Health Protection Agency

English National Point Prevalence Survey on Healthcare-associated Infections and Antimicrobial Use, 2011

Preliminary data

ips Infection Prevention Society

HEALTHCARE INFECTION SOCIETY

BIA British Infection Association

BSAC british society for antimicrobial chemotherapy

Acknowledgements

This survey would not have been possible without the participation and support of infection prevention and control teams and antimicrobial stewardship teams in all the participating hospitals. Their collaboration is gratefully appreciated. A list of the trusts and independent sector organisations that confirmed that they would like their hospital listed in this report is in Appendix 1.

We would like to acknowledge and thank the members of the Point Prevalence Survey Steering Group for their expert insight and active participation. Their valuable contribution has made this survey possible. A list of all members of the group is in Appendix 2.

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Key points

- The prevalence of healthcare-associated infections (HCAI) was 6.4% in 2011 compared to 8.2% in 2006.
- The most frequent HCAIs detected were respiratory tract, urinary tract and surgical site infections.
- The prevalence of antimicrobial use (AMU) was 34.7%. This is the first time AMU was measured nationally. This provides a baseline for future monitoring.
- The prevalence of HCAIs, AMU and device use was highest in intensive care units, which relates in part to the complexity and vulnerability of patients in this setting.

1.0 Executive summary

1.1. Background

The Health Protection Agency (HPA) coordinated the fourth National Point Prevalence Survey (PPS) on healthcare-associated infection (HCAI) and first National PPS on antimicrobial use (AMU) in England. This survey is not directly comparable to previous surveys.

1.2. Aims

The aims of the PPS were to determine the burden of HCAI and AMU in acute hospitals and to use the results to identify priority areas for the future.

1.3. Methods

The English PPS data collection took place between September and November 2011. This survey included NHS acute trusts (n=99) and independent sector organisations (n=5). The data presented here is preliminary, further analyses are under way including complex mixed effects models to explore the heterogeneity and organisational clusters (variation across organisations).

1.4. Highlighted results

1.4.1. Overall population

Data from 103 organisations was analysed (one NHS trust was excluded as it submitted incomplete data). These organisations surveyed 52,443 eligible patients. The independent sector included 1,665 patients.

1.4.2. Overall HCAI prevalence

The overall prevalence of HCAI was 6.4% (95% confidence interval (CI) 4.7 – 8.7%). Independent sector hospitals had a significantly lower prevalence of HCAI with an overall prevalence of 2.2% (95% CI 1.3 – 3.8%) compared with NHS organisations at 6.5% (95% CI 4.8 – 8.8%); it should be noted that while 114 hospital sites from five independent sector organisations were surveyed, many sites had small numbers (<50) of inpatient beds. The paediatric HCAI prevalence was 5.4% (95% CI 3.9 – 7.5%). When comparing ward specialties, HCAI prevalence was highest in patients in the intensive care units (ICUs) (23.4%) followed by surgical wards (8.0%).

1.4.3. Characteristics of HCAI

A total of 3,360 (6.4%) patients were diagnosed with an active HCAI.

The six most common types of HCAI, which accounted for more than 80% of all HCAI, were respiratory tract infections (pneumonia and other respiratory infections) (22.8%), urinary tract infections (UTI) (17.2%), surgical site infections (SSI) (15.7%), clinical sepsis

(10.5%), gastrointestinal infections (8.8%) and bloodstream infections (BSI) (7.3%). In the paediatric survey population, the most common HCAI were clinical sepsis (40.2%), respiratory tract infections (15.9%) and bloodstream infections (BSI) (15.1%).

Enterobacteriaceae were the most frequently reported organisms associated with HCAI (0.9% of the survey population) – 12.4% were reported as resistant to third generation cephalosporins. Less than 0.1% of the survey population had a HCAI caused by meticillin resistant *Staphylococcus aureus* (MRSA) and 0.4% had *Clostridium difficile* infection (CDI).

Sixty-four percent of patients with BSI had a vascular access device (peripheral or central) in the 48 hours prior to the onset of infection. Forty-three percent of patients with UTI had a urinary catheter present within seven days prior to the onset of infection.

