term care/other HAI	85	1.0	138	2.0
Surgical prophylaxis	1380	16.7	1877	26.7
Single dose	108	1.3	126	1.8
One day	216	2.6	259	3.7
>1 day	1088	13.2	1493	21.3
Medical prophylaxis	830	10.1	1137	16.2
Other indication	110	1.3	165	2.4
Unknown	71	0.9	111	1.6

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

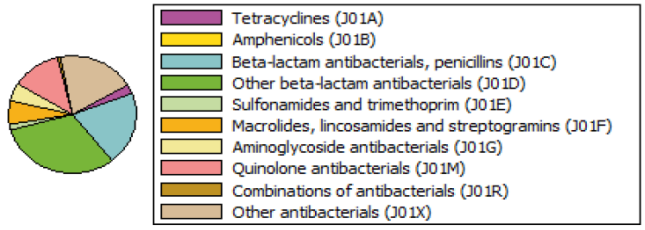


Figure 5. Top ten antimicrobial agents (AMs)

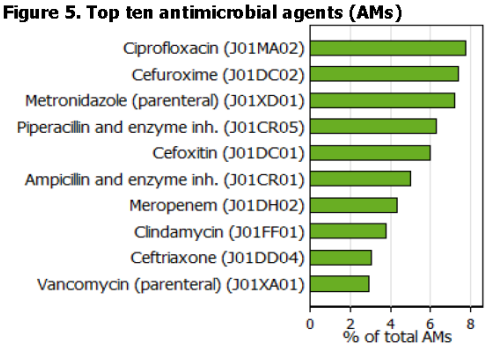


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	4487	54.4	439	9.8	2488	55.4
Age, <1 year	449	5.4	35	7.8	172	38.3
Age, 1-44 years	1948	23.6	108	5.5	1055	54.2
Age, ≥45 years	5848	70.9	603	10.3	3287	56.2
Length of stay, 1-3 days	2661	32.3	93	3.5	1187	44.6
Length of stay, 4-7 days	2522	30.6	175	6.9	1471	58.3
Length of stay, 8-14 days	1693	20.5	187	11.0	1062	62.7
Length of stay,≥15 days	1364	16.5	290	21.3	792	58.1
Length of stay, Missing/Unknown	7	0.1	1	14.3	2	28.6
McCabe score, Non fatal	5897	71.5	349	5.9	2993	50.8
McCabe score, Ultimately fatal	1719	20.8	242	14.1	1073	62.4
McCabe score, Rapidly fatal	497	6.0	140	28.2	374	75.3
McCabe score, Missing/Unknown	134	1.6	15	11.2	74	55.2
Surgery since hospital admission	2322	28.2	235	10.1	1759	75.8
Central vascular catheter	851	10.3	271	31.8	683	80.3
Peripheral vascular catheter	5825	70.6	489	8.4	3524	60.5
Urinary catheter	2527	30.6	473	18.7	1897	75.1
Intubation	371	4.5	183	49.3	325	87.6
Total	8247	100.0	746	9.0	4514	54.7

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Hungary

PPS data from 01/05/2012 to 30/06/2012

Number of hospitals	29
Standard protocol	29
Light protocol	0
Number of patients	10180

Comments

In Hungary, the first national PPS used a representative sample of hospitals within the framework of the EU PPS. Primary PPS data were collected by trained infection control practitioners in each hospital; however, the observed prevalence of HAI might be underestimated due to limited availability of microbiological results, only partly stringent case definitions, and the exclusion of chronic-care wards as per protocol. Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	14	48.3
Secondary	9	31
Tertiary	3	10.3
Specialised	3	10.3
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	605	[414-1123]
Average length of stay (days)*	6.2	[5.4-8.5]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	462
HAI prevalence % (95%CI)	**4.5 (4.0-5.2)**
N of HAIs	498
N of HAIs per infected patient	1.08
N HAIs with microorganism (%)	206 (41.4)
Total N of reported microorg.	257

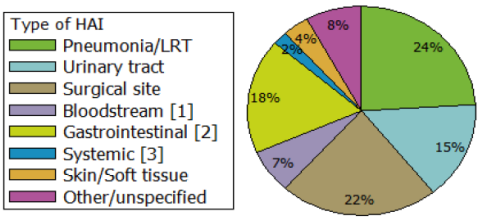
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	121	24.3	116	1.1
Origin of HAI=Same hospital	79	65.3	77	0.8
Origin of HAI=Other hospital	32	26.4	30	0.3
Origin of HAI=Other/unknown	10	8.3	9	0.1
HAI during current hospitalisation	377	75.7	346	3.4
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (3.0%)
[2] incl. *C. difficile* infections (10.6%)
[3] incl. clinical sepsis (1.8%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2891	28.4	158	5.5
Medicine	4650	45.7	186	4.0
Paediatrics	667	6.6	14	2.1
Intensive care*	390	3.8	92	23.6
Obstetrics and gynaecology	866	8.5	7	0.8
Geriatrics	31	0.3	2	6.5
Psychiatry	579	5.7	2	0.3
Rehabilitation/Other	106	1	1	0.9
All specialties	10180	100	462	4.5

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

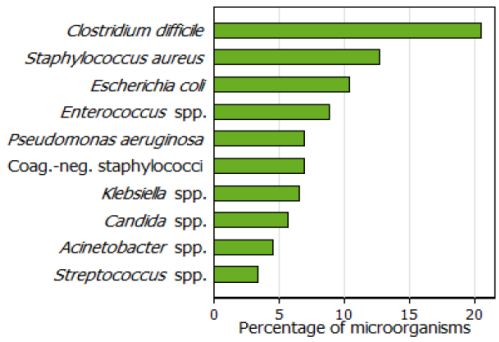


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	33	27	10	37.0
Enterococci / VRE	23	16	0	0.0
Enterococcus faecalis / VAN-R	11	7	0	—
Enterococcus faecium / VAN-R	4	2	0	—
Enterobacteriaceae / 3GC-NS	60	43	18	41.9
Escherichia coli / 3GC-NS	27	19	5	26.3
Klebsiella spp. / 3GC-NS	17	15	9	60.0
Enterobacter spp. / 3GC-NS	7	3	2	—
Enterobacteriaceae / CAR-NS	60	40	2	5.0
Escherichia coli / CAR-NS	27	19	1	5.3
Klebsiella spp. / CAR-NS	17	13	1	7.7
Enterobacter spp. / CAR-NS	7	2	0	—
Pseudomonas aeruginosa / CAR-NS	18	12	3	25.0
Acinetobacter baumannii / CAR-NS	10	9	3	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Hungary (continued)

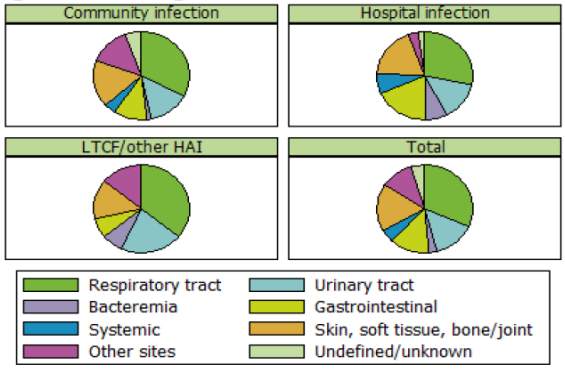
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	2318	
AU prevalence % (95%CI)	22.8 (20.7-25.0)	
N of antimicrobials	2744	
N of antimicrobials per patient	1.18	
	N	Rel%
Reason in patient charts/notes, Yes	2445	89.1
Reason in patient charts/notes, No	299	10.9
Reason in patient charts/notes, Unknown	0	0
Route of administration, Parenteral	1705	62.1
Route of administration, Oral	1037	37.8
Route of administration, Other/unknown	2	0.1

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

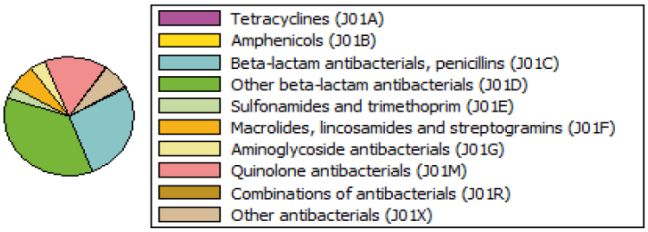


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2891	28.4	891	30.8
Medicine	4650	45.7	830	17.8
Paediatrics	667	6.6	199	29.8
Intensive care*	390	3.8	233	59.7
Obstetrics and gynaecology	866	8.5	141	16.3
Geriatrics	31	0.3	2	6.5
Psychiatry	579	5.7	6	1.0
Rehabilitation/Other	106	1.0	16	15.1
All specialties	10180	100	2318	22.8

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1470	14.4	1759	64.1
Community infection	1077	10.6	1252	45.6
Hospital infection	390	3.8	490	17.9
Long-term care/other HAI	14	0.1	17	0.6
Surgical prophylaxis	536	5.3	594	21.6
Single dose	181	1.8	191	7.0
One day	79	0.8	85	3.1
>1 day	283	2.8	318	11.6
Medical prophylaxis	212	2.1	246	9.0
Other indication	113	1.1	134	4.9
Unknown	14	0.1	14	0.5

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

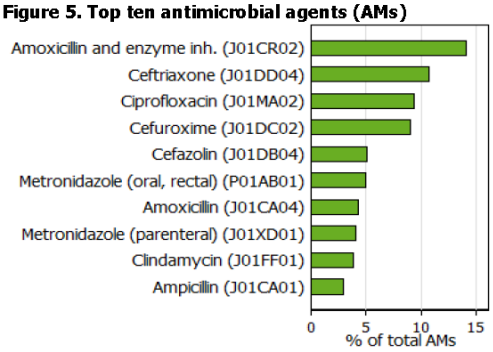


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	4405	43.3	242	5.5	1135	25.8
Age, <1 year	568	5.6	28	4.9	161	28.3
Age, 1-44 years	2364	23.2	43	1.8	523	22.1
Age, ≥45 years	7248	71.2	391	5.4	1634	22.5
Length of stay, 1-3 days	3683	36.2	58	1.6	695	18.9
Length of stay, 4-7 days	3341	32.8	182	5.4	891	26.7
Length of stay, 8-14 days	2072	20.4	126	6.1	490	23.6
Length of stay, ≥15 days	1083	10.6	96	8.9	242	22.3
Length of stay, Missing/Unknown	1	0.0	0	0.0	0	0.0
McCabe score, Non fatal	6409	63.0	208	3.2	1313	20.5
McCabe score, Ultimately fatal	876	8.6	65	7.4	226	25.8
McCabe score, Rapidly fatal	435	4.3	52	12.0	151	34.7
McCabe score, Missing/Unknown	2460	24.2	137	5.6	628	25.5
Surgery since hospital admission	2653	26.1	190	7.2	884	33.3
Central vascular catheter	424	4.2	110	25.9	271	63.9
Peripheral vascular catheter	3370	33.1	222	6.6	1299	38.5
Urinary catheter	1238	12.2	200	16.2	686	55.4
Intubation	192	1.9	82	42.7	141	73.4
Total	10180	100.0	462	4.5	2318	22.8

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Iceland

PPS data from 14/05/2012 to 30/05/2012

Number of hospitals	2
Standard protocol	2
Light protocol	0
Number of patients	462

Comments

Data representativeness: good

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	1	50
Secondary	0	0
Tertiary	1	50
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	390	[120-659]
Average length of stay (days)*	6.9	[5.6-8.3]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	47
HAI prevalence % (95%CI)	**10.2 (5.6-17.9)**
N of HAIs	51
N of HAIs per infected patient	1.09
N HAIs with microorganism (%)	27 (52.9)
Total N of reported microorg.	37

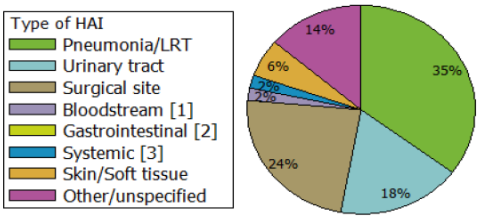
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	5	9.8	5	1.1
Origin of HAI=Same hospital	2	40	2	0.4
Origin of HAI=Other hospital	3	60	3	0.6
Origin of HAI=Other/unknown	0	0	0	0
HAI during current hospitalisation	46	90.2	42	9.1
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (0.0%)
[2] incl. *C. difficile* infections (0.0%)
[3] incl. clinical sepsis (2.0%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	91	19.7	12	13.2
Medicine	208	45	21	10.1
Paediatrics	25	5.4	3	12.0
Intensive care*	24	5.2	5	20.8
Obstetrics and gynaecology	25	5.4	4	16.0
Geriatrics	21	4.5	2	9.5
Psychiatry	68	14.7	0	0.0
Rehabilitation/Other	0	0	0	—
All specialties	462	100	47	10.2

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

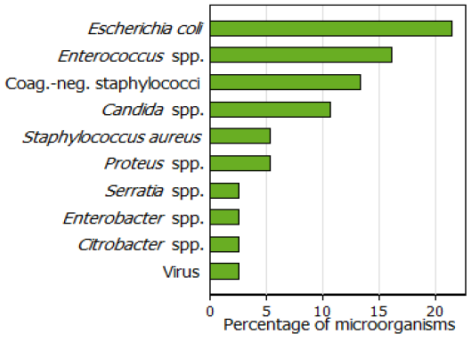


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	2	2	0	—
Enterococci / VRE	6	6	0	—
Enterococcus faecalis / VAN-R	3	3	0	—
Enterococcus faecium / VAN-R	1	1	0	—
Enterobacteriaceae / 3GC-NS	13	12	2	16.7
Escherichia coli / 3GC-NS	8	7	1	—
Klebsiella spp. / 3GC-NS	0	0	0	—
Enterobacter spp. / 3GC-NS	1	1	0	—
Enterobacteriaceae / CAR-NS	13	12	0	0.0
Escherichia coli / CAR-NS	8	7	0	—
Klebsiella spp. / CAR-NS	0	0	0	—
Enterobacter spp. / CAR-NS	1	1	0	—
Pseudomonas aeruginosa / CAR-NS	0	0	0	—
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Iceland (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	181	
AU prevalence % (95%CI)	39.2 (15.1-70.1)	
N of antimicrobials	247	
N of antimicrobials per patient	1.36	
	N	Rel%
Reason in patient charts/notes, Yes	204	82.6
Reason in patient charts/notes, No	20	8.1
Reason in patient charts/notes, Unknown	23	9.3
Route of administration, Parenteral	154	62.3
Route of administration, Oral	93	37.7
Route of administration, Other/unknown	0	0

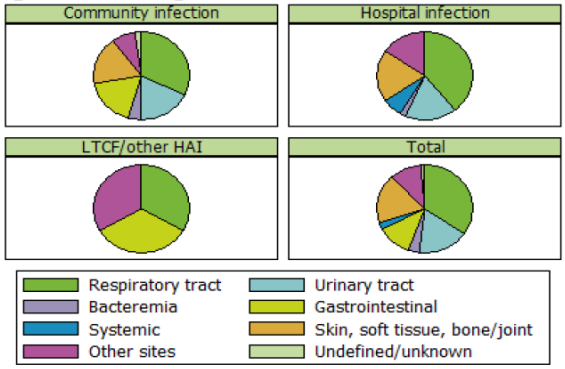
N=Number, Rel%=percentage of total N of antimicrobials

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	91	19.7	47	51.6
Medicine	208	45.0	93	44.7
Paediatrics	25	5.4	10	40.0
Intensive care*	24	5.2	11	45.8
Obstetrics and gynaecology	25	5.4	13	52.0
Geriatrics	21	4.5	7	33.3
Psychiatry	68	14.7	0	0.0
Rehabilitation/Other	0	0.0	0	—
All specialties	462	100	181	39.2

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	132	28.6	169	68.4
Community infection	90	19.5	112	45.3
Hospital infection	42	9.1	54	21.9
Long-term care/other HAI	3	0.6	3	1.2
Surgical prophylaxis	30	6.5	43	17.4
Single dose	14	3.0	17	6.9
One day	9	1.9	10	4.0
>1 day	11	2.4	16	6.5
Medical prophylaxis	18	3.9	28	11.3
Other indication	4	0.9	4	1.6
Unknown	3	0.6	3	1.2

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

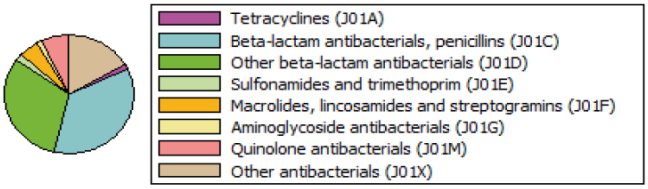


Figure 5. Top ten antimicrobial agents (AMs)

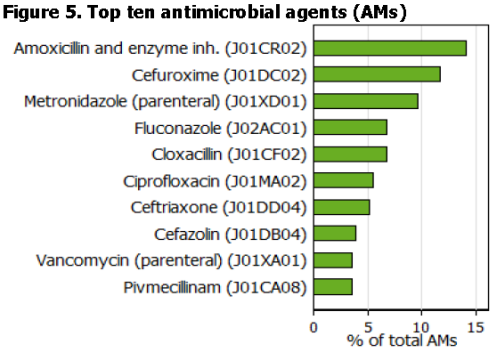


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	216	46.8	22	10.2	78	36.1
Age, <1 year	27	5.8	3	11.1	7	25.9
Age, 1-44 years	104	22.5	5	4.8	27	26.0
Age, ≥45 years	331	71.6	39	11.8	147	44.4
Length of stay, 1-3 days	127	27.5	7	5.5	64	50.4
Length of stay, 4-7 days	126	27.3	13	10.3	46	36.5
Length of stay, 8-14 days	91	19.7	8	8.8	37	40.7
Length of stay, ≥15 days	118	25.5	19	16.1	34	28.8
Length of stay, Missing/Unknown	0	0.0	0	—	0	—
McCabe score, Non fatal	307	66.5	23	7.5	99	32.2
McCabe score, Ultimately fatal	77	16.7	10	13.0	37	48.1
McCabe score, Rapidly fatal	25	5.4	6	24.0	18	72.0
McCabe score, Missing/Unknown	53	11.5	8	15.1	27	50.9
Surgery since hospital admission	122	26.4	22	18.0	65	53.3
Central vascular catheter	44	9.5	15	34.1	33	75.0
Peripheral vascular catheter	197	42.6	23	11.7	115	58.4
Urinary catheter	61	13.2	15	24.6	40	65.6
Intubation	10	2.2	5	50.0	10	100.0
Total	462	100.0	47	10.2	181	39.2

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Ireland

PPS data from 01/05/2012 to 25/05/2012

Number of hospitals	50
Standard protocol	50
Light protocol	0
Number of patients	9030

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	15	30
Secondary	10	20
Tertiary	6	12
Specialised	19	38
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	188	[125-302]
Average length of stay (days)*	5	[3.4-6.3]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	467
HAI prevalence % (95%CI)	**5.2 (4.3-6.3)**
N of HAIs	501
N of HAIs per infected patient	1.07
N HAIs with microorganism (%)	261 (52.1)
Total N of reported microorg.	310

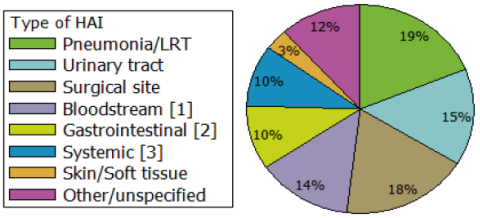
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	119	23.8	112	1.2
Origin of HAI=Same hospital	53	44.5	52	0.6
Origin of HAI=Other hospital	57	47.9	53	0.6
Origin of HAI=Other/unknown	9	7.6	7	0.1
HAI during current hospitalisation	382	76.2	355	3.9
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (5.6%)
[2] incl. *C. difficile* infections (5.8%)
[3] incl. clinical sepsis (9.4%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2240	24.8	161	7.2
Medicine	4052	44.9	194	4.8
Paediatrics	553	6.1	4	0.7
Intensive care*	444	4.9	71	16.0
Obstetrics and gynaecology	886	9.8	16	1.8
Geriatrics	372	4.1	13	3.5
Psychiatry	460	5.1	7	1.5
Rehabilitation/Other	23	0.3	1	4.3
All specialties	9030	100	467	5.2

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

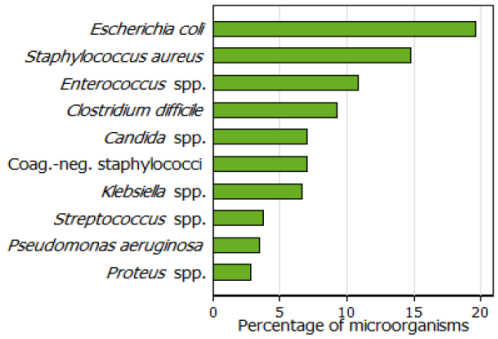


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	46	44	17	38.6
Enterococci / VRE	34	29	9	31.0
Enterococcus faecalis / VAN-R	10	10	1	10.0
Enterococcus faecium / VAN-R	10	9	6	—
Enterobacteriaceae / 3GC-NS	103	91	26	28.6
Escherichia coli / 3GC-NS	61	51	11	21.6
Klebsiella spp. / 3GC-NS	21	19	6	31.6
Enterobacter spp. / 3GC-NS	8	8	5	—
Enterobacteriaceae / CAR-NS	103	91	2	2.2
Escherichia coli / CAR-NS	61	51	1	2.0
Klebsiella spp. / CAR-NS	21	19	0	0.0
Enterobacter spp. / CAR-NS	8	8	1	—
Pseudomonas aeruginosa / CAR-NS	11	11	4	36.4
Acinetobacter baumannii / CAR-NS	2	2	0	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Ireland (continued)