The majority of HCAI developed during the patients' stay in hospital (72.2%). Nineteen percent of patients with a HCAI were admitted with the infection, however 44.9% of these were not considered to be related to the hospital the patient was in at the time of the survey.

1.4.4. Antimicrobial use prevalence

The overall prevalence of AMU was 34.7%. The prevalence of AMU was greatest in the independent sector hospitals (46.7%) compared with NHS organisations at 34.3%. The prevalence of AMU in adults was 35.3% and in paediatrics 28.7%. AMU prevalence was greatest in ICU at 60.8%.

The total number of antimicrobials prescribed in the survey was 25,942 for 18,219 (34.7%) patients, which equates to 1.4 AM per patient prescribed antimicrobials.

AMU were most frequently prescribed for community acquired infections (53.0%). Thirteen percent of patients were on an antimicrobial (AM) for surgical prophylaxis; 30.3% of surgical prophylaxis was administered for greater than one day. The majority of AMU was for respiratory tract infections (30.9%). The second most common reason for AMU was skin, soft tissue, bone and joint infections (19.0%).

The most common antimicrobials prescribed were combinations of beta-lactam antibiotics and enzyme inhibitors.

Eighty-five percent of antimicrobials had the reason for their use recorded in the medical notes.

1.5. Conclusion

This survey has demonstrated that national policies for the control of MRSA and CDI have clearly brought rewards. This focus should remain.

The evidence from this PPS points towards a number of key areas that require consideration (Box 1). The priority areas for HCAI include sustained education of clinical staff, the development of learning tools for the prevention and surveillance of pneumonia

and a review of surgical site surveillance. The priority area for AMU is the development of antimicrobial stewardship and prescribing competencies.

These areas identified will need to be considered carefully by individual healthcare and professional organisations and the Department of Health so that an action plan can be developed.

Box 1. Priority areas for the future

HCAI

- Sustained education of all clinical staff on the methods of prevention of HCAI.
- Development of learning tools for the prevention of healthcare-associated pneumonia.
- Assessment of competency for device insertion – urinary catheter, central and peripheral vascular catheters – should be regularly undertaken and be reviewed at each new healthcare setting or site.
- Guidance on the prevention and control of Enterobacteriaceae within healthcare settings.
- Increased surveillance on surgical site infections, especially in surgical specialties where a high prevalence was detected.
- Development of standardised incidence surveillance methodology for pneumonia and catheter-associated UTI.
- Public benchmarking and incidence surveillance in ICU – particularly ventilator-associated pneumonia.
- Public reporting of organisations device prevalence to assist in reducing device use and shortening duration of use.

AMU

- Development of guidelines for important broad spectrum antimicrobials, for example, meropenem.
- Development of antimicrobial stewardship and prescribing competencies.
- Public reporting of antimicrobial consumption data for each hospital, with case mix stratification.
- Improvement in the documentation of antimicrobial indication in clinical notes (either electronic or paper).
- Education of clinical staff to ensure they document an accurate reason for antimicrobial prescribing.
- Developing of AMU national quality indicators for benchmarking across organisations in England.

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Abbreviations

AM	Antimicrobial
AMU	Antimicrobial use
AMR	Antimicrobial resistance
BJI	Bone and joint infection
BSI	Bloodstream infection
CAUTI	Catheter-associated urinary tract infection
CDC	Centre for Disease Control and Prevention
CDI	*Clostridium difficile* Infection
CI	Confidence interval
CAI	Community-acquired infection
CMO	Chief medical officer
CNS	Central nervous system
CVC	Central vascular catheter
CVS	Cardiovascular system
EENTM	Eye, ear, nose, throat or mouth infection
ERIC	Estates return information collection
ESAC	European Surveillance of Antimicrobial Chemotherapy
ESBL	Extended spectrum beta-lactamase
GI	Gastrointestinal infection
GP	General practitioner
GRE	Glycopeptide resistant *Enterococcus*
HCAI	Healthcare-associated infection
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
HAI	Hospital-acquired infection
HIS	Healthcare Infection Society
HPA	Health Protection Agency
HPS	Health Protection Scotland
IC	Infection control
ICD 10	International Classification of Disease Version 10
ICM	Infection control manager
ICN	Infection prevention and control nurse
ICT	Infection control team
ICU	Intensive care unit
IPC	Infection prevention and control
IPS	Infection Prevention Society
IQR	Interquartile range
IRR	Inter-rater reliability
IT	Information technology
KISS	[Krankenhaus Infektions Surveillance System] (German)
LOS	Length of stay
LRT	Lower respiratory tract infection other than pneumonia
MRSA	Meticillin resistant *Staphylococcus aureus*