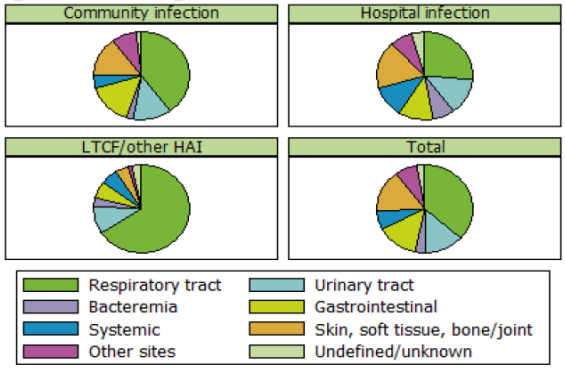
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	3108	
AU prevalence % (95%CI)	34.4 (31.3-37.7)	
N of antimicrobials	4532	
N of antimicrobials per patient	1.46	
	N	Rel%
Reason in patient charts/notes, Yes	3767	83.1
Reason in patient charts/notes, No	691	15.2
Reason in patient charts/notes, Unknown	74	1.6
Route of administration, Parenteral	2855	63
Route of administration, Oral	1657	36.6
Route of administration, Other/unknown	20	0.4

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

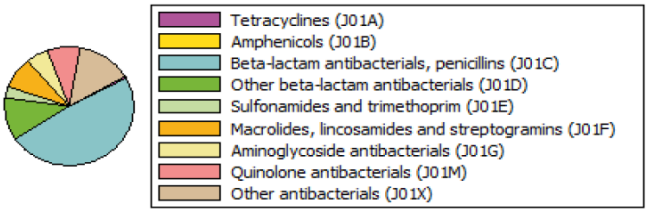


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2240	24.8	960	42.9
Medicine	4052	44.9	1515	37.4
Paediatrics	553	6.1	113	20.4
Intensive care*	444	4.9	213	48.0
Obstetrics and gynaecology	886	9.8	195	22.0
Geriatrics	372	4.1	83	22.3
Psychiatry	460	5.1	25	5.4
Rehabilitation/Other	23	0.3	4	17.4
All specialties	9030	100	3108	34.4

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	2384	26.4	3526	77.8
Community infection	1656	18.3	2415	53.3
Hospital infection	687	7.6	1025	22.6
Long-term care/other HAI	67	0.7	86	1.9
Surgical prophylaxis	417	4.6	508	11.2
Single dose	123	1.4	138	3.0
One day	123	1.4	133	2.9
>1 day	185	2.0	237	5.2
Medical prophylaxis	294	3.3	361	8.0
Other indication	32	0.4	38	0.8
Unknown	84	0.9	99	2.2

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

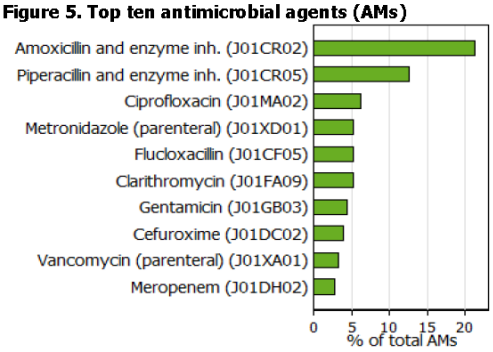


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	4180	46.3	244	5.8	1503	36.0
Age, <1 year	711	7.9	23	3.2	112	15.8
Age, 1-44 years	2099	23.2	71	3.4	689	32.8
Age, ≥45 years	6220	68.9	373	6.0	2307	37.1
Length of stay, 1-3 days	2994	33.2	48	1.6	1001	33.4
Length of stay, 4-7 days	2075	23.0	105	5.1	913	44.0
Length of stay, 8-14 days	1512	16.7	114	7.5	579	38.3
Length of stay, ≥15 days	2409	26.7	198	8.2	609	25.3
Length of stay, Missing/Unknown	40	0.4	2	5.0	6	15.0
McCabe score, Non fatal	6673	73.9	270	4.0	2087	31.3
McCabe score, Ultimately fatal	1955	21.7	157	8.0	842	43.1
McCabe score, Rapidly fatal	311	3.4	34	10.9	154	49.5
McCabe score, Missing/Unknown	91	1.0	6	6.6	25	27.5
Surgery since hospital admission	1591	17.6	165	10.4	761	47.8
Central vascular catheter	544	6.0	124	22.8	371	68.2
Peripheral vascular catheter	3679	40.7	267	7.3	2078	56.5
Urinary catheter	1119	12.4	145	13.0	633	56.6
Intubation	127	1.4	41	32.3	96	75.6
Total	9030	100.0	467	5.2	3108	34.4

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Italy

PPS data from 06/09/2011 to 25/11/2011

Number of hospitals	49
Standard protocol	49
Light protocol	0
Number of patients	14784

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	8	16.3
Secondary	22	44.9
Tertiary	17	34.7
Specialised	2	4.1
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]	
Size (number of beds)	393	[210-575]	
Average length of stay (days)*	6.3	[5.2-7.3]	

*Hospital statistics of year preceding PPS

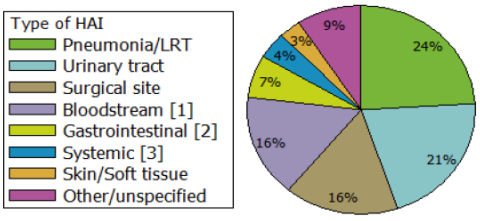
II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	938
HAI prevalence % (95%CI)	**6.3 (5.4-7.4)**
N of HAIs	1068
N of HAIs per infected patient	1.14
N HAIs with microorganism (%)	652 (61.0)
Total N of reported microorg.	841

N=number

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (8.9%)
[2] incl. *C. difficile* infections (2.8%)
[3] incl. clinical sepsis (3.9%)
LRT=Lower respiratory tract

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	249	23.3	224	1.5
Origin of HAI=Same hospital	148	59.4	132	0.9
Origin of HAI=Other hospital	73	29.3	67	0.5
Origin of HAI=Other/unknown	28	11.2	25	0.2
HAI during current hospitalisation	814	76.2	709	4.8
Missing	5	0.5		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	4807	32.5	302	6.3
Medicine	5887	39.8	410	7.0
Paediatrics	784	5.3	9	1.1
Intensive care*	1047	7.1	155	14.8
Obstetrics and gynaecology	1146	7.8	14	1.2
Geriatrics	333	2.3	18	5.4
Psychiatry	378	2.6	6	1.6
Rehabilitation/Other	402	2.7	24	6.0
All specialties	14784	100	938	6.3

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

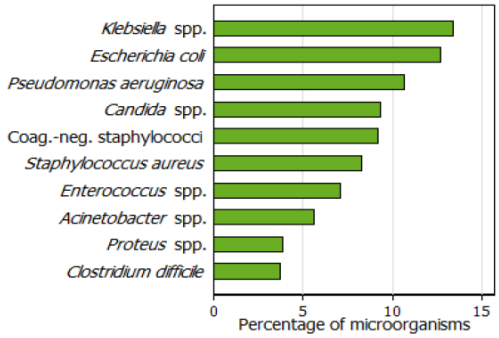


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	70	66	41	62.1
Enterococci / VRE	60	53	6	11.3
Enterococcus faecalis / VAN-R	57	50	6	12.0
Enterococcus faecium / VAN-R	1	1	0	–
Enterobacteriaceae / 3GC-NS	314	276	133	48.2
Escherichia coli / 3GC-NS	107	103	36	35.0
Klebsiella spp. / 3GC-NS	113	100	65	65.0
Enterobacter spp. / 3GC-NS	32	26	11	42.3
Enterobacteriaceae / CAR-NS	314	276	61	22.1
Escherichia coli / CAR-NS	107	103	9	8.7
Klebsiella spp. / CAR-NS	113	100	46	46.0
Enterobacter spp. / CAR-NS	32	26	1	3.8
Pseudomonas aeruginosa / CAR-NS	90	78	35	44.9
Acinetobacter baumannii / CAR-NS	47	41	39	95.1

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Italy (continued)

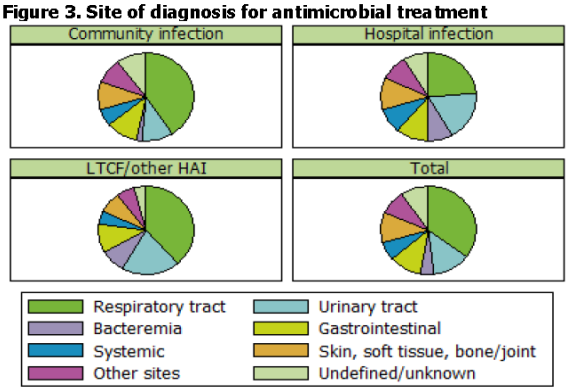
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	6509	
AU prevalence % (95%CI)	44.0 (42.1-46.0)	
N of antimicrobials	9052	
N of antimicrobials per patient	1.39	
	N	Rel%
Reason in patient charts/notes, Yes	6066	67
Reason in patient charts/notes, No	2439	26.9
Reason in patient charts/notes, Unknown	547	6
Route of administration, Parenteral	6875	76
Route of administration, Oral	2135	23.6
Route of administration, Other/unknown	42	0.5

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

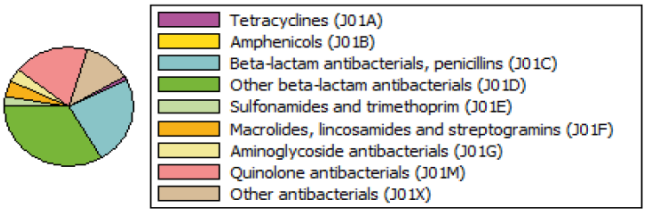


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	4807	32.5	2386	49.6
Medicine	5887	39.8	2715	46.1
Paediatrics	784	5.3	198	25.3
Intensive care*	1047	7.1	578	55.2
Obstetrics and gynaecology	1146	7.8	332	29.0
Geriatrics	333	2.3	160	48.0
Psychiatry	378	2.6	15	4.0
Rehabilitation/Other	402	2.7	125	31.1
All specialties	14784	100	6509	44.0

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	3138	21.2	4822	53.3
Community infection	2106	14.2	3121	34.5
Hospital infection	983	6.6	1567	17.3
Long-term care/other HAI	92	0.6	134	1.5
Surgical prophylaxis	1524	10.3	1707	18.9
Single dose	431	2.9	447	4.9
One day	171	1.2	177	2.0
>1 day	940	6.4	1083	12.0
Medical prophylaxis	1752	11.9	2152	23.8
Other indication	123	0.8	155	1.7
Unknown	182	1.2	218	2.4

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

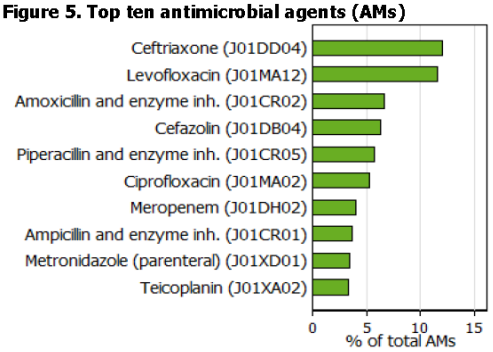


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	7247	49.0	534	7.4	3487	48.1
Age, <1 year	904	6.1	32	3.5	216	23.9
Age, 1-44 years	3214	21.7	113	3.5	1345	41.8
Age, ≥45 years	10562	71.4	785	7.4	4909	46.5
Length of stay, 1-3 days	4528	30.6	115	2.5	1719	38.0
Length of stay, 4-7 days	4240	28.7	203	4.8	1933	45.6
Length of stay, 8-14 days	3230	21.8	256	7.9	1590	49.2
Length of stay, ≥15 days	2595	17.6	356	13.7	1205	46.4
Length of stay, Missing/Unknown	191	1.3	8	4.2	62	32.5
McCabe score, Non fatal	10887	73.6	485	4.5	4353	40.0
McCabe score, Ultimately fatal	2022	13.7	238	11.8	1131	55.9
McCabe score, Rapidly fatal	1257	8.5	163	13.0	700	55.7
McCabe score, Missing/Unknown	618	4.2	52	8.4	325	52.6
Surgery since hospital admission	4670	31.6	432	9.3	2647	56.7
Central vascular catheter	1791	12.1	384	21.4	1294	72.3
Peripheral vascular catheter	8277	56.0	561	6.8	4587	55.4
Urinary catheter	3646	24.7	480	13.2	2391	65.6
Intubation	440	3.0	136	30.9	342	77.7
Total	14784	100.0	938	6.3	6509	44.0

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Latvia

PPS data from 07/05/2011 to 05/08/2011

Number of hospitals	15
Standard protocol	14
Light protocol	1
Number of patients	3447

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	2	13.3
Secondary	5	33.3
Tertiary	5	33.3
Specialised	3	20
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	283	[200-410]
Average length of stay (days)*	6.5	[6.1-6.8]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	80
HAI prevalence % (95%CI)	**2.3 (1.5-3.6)**
N of HAIs	82
N of HAIs per infected patient	1.02
N HAIs with microorganism (%)	37 (45.1)
Total N of reported microorg.	47

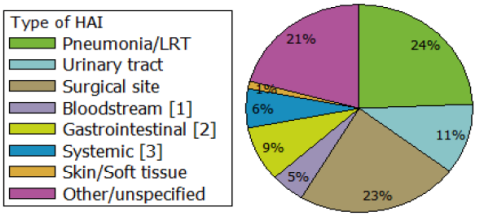
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	24	29.3	23	0.7
Origin of HAI=Same hospital	9	37.5	8	0.2
Origin of HAI=Other hospital	14	58.3	14	0.4
Origin of HAI=Other/unknown	1	4.2	1	0
HAI during current hospitalisation	58	70.7	57	1.7
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (2.4%)
[2] incl. *C. difficile* infections (6.1%)
[3] incl. clinical sepsis (6.1%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	1258	36.5	33	2.6
Medicine	1517	44	18	1.2
Paediatrics	279	8.1	8	2.9
Intensive care*	119	3.5	20	16.8
Obstetrics and gynaecology	247	7.2	1	0.4
Geriatrics	0	0	0	—
Psychiatry	27	0.8	0	0.0
Rehabilitation/Other	0	0	0	—
All specialties	3447	100	80	2.3

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

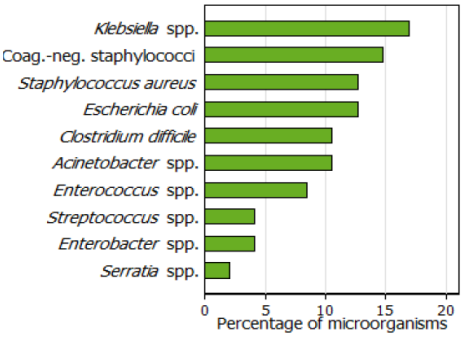


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	6	4	2	—
Enterococci / VRE	4	2	1	—
Enterococcus faecalis / VAN-R	0	0	0	—
Enterococcus faecium / VAN-R	0	0	0	—
Enterobacteriaceae / 3GC-NS	17	14	10	71.4
Escherichia coli / 3GC-NS	6	5	3	—
Klebsiella spp. / 3GC-NS	8	8	6	—
Enterobacter spp. / 3GC-NS	2	1	1	—
Enterobacteriaceae / CAR-NS	17	14	0	0.0
Escherichia coli / CAR-NS	6	5	0	—
Klebsiella spp. / CAR-NS	8	8	0	—
Enterobacter spp. / CAR-NS	2	1	0	—
Pseudomonas aeruginosa / CAR-NS	0	0	0	—
Acinetobacter baumannii / CAR-NS	5	5	5	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Latvia (continued)

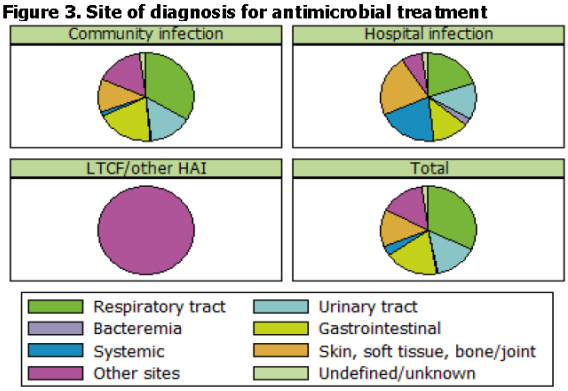
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	1322	
AU prevalence % (95%CI)	38.4 (34.7-42.1)	
N of antimicrobials	1743	
N of antimicrobials per patient	1.32	
	N	Rel%
Reason in patient charts/notes, Yes	1413	81.1
Reason in patient charts/notes, No	179	10.3
Reason in patient charts/notes, Unknown	151	8.7
Route of administration, Parenteral	1441	82.7
Route of administration, Oral	281	16.1
Route of administration, Other/unknown	21	1.2

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

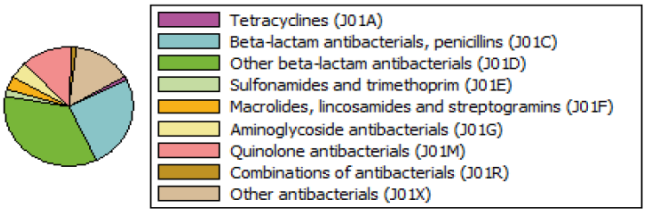


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	1258	36.5	521	41.4
Medicine	1517	44.0	516	34.0
Paediatrics	279	8.1	134	48.0
Intensive care*	119	3.5	84	70.6
Obstetrics and gynaecology	247	7.2	67	27.1
Geriatrics	0	0.0	0	.
Psychiatry	27	0.8	0	0.0
Rehabilitation/Other	0	0.0	0	.
All specialties	3447	100	1322	38.4

N pts=number of patients, Rel%=% of total N patients, with AU= with≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1003	29.1	1353	77.6
Community infection	890	25.8	1193	68.4
Hospital infection	117	3.4	159	9.1
Long-term care/other HAI	1	0.0	1	0.1
Surgical prophylaxis	147	4.3	177	10.2
Single dose	22	0.6	28	1.6
One day	46	1.3	51	2.9
>1 day	79	2.3	98	5.6
Medical prophylaxis	56	1.6	66	3.8
Other indication	8	0.2	11	0.6
Unknown	118	3.4	136	7.8

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

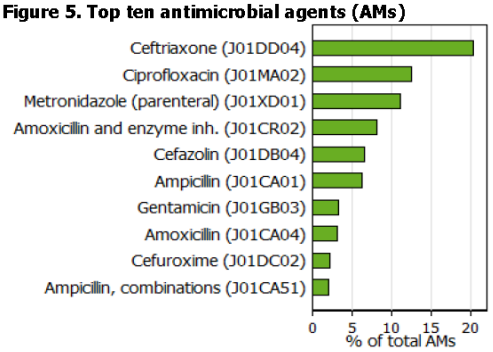


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	1350	47.7	34	2.5	545	40.4
Age, <1 year	204	7.2	10	4.9	70	34.3
Age, 1-44 years	994	35.1	6	0.6	392	39.4
Age, ≥45 years	1634	57.7	49	3.0	633	38.7
Length of stay, 1-3 days	970	34.3	6	0.6	310	32.0
Length of stay, 4-7 days	866	30.6	21	2.4	385	44.5
Length of stay, 8-14 days	622	22.0	21	3.4	270	43.4
Length of stay, ≥15 days	372	13.1	17	4.6	129	34.7
Length of stay, Missing/Unknown	2	0.1	0	0.0	1	50.0
McCabe score, Non fatal	2515	88.8	39	1.6	939	37.3
McCabe score, Ultimately fatal	218	7.7	19	8.7	106	48.6
McCabe score, Rapidly fatal	21	0.7	2	9.5	10	47.6
McCabe score, Missing/Unknown	78	2.8	5	6.4	40	51.3
Surgery since hospital admission	702	24.8	31	4.4	351	50.0
Central vascular catheter	123	4.3	20	16.3	86	69.9
Peripheral vascular catheter	1407	49.7	39	2.8	756	53.7
Urinary catheter	239	8.4	24	10.0	153	64.0
Intubation	36	1.3	11	30.6	26	72.2
Total	2832	100.0	65	2.3	1095	38.7

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Lithuania

PPS data from 11/04/2012 to 14/06/2012

Number of hospitals	44
Standard protocol	44
Light protocol	0
Number of patients	7761

Comments

Data representativeness: good

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	20	45.5
Secondary	15	34.1
Tertiary	7	15.9
Specialised	2	4.5
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	195	[152-338]
Average length of stay (days)*	7.5	[6.3-8.9]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	255
HAI prevalence % (95%CI)	**3.3 (2.1-5.1)**
N of HAIs	270
N of HAIs per infected patient	1.06
N HAIs with microorganism (%)	130 (48.1)
Total N of reported microorg.	181

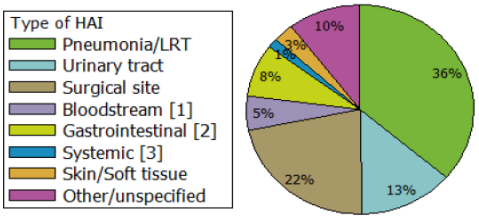
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	77	28.5	75	1
Origin of HAI=Same hospital	37	48.1	36	0.5
Origin of HAI=Other hospital	40	51.9	39	0.5
Origin of HAI=Other/unknown	0	0	0	0
HAI during current hospitalisation	193	71.5	180	2.3
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (1.5%)
[2] incl. *C. difficile* infections (0.0%)
[3] incl. clinical sepsis (1.5%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2270	29.2	122	5.4
Medicine	3944	50.8	66	1.7
Paediatrics	432	5.6	7	1.6
Intensive care*	272	3.5	49	18.0
Obstetrics and gynaecology	407	5.2	11	2.7
Geriatrics	0	0	0	—
Psychiatry	224	2.9	0	0.0
Rehabilitation/Other	212	2.7	0	0.0
All specialties	7761	100	255	3.3

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

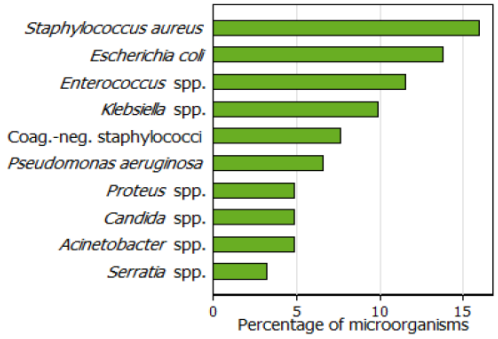


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	29	28	11	39.3
Enterococci / VRE	21	19	4	21.1
Enterococcus faecalis / VAN-R	8	8	0	—
Enterococcus faecium / VAN-R	9	9	4	—
Enterobacteriaceae / 3GC-NS	63	58	24	41.4
Escherichia coli / 3GC-NS	25	23	5	21.7
Klebsiella spp. / 3GC-NS	18	17	10	58.8
Enterobacter spp. / 3GC-NS	3	2	0	—
Enterobacteriaceae / CAR-NS	63	16	10	62.5
Escherichia coli / CAR-NS	25	0	0	—
Klebsiella spp. / CAR-NS	18	12	8	66.7
Enterobacter spp. / CAR-NS	3	2	0	—
Pseudomonas aeruginosa / CAR-NS	12	9	4	—
Acinetobacter baumannii / CAR-NS	4	4	4	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Lithuania (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	2574	
AU prevalence % (95%CI)	33.2 (30.0-36.5)	
N of antimicrobials	3085	
N of antimicrobials per patient	1.2	
	N	Rel%
Reason in patient charts/notes, Yes	2512	81.4
Reason in patient charts/notes, No	530	17.2
Reason in patient charts/notes, Unknown	43	1.4
Route of administration, Parenteral	2776	90
Route of administration, Oral	304	9.9
Route of administration, Other/unknown	5	0.2

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment

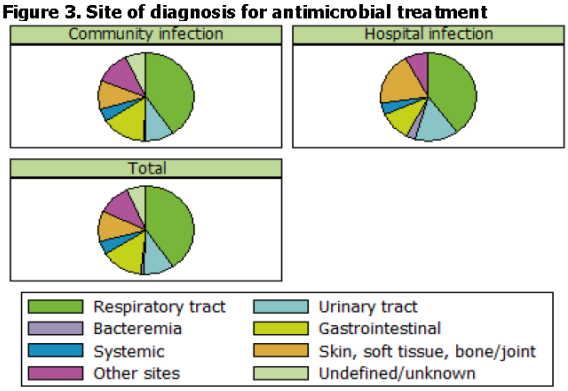


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2270	29.2	1043	45.9
Medicine	3944	50.8	969	24.6
Paediatrics	432	5.6	247	57.2
Intensive care*	272	3.5	164	60.3
Obstetrics and gynaecology	407	5.2	116	28.5
Geriatrics	0	0.0	0	—
Psychiatry	224	2.9	5	2.2
Rehabilitation/Other	212	2.7	30	14.2
All specialties	7761	100	2574	33.2

N pts=number of patients, Rel%=% of total N patients, with AU= with≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1824	23.5	2182	70.7
Community infection	1606	20.7	1899	61.6
Hospital infection	219	2.8	283	9.2
Long-term care/other HAI	0	0.0	0	0.0
Surgical prophylaxis	614	7.9	664	21.5
Single dose	177	2.3	193	6.3
One day	106	1.4	106	3.4
>1 day	336	4.3	365	11.8
Medical prophylaxis	161	2.1	200	6.5
Other indication	0	0.0	0	0.0
Unknown	28	0.4	39	1.3

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

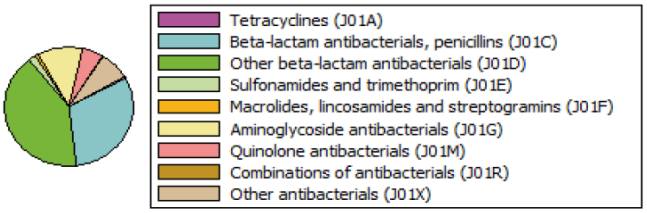


Figure 5. Top ten antimicrobial agents (AMs)

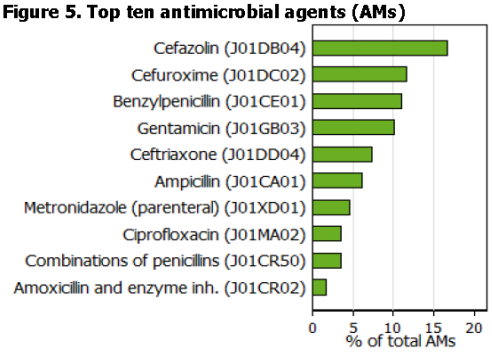


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	3451	44.5	142	4.1	1273	36.9
Age, <1 year	249	3.2	8	3.2	66	26.5
Age, 1-44 years	1766	22.8	41	2.3	687	38.9
Age, ≥45 years	5730	73.8	206	3.6	1815	31.7
Length of stay, 1-3 days	2782	35.8	34	1.2	818	29.4
Length of stay, 4-7 days	2448	31.5	88	3.6	933	38.1
Length of stay, 8-14 days	1783	23.0	61	3.4	601	33.7
Length of stay, ≥15 days	748	9.6	72	9.6	222	29.7
Length of stay, Missing/Unknown	0	0.0	0	—	0	—
McCabe score, Non fatal	6204	79.9	141	2.3	1979	31.9
McCabe score, Ultimately fatal	327	4.2	29	8.9	151	46.2
McCabe score, Rapidly fatal	127	1.6	23	18.1	66	52.0
McCabe score, Missing/Unknown	1103	14.2	62	5.6	378	34.3
Surgery since hospital admission	1911	24.6	146	7.6	1023	53.5
Central vascular catheter	297	3.8	71	23.9	208	70.0
Peripheral vascular catheter	2979	38.4	144	4.8	1811	60.8
Urinary catheter	498	6.4	68	13.7	373	74.9
Intubation	126	1.6	36	28.6	101	80.2
Total	7761	100.0	255	3.3	2574	33.2

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Luxembourg

PPS data from 18/04/2012 to 16/05/2012

Number of hospitals	9
Standard protocol	9
Light protocol	0
Number of patients	1744

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	1	11.1
Secondary	5	55.6
Tertiary	1	11.1
Specialised	2	22.2
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	306	[100-375]
Average length of stay (days)*	6.4	[6.0-15.5]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	94
HAI prevalence % (95%CI)	**5.4 (3.6-8.0)**
N of HAIs	102
N of HAIs per infected patient	1.09
N HAIs with microorganism (%)	60 (58.8)
Total N of reported microorg.	76

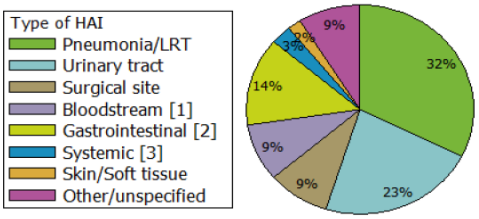
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	37	36.3	36	2.1
Origin of HAI=Same hospital	7	18.9	7	0.4
Origin of HAI=Other hospital	15	40.5	15	0.9
Origin of HAI=Other/unknown	15	40.5	14	0.8
HAI during current hospitalisation	65	63.7	58	3.3
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (2.0%)
[2] incl. *C. difficile* infections (10.8%)
[3] incl. clinical sepsis (2.9%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	450	25.8	19	4.2
Medicine	673	38.6	36	5.3
Paediatrics	35	2	0	0.0
Intensive care*	128	7.3	25	19.5
Obstetrics and gynaecology	142	8.1	1	0.7
Geriatrics	112	6.4	13	11.6
Psychiatry	192	11	0	0.0
Rehabilitation/Other	12	0.7	0	0.0
All specialties	1744	100	94	5.4

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

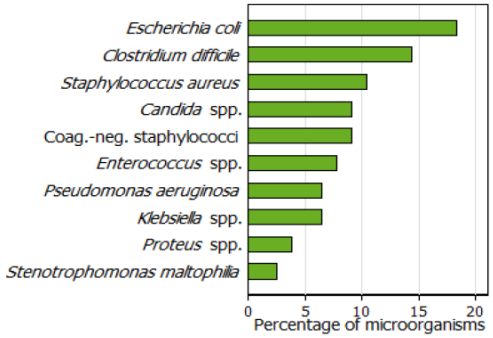


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	8	8	1	—
Enterococci / VRE	6	5	0	—
Enterococcus faecalis / VAN-R	5	4	0	—
Enterococcus faecium / VAN-R	1	1	0	—
Enterobacteriaceae / 3GC-NS	28	21	7	33.3
Escherichia coli / 3GC-NS	14	12	4	33.3
Klebsiella spp. / 3GC-NS	5	3	2	—
Enterobacter spp. / 3GC-NS	2	2	0	—
Enterobacteriaceae / CAR-NS	28	21	0	0.0
Escherichia coli / CAR-NS	14	12	0	0.0
Klebsiella spp. / CAR-NS	5	3	0	—
Enterobacter spp. / CAR-NS	2	2	0	—
Pseudomonas aeruginosa / CAR-NS	5	4	2	—
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Luxembourg (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	515	
AU prevalence % (95%CI)	29.5 (26.4-32.9)	
N of antimicrobials	679	
N of antimicrobials per patient	1.32	
	N	Rel%
Reason in patient charts/notes, Yes	454	66.9
Reason in patient charts/notes, No	221	32.5
Reason in patient charts/notes, Unknown	4	0.6
Route of administration, Parenteral	431	63.5
Route of administration, Oral	248	36.5
Route of administration, Other/unknown	0	0

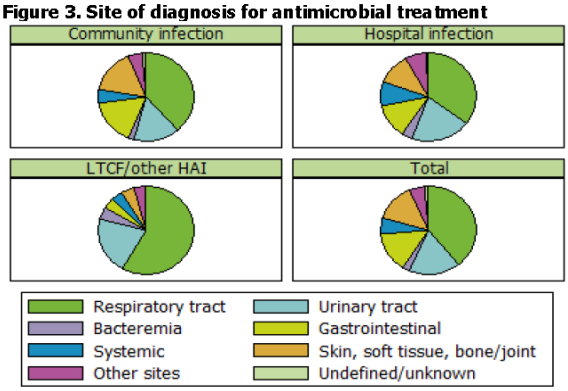
N=Number, Rel%=percentage of total N of antimicrobials

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	450	25.8	170	37.8
Medicine	673	38.6	223	33.1
Paediatrics	35	2.0	7	20.0
Intensive care*	128	7.3	66	51.6
Obstetrics and gynaecology	142	8.1	19	13.4
Geriatrics	112	6.4	23	20.5
Psychiatry	192	11.0	6	3.1
Rehabilitation/Other	12	0.7	1	8.3
All specialties	1744	100	515	29.5

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	294	16.9	400	58.9
Community infection	193	11.1	258	38.0
Hospital infection	84	4.8	113	16.6
Long-term care/other HAI	23	1.3	29	4.3
Surgical prophylaxis	130	7.5	143	21.1
Single dose	47	2.7	47	6.9
One day	11	0.6	11	1.6
>1 day	76	4.4	86	12.7
Medical prophylaxis	29	1.7	37	5.4
Other indication	6	0.3	6	0.9
Unknown	70	4.0	93	13.7

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

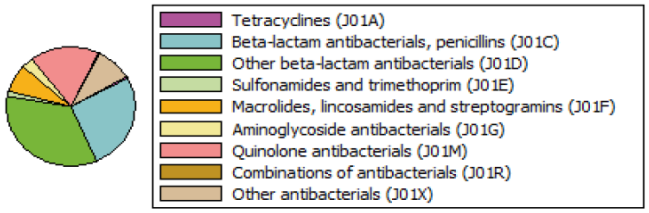


Figure 5. Top ten antimicrobial agents (AMs)

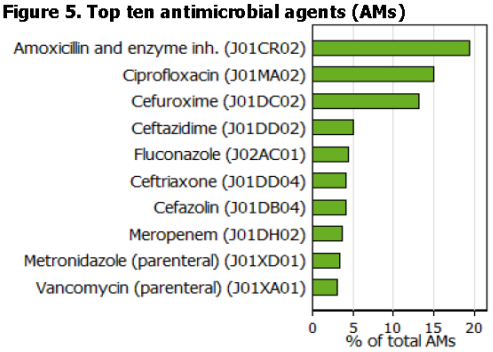


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	802	46.0	47	5.9	275	34.3
Age, <1 year	71	4.1	3	4.2	8	11.3
Age, 1-44 years	362	20.8	4	1.1	80	22.1
Age, ≥45 years	1311	75.2	87	6.6	427	32.6
Length of stay, 1-3 days	411	23.6	9	2.2	137	33.3
Length of stay, 4-7 days	440	25.2	17	3.9	134	30.5
Length of stay, 8-14 days	347	19.9	14	4.0	102	29.4
Length of stay, ≥15 days	544	31.2	54	9.9	141	25.9
Length of stay, Missing/Unknown	2	0.1	0	0.0	1	50.0
McCabe score, Non fatal	1199	68.8	54	4.5	317	26.4
McCabe score, Ultimately fatal	361	20.7	28	7.8	139	38.5
McCabe score, Rapidly fatal	128	7.3	10	7.8	50	39.1
McCabe score, Missing/Unknown	56	3.2	2	3.6	9	16.1
Surgery since hospital admission	555	31.8	33	5.9	209	37.7
Central vascular catheter	164	9.4	28	17.1	99	60.4
Peripheral vascular catheter	637	36.5	42	6.6	313	49.1
Urinary catheter	214	12.3	34	15.9	122	57.0
Intubation	45	2.6	16	35.6	30	66.7
Total	1744	100.0	94	5.4	515	29.5

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Malta

PPS data from 07/05/2012 to 01/06/2012

Number of hospitals	3
Standard protocol	3
Light protocol	0
Number of patients	757

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	0	0
Secondary	2	66.7
Tertiary	1	33.3
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	291	[75-973]
Average length of stay (days)*	4	[3.6-5.3]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	33
HAI prevalence % (95%CI)	**4.4 (3.0-6.3)**
N of HAIs	35
N of HAIs per infected patient	1.06
N HAIs with microorganism (%)	20 (57.1)
Total N of reported microorg.	34

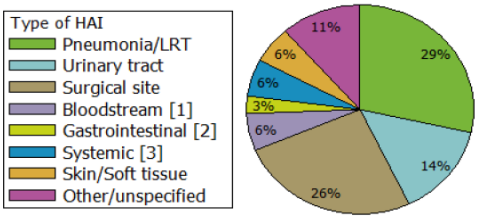
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	7	20	7	0.9
Origin of HAI=Same hospital	7	100	7	0.9
Origin of HAI=Other hospital	0	0	0	0
Origin of HAI=Other/unknown	0	0	0	0
HAI during current hospitalisation	28	80	26	3.4
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (2.9%)
[2] incl. *C. difficile* infections (2.9%)
[3] incl. clinical sepsis (5.7%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	284	37.5	14	4.9
Medicine	314	41.5	12	3.8
Paediatrics	45	5.9	1	2.2
Intensive care	36	4.8	6	16.7
Obstetrics and gynaecology	66	8.7	0	0.0
Geriatrics	0	0	0	—
Psychiatry	12	1.6	0	0.0
Rehabilitation/Other	0	0	0	—
All specialties	757	100	33	4.4

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty

Figure 2. Top ten microorganisms isolated in HAIs

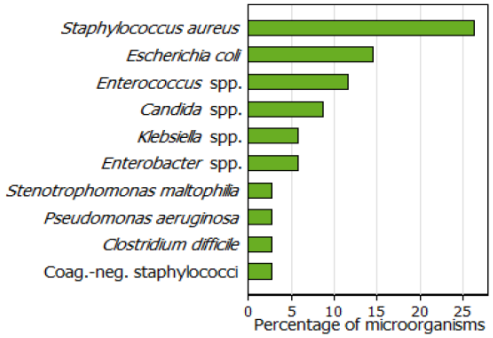


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	9	9	7	—
Enterococci / VRE	4	4	0	—
Enterococcus faecalis / VAN-R	4	4	0	—
Enterococcus faecium / VAN-R	0	0	0	—
Enterobacteriaceae / 3GC-NS	10	10	3	30.0
Escherichia coli / 3GC-NS	5	5	0	—
Klebsiella spp. / 3GC-NS	2	2	0	—
Enterobacter spp. / 3GC-NS	2	2	2	—
Enterobacteriaceae / CAR-NS	10	10	0	0.0
Escherichia coli / CAR-NS	5	5	0	—
Klebsiella spp. / CAR-NS	2	2	0	—
Enterobacter spp. / CAR-NS	2	2	0	—
Pseudomonas aeruginosa / CAR-NS	1	1	0	—
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Malta (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	286	
AU prevalence % (95%CI)	37.8 (34.3-41.4)	
N of antimicrobials	410	
N of antimicrobials per patient	1.43	
	N	Rel%
Reason in patient charts/notes, Yes	252	61.5
Reason in patient charts/notes, No	154	37.6
Reason in patient charts/notes, Unknown	4	1
Route of administration, Parenteral	236	57.6
Route of administration, Oral	173	42.2
Route of administration, Other/unknown	1	0.2

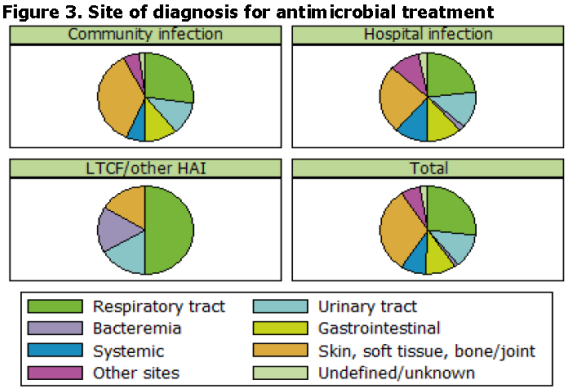
N=Number, Rel%=percentage of total N of antimicrobials

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	284	37.5	131	46.1
Medicine	314	41.5	100	31.8
Paediatrics	45	5.9	11	24.4
Intensive care	36	4.8	20	55.6
Obstetrics and gynaecology	66	8.7	24	36.4
Geriatrics	0	0.0	0	—
Psychiatry	12	1.6	0	0.0
Rehabilitation/Other	0	0.0	0	—
All specialties	757	100	286	37.8

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	178	23.5	265	64.6
Community infection	117	15.5	175	42.7
Hospital infection	58	7.7	79	19.3
Long-term care/other HAI	6	0.8	11	2.7
Surgical prophylaxis	66	8.7	81	19.8
Single dose	0	0.0	0	0.0
One day	13	1.7	14	3.4
>1 day	53	7.0	67	16.3
Medical prophylaxis	22	2.9	30	7.3
Other indication	0	0.0	0	0.0
Unknown	26	3.4	34	8.3

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

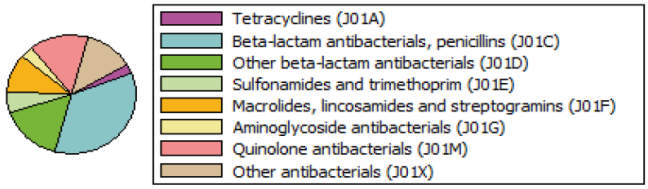


Figure 5. Top ten antimicrobial agents (AMs)