MSSA	Meticillin sensitive *Staphylococcus aureus*
NHS	National Health Service
NHSN	National Healthcare Safety Network
NI	Nosocomial infection
NNIS	National Nosocomial Infection Surveillance
PII	Patient identifiable information
PVC	Peripheral vascular catheter
ROI	Republic of Ireland
RSI	Reproductive system infections
SHA	Strategic health authority
SOP	Standard operating procedure
SSI	Surgical site infection
SSTI	Skin and soft tissue infection
UC	Urinary catheter
UK	United Kingdom
US	United States of America
UTI	Urinary tract infection
VAP	Ventilator-associated pneumonia

2.0 Introduction

Healthcare-associated infections (HCAIs) are infections that are associated with interventions, devices or procedures carried out in healthcare facilities. It has previously estimated that 300,000 HCAIs occur annually.[1] The estimated cost to NHS hospitals of caring for people that acquire a HCAI has been estimated conservatively as over £1 billion a year.[2] Published evidence suggests that at least 20% of HCAIs are avoidable [3] and infection prevention and control strategies provide cost-effective solutions. Reducing the burden of HCAIs has been a government priority in England for the last 15 years. Policy decisions including organisational (NHS trust) targets to reduce meticillin resistant *Staphylococcus aureus* (MRSA) bacteraemia and *Clostridium difficile* infection (CDI) have been successful in reducing the incidence of these infections by more than 70% over the last five years.[4] A National Audit Office (NAO) report has estimated that these reductions saved the NHS between £45 and £59 million.[5] However, there are no national surveillance systems to determine the number of common HCAI (e.g. pneumonia, urinary tract infections (UTI)).

There are two approaches to assessing the burden of HCAI – continuous (incidence) surveillance or point prevalence ('snapshot') surveys (PPS). PPS have value in determining the burden of HCAI and highlighting areas that need further exploration.[6-18] Assessing the true impact of all HCAI would require continuous prospective surveillance for all HCAI which requires sequential data collection for every hospital patient, a labour and resource intensive process that is not feasible. Prevalence surveys provide a cost-effective method for collecting valuable data on HCAI [6, 19, 20]. PPS are also useful for describing antimicrobial (AM) prescribing patterns and when used repeatedly allow the identification of changes in prescribing over time.

Point prevalence surveys where each ward has been surveyed on one day in order to measure the burden of HCAI in acute care hospitals, have been performed in England on three previous occasions.[21-23]

In 2010, the Department of Health Advisory Committee on Antimicrobial Resistance and Healthcare-associated infections (ARHAI) published advice on surveillance priorities for HCAI in England. The report highlighted that there was value in performing local/national PPS periodically with the aim of providing a focus on identification of gaps within current incidence surveillance systems.[24]

There is no nationally reported antimicrobial use (AMU) data available for NHS acute trusts in England. IMS Health, a commercial organisation, collates this information from NHS acute hospital pharmacy records but this data is unavailable for feedback and comparison of individual organisations. England has participated in European PPS on AMU previously, but no published data on the English component alone is available in the public domain. The Department of Health and ARHAI have developed a strong AM stewardship strategy and have promoted stewardship teams in NHS organisations, with over 90% of trusts engaged with pharmacists to develop and reinforce AM policies.[25] ARHAI is developing and assessing quality indicators relating to AM prescribing, as well as agreeing AM stewardship competencies. The use of PPS to assess AMU and quality indicators for AM prescribing, used extensively by European Society Antimicrobial

Chemotherapy (ESAC) across Europe over the last 10 years, were incorporated into the current PPS alongside HCAI.

A glossary of terms and short summary of surveillance of HCAI in England is included in Appendix 3 and 4.