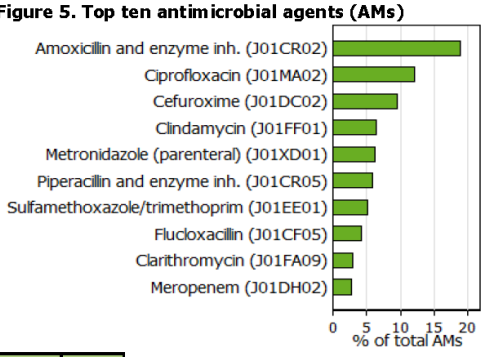


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	366	48.3	17	4.6	147	40.2
Age, <1 year	41	5.4	1	2.4	5	12.2
Age, 1-44 years	172	22.7	4	2.3	67	39.0
Age, ≥45 years	542	71.6	28	5.2	213	39.3
Length of stay, 1-3 days	237	31.3	2	0.8	73	30.8
Length of stay, 4-7 days	218	28.8	10	4.6	107	49.1
Length of stay, 8-14 days	122	16.1	6	4.9	49	40.2
Length of stay, ≥15 days	180	23.8	15	8.3	57	31.7
Length of stay, Missing/Unknown	0	0.0	0	—	0	—
McCabe score, Non fatal	499	65.9	19	3.8	186	37.3
McCabe score, Ultimately fatal	146	19.3	12	8.2	66	45.2
McCabe score, Rapidly fatal	29	3.8	1	3.4	12	41.4
McCabe score, Missing/Unknown	83	11.0	1	1.2	22	26.5
Surgery since hospital admission	186	24.6	18	9.7	109	58.6
Central vascular catheter	44	5.8	5	11.4	25	56.8
Peripheral vascular catheter	339	44.8	25	7.4	179	52.8
Urinary catheter	123	16.2	10	8.1	65	52.8
Intubation	12	1.6	5	41.7	8	66.7
Total	757	100.0	33	4.4	286	37.8

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Netherlands

PPS data from 03/10/2011 to 31/10/2011

Number of hospitals	33
Standard protocol	33
Light protocol	0
Number of patients	7540

Comments

In the Netherlands, the HAIs present on admission were registered based on the diagnosis of the physician at admission and not based on the definitions of HAI in the PPS. Only data on resistant isolates were collected in the Dutch national PPS protocol. The susceptibility of other isolates could be either 'susceptible' or 'unknown'. The percentage of non-susceptible isolates is therefore not given.
Link to national report: www.prezies.nl.
Data representativeness: good

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	21	63.6
Secondary	0	0
Tertiary	12	36.4
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	427	[264-605]
Average length of stay (days)*	5.4	[4.8-5.8]

*Hospital statistics of year preceding PPS

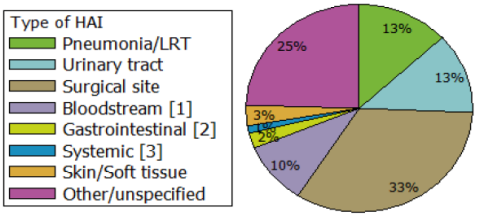
II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	555
HAI prevalence % (95%CI)	**7.4 (6.2-8.8)**
N of HAIs	598
N of HAIs per infected patient	1.08
N HAIs with microorganism (%)	277 (46.3)
Total N of reported microorg.	329

N=number

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (1.3%)
[2] incl. *C. difficile* infections (0.8%)
[3] incl. clinical sepsis (1.2%)
LRT=Lower respiratory tract

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission*	238	39.8	229	3
Origin of HAI=Same hospital	158	66.4	152	2
Origin of HAI=Other hospital	0	0	0	0
Origin of HAI=Other/unknown	80	33.6	77	1
HAI during current hospitalisation	360	60.2	326	4.3
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category
*see country comments, above

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2459	32.6	267	10.9
Medicine	3523	46.7	177	5.0
Paediatrics	342	4.5	16	4.7
Intensive care*	520	6.9	76	14.6
Obstetrics and gynaecology	509	6.8	9	1.8
Geriatrics	187	2.5	10	5.3
Psychiatry	0	0	0	—
Rehabilitation/Other	0	0	0	—
All specialties	7540	100	555	7.4

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

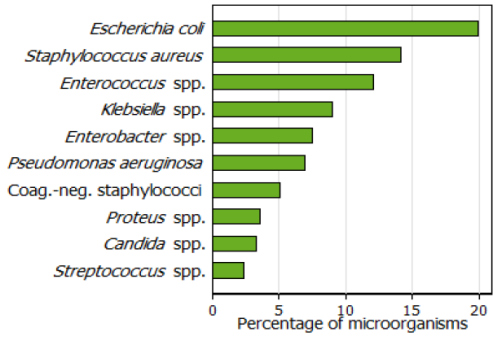


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS*
Staphylococcus aureus / MRSA	47	0	0	—
Enterococci / VRE	40	1	1	—
Enterococcus faecalis / VAN-R	21	0	0	—
Enterococcus faecium / VAN-R	18	1	1	—
Enterobacteriaceae / 3GC-NS	142	24	24	—
Escherichia coli / 3GC-NS	66	11	11	—
Klebsiella spp. / 3GC-NS	30	6	6	—
Enterobacter spp. / 3GC-NS	25	6	6	—
Enterobacteriaceae / CAR-NS	142	0	0	—
Escherichia coli / CAR-NS	66	0	0	—
Klebsiella spp. / CAR-NS	30	0	0	—
Enterobacter spp. / CAR-NS	25	0	0	—
Pseudomonas aeruginosa / CAR-NS	23	2	2	—
Acinetobacter baumannii / CAR-NS	1	0	0	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem
*see country comments, above

Netherlands (continued)

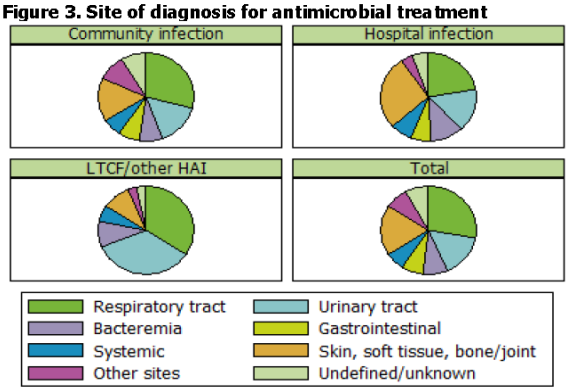
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	2394	
AU prevalence % (95%CI)	31.8 (30.0-33.6)	
N of antimicrobials	3088	
N of antimicrobials per patient	1.29	
	N	Rel%
Reason in patient charts/notes, Yes	2589	83.8
Reason in patient charts/notes, No	499	16.2
Reason in patient charts/notes, Unknown	0	0
Route of administration, Parenteral	1998	64.7
Route of administration, Oral	1090	35.3
Route of administration, Other/unknown	0	0

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

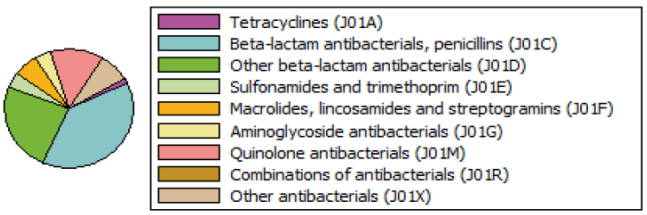


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2459	32.6	820	33.3
Medicine	3523	46.7	1132	32.1
Paediatrics	342	4.5	64	18.7
Intensive care*	520	6.9	252	48.5
Obstetrics and gynaecology	509	6.8	66	13.0
Geriatrics	187	2.5	60	32.1
Psychiatry	0	0.0	0	—
Rehabilitation/Other	0	0.0	0	—
All specialties	7540	100	2394	31.8

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1597	21.2	2025	65.6
Community infection	1207	16.0	1512	49.0
Hospital infection	368	4.9	478	15.5
Long-term care/other HAI	30	0.4	35	1.1
Surgical prophylaxis	289	3.8	323	10.5
Single dose	63	0.8	66	2.1
One day	78	1.0	84	2.7
>1 day	154	2.0	173	5.6
Medical prophylaxis	352	4.7	457	14.8
Other indication	70	0.9	88	2.8
Unknown	162	2.1	196	6.3

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

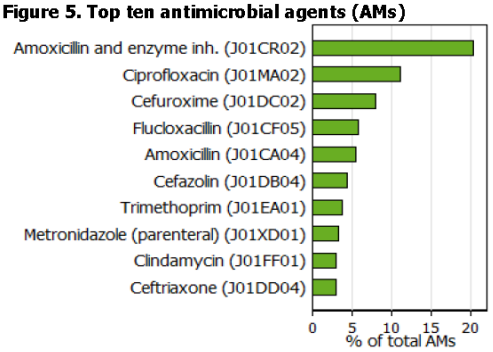


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	3590	47.6	312	8.7	1296	36.1
Age, <1 year	523	6.9	32	6.1	98	18.7
Age, 1–44 years	1297	17.2	58	4.5	357	27.5
Age, ≥45 years	5720	75.9	465	8.1	1939	33.9
Length of stay, 1–3 days	2727	36.2	65	2.4	679	24.9
Length of stay, 4–7 days	2125	28.2	141	6.6	737	34.7
Length of stay, 8–14 days	1499	19.9	157	10.5	539	36.0
Length of stay, ≥15 days	1143	15.2	186	16.3	425	37.2
Length of stay, Missing/Unknown	46	0.6	6	13.0	14	30.4
McCabe score, Non-fatal	4268	56.6	279	6.5	1241	29.1
McCabe score, Ultimately fatal	695	9.2	64	9.2	249	35.8
McCabe score, Rapidly fatal	217	2.9	22	10.1	79	36.4
McCabe score, Missing/Unknown	2360	31.3	190	8.1	825	35.0
Surgery since hospital admission	2544	33.7	276	10.8	868	34.1
Central vascular catheter	512	6.8	121	23.6	347	67.8
Peripheral vascular catheter	3332	44.2	290	8.7	1463	43.9
Urinary catheter	1520	20.2	182	12.0	699	46.0
Intubation	134	1.8	42	31.3	112	83.6
Total	7540	100.0	555	7.4	2394	31.8

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Norway

PPS data from 24/04/2012 to 07/06/2012

Number of hospitals	7
Standard protocol	7
Light protocol	0
Number of patients	1465

Comments

Please note that the seven hospitals are voluntary participants by invitation and not representative of all hospitals in Norway. The PPS was performed by trained infection control personnel with long experience in national HAI prevalence and incidence surveillance and reporting.
Data representativeness: poor

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	3	42.9
Secondary	2	28.6
Tertiary	1	14.3
Specialised	1	14.3
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	132	[96-229]
Average length of stay (days)*	3.9	[2.1-5.0]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	115
HAI prevalence % (95%CI)	**7.8 (5.3-11.5)**
N of HAIs	121
N of HAIs per infected patient	1.05
N HAIs with microorganism (%)	52 (43.0)
Total N of reported microorg.	67

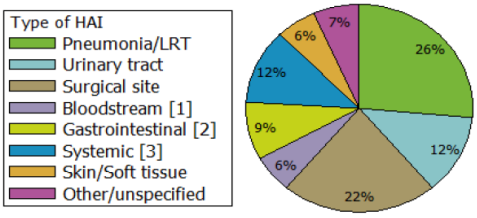
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	30	24.8	30	2
Origin of HAI=Same hospital	19	63.3	19	1.3
Origin of HAI=Other hospital	11	36.7	11	0.8
Origin of HAI=Other/unknown	0	0	0	0
HAI during current hospitalisation	91	75.2	85	5.8
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (1.7%)
[2] incl. *C. difficile* infections (3.3%)
[3] incl. clinical sepsis (10.7%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	480	32.8	52	10.8
Medicine	684	46.7	46	6.7
Paediatrics	91	6.2	0	0.0
Intensive care*	76	5.2	13	17.1
Obstetrics and gynaecology	121	8.3	3	2.5
Geriatrics	0	0	0	—
Psychiatry	0	0	0	—
Rehabilitation/Other	13	0.9	1	7.7
All specialties	1465	100	115	7.8

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

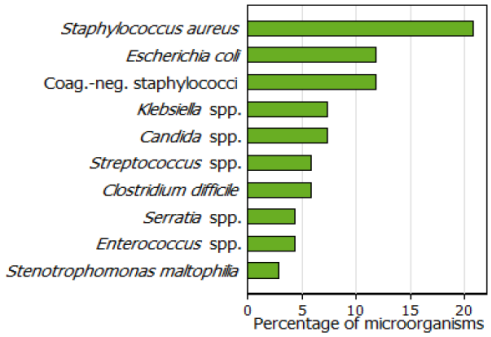


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	14	14	0	0.0
Enterococci / VRE	3	2	0	—
Enterococcus faecalis / VAN-R	1	1	0	—
Enterococcus faecium / VAN-R	0	0	0	—
Enterobacteriaceae / 3GC-NS	16	13	1	7.7
Escherichia coli / 3GC-NS	8	8	0	—
Klebsiella spp. / 3GC-NS	5	4	1	—
Enterobacter spp. / 3GC-NS	0	0	0	—
Enterobacteriaceae / CAR-NS	16	13	0	0.0
Escherichia coli / CAR-NS	8	8	0	—
Klebsiella spp. / CAR-NS	5	4	0	—
Enterobacter spp. / CAR-NS	0	0	0	—
Pseudomonas aeruginosa / CAR-NS	1	1	0	—
Acinetobacter baumannii / CAR-NS	1	0	0	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Norway (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	492	
AU prevalence % (95%CI)	33.6 (27.2-40.6)	
N of antimicrobials	659	
N of antimicrobials per patient	1.34	
	N	Rel%
Reason in patient charts/notes, Yes	614	93.2
Reason in patient charts/notes, No	43	6.5
Reason in patient charts/notes, Unknown	2	0.3
Route of administration, Parenteral	453	68.7
Route of administration, Oral	204	31
Route of administration, Other/unknown	2	0.3

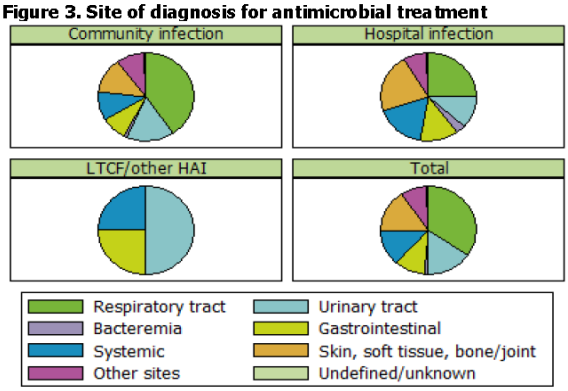
N=Number, Rel%=percentage of total N of antimicrobials

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	480	32.8	164	34.2
Medicine	684	46.7	259	37.9
Paediatrics	91	6.2	14	15.4
Intensive care*	76	5.2	43	56.6
Obstetrics and gynaecology	121	8.3	9	7.4
Geriatrics	0	0.0	0	—
Psychiatry	0	0.0	0	—
Rehabilitation/Other	13	0.9	3	23.1
All specialties	1465	100	492	33.6

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	373	25.5	497	75.4
Community infection	249	17.0	314	47.6
Hospital infection	123	8.4	179	27.2
Long-term care/other HAI	4	0.3	4	0.6
Surgical prophylaxis	71	4.8	83	12.6
Single dose	17	1.2	24	3.6
One day	32	2.2	34	5.2
>1 day	22	1.5	25	3.8
Medical prophylaxis	45	3.1	58	8.8
Other indication	6	0.4	9	1.4
Unknown	8	0.5	12	1.8

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

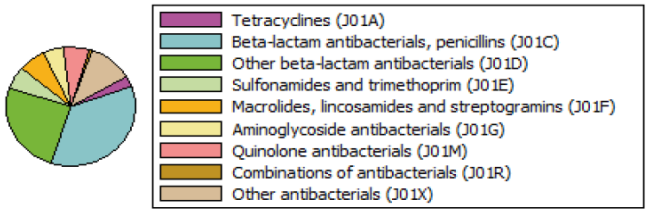


Figure 5. Top ten antimicrobial agents (AMs)

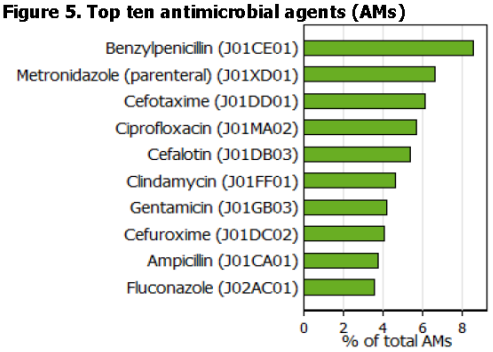


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	692	47.2	69	10.0	260	37.6
Age, <1 year	93	6.3	4	4.3	15	16.1
Age, 1-44 years	348	23.8	19	5.5	96	27.6
Age, ≥45 years	1024	69.9	92	9.0	381	37.2
Length of stay, 1-3 days	671	45.8	13	1.9	173	25.8
Length of stay, 4-7 days	395	27.0	42	10.6	155	39.2
Length of stay, 8-14 days	218	14.9	25	11.5	87	39.9
Length of stay, ≥15 days	177	12.1	35	19.8	76	42.9
Length of stay, Missing/Unknown	4	0.3	0	0.0	1	25.0
McCabe score, Non fatal	0	0.0	0	—	0	—
McCabe score, Ultimately fatal	0	0.0	0	—	0	—
McCabe score, Rapidly fatal	5	0.3	0	0.0	2	40.0
McCabe score, Missing/Unknown	1460	99.7	115	7.9	490	33.6
Surgery since hospital admission	370	25.3	50	13.5	157	42.4
Central vascular catheter	146	10.0	41	28.1	90	61.6
Peripheral vascular catheter	730	49.8	68	9.3	343	47.0
Urinary catheter	226	15.4	44	19.5	135	59.7
Intubation	29	2.0	7	24.1	19	65.5
Total	1465	100.0	115	7.8	492	33.6

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Poland

PPS data from 07/05/2012 to 29/06/2012

Number of hospitals	35
Standard protocol	35
Light protocol	0
Number of patients	8067

Comments

Data representativeness: good

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	8	22.9
Secondary	10	28.6
Tertiary	7	20
Specialised	10	28.6
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	382	[189-615]
Average length of stay (days)*	5.6	[4.4-6.5]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	518
HAI prevalence % (95%CI)	**6.4 (5.0-8.2)**
N of HAIs	548
N of HAIs per infected patient	1.06
N HAIs with microorganism (%)	268 (48.9)
Total N of reported microorg.	324

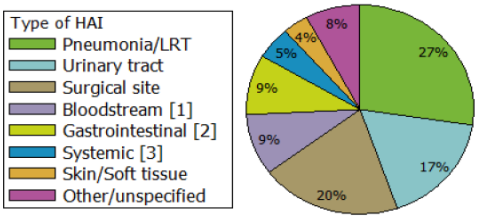
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	140	25.5	134	1.7
Origin of HAI=Same hospital	74	52.9	71	0.9
Origin of HAI=Other hospital	61	43.6	58	0.7
Origin of HAI=Other/unknown	5	3.6	5	0.1
HAI during current hospitalisation	403	73.5	379	4.7
Missing	5	0.9		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (3.3%)
[2] incl. *C. difficile* infections (4.6%)
[3] incl. clinical sepsis (4.6%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2576	31.9	144	5.6
Medicine	3611	44.8	189	5.2
Paediatrics	669	8.3	51	7.6
Intensive care*	330	4.1	115	34.8
Obstetrics and gynaecology	616	7.6	12	1.9
Geriatrics	70	0.9	3	4.3
Psychiatry	116	1.4	2	1.7
Rehabilitation/Other	79	1	2	2.5
All specialties	8067	100	518	6.4

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

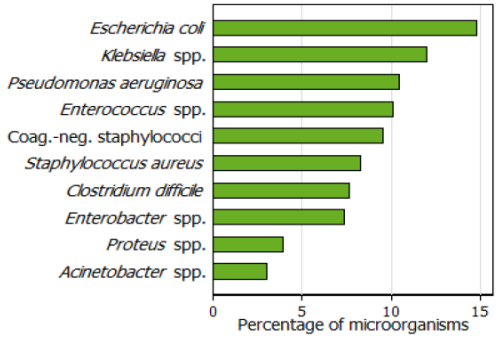


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	27	27	2	7.4
Enterococci / VRE	33	26	1	3.8
Enterococcus faecalis / VAN-R	19	15	0	0.0
Enterococcus faecium / VAN-R	11	9	1	—
Enterobacteriaceae / 3GC-NS	130	122	48	39.3
Escherichia coli / 3GC-NS	48	45	7	15.6
Klebsiella spp. / 3GC-NS	39	37	27	73.0
Enterobacter spp. / 3GC-NS	24	23	11	47.8
Enterobacteriaceae / CAR-NS	130	122	7	5.7
Escherichia coli / CAR-NS	48	45	1	2.2
Klebsiella spp. / CAR-NS	39	37	4	10.8
Enterobacter spp. / CAR-NS	24	23	2	8.7
Pseudomonas aeruginosa / CAR-NS	34	32	11	34.4
Acinetobacter baumannii / CAR-NS	9	9	3	—

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Poland (continued)

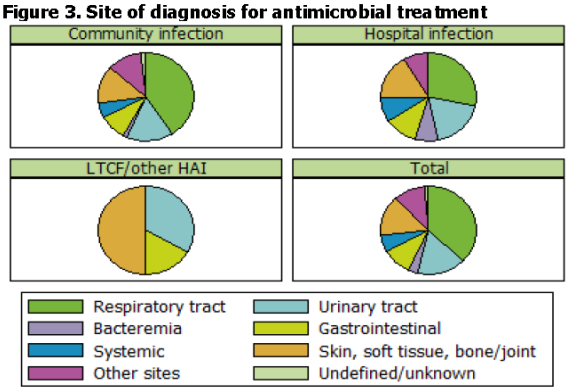
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	2570	
AU prevalence % (95%CI)	31.9 (28.8-35.1)	
N of antimicrobials	3339	
N of antimicrobials per patient	1.3	
	N	Rel%
Reason in patient charts/notes, Yes	2354	70.5
Reason in patient charts/notes, No	947	28.4
Reason in patient charts/notes, Unknown	38	1.1
Route of administration, Parenteral	2772	83
Route of administration, Oral	557	16.7
Route of administration, Other/unknown	10	0.3

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

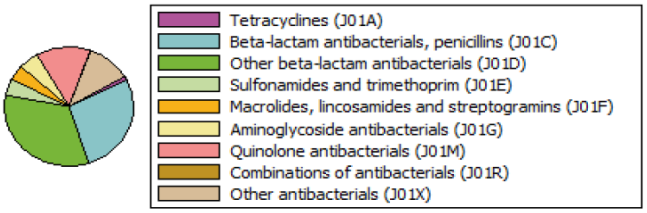


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2576	31.9	865	33.6
Medicine	3611	44.8	1095	30.3
Paediatrics	669	8.3	239	35.7
Intensive care*	330	4.1	207	62.7
Obstetrics and gynaecology	616	7.6	131	21.3
Geriatrics	70	0.9	14	20.0
Psychiatry	116	1.4	4	3.4
Rehabilitation/Other	79	1.0	15	19.0
All specialties	8067	100	2570	31.9

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1660	20.6	2203	66.0
Community infection	1201	14.9	1552	46.5
Hospital infection	463	5.7	645	19.3
Long-term care/other HAI	6	0.1	6	0.2
Surgical prophylaxis	438	5.4	483	14.5
Single dose	167	2.1	171	5.1
One day	98	1.2	102	3.1
>1 day	176	2.2	210	6.3
Medical prophylaxis	419	5.2	503	15.1
Other indication	31	0.4	36	1.1
Unknown	99	1.2	115	3.4

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

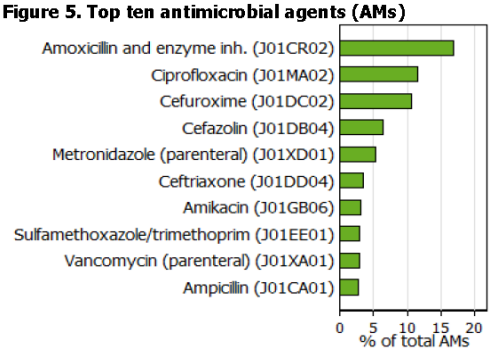


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	3951	49.0	284	7.2	1424	36.0
Age, <1 year	663	8.2	112	16.9	283	42.7
Age, 1-44 years	2378	29.5	98	4.1	734	30.9
Age, ≥45 years	5026	62.3	308	6.1	1553	30.9
Length of stay, 1-3 days	3035	37.6	63	2.1	674	22.2
Length of stay, 4-7 days	2335	28.9	137	5.9	795	34.0
Length of stay, 8-14 days	1601	19.8	137	8.6	700	43.7
Length of stay, ≥15 days	1094	13.6	181	16.5	401	36.7
Length of stay, Missing/Unknown	2	0.0	0	0.0	0	0.0
McCabe score, Non fatal	6169	76.5	316	5.1	1830	29.7
McCabe score, Ultimately fatal	1012	12.5	123	12.2	412	40.7
McCabe score, Rapidly fatal	337	4.2	53	15.7	146	43.3
McCabe score, Missing/Unknown	549	6.8	26	4.7	182	33.2
Surgery since hospital admission	2235	27.7	220	9.8	929	41.6
Central vascular catheter	638	7.9	175	27.4	399	62.5
Peripheral vascular catheter	4472	55.4	336	7.5	2032	45.4
Urinary catheter	1191	14.8	194	16.3	688	57.8
Intubation	262	3.2	98	37.4	180	68.7
Total	8067	100.0	518	6.4	2570	31.9

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Portugal

PPS data from 21/05/2012 to 30/06/2012

Number of hospitals	57
Standard protocol	56
Light protocol	1
Number of patients	10418

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	15	26.3
Secondary	19	33.3
Tertiary	15	26.3
Specialised	7	12.3
Unknown	1	1.8

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	200	[98-377]
Average length of stay (days)*	7.6	[5.0-9.2]

*Hospital statistics of year preceding PPS

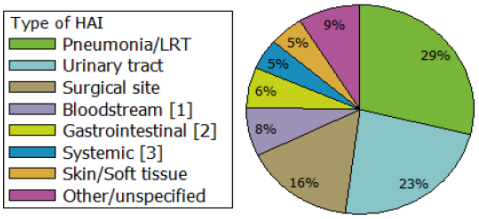
II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	1128
HAI prevalence % (95%CI)	**10.8 (9.5-12.3)**
N of HAIs	1231
N of HAIs per infected patient	1.09
N HAIs with microorganism (%)	658 (53.5)
Total N of reported microorg.	775

N=number

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (3.2%)
[2] incl. *C. difficile* infections (2.3%)
[3] incl. clinical sepsis (4.2%)
LRT=Lower respiratory tract

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	282	22.9	267	2.6
Origin of HAI=Same hospital	161	57.1	154	1.5
Origin of HAI=Other hospital	82	29.1	78	0.7
Origin of HAI=Other/unknown	39	13.8	35	0.3
HAI during current hospitalisation	946	76.8	858	8.2
Missing	3	0.2		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	3839	36.8	395	10.3
Medicine	4206	40.4	542	12.9
Paediatrics	468	4.5	13	2.8
Intensive care*	601	5.8	137	22.8
Obstetrics and gynaecology	573	5.5	15	2.6
Geriatrics	0	0	0	–
Psychiatry	633	6.1	8	1.3
Rehabilitation/Other	98	0.9	18	18.4
All specialties	10418	100	1128	10.8

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

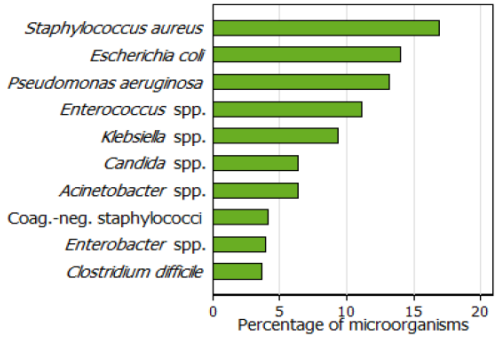


Table 6. Percentage of antimicrobial resistance for selected microorganism-antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	132	126	101	80.2
Enterococci / VRE	87	77	18	23.4
Enterococcus faecalis / VAN-R	50	45	8	17.8
Enterococcus faecium / VAN-R	31	30	8	26.7
Enterobacteriaceae / 3GC-NS	260	226	86	38.1
Escherichia coli / 3GC-NS	109	97	26	26.8
Klebsiella spp. / 3GC-NS	73	63	36	57.1
Enterobacter spp. / 3GC-NS	31	30	13	43.3
Enterobacteriaceae / CAR-NS	260	226	13	5.8
Escherichia coli / CAR-NS	109	97	2	2.1
Klebsiella spp. / CAR-NS	73	63	6	9.5
Enterobacter spp. / CAR-NS	31	30	2	6.7
Pseudomonas aeruginosa / CAR-NS	103	94	31	33.0
Acinetobacter baumannii / CAR-NS	48	45	45	100.0

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Portugal (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	4835	
AU prevalence % (95%CI)	46.4 (43.8-49.0)	
N of antimicrobials	6453	
N of antimicrobials per patient	1.33	
	N	Rel%
Reason in patient charts/notes, Yes	5206	80.7
Reason in patient charts/notes, No	1222	18.9
Reason in patient charts/notes, Unknown	25	0.4
Route of administration, Parenteral	5191	80.4
Route of administration, Oral	1225	19
Route of administration, Other/unknown	37	0.6

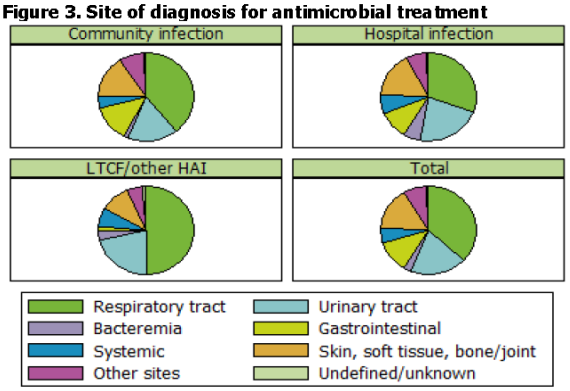
N=Number, Rel%=percentage of total N of antimicrobials

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	3839	36.8	1957	51.0
Medicine	4206	40.4	2162	51.4
Paediatrics	468	4.5	141	30.1
Intensive care*	601	5.8	333	55.4
Obstetrics and gynaecology	573	5.5	183	31.9
Geriatrics	0	0.0	0	—
Psychiatry	633	6.1	26	4.1
Rehabilitation/Other	98	0.9	33	33.7
All specialties	10418	100	4835	46.4

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	3290	31.6	4548	70.5
Community infection	2059	19.8	2777	43.0
Hospital infection	1101	10.6	1539	23.8
Long-term care/other HAI	169	1.6	233	3.6
Surgical prophylaxis	1026	9.8	1149	17.8
Single dose	205	2.0	211	3.3
One day	170	1.6	174	2.7
>1 day	663	6.4	764	11.8
Medical prophylaxis	442	4.2	530	8.2
Other indication	63	0.6	89	1.4
Unknown	126	1.2	138	2.1

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

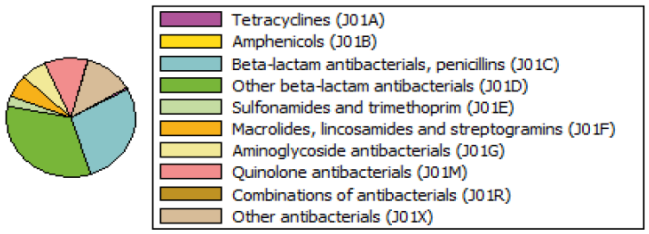


Figure 5. Top ten antimicrobial agents (AMs)

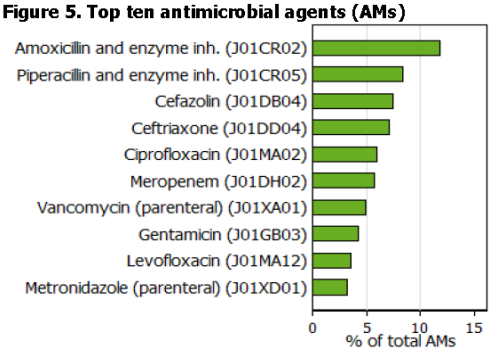


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	5202	50.2	656	12.6	2580	49.6
Age, <1 year	521	5.0	21	4.0	114	21.9
Age, 1-44 years	1988	19.2	125	6.3	815	41.0
Age, ≥45 years	7850	75.8	978	12.5	3876	49.4
Length of stay, 1-3 days	2667	25.7	113	4.2	1143	42.9
Length of stay, 4-7 days	2774	26.8	263	9.5	1462	52.7
Length of stay, 8-14 days	2227	21.5	287	12.9	1149	51.6
Length of stay, ≥15 days	2646	25.5	459	17.3	1043	39.4
Length of stay, Missing/Unknown	45	0.4	2	4.4	8	17.8
McCabe score, Non-fatal	6948	67.1	544	7.8	2939	42.3
McCabe score, Ultimately fatal	2382	23.0	390	16.4	1321	55.5
McCabe score, Rapidly fatal	728	7.0	153	21.0	395	54.3
McCabe score, Missing/Unknown	301	2.9	37	12.3	150	49.8
Surgery since hospital admission	3230	31.2	436	13.5	1842	57.0
Central vascular catheter	980	9.5	310	31.6	683	69.7
Peripheral vascular catheter	6906	66.7	825	11.9	3993	57.8
Urinary catheter	2484	24.0	527	21.2	1689	68.0
Intubation	419	4.0	134	32.0	301	71.8
Total	10359	100.0	1124	10.9	4805	46.4

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Romania

PPS data from 19/06/2012 to 18/07/2012

Number of hospitals	10
Standard protocol	0
Light protocol	10
Number of patients	2417

Comments

Data representativeness: poor

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	1	10
Secondary	6	60
Tertiary	0	0
Specialised	3	30
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	683	[341-1174]
Average length of stay (days)*	6.4	[5.4-6.8]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	68
HAI prevalence % (95%CI)	**2.8 (2.0-3.9)**
N of HAIs	77
N of HAIs per infected patient	1.13
N HAIs with microorganism (%)	62 (80.5)
Total N of reported microorg.	74

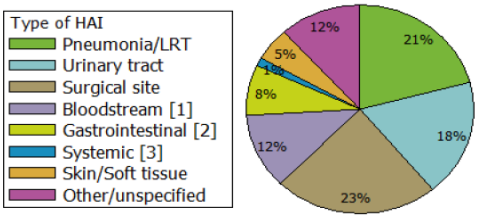
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	10	13	9	0.4
Origin of HAI=Same hospital	7	70	6	0.2
Origin of HAI=Other hospital	3	30	3	0.1
Origin of HAI=Other/unknown	0	0	0	0
HAI during current hospitalisation	66	85.7	58	2.4
Missing	1	1.3		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (5.2%)
[2] incl. *C. difficile* infections (2.6%)
[3] incl. clinical sepsis (0.0%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	1068	44.2	26	2.4
Medicine	604	25	6	1.0
Paediatrics	347	14.4	5	1.4
Intensive care*	219	9.1	29	13.2
Obstetrics and gynaecology	133	5.5	1	0.8
Geriatrics	0	0	0	—
Psychiatry	0	0	0	—
Rehabilitation/Other	46	1.9	1	2.2
All specialties	2417	100	68	2.8

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

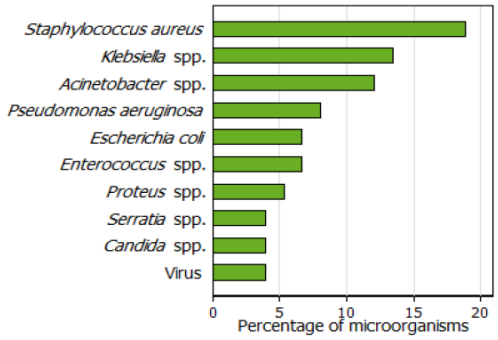


Table 6. Percentage of antimicrobial resistance for selected microorganism-antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	14	11	10	90.9
Enterococci / VRE	5	3	0	—
Enterococcus faecalis / VAN-R	1	1	0	—
Enterococcus faecium / VAN-R	1	1	0	—
Enterobacteriaceae / 3GC-NS	23	9	9	—
Escherichia coli / 3GC-NS	5	2	2	—
Klebsiella spp. / 3GC-NS	10	6	6	—
Enterobacter spp. / 3GC-NS	0	0	0	—
Enterobacteriaceae / CAR-NS	23	9	1	—
Escherichia coli / CAR-NS	5	2	0	—
Klebsiella spp. / CAR-NS	10	6	1	—
Enterobacter spp. / CAR-NS	0	0	0	—
Pseudomonas aeruginosa / CAR-NS	6	5	3	—
Acinetobacter baumannii / CAR-NS	7	5	5	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Romania (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	1206	
AU prevalence % (95%CI)	49.9 (38.9-60.9)	
N of antimicrobials	1705	
N of antimicrobials per patient	1.41	
	N	Rel%
Reason in patient charts/notes, Yes	844	49.5
Reason in patient charts/notes, No	754	44.2
Reason in patient charts/notes, Unknown	107	6.3
Route of administration, Parenteral	1592	93.4
Route of administration, Oral	113	6.6
Route of administration, Other/unknown	0	0

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment

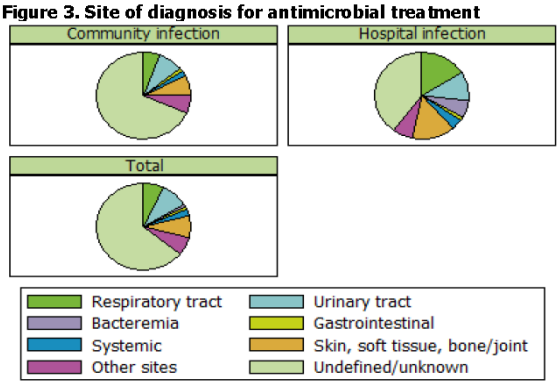


Figure 4. Distribution of antibacterials for systemic use (J01)

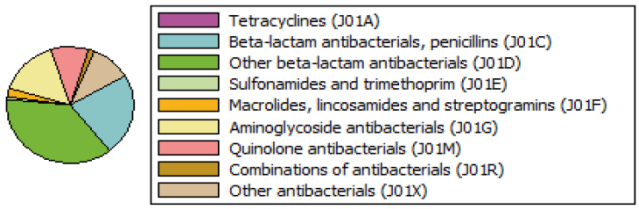


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Light protocol data only

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	1068	44.2	566	53.0
Medicine	604	25.0	249	41.2
Paediatrics	347	14.4	140	40.3
Intensive care*	219	9.1	152	69.4
Obstetrics and gynaecology	133	5.5	59	44.4
Geriatrics	0	0.0	0	—
Psychiatry	0	0.0	0	—
Rehabilitation/Other	46	1.9	40	87.0
All specialties	2417	100	1206	49.9

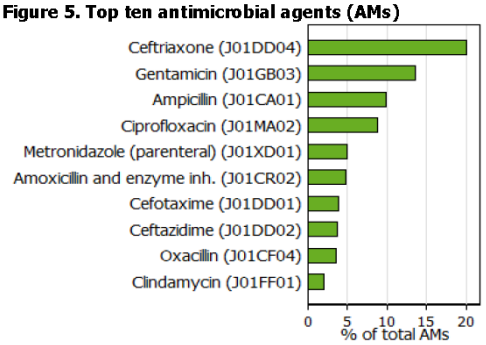
N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	453	18.7	630	37.0
Community infection	382	15.8	503	29.5
Hospital infection	74	3.1	127	7.4
Long-term care/other HAI	0	0.0	0	0.0
Surgical prophylaxis	503	20.8	716	42.0
Single dose	12	0.5	17	1.0
One day	30	1.2	38	2.2
>1 day	463	19.2	661	38.8
Medical prophylaxis	189	7.8	251	14.7
Other indication	36	1.5	50	2.9
Unknown	49	2.0	58	3.4

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)



Slovakia

PPS data from 02/05/2012 to 28/06/2012

Number of hospitals	40
Standard protocol	40
Light protocol	0
Number of patients	8397

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	21	52.5
Secondary	6	15
Tertiary	8	20
Specialised	5	12.5
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	370	[263-511]
Average length of stay (days)*	6.3	[5.4-7.0]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	298
HAI prevalence % (95%CI)	**3.5 (2.7-4.6)**
N of HAIs	324
N of HAIs per infected patient	1.09
N HAIs with microorganism (%)	214 (66.0)
Total N of reported microorg.	287

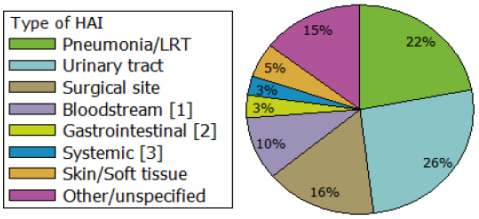
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	46	14.2	46	0.5
Origin of HAI=Same hospital	26	56.5	26	0.3
Origin of HAI=Other hospital	19	41.3	19	0.2
Origin of HAI=Other/unknown	1	2.2	1	0
HAI during current hospitalisation	273	84.3	247	2.9
Missing	5	1.5		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (6.2%)
[2] incl. *C. difficile* infections (1.2%)
[3] incl. clinical sepsis (1.5%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2104	25.1	75	3.6
Medicine	3075	36.6	112	3.6
Paediatrics	915	10.9	20	2.2
Intensive care*	547	6.5	68	12.4
Obstetrics and gynaecology	815	9.7	10	1.2
Geriatrics	279	3.3	7	2.5
Psychiatry	554	6.6	2	0.4
Rehabilitation/Other	108	1.3	4	3.7
All specialties	8397	100	298	3.5

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

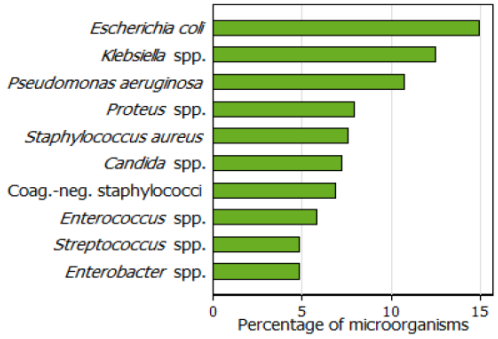


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	22	19	5	26.3
Enterococci / VRE	17	11	2	18.2
Enterococcus faecalis / VAN-R	9	5	1	—
Enterococcus faecium / VAN-R	3	2	1	—
Enterobacteriaceae / 3GC-NS	122	84	45	53.6
Escherichia coli / 3GC-NS	43	29	14	48.3
Klebsiella spp. / 3GC-NS	36	25	18	72.0
Enterobacter spp. / 3GC-NS	14	8	3	—
Enterobacteriaceae / CAR-NS	122	84	17	20.2
Escherichia coli / CAR-NS	43	29	5	17.2
Klebsiella spp. / CAR-NS	36	25	4	16.0
Enterobacter spp. / CAR-NS	14	8	2	—
Pseudomonas aeruginosa / CAR-NS	31	17	7	41.2
Acinetobacter baumannii / CAR-NS	4	3	2	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Slovakia (continued)