2.1 PPS in England

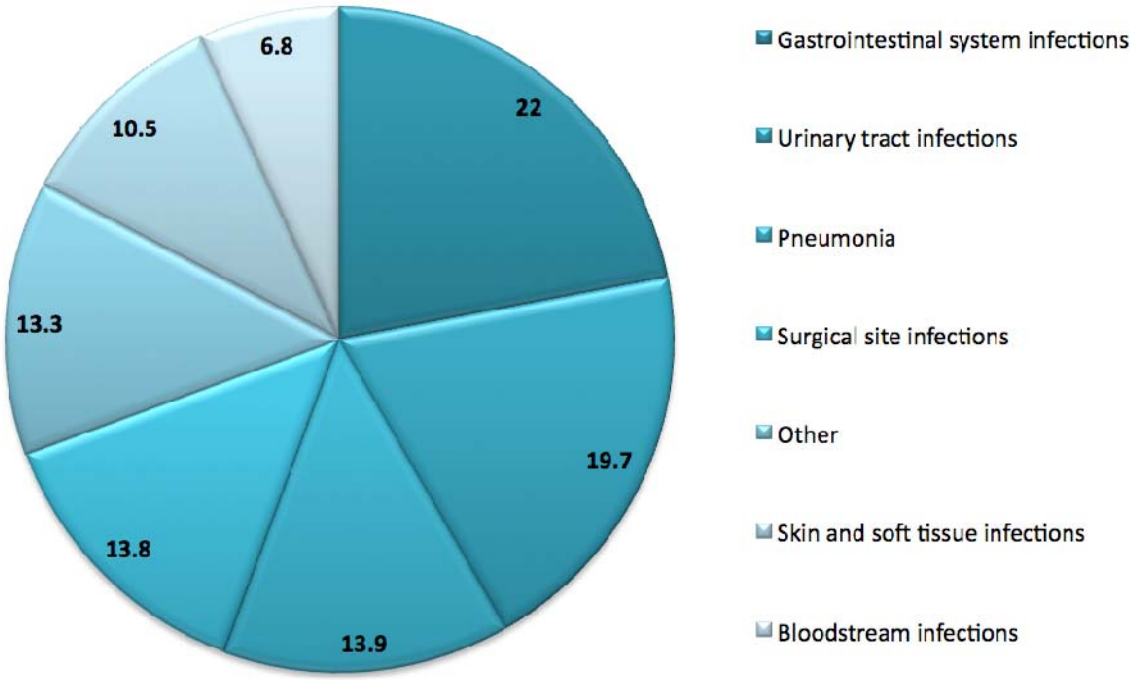
Three previous HCAI PPS have been performed in England. These were conducted in 1980[21], 1993/4[22] and 2006[18] and the prevalence from each is summarised in Table 2-1. Each survey adopted slightly different methodologies so direct comparisons should be made with caution.

Table 2-1: Results from previous HCAI prevalence surveys in England and UK

Prevalence study	Total patients surveyed	Total number with HCAI	Prevalence	95% confidence interval (CI)
	N	N	%	%
2006 England	58775	4812	8.2	8.0-8.4
UK 1993/4	37111	3353	9.0	8.8-9.3
UK 1980	18163	1671	9.2	8.8-9.6

The 2006 prevalence survey showed that 22.0% of infections at the time were gastrointestinal infections (GI), 19.7% were UTI, 13.9% were pneumonia, 13.8% were surgical site infections (SSI), 10.5% were skin and soft tissue infection (SSTI) and 6.8% were bloodstream infections (BSI) (Figure 2-1).

Figure 2-1: The most common types (%) of HCAI recorded in the 2006 England PPS



3.0 Aims and objectives of 2011 PPS

The aims of this survey were to determine the burden of HCAI and AMU and to identify priority areas for the future.

The specific objectives were to

- To estimate the total burden (prevalence) of HCAI and AMU in acute care hospitals in England.
- To describe patients, invasive devices, HCAI and AMU by types of patients, specialties, and healthcare facilities.
- To describe the HCAI sites, micro-organisms and markers of resistance.
- To describe the AM compounds prescribed, their indications and AMU quality indicators.
- To disseminate the results to those who need to know at local, regional and national level to raise awareness.
- To train and reinforce surveillance structures and skills, by developing a comprehensive training programme on the protocol and definitions.
- To identify areas of concern and develop appropriate national priorities for incidence surveillance, research and policy interventions.
- To identify and develop priority areas for AMU quality indicators in line with the national AM stewardship programme.