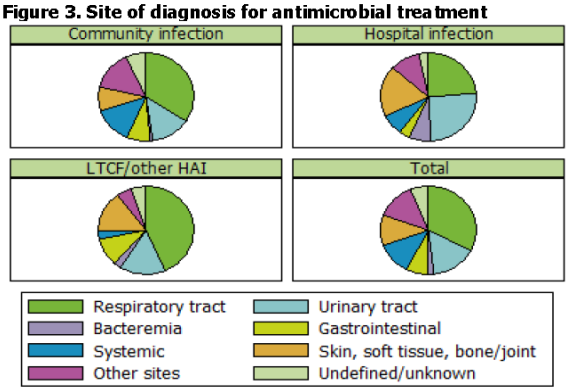
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	2575	
AU prevalence % (95%CI)	30.7 (27.9-33.6)	
N of antimicrobials	3205	
N of antimicrobials per patient	1.24	
	N	Rel%
Reason in patient charts/notes, Yes	2752	85.9
Reason in patient charts/notes, No	358	11.2
Reason in patient charts/notes, Unknown	95	3
Route of administration, Parenteral	2174	67.8
Route of administration, Oral	1015	31.7
Route of administration, Other/unknown	16	0.5

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

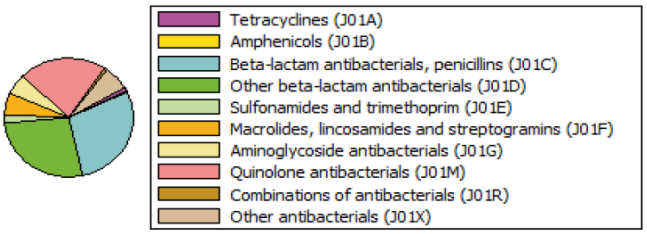


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2104	25.1	831	39.5
Medicine	3075	36.6	890	28.9
Paediatrics	915	10.9	283	30.9
Intensive care*	547	6.5	297	54.3
Obstetrics and gynaecology	815	9.7	176	21.6
Geriatrics	279	3.3	64	22.9
Psychiatry	554	6.6	13	2.3
Rehabilitation/Other	108	1.3	21	19.4
All specialties	8397	100	2575	30.7

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1521	18.1	1964	61.3
Community infection	1229	14.6	1541	48.1
Hospital infection	266	3.2	366	11.4
Long-term care/other HAI	38	0.5	57	1.8
Surgical prophylaxis	628	7.5	712	22.2
Single dose	33	0.4	33	1.0
One day	95	1.1	99	3.1
>1 day	504	6.0	580	18.1
Medical prophylaxis	345	4.1	402	12.5
Other indication	69	0.8	92	2.9
Unknown	31	0.4	35	1.1

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

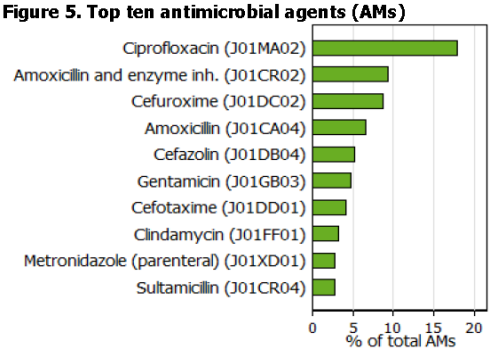


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	3792	45.2	161	4.2	1305	34.4
Age, <1 year	672	8.0	17	2.5	160	23.8
Age, 1-44 years	2363	28.1	50	2.1	675	28.6
Age, ≥45 years	5362	63.9	231	4.3	1740	32.5
Length of stay, 1-3 days	2989	35.6	44	1.5	748	25.0
Length of stay, 4-7 days	2726	32.5	113	4.1	936	34.3
Length of stay, 8-14 days	1704	20.3	73	4.3	602	35.3
Length of stay, ≥15 days	975	11.6	68	7.0	287	29.4
Length of stay, Missing/Unknown	3	0.0	0	0.0	2	66.7
McCabe score, Non fatal	7073	84.2	173	2.4	1992	28.2
McCabe score, Ultimately fatal	929	11.1	88	9.5	413	44.5
McCabe score, Rapidly fatal	164	2.0	16	9.8	77	47.0
McCabe score, Missing/Unknown	231	2.8	21	9.1	93	40.3
Surgery since hospital admission	1837	21.9	124	6.8	876	47.7
Central vascular catheter	287	3.4	70	24.4	200	69.7
Peripheral vascular catheter	3426	40.8	200	5.8	1686	49.2
Urinary catheter	1186	14.1	136	11.5	719	60.6
Intubation	177	2.1	52	29.4	127	71.8
Total	8397	100.0	298	3.5	2575	30.7

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Slovenia

PPS data from 03/10/2011 to 21/10/2011

Number of hospitals	21
Standard protocol	21
Light protocol	0
Number of patients	5628

Comments

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	3	14.3
Secondary	7	33.3
Tertiary	2	9.5
Specialised	9	42.9
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	260	[107-388]
Average length of stay (days)*	5.2	[4.4-6.0]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	358
HAI prevalence % (95%CI)	**6.4 (5.0-8.1)**
N of HAIs	396
N of HAIs per infected patient	1.11
N HAIs with microorganism (%)	220 (55.6)
Total N of reported microorg.	312

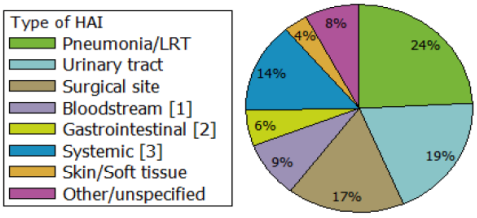
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	61	15.4	58	1
Origin of HAI=Same hospital	36	59	35	0.6
Origin of HAI=Other hospital	21	34.4	21	0.4
Origin of HAI=Other/unknown	4	6.6	2	0
HAI during current hospitalisation	335	84.6	300	5.3
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (3.0%)
[2] incl. *C. difficile* infections (0.5%)
[3] incl. clinical sepsis (13.6%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2103	37.4	135	6.4
Medicine	2023	35.9	121	6.0
Paediatrics	563	10	10	1.8
Intensive care*	207	3.7	74	35.7
Obstetrics and gynaecology	513	9.1	12	2.3
Geriatrics	0	0	0	—
Psychiatry	141	2.5	1	0.7
Rehabilitation/Other	78	1.4	5	6.4
All specialties	5628	100	358	6.4

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

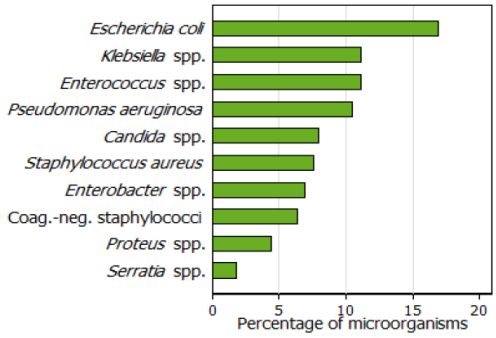


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	24	24	4	16.7
Enterococci / VRE	35	31	0	0.0
Enterococcus faecalis / VAN-R	25	22	0	0.0
Enterococcus faecium / VAN-R	6	6	0	—
Enterobacteriaceae / 3GC-NS	133	128	32	25.0
Escherichia coli / 3GC-NS	53	50	7	14.0
Klebsiella spp. / 3GC-NS	35	34	18	52.9
Enterobacter spp. / 3GC-NS	22	22	6	27.3
Enterobacteriaceae / CAR-NS	133	128	0	0.0
Escherichia coli / CAR-NS	53	50	0	0.0
Klebsiella spp. / CAR-NS	35	34	0	0.0
Enterobacter spp. / CAR-NS	22	22	0	0.0
Pseudomonas aeruginosa / CAR-NS	33	31	13	41.9
Acinetobacter baumannii / CAR-NS	5	5	1	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Slovenia (continued)

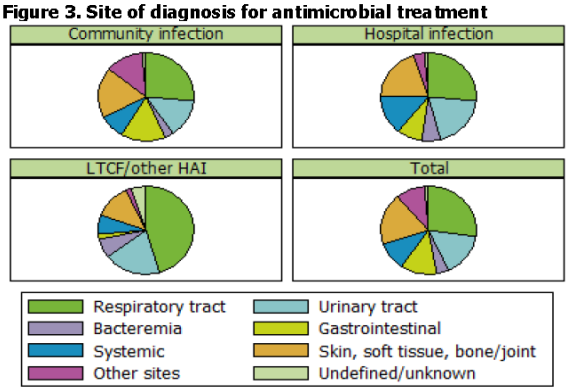
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	1761	
AU prevalence % (95%CI)	31.3 (28.9-33.8)	
N of antimicrobials	2247	
N of antimicrobials per patient	1.28	
	N	Rel%
Reason in patient charts/notes, Yes	2114	94.1
Reason in patient charts/notes, No	133	5.9
Reason in patient charts/notes, Unknown	0	0
Route of administration, Parenteral	1546	68.8
Route of administration, Oral	700	31.2
Route of administration, Other/unknown	1	0

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

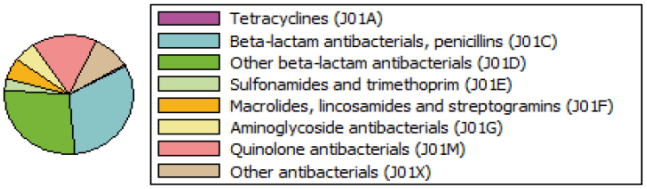


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2103	37.4	666	31.7
Medicine	2023	35.9	701	34.7
Paediatrics	563	10.0	114	20.2
Intensive care*	207	3.7	160	77.3
Obstetrics and gynaecology	513	9.1	95	18.5
Geriatrics	0	0.0	0	—
Psychiatry	141	2.5	3	2.1
Rehabilitation/Other	78	1.4	22	28.2
All specialties	5628	100	1761	31.3

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1337	23.8	1723	76.7
Community infection	932	16.6	1178	52.4
Hospital infection	361	6.4	483	21.5
Long-term care/other HAI	56	1.0	63	2.8
Surgical prophylaxis	327	5.8	381	17.0
Single dose	103	1.8	110	4.9
One day	43	0.8	48	2.1
>1 day	182	3.2	223	9.9
Medical prophylaxis	105	1.9	128	5.7
Other indication	3	0.1	3	0.1
Unknown	15	0.3	16	0.7

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

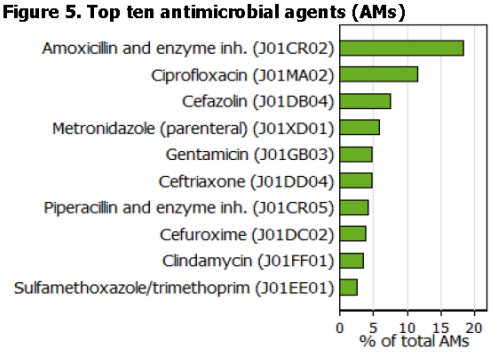


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	2692	47.8	216	8.0	923	34.3
Age, <1 year	335	6.0	13	3.9	42	12.5
Age, 1-44 years	1326	23.6	35	2.6	335	25.3
Age, ≥45 years	3967	70.5	310	7.8	1384	34.9
Length of stay, 1-3 days	1899	33.7	32	1.7	465	24.5
Length of stay, 4-7 days	1630	29.0	94	5.8	577	35.4
Length of stay, 8-14 days	1112	19.8	95	8.5	406	36.5
Length of stay, ≥15 days	977	17.4	137	14.0	311	31.8
Length of stay, Missing/Unknown	10	0.2	0	0.0	2	20.0
McCabe score, Non fatal	4394	78.1	191	4.3	1199	27.3
McCabe score, Ultimately fatal	921	16.4	115	12.5	410	44.5
McCabe score, Rapidly fatal	287	5.1	50	17.4	147	51.2
McCabe score, Missing/Unknown	26	0.5	2	7.7	5	19.2
Surgery since hospital admission	1719	30.5	194	11.3	715	41.6
Central vascular catheter	410	7.3	137	33.4	295	72.0
Peripheral vascular catheter	2635	46.8	231	8.8	1284	48.7
Urinary catheter	911	16.2	172	18.9	553	60.7
Intubation	170	3.0	63	37.1	122	71.8
Total	5628	100.0	358	6.4	1761	31.3

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

Spain

PPS data from 16/04/2012 to 05/07/2012

Number of hospitals	59
Standard protocol	59
Light protocol	0
Number of patients	13520

Comments

National PPS website: http://hws.vhebron.net/epine/

Data representativeness: good

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	12	20.3
Secondary	22	37.3
Tertiary	20	33.9
Specialised	3	5.1
Unknown	2	3.4

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	265	[149-518]
Average length of stay (days)*	6.3	[5.4-7.3]

*Hospital statistics of year preceding PPS

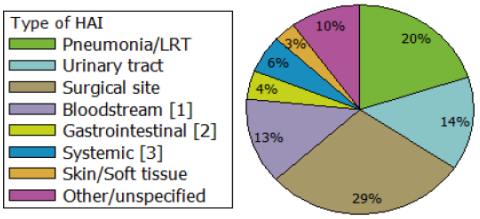
II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	1115
HAI prevalence % (95%CI)	**8.2 (7.5-9.1)**
N of HAIs	1257
N of HAIs per infected patient	1.13
N HAIs with microorganism (%)	796 (63.3)
Total N of reported microorg.	1024

N=number

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (5.3%)
[2] incl. *C. difficile* infections (0.7%)
[3] incl. clinical sepsis (4.9%)
LRT=Lower respiratory tract

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	266	21.2	249	1.8
Origin of HAI=Same hospital	188	70.7	178	1.3
Origin of HAI=Other hospital	67	25.2	60	0.4
Origin of HAI=Other/unknown	11	4.1	11	0.1
HAI during current hospitalisation	969	77.1	846	6.3
Missing	22	1.8		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	4416	32.7	466	10.6
Medicine	6103	45.1	398	6.5
Paediatrics	704	5.2	16	2.3
Intensive care*	745	5.5	201	27.0
Obstetrics and gynaecology	955	7.1	20	2.1
Geriatrics	82	0.6	3	3.7
Psychiatry	463	3.4	7	1.5
Rehabilitation/Other	52	0.4	4	7.7
All specialties	13520	100	1115	8.2

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

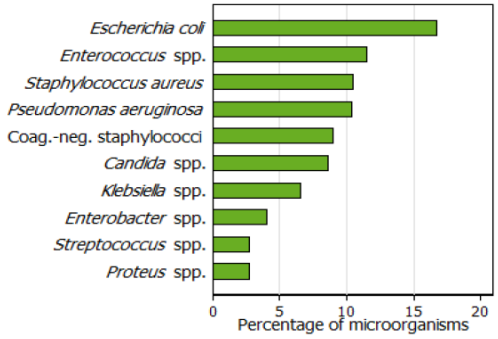


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	108	105	46	43.8
Enterococci / VRE	119	111	5	4.5
Enterococcus faecalis / VAN-R	75	71	3	4.2
Enterococcus faecium / VAN-R	37	35	1	2.9
Enterobacteriaceae / 3GC-NS	346	329	83	25.2
Escherichia coli / 3GC-NS	172	165	35	21.2
Klebsiella spp. / 3GC-NS	68	63	24	38.1
Enterobacter spp. / 3GC-NS	42	40	14	35.0
Enterobacteriaceae / CAR-NS	346	329	14	4.3
Escherichia coli / CAR-NS	172	165	5	3.0
Klebsiella spp. / CAR-NS	68	63	6	9.5
Enterobacter spp. / CAR-NS	42	40	1	2.5
Pseudomonas aeruginosa / CAR-NS	107	103	27	26.2
Acinetobacter baumannii / CAR-NS	20	19	17	89.5

N=number, N isol.=total N of isolates, N test.=N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Spain (continued)

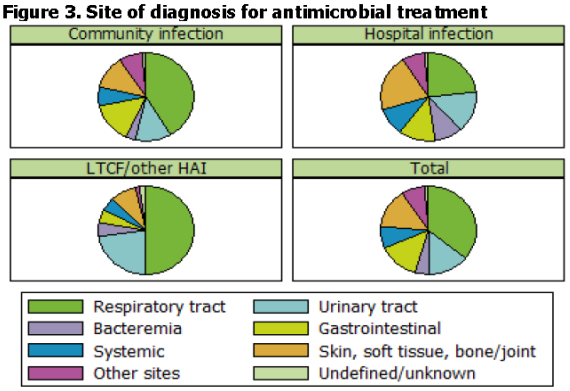
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	6101	
AU prevalence % (95%CI)	45.1 (43.7-46.6)	
N of antimicrobials	8436	
N of antimicrobials per patient	1.38	
	N	Rel%
Reason in patient charts/notes, Yes	6473	76.7
Reason in patient charts/notes, No	1612	19.1
Reason in patient charts/notes, Unknown	351	4.2
Route of administration, Parenteral	6492	77
Route of administration, Oral	1886	22.4
Route of administration, Other/unknown	58	0.7

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

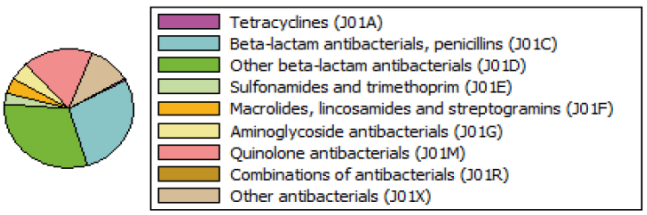


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	4416	32.7	2248	50.9
Medicine	6103	45.1	2939	48.2
Paediatrics	704	5.2	170	24.1
Intensive care*	745	5.5	480	64.4
Obstetrics and gynaecology	955	7.1	197	20.6
Geriatrics	82	0.6	39	47.6
Psychiatry	463	3.4	16	3.5
Rehabilitation/Other	52	0.4	12	23.1
All specialties	13520	100	6101	45.1

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	3837	28.4	5491	65.1
Community infection	2673	19.8	3658	43.4
Hospital infection	1141	8.4	1729	20.5
Long-term care/other HAI	77	0.6	104	1.2
Surgical prophylaxis	1108	8.2	1234	14.6
Single dose	292	2.2	318	3.8
One day	245	1.8	258	3.1
>1 day	586	4.3	658	7.8
Medical prophylaxis	1122	8.3	1431	17.0
Other indication	75	0.6	88	1.0
Unknown	168	1.2	192	2.3

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

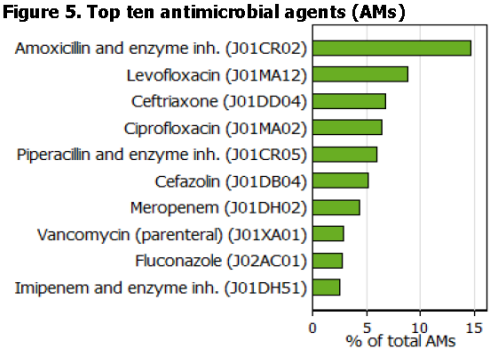


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	7176	53.1	663	9.2	3504	48.8
Age, <1 year	674	5.0	32	4.7	128	19.0
Age, 1-44 years	2682	19.8	146	5.4	1011	37.7
Age, ≥45 years	10164	75.2	937	9.2	4962	48.8
Length of stay, 1-3 days	4094	30.3	89	2.2	1651	40.3
Length of stay, 4-7 days	3957	29.3	271	6.8	1858	47.0
Length of stay, 8-14 days	2981	22.0	317	10.6	1441	48.3
Length of stay, ≥15 days	2473	18.3	436	17.6	1143	46.2
Length of stay, Missing/Unknown	15	0.1	2	13.3	8	53.3
McCabe score, Non-fatal	9685	71.6	608	6.3	3945	40.7
McCabe score, Ultimately fatal	2743	20.3	359	13.1	1538	56.1
McCabe score, Rapidly fatal	1023	7.6	144	14.1	583	57.0
McCabe score, Missing/Unknown	69	0.5	4	5.8	35	50.7
Surgery since hospital admission	3926	29.0	530	13.5	2166	55.2
Central vascular catheter	1816	13.4	463	25.5	1229	67.7
Peripheral vascular catheter	8980	66.4	706	7.9	4800	53.5
Urinary catheter	2662	19.7	452	17.0	1781	66.9
Intubation	375	2.8	146	38.9	296	78.9
Total	13520	100.0	1115	8.2	6101	45.1

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU=N patients with AU, HAI%/AU%=HAI/AU prevalence % within category