4.0 Methods

4.1 Study design and protocol development

The English PPS data collection took place between September and November 2011. All acute NHS trusts were invited to participate in the 2011 PPS via an email to the Directors of Infection Prevention and Control (DIPC) (Part 2, Appendix 1). The independent sector organisations were invited to participate via the surveillance coordinator.

The English Protocol was developed using the ECDC protocol and codebooks.[26] These were reformatted for England, without making any modifications to the definitions or the methodology. These were included in the training materials and uploaded to the HPA dedicated PPS England website. (Part 2, Appendix 2, 3 and 4)[27]

The protocol and data collection were approved by National Information Governance Board, Ethics and Confidentiality Committee and the NHS Information Centre (Part 2, Appendix, 5).

4.2 Training and support

There were ten training events in England for participating hospitals (See Part 2, Appendix 6 for a full list of the training events). Those individuals participating in the training were allocated as the local organisation training leads and were responsible for taking the training material back to their hospital and training their hospital colleagues who would be conducting the surveillance (See Part 2, Appendix 7 for the full training curriculum).

Following the training days, participants were asked to submit two completed case studies per organisation, which incorporated all aspects of the PPS methodology, data collection and definitions. Case studies were marked against the gold standard answer (See Part 2, Appendix 8 for the three case studies and answers).

All organisations/trusts that collected PPS data successfully completed the training programme. A report and evaluation of the training can be found in Part 2, Appendix 9.

All queries from organisations were emailed to a generic HPA email address, which was manned by the HPA PPS team daily.

4.3 Inclusion and exclusion criteria

Hospitals inclusion criteria

- All acute care hospitals were eligible for inclusion.
- There was no minimum size of hospitals.

Hospital exclusion criteria

- Long term care facilities.
- Rehabilitation facilities.
- Community hospitals

Wards inclusion criteria

- All acute care wards in acute care facilities were included (e.g. acute psychiatric wards and neonatal ICUs were included).

Ward exclusion criteria

- Long-term care wards in acute care facilities (e.g. nursing home wards).
- Accident and emergency departments (A&E) (wards attached to A&E departments where patients are monitored for more than 24 hours were included).

Patient inclusion criteria

- All patients admitted to the ward by 8:00am and not discharged from the ward at the time of the survey.
- Neonates on maternity and paediatric wards, if born before/at 8:00am
- Patients who were temporarily away from the ward at the PPS time for diagnostic investigations, procedures.

Patient exclusion criteria

- Patients who were classified as day case (i.e. same day treatment or surgery), reviewed at outpatient department, emergency room or outpatient dialysis centres were excluded.

4.4 Data collection

Data collection was undertaken on each ward within a single day, however the whole hospital surveillance could take place over a two to three week period depending on the size of the hospital. Because in some units more patients are admitted on Monday for elective procedures, it was recommended that the survey be performed in these units between Tuesday and Friday if possible.

The composition of the team responsible for the data collection in hospitals varied from one hospital to another. It was recommended that hospital infection prevention and control personnel (nurses, doctors and surveillance officers), AM stewardship team (pharmacists, doctors etc) and the primary team in charge of patient care were involved in data collection.

Data was collected on the data collection forms (Part 2, Appendix 11) which were distributed as part of the training package and also available to print from the website.[27] After completing the forms, data was then entered into the Helicswin.Net access database. Data entry was the responsibility of the participating hospital.

4.5 Data definitions

4.5.1 Hospital type

An acute care NHS trust was defined according to national definitions, published on the Hospital Estates and Facilities Statistics Centre website - Estates Return Information collection (ERIC).[28] Additionally all hospitals self-defined their hospital type using ECDC definitions for acute hospitals, (primary, secondary, tertiary or specialised) (Part 2, Appendix 2). All data sub-divided by ECDC definitions are displayed in Appendix 5 of this report.

The national definitions for acute hospitals:

- *Acute – Multi-service:* trusts comprising a district general type of acute hospital that also has significant amounts of community activity (non-acute expenditure greater than 15%). Acute – Multi-service trusts were recoded according to ERIC data[28] into Acute – Large/Medium/Small as community activity was not recorded for this survey.

- *Acute – Teaching:* trusts with an attached undergraduate medical school.

- *Acute – Large/Medium/Small:* trusts with an A&E department and all core acute specialties. Subdivided into three categories, based on 2010-11 ERIC data.[28]

- *Acute – Specialist:* trusts with very restricted specialties, such as orthopaedic and children's trusts.

4.5.2 HCAI data

HCAI data was collected for all active HCAI present on the day of the survey.
All HCAI had to meet a specific HCAI case definition. Detailed case definitions are in Part 2, Appendix 3 and 4.

An active HCAI was defined as when signs and symptoms of the HCAI were present on the survey date **or** the patient was receiving treatment for HCAI on the survey date, where the signs and symptoms were present at any time since starting treatment.

The onset of the HCAI must also have occurred within one of the following timescales:

- The onset of symptoms was on Day 3 or later (day of admission = Day 1) of the current admission.
- The patient presented with an infection less than two days after a previous admission to an acute care hospital.
- The patient was admitted (or developed symptoms within two days) with an infection that met the case definition of SSI.
- The patient has been admitted (or develops symptoms within two days) with CDI less than 28 days from a previous discharge from an acute care hospital .
- A device-associated infection following insertion of the device on Day 1 or Day 2 of admission.

Results of tests/examinations that were not available on the survey date were **not** taken into account to establish whether the case definition criteria were fulfilled.

Microbiological data that was available on the day of the survey was also collected. Key resistance mechanisms for important HCAI pathogens were included as data variables.

4.5.3 Antimicrobial use data

Antimicrobial use (AMU) data was collected if the patient was:

- Receiving an AM for treatment or medical prophylaxis at the time of survey; and/or
- Had received at least one dose of surgical prophylaxis prior to 8am on the day of the survey.

Antifungal treatment was included in this survey. Tuberculosis and antiviral treatments were excluded from the survey.

The aim for the AM section of the survey was to find out what the medical team thought they were treating. To determine the reason for treatment, all patient records were reviewed and information was sought from nurses, pharmacists or doctors. Quality indicators of AMU were included. These were whether the AM was administered parenterally versus orally, and whether the indication was noted in the patient electronic or paper notes.

4.6 Data management

4.6.1 Data processing

Data was collected on forms and subsequently entered into an access database by the hospital staff after data verification. The ECDC developed the free software tool for data entry at the hospital level (the HELICSwin.Net database). An overview of how to use the database was given at the training days and all participants received the HELICSwin.Net user manual protocol (Part 2, Appendix 11).

Once data was entered and verified by the hospital PPS team, the hospital/ trust then sent an email to the HPA coordinator requesting an encryption email for data transfer. The protocol for data export and transfer to the HPA is outlined in Part 2, Appendix 12).

4.6.2 Analysis

The hospitals/ trusts sent their access database in mdb format via the secure encryption email system. Databases were converted to odbc format and exported into STATA 11 (Stata Corporation ©, Texas). Data was cleaned, labelled and re-shaped in STATA 11 in preparation for data analysis. Data was analysed in STATA 11 and 12. All data was stored on the HCAI and AMR Department, Colindale secure server with limited access according to the Systems Level Security Policy.

All hospitals received an initial data report and presentation within six weeks of receipt at the HPA and were asked to check their data for consistency and accuracy. The final deadline for any modified data to be received by the HPA was 14 February 2012.

Data was checked for possible errors and for data that fell outside reasonable ranges such as negative ages, extreme outliers, missing values and duplicates. Extreme outliers, and inconsistent ages for ward/consultant specialty were recoded as missing. Consistency checks were also performed to ensure cases of HCAI and AMU data matched across the dataset and ages matched ward categories.

Where an individual was recorded as either having a HCAI or receiving an AM in the primary database but no HCAI or AMU data was entered, the primary data field remained unchanged and all the data fields relating to the HCAI and AM were coded as 'unknown'.