Sweden

PPS data from 20/03/2012 to 08/05/2012

Number of hospitals	4
Standard protocol	4
Light protocol	0
Number of patients	613

Comments

Data representativeness: very poor

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	4	100
Secondary	0	0
Tertiary	0	0
Specialised	0	0
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	180	[139-251]
Average length of stay (days)*	4.5	[3.7-5.3]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	45
HAI prevalence % (95%CI)	**7.3 (3.9-13.4)**
N of HAIs	50
N of HAIs per infected patient	1.11
N HAIs with microorganism (%)	23 (46.0)
Total N of reported microorg.	29

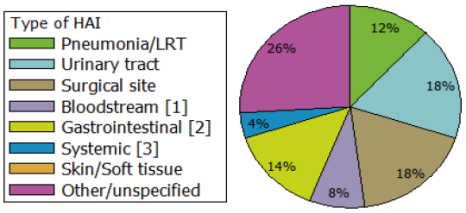
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	8	16	8	1.3
Origin of HAI=Same hospital	4	50	4	0.7
Origin of HAI=Other hospital	2	25	2	0.3
Origin of HAI=Other/unknown	2	25	2	0.3
HAI during current hospitalisation	42	84	37	6
Missing	0	0		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (4.0%)
[2] incl. *C. difficile* infections (4.0%)
[3] incl. clinical sepsis (4.0%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	200	32.6	19	9.5
Medicine	309	50.4	18	5.8
Paediatrics	0	0	0	–
Intensive care*	8	1.3	4	50.0
Obstetrics and gynaecology	17	2.8	0	0.0
Geriatrics	53	8.6	4	7.5
Psychiatry	0	0	0	—
Rehabilitation/Other	26	4.2	0	0.0
All specialties	613	100	45	7.3

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

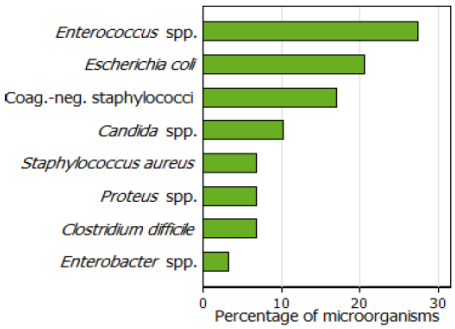


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism /Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	2	2	0	—
Enterococci / VRE	8	0	0	—
Enterococcus faecalis / VAN-R	2	0	0	—
Enterococcus faecium / VAN-R	3	0	0	—
Enterobacteriaceae / 3GC-NS	9	7	0	—
Escherichia coli / 3GC-NS	6	6	0	—
Klebsiella spp. / 3GC-NS	0	0	0	—
Enterobacter spp. / 3GC-NS	1	1	0	—
Enterobacteriaceae / CAR-NS	9	7	0	—
Escherichia coli / CAR-NS	6	6	0	—
Klebsiella spp. / CAR-NS	0	0	0	—
Enterobacter spp. / CAR-NS	1	1	0	—
Pseudomonas aeruginosa / CAR-NS	0	0	0	—
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

Sweden (continued)

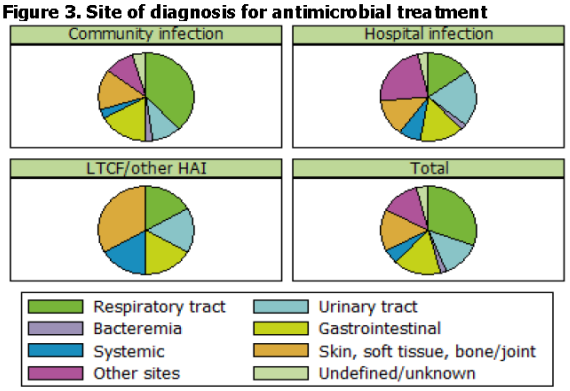
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	241	
AU prevalence % (95%CI)	39.3 (29.1-50.5)	
N of antimicrobials	292	
N of antimicrobials per patient	1.21	
	N	Rel%
Reason in patient charts/notes, Yes	259	88.7
Reason in patient charts/notes, No	19	6.5
Reason in patient charts/notes, Unknown	14	4.8
Route of administration, Parenteral	145	49.7
Route of administration, Oral	146	50
Route of administration, Other/unknown	1	0.3

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

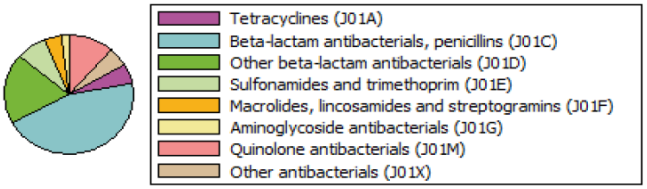


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	200	32.6	100	50.0
Medicine	309	50.4	104	33.7
Paediatrics	0	0.0	0	—
Intensive care*	8	1.3	6	75.0
Obstetrics and gynaecology	17	2.8	3	17.6
Geriatrics	53	8.6	12	22.6
Psychiatry	0	0.0	0	—
Rehabilitation/Other	26	4.2	16	61.5
All specialties	613	100	241	39.3

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	174	28.4	213	72.9
Community infection	120	19.6	147	50.3
Hospital infection	50	8.2	60	20.5
Long-term care/other HAI	6	1.0	6	2.1
Surgical prophylaxis	59	9.6	68	23.3
Single dose	22	3.6	28	9.6
One day	21	3.4	21	7.2
>1 day	17	2.8	19	6.5
Medical prophylaxis	3	0.5	3	1.0
Other indication	1	0.2	1	0.3
Unknown	7	1.1	7	2.4

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

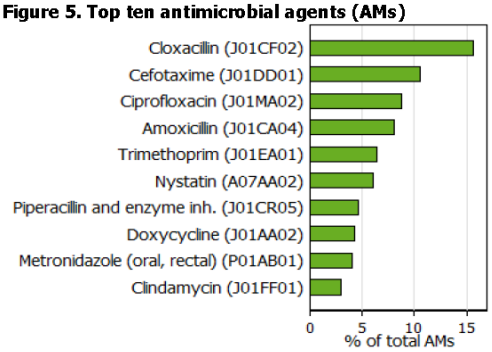


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	280	45.7	19	6.8	121	43.2
Age, <1 year	6	1.0	0	0.0	0	0.0
Age, 1-44 years	54	8.8	2	3.7	20	37.0
Age, ≥45 years	553	90.2	43	7.8	221	40.0
Length of stay, 1-3 days	261	42.6	7	2.7	107	41.0
Length of stay, 4-7 days	160	26.1	19	11.9	70	43.8
Length of stay, 8-14 days	101	16.5	12	11.9	39	38.6
Length of stay, ≥15 days	91	14.8	7	7.7	25	27.5
Length of stay, Missing/Unknown	0	0.0	0	—	0	—
McCabe score, Non-fatal	472	77.0	24	5.1	169	35.8
McCabe score, Ultimately fatal	105	17.1	15	14.3	53	50.5
McCabe score, Rapidly fatal	26	4.2	5	19.2	12	46.2
McCabe score, Missing/Unknown	10	1.6	1	10.0	7	70.0
Surgery since hospital admission	137	22.3	14	10.2	86	62.8
Central vascular catheter	31	5.1	12	38.7	26	83.9
Peripheral vascular catheter	384	62.6	33	8.6	178	46.4
Urinary catheter	137	22.3	25	18.2	89	65.0
Intubation	3	0.5	2	66.7	3	100.0
Total	613	100.0	45	7.3	241	39.3

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

UK-England

PPS data from 24/08/2011 to 25/11/2011

Number of hospitals	51
Standard protocol	51
Light protocol	0
Number of patients	25727

Comments

National report:
http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/AntimicrobialResistance/HCAIPointPrevalenceSurvey/

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	14	27.5
Secondary	24	47.1
Tertiary	7	13.7
Specialised	4	7.8
Unknown	2	3.9

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	649	[402-898]
Average length of stay (days)*	2.7	[2.2-4.0]

*Hospital statistics of year preceding PPS

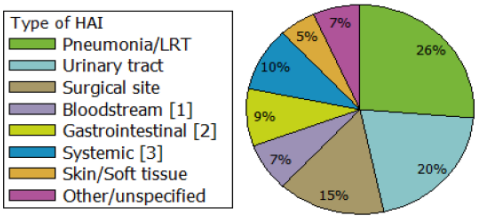
II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	1532
HAI prevalence % (95%CI)	**6.0 (5.2-6.9)**
N of HAIs	1602
N of HAIs per infected patient	1.05
N HAIs with microorganism (%)	644 (40.2)
Total N of reported microorg.	725

N=number

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (2.6%)
[2] incl. *C. difficile* infections (5.6%)
[3] incl. clinical sepsis (9.4%)
LRT=Lower respiratory tract

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	356	22.2	349	1.4
Origin of HAI=Same hospital	180	50.6	175	0.7
Origin of HAI=Other hospital	85	23.9	83	0.3
Origin of HAI=Other/unknown	91	25.6	91	0.4
HAI during current hospitalisation	1238	77.3	1175	4.6
Missing	8	0.5		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	7676	29.8	539	7.0
Medicine	10693	41.6	576	5.4
Paediatrics	1166	4.5	29	2.5
Intensive care*	971	3.8	187	19.3
Obstetrics and gynaecology	1989	7.7	34	1.7
Geriatrics	2365	9.2	113	4.8
Psychiatry	12	0	0	0.0
Rehabilitation/Other	855	3.3	54	6.3
All specialties	25727	100	1532	6.0

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

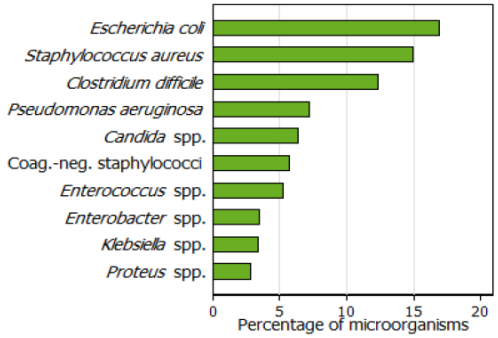


Table 6. Percentage of antimicrobial resistance for selected microorganism-antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	109	78	24	30.8
Enterococci / VRE	39	25	6	24.0
Enterococcus faecalis / VAN-R	10	7	0	—
Enterococcus faecium / VAN-R	8	8	5	—
Enterobacteriaceae / 3GC-NS	204	139	30	21.6
Escherichia coli / 3GC-NS	123	85	18	21.2
Klebsiella spp. / 3GC-NS	25	16	4	25.0
Enterobacter spp. / 3GC-NS	26	21	7	33.3
Enterobacteriaceae / CAR-NS	204	139	2	1.4
Escherichia coli / CAR-NS	123	85	1	1.2
Klebsiella spp. / CAR-NS	25	16	0	0.0
Enterobacter spp. / CAR-NS	26	21	0	0.0
Pseudomonas aeruginosa / CAR-NS	53	35	5	14.3
Acinetobacter baumannii / CAR-NS	6	5	4	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

UK-England (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	8748	
AU prevalence % (95%CI)	34.0 (32.3-35.7)	
N of antimicrobials	12630	
N of antimicrobials per patient	1.44	
	N	Rel%
Reason in patient charts/notes, Yes	10815	85.6
Reason in patient charts/notes, No	1388	11
Reason in patient charts/notes, Unknown	427	3.4
Route of administration, Parenteral	7320	58
Route of administration, Oral	5076	40.2
Route of administration, Other/unknown	234	1.9

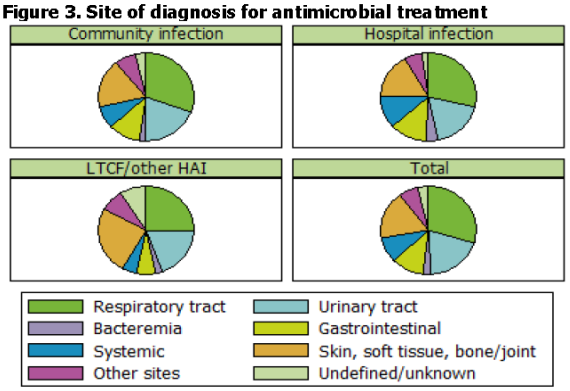
N=Number, Rel%=percentage of total N of antimicrobials

Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	7676	29.8	2853	37.2
Medicine	10693	41.6	3756	35.1
Paediatrics	1166	4.5	363	31.1
Intensive care*	971	3.8	503	51.8
Obstetrics and gynaecology	1989	7.7	400	20.1
Geriatrics	2365	9.2	641	27.1
Psychiatry	12	0.0	1	8.3
Rehabilitation/Other	855	3.3	231	27.0
All specialties	25727	100	8748	34.0

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	6763	26.3	9620	76.2
Community infection	4840	18.8	6895	54.6
Hospital infection	1819	7.1	2501	19.8
Long-term care/other HAI	173	0.7	224	1.8
Surgical prophylaxis	1248	4.9	1712	13.6
Single dose	650	2.5	836	6.6
One day	336	1.3	388	3.1
>1 day	384	1.5	500	4.0
Medical prophylaxis	732	2.8	923	7.3
Other indication	124	0.5	159	1.3
Unknown	171	0.7	224	1.8

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

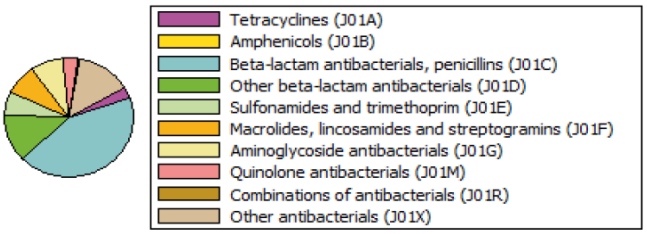


Figure 5. Top ten antimicrobial agents (AMs)

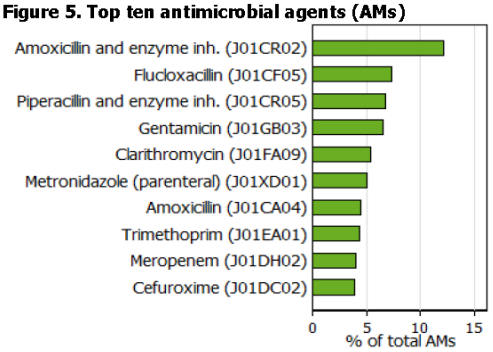


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	11498	44.7	726	6.3	4143	36.0
Age, <1 year	1542	6.0	79	5.1	347	22.5
Age, 1-44 years	4713	18.3	172	3.6	1604	34.0
Age, ≥45 years	19402	75.4	1280	6.6	6784	35.0
Length of stay, 1-3 days	8264	32.1	185	2.2	2788	33.7
Length of stay, 4-7 days	6080	23.6	373	6.1	2537	41.7
Length of stay, 8-14 days	4796	18.6	376	7.8	1681	35.1
Length of stay, ≥15 days	6459	25.1	591	9.2	1686	26.1
Length of stay, Missing/Unknown	128	0.5	7	5.5	56	43.8
McCabe score, Non fatal	12287	47.8	607	4.9	3972	32.3
McCabe score, Ultimately fatal	4257	16.5	376	8.8	1655	38.9
McCabe score, Rapidly fatal	1020	4.0	84	8.2	404	39.6
McCabe score, Missing/Unknown	8163	31.7	465	5.7	2717	33.3
Surgery since hospital admission	6412	24.9	572	8.9	2567	40.0
Central vascular catheter	1441	5.6	303	21.0	945	65.6
Peripheral vascular catheter	9988	38.8	827	8.3	5243	52.5
Urinary catheter	4703	18.3	556	11.8	2233	47.5
Intubation	400	1.6	102	25.5	260	65.0
Total	25727	100.0	1532	6.0	8748	34.0

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

UK-Northern Ireland

PPS data from 18/05/2012 to 10/09/2012

Number of hospitals	16
Standard protocol	16
Light protocol	0
Number of patients	3992

Comments

National report: http://www.publichealth.hscni.net/publications/northern-ireland-point-prevalence-survey-hospital-acquired-infections-and-antimicrobial

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	6	37.5
Secondary	4	25
Tertiary	2	12.5
Specialised	4	25
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	252	[121-499]
Average length of stay (days)*	5.2	[3.7-6.8]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	166
HAI prevalence % (95%CI)	**4.2 (2.8-6.1)**
N of HAIs	169
N of HAIs per infected patient	1.02
N HAIs with microorganism (%)	78 (46.2)
Total N of reported microorg.	99

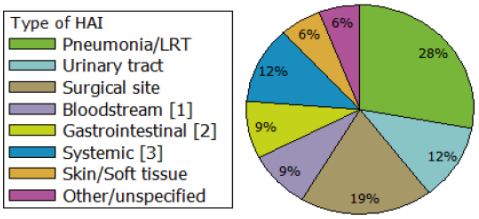
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	31	18.3	31	0.8
Origin of HAI=Same hospital	22	71	22	0.6
Origin of HAI=Other hospital	9	29	9	0.2
Origin of HAI=Other/unknown	0	0	0	0
HAI during current hospitalisation	132	78.1	129	3.2
Missing	6	3.6		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (2.4%)
[2] incl. *C. difficile* infections (4.7%)
[3] incl. clinical sepsis (11.8%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	1042	26.1	54	5.2
Medicine	1776	44.5	71	4.0
Paediatrics	130	3.3	2	1.5
Intensive care*	140	3.5	15	10.7
Obstetrics and gynaecology	382	9.6	4	1.0
Geriatrics	315	7.9	18	5.7
Psychiatry	201	5	2	1.0
Rehabilitation/Other	6	0.2	0	0.0
All specialties	3992	100	166	4.2

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

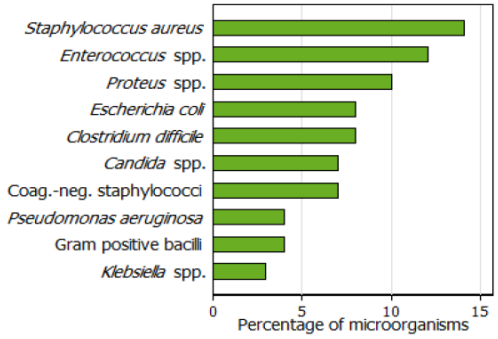


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	14	14	5	35.7
Enterococci / VRE	12	11	3	27.3
Enterococcus faecalis / VAN-R	5	4	0	—
Enterococcus faecium / VAN-R	4	4	3	—
Enterobacteriaceae / 3GC-NS	26	22	4	18.2
Escherichia coli / 3GC-NS	8	6	1	—
Klebsiella spp. / 3GC-NS	3	3	0	—
Enterobacter spp. / 3GC-NS	2	2	1	—
Enterobacteriaceae / CAR-NS	26	22	0	0.0
Escherichia coli / CAR-NS	8	6	0	—
Klebsiella spp. / CAR-NS	3	3	0	—
Enterobacter spp. / CAR-NS	2	2	0	—
Pseudomonas aeruginosa / CAR-NS	4	3	1	—
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

UK-Northern Ireland (continued)

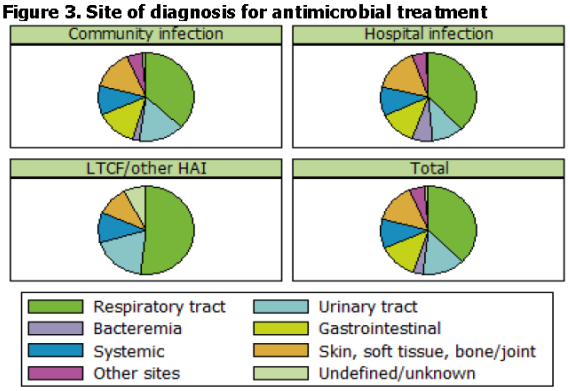
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	1178	
AU prevalence % (95%CI)	29.5 (26.8-32.3)	
N of antimicrobials	1751	
N of antimicrobials per patient	1.49	
	N	Rel%
Reason in patient charts/notes, Yes	1587	90.6
Reason in patient charts/notes, No	113	6.5
Reason in patient charts/notes, Unknown	51	2.9
Route of administration, Parenteral	1142	65.2
Route of administration, Oral	606	34.6
Route of administration, Other/unknown	3	0.2

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

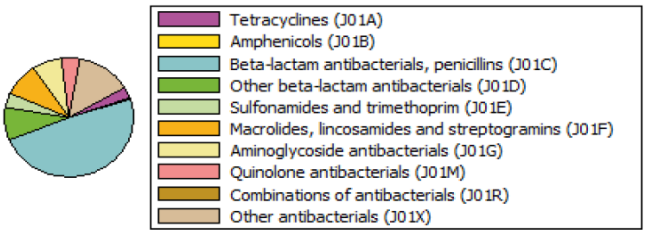


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	1042	26.1	311	29.8
Medicine	1776	44.5	607	34.2
Paediatrics	130	3.3	39	30.0
Intensive care*	140	3.5	69	49.3
Obstetrics and gynaecology	382	9.6	58	15.2
Geriatrics	315	7.9	85	27.0
Psychiatry	201	5.0	8	4.0
Rehabilitation/Other	6	0.2	1	16.7
All specialties	3992	100	1178	29.5