The population was divided into paediatric (<16 years) and adult groups. Age was treated as a categorical variable and distributed into the following age groups: <1 month (neonate), 1-23 months, 2-15 years, 16-29 years, 30-49 years, 50-64 years, 65-79 years and 80+ years.

Single variable analysis was conducted to give an overall description of the data. Binomial or Poisson 95% confidential intervals (CI) were determined as appropriate. Comparison of prevalence was performed using estimations to assess overlapping CI.

As multiple observations were received from individual hospitals/ organisations, they were both interdependent and clustered. Therefore a linear mixed effects model was applied to the major results for each section. This allowed the inclusion of both fixed and random effects. Fixed effects led to the description of the survey population (the average response for England), while random effects allowed estimation of organisation specific means and accounted for the heterogeneity in the responses from different organisations. This linear model provided flexibility of modelling variances and covariances in addition to means from a cross-sectional regression model.

5.0 Results

5.1 Overview of participating and non-participating trusts

5.1.1 Hospital characteristics

One hundred and sixty seven acute NHS trusts in England contribute data to mandatory surveillance schemes in the HPA; 99 trusts (59.3% of NHS acute trusts) contributed data to the PPS. An overview of participating and non participating trusts is described in Table 5-1. There was no statistical difference in the types of trusts participating, though less Acute – Specialised trusts participated than other trust types.

Twenty four independent sector organisations with 226 hospital sites submit data to MRSA and *C difficile* surveillance scheme run by the HPA. Five independent sector organisations with 114 hospital sites (50.4% of independent sector sites) participated in this PPS.

The mean size of the NHS hospitals included in this survey was 518 beds compared with 15 beds per hospital site from independent organisations.

Table 5-1: Participating and non-participating trusts by type of trust

Type of trust	Did not participate	Participated	Total	p value*
	N (%)	N (%)	N (%)	
Acute – Large	18 (26.5)	25 (25.2)	43 (25.7)	
Acute – Medium	16 (25.3)	22 (22.2)	38 (22.7)	
Acute – Small[1]	13 (19.1)	25 (25.2)	38 (22.8)	
Acute – Specialised	13 (19.1)	7 (7.1)	20 (12.0)	
Acute – Teaching	8 (11.8)	20 (20.2)	28 (16.8)	
Total	68 (100)	99(100)	167 (100)	p=0.1

[1]multi-specialised hospitals were recoded as Acute – Small as this category is not used for the surveillance datasets
*Chi-squared

The proportion of beds surveyed in NHS trusts did not vary significantly across regions (p=0.5, see Appendix 5, Figure A-1).

All regions were represented in this survey. There was no statistical difference detected in regional representation (p=0.7, see Appendix 5, Table A-2).

5.2 Survey characteristics

5.2.1 Characteristics of patients surveyed by hospital and organisation type

One NHS trust submitted numerator data only and was excluded from further analysis. A total of 52,443 eligible patients in 103 organisations were included in the analysis.

A total of 50,778 (96.8%) patients were surveyed from NHS organisations. The independent sector organisations contributed 1,665 (3.2%) patients to the survey (Table 5-3).