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	964	24.1	1410	80.5
Community infection	731	18.3	1053	60.1
Hospital infection	213	5.3	320	18.3
Long-term care/other HAI	27	0.7	37	2.1
Surgical prophylaxis	99	2.5	122	7.0
Single dose	67	1.7	87	5.0
One day	21	0.5	22	1.3
>1 day	12	0.3	13	0.7
Medical prophylaxis	93	2.3	116	6.6
Other indication	35	0.9	52	3.0
Unknown	42	1.1	51	2.9

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

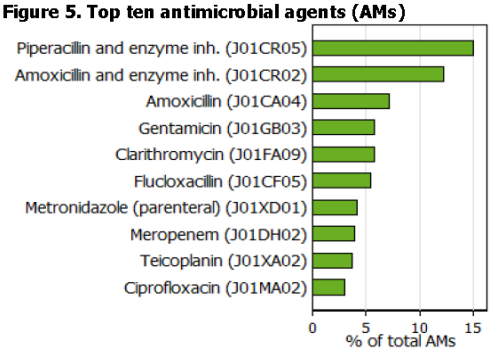


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	1823	45.7	85	4.7	587	32.2
Age, <1 year	186	4.7	3	1.6	23	12.4
Age, 1-44 years	910	22.8	29	3.2	240	26.4
Age, ≥45 years	2896	72.5	134	4.6	915	31.6
Length of stay, 1-3 days	1338	33.5	32	2.4	362	27.1
Length of stay, 4-7 days	981	24.6	35	3.6	386	39.3
Length of stay, 8-14 days	714	17.9	42	5.9	218	30.5
Length of stay, ≥15 days	949	23.8	56	5.9	210	22.1
Length of stay, Missing/Unknown	10	0.3	1	10.0	2	20.0
McCabe score, Non fatal	2792	69.9	83	3.0	720	25.8
McCabe score, Ultimately fatal	844	21.1	59	7.0	340	40.3
McCabe score, Rapidly fatal	109	2.7	9	8.3	42	38.5
McCabe score, Missing/Unknown	247	6.2	15	6.1	76	30.8
Surgery since hospital admission	664	16.6	53	8.0	242	36.4
Central vascular catheter	200	5.0	41	20.5	131	65.5
Peripheral vascular catheter	1733	43.4	110	6.3	802	46.3
Urinary catheter	681	17.1	64	9.4	308	45.2
Intubation	97	2.4	16	16.5	53	54.6
Total	3992	100.0	166	4.2	1178	29.5

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

UK-Scotland

PPS data from 01/09/2011 to 08/11/2011

Number of hospitals	52
Standard protocol	52
Light protocol	0
Number of patients	11902

Comments

National report:
http://www.documents.hps.scot.nhs.uk/hai/sshaip/prevalence/report-2012-04.pdf

Data representativeness: optimal

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	13	25
Secondary	17	32.7
Tertiary	8	15.4
Specialised	14	26.9
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	220	[60-471]
Average length of stay (days)*	—	—

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	563
HAI prevalence % (95%CI)	**4.7 (4.2-5.4)**
N of HAIs	601
N of HAIs per infected patient	1.07
N HAIs with microorganism (%)	322 (53.6)
Total N of reported microorg.	355

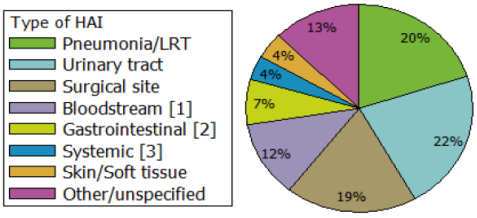
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	96	16	93	0.8
Origin of HAI=Same hospital	56	58.3	54	0.5
Origin of HAI=Other hospital	32	33.3	31	0.3
Origin of HAI=Other/unknown	8	8.3	8	0.1
HAI during current hospitalisation	455	75.7	421	3.5
Missing	50	8.3		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (1.5%)
[2] incl. *C. difficile* infections (5.2%)
[3] incl. clinical sepsis (3.7%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	3306	27.8	190	5.7
Medicine	4309	36.2	208	4.8
Paediatrics	474	4	4	0.8
Intensive care*	354	3	44	12.4
Obstetrics and gynaecology	582	4.9	12	2.1
Geriatrics	1917	16.1	79	4.1
Psychiatry	494	4.2	6	1.2
Rehabilitation/Other	466	3.9	20	4.3
All specialties	11902	100	563	4.7

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

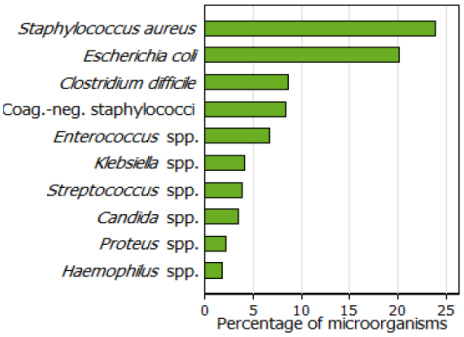


Table 6. Percentage of antimicrobial resistance for selected microorganism-antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	85	64	26	40.6
Enterococci / VRE	24	12	1	8.3
Enterococcus faecalis / VAN-R	12	8	0	—
Enterococcus faecium / VAN-R	4	3	1	—
Enterobacteriaceae / 3GC-NS	106	46	9	19.6
Escherichia coli / 3GC-NS	72	30	6	20.0
Klebsiella spp. / 3GC-NS	15	7	2	—
Enterobacter spp. / 3GC-NS	6	3	1	—
Enterobacteriaceae / CAR-NS	106	46	1	2.2
Escherichia coli / CAR-NS	72	30	1	3.3
Klebsiella spp. / CAR-NS	15	7	0	—
Enterobacter spp. / CAR-NS	6	3	0	—
Pseudomonas aeruginosa / CAR-NS	7	4	0	—
Acinetobacter baumannii / CAR-NS	1	1	1	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

UK-Scotland (continued)

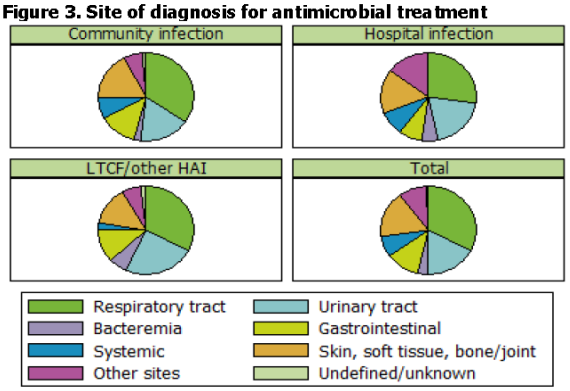
III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	3858	
AU prevalence % (95%CI)	32.4 (30.4-34.5)	
N of antimicrobials	5815	
N of antimicrobials per patient	1.51	
	N	Rel%
Reason in patient charts/notes, Yes	4741	81.5
Reason in patient charts/notes, No	876	15.1
Reason in patient charts/notes, Unknown	198	3.4
Route of administration, Parenteral	2878	49.5
Route of administration, Oral	2890	49.7
Route of administration, Other/unknown	47	0.8

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment



LTCF=long-term care facility

Figure 4. Distribution of antibacterials for systemic use (J01)

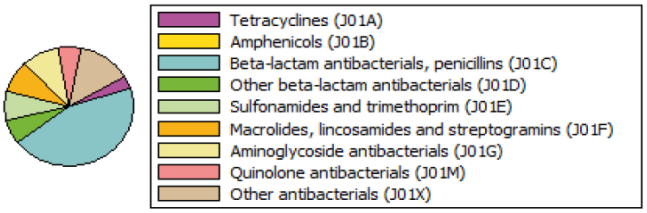


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	3306	27.8	1241	37.5
Medicine	4309	36.2	1643	38.1
Paediatrics	474	4.0	81	17.1
Intensive care*	354	3.0	162	45.8
Obstetrics and gynaecology	582	4.9	137	23.5
Geriatrics	1917	16.1	445	23.2
Psychiatry	494	4.2	39	7.9
Rehabilitation/Other	466	3.9	110	23.6
All specialties	11902	100	3858	32.4

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	2993	25.1	4376	75.3
Community infection	2065	17.4	3041	52.3
Hospital infection	937	7.9	1266	21.8
Long-term care/other HAI	47	0.4	71	1.2
Surgical prophylaxis	364	3.1	528	9.1
Single dose	219	1.8	308	5.3
One day	78	0.7	92	1.6
>1 day	98	0.8	128	2.2
Medical prophylaxis	374	3.1	475	8.2
Other indication	54	0.5	70	1.2
Unknown	302	2.5	373	6.4

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 5. Top ten antimicrobial agents (AMs)

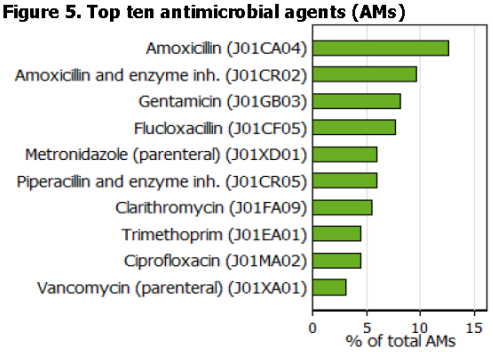


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	5152	43.3	278	5.4	1812	35.2
Age, <1 year	561	4.7	19	3.4	98	17.5
Age, 1-44 years	1999	16.8	69	3.5	629	31.5
Age, ≥45 years	9338	78.5	475	5.1	3128	33.5
Length of stay, 1-3 days	3332	28.0	45	1.4	1082	32.5
Length of stay, 4-7 days	2766	23.2	110	4.0	1115	40.3
Length of stay, 8-14 days	2160	18.1	147	6.8	778	36.0
Length of stay, ≥15 days	3445	28.9	255	7.4	836	24.3
Length of stay, Missing/Unknown	199	1.7	6	3.0	47	23.6
McCabe score, Non fatal	7756	65.2	310	4.0	2282	29.4
McCabe score, Ultimately fatal	2870	24.1	162	5.6	1138	39.7
McCabe score, Rapidly fatal	1071	9.0	82	7.7	371	34.6
McCabe score, Missing/Unknown	205	1.7	9	4.4	67	32.7
Surgery since hospital admission	2701	22.7	218	8.1	1079	39.9
Central vascular catheter	509	4.3	94	18.5	336	66.0
Peripheral vascular catheter	3742	31.4	254	6.8	1985	53.0
Urinary catheter	2227	18.7	179	8.0	1022	45.9
Intubation	175	1.5	30	17.1	109	62.3
Total	11902	100.0	563	4.7	3858	32.4

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category

UK-Wales

PPS data from 01/11/2011 to 29/11/2011

Number of hospitals	22
Standard protocol	22
Light protocol	0
Number of patients	6852

Comments

Data representativeness: good

I. Hospital characteristics

Table 1. Types of hospitals

Hospital type	N	%
Primary	2	9.1
Secondary	13	59.1
Tertiary	4	18.2
Specialised	3	13.6
Unknown	0	0

Table 2. Size of the hospitals and average length of stay

	Median	[IQR]
Size (number of beds)	352	[133-506]
Average length of stay (days)*	5.3	[4.4-5.9]

*Hospital statistics of year preceding PPS

II. Healthcare-associated infections (HAIs) and antimicrobial resistance

Table 3. HAI prevalence and key results

Number of patients with HAI	283
HAI prevalence % (95%CI)	**4.1 (3.1-5.5)**
N of HAIs	300
N of HAIs per infected patient	1.06
N HAIs with microorganism (%)	164 (54.7)
Total N of reported microorg.	180

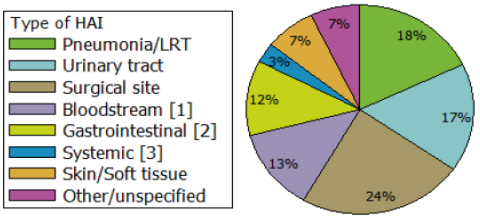
N=number

Table 4. Origin of HAIs

Origin of HAI	N HAIs	Rel%	Pts HAI	HAI%
HAI present on admission	79	26.3	77	1.1
Origin of HAI=Same hospital	44	55.7	43	0.6
Origin of HAI=Other hospital	23	29.1	22	0.3
Origin of HAI=Other/unknown	12	15.2	12	0.2
HAI during current hospitalisation	220	73.3	205	3
Missing	1	0.3		

N HAIs=number of HAIs, Rel%=% of total number of HAIs,
Pts HAI=N patients with HAI, HAI%=HAI prevalence % within category

Figure 1. Distribution of types of HAI



[1] incl. catheter-related bloodstream infections (3.3%)
[2] incl. *C. difficile* infections (11.3%)
[3] incl. clinical sepsis (2.3%)
LRT=Lower respiratory tract

Table 5. HAI prevalence by specialty

Specialty	N pts	Rel%	N pts with HAI	HAI%
Surgery	2089	30.5	106	5.1
Medicine	2938	42.9	120	4.1
Paediatrics	298	4.3	5	1.7
Intensive care*	214	3.1	26	12.1
Obstetrics and gynaecology	362	5.3	9	2.5
Geriatrics	397	5.8	8	2.0
Psychiatry	290	4.2	2	0.7
Rehabilitation/Other	264	3.9	7	2.7
All specialties	6852	100	283	4.1

N pts=number of patients, Rel%=% of total N pts, N pts with HAI=
N of patients with ≥1 HAI, HAI%=HAI prevalence % for specialty
*includes non-intensive care specialties in intensive care units

Figure 2. Top ten microorganisms isolated in HAIs

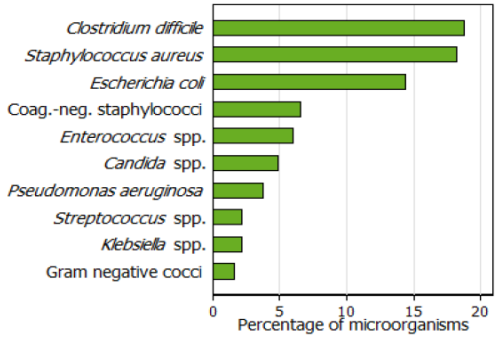


Table 6. Percentage of antimicrobial resistance for selected microorganism–antimicrobial combinations

Microorganism / Resistance	N isol.	N test.	N NS	% NS
Staphylococcus aureus / MRSA	33	25	14	56.0
Enterococci / VRE	11	7	3	–
Enterococcus faecalis / VAN-R	1	0	0	—
Enterococcus faecium / VAN-R	1	1	1	—
Enterobacteriaceae / 3GC-NS	36	21	4	19.0
Escherichia coli / 3GC-NS	26	15	3	20.0
Klebsiella spp. / 3GC-NS	4	2	0	—
Enterobacter spp. / 3GC-NS	1	1	0	—
Enterobacteriaceae / CAR-NS	36	18	1	5.6
Escherichia coli / CAR-NS	26	13	1	7.7
Klebsiella spp. / CAR-NS	4	2	0	—
Enterobacter spp. / CAR-NS	1	1	0	—
Pseudomonas aeruginosa / CAR-NS	7	4	1	—
Acinetobacter baumannii / CAR-NS	0	0	0	—

N=number, N isol.=total N of isolates, N test.= N of isolates with known susceptibility results, R=resistant, NS=non-susceptible,
N NS=N of NS isolates (only R isolates for MRSA, VRE and VAN-R),
% NS=N NS/N test. (not shown if N test.<10 isolates),
MRSA=meticillin-resistant *S. aureus*, VAN=vancomycin,
3GC=third-generation cephalosporin, CAR=carbapenem

UK-Wales (continued)

III. Antimicrobial use (AU)

Table 7. Antimicrobial use (AU) prevalence

N of patients with antimicrobials	2170	
AU prevalence % (95%CI)	31.7 (29.4-34.1)	
N of antimicrobials	3041	
N of antimicrobials per patient	1.4	
	N	Rel%
Reason in patient charts/notes, Yes	2305	75.8
Reason in patient charts/notes, No	448	14.7
Reason in patient charts/notes, Unknown	288	9.5
Route of administration, Parenteral	1450	47.7
Route of administration, Oral	1582	52
Route of administration, Other/unknown	9	0.3

N=Number, Rel%=percentage of total N of antimicrobials

Figure 3. Site of diagnosis for antimicrobial treatment

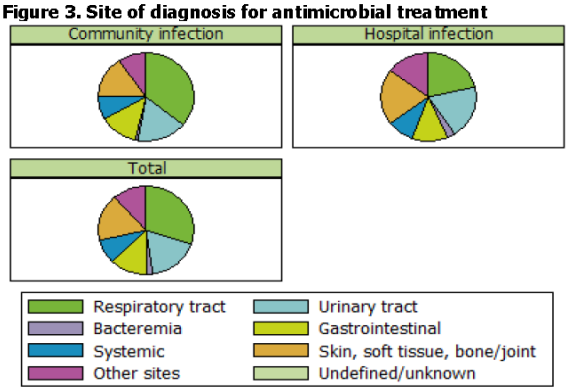


Table 8. Antimicrobial use (AU) prevalence by specialty

Specialty	N pts	Rel%	N pts with AU	AU%
Surgery	2089	30.5	683	32.7
Medicine	2938	42.9	1050	35.7
Paediatrics	298	4.3	77	25.8
Intensive care*	214	3.1	100	46.7
Obstetrics and gynaecology	362	5.3	73	20.2
Geriatrics	397	5.8	112	28.2
Psychiatry	290	4.2	28	9.7
Rehabilitation/Other	264	3.9	47	17.8
All specialties	6852	100	2170	31.7

N pts=number of patients, Rel%=% of total N patients, with AU= with ≥1 antimicrobial, AU%=AU prevalence for specialty
*includes non-intensive care specialties in intensive care units

Table 9. Indication for antimicrobial use (AU)

Indication	N pts	AU%	N AMs	Rel%
Treatment	1831	26.7	2480	81.6
Community infection	1146	16.7	1577	51.9
Hospital infection	705	10.3	905	29.8
Long-term care/other HAI	0	0.0	0	0.0
Surgical prophylaxis	110	1.6	137	4.5
Single dose	24	0.4	30	1.0
One day	35	0.5	38	1.2
>1 day	60	0.9	73	2.4
Medical prophylaxis	250	3.6	321	10.6
Other indication	7	0.1	7	0.2
Unknown	70	1.0	97	3.2

AU%=AU prevalence % for indication, AMs=antimicrobial agents, Rel%=% of total N of AMs

Figure 4. Distribution of antibacterials for systemic use (J01)

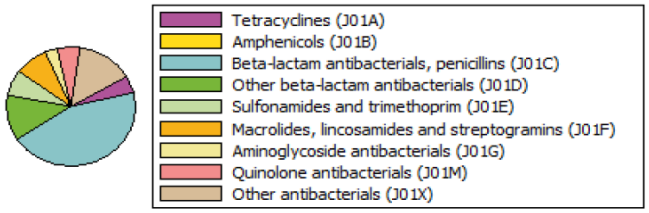


Figure 5. Top ten antimicrobial agents (AMs)

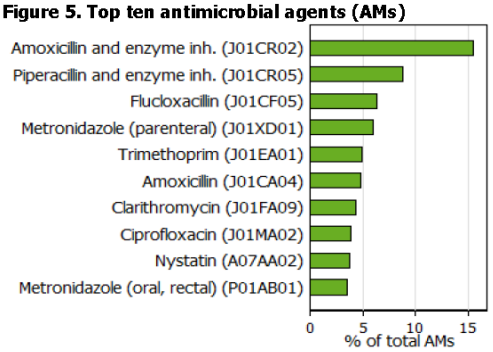


Table 10. Prevalence of healthcare-associated infections (HAI) and antimicrobial use (AU) by patient risk factors (std. protocol)

Patient risk factor	N pts	Rel%	Pts HAI	HAI %	Pts AU	AU %
Male gender	2993	43.7	149	5.0	1065	35.6
Age, <1 year	251	3.7	9	3.6	50	19.9
Age, 1-44 years	1100	16.1	30	2.7	305	27.7
Age, ≥45 years	5476	79.9	243	4.4	1813	33.1
Length of stay, 1-3 days	1897	27.7	39	2.1	563	29.7
Length of stay, 4-7 days	1480	21.6	61	4.1	613	41.4
Length of stay, 8-14 days	1308	19.1	66	5.0	434	33.2
Length of stay, ≥15 days	2100	30.6	113	5.4	539	25.7
Length of stay, Missing/Unknown	67	1.0	4	6.0	21	31.3
McCabe score, Non fatal	2943	43.0	91	3.1	857	29.1
McCabe score, Ultimately fatal	730	10.7	36	4.9	262	35.9
McCabe score, Rapidly fatal	286	4.2	20	7.0	102	35.7
McCabe score, Missing/Unknown	2893	42.2	136	4.7	949	32.8
Surgery since hospital admission	1484	21.7	99	6.7	495	33.4
Central vascular catheter	334	4.9	44	13.2	201	60.2
Peripheral vascular catheter	2302	33.6	151	6.6	1111	48.3
Urinary catheter	1271	18.5	113	8.9	590	46.4
Intubation	166	2.4	18	10.8	82	49.4
Total	6852	100.0	283	4.1	2170	31.7

N pts=number of patients, Rel%=% of total, Pts HAI=N patients with at least one HAI, Pts AU= N patients with AU, HAI%/AU%= HAI/AU prevalence % within category