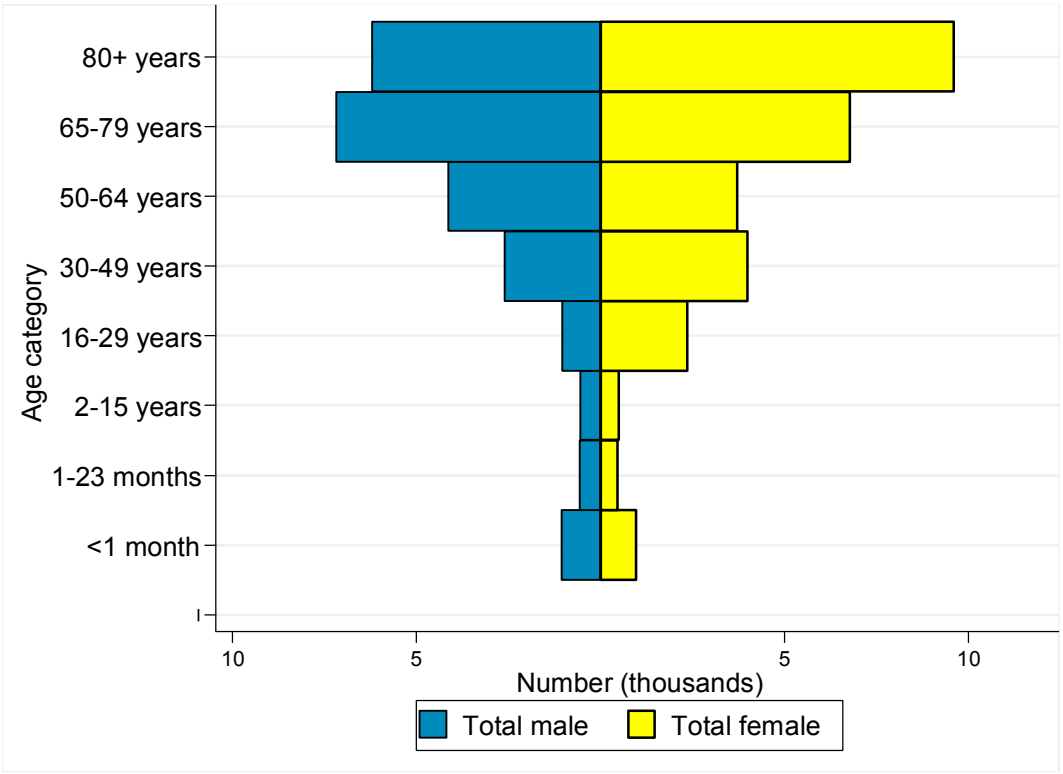
5.2.2 Demographics of the survey population

Male and female patients accounted for 44.9% and 54.7% of the hospital population respectively (gender was unrecorded in 0.4% of cases). The age and sex distribution of the population are described in Figure 5-1.

The median age of all patients was 69 years (Inter-quartile range (IQR) 46-82 years). The median age in male and female patients was 69 (IQR 39-80) years and 70 (IQR 43-83) years respectively. The proportion of individuals over 65 years was 57.4% with similar proportions in males and females, these being 56.9% and 57.1% respectively. Those aged under 16 years represented 8.4% of the total survey population.

Four thousand, three hundred and seventy two patients were surveyed from paediatric wards and specialties (including babies with mothers on postnatal wards ‘well babies’). The median age in those aged <16 years was 1 month (IQR 0 months to 2 years). When the ‘well babies’ were excluded, the median age was 3 months (IQR 0 months to 5 years). The population pyramid displayed below demonstrates a higher proportion of females than males in the 16 to 49-year-old age groups (reflecting obstetrics and gynaecology) and in the over 80-year-old age groups (Figure 5-1).

Figure 5-1: Population pyramid: Number of patients surveyed by age and sex



5.2.3 Patients surveyed by intrinsic risk factors for HCAI

Fifty percent of patients were estimated to have a non-fatal disease (life expectancy >5 years) using the McCabe score, 17.5% were determined by the data collectors to have an ultimately fatal disease (life expectancy 1-5 years) and 4.0% a rapidly fatal disease (life expectancy <1 year). This was the least well completed variable in the dataset with 28.4% of patients recorded as unknown, suggesting that the estimated life expectancy was not recorded in the available notes or the attending physician was unable to define this to the data collector.

Twenty six percent of patients had a surgical procedure performed since admission to hospital: 21.1% NHSN surgery and 4.9% non-NHSN surgery (See Appendix 5, Table A-3).

5.2.4 Patients surveyed by ward specialty and consultant specialty

The distribution of number of patients surveyed by ward specialty of care is described in Table 5-2 below. One thousand three hundred and fifty one (2.6%) patients were resident in an Intensive Care Unit (ICU). Seventy five (0.1%) patients were resident in a paediatric ICU and 550 patients (1.0%) were in a neonatal ICU (Appendix 5, Table A-15).

For a breakdown of the number of patients surveyed by consultant specialty see Appendix 5, Table A-4).

Table 5-2: Number of patients surveyed by ward specialty

Ward specialty	Number of patients surveyed N	Proportion of total patients surveyed % (95% CI)
Total	52443	100.0
Medical	17029	32.5 (32.0 - 33.0)
Surgical	11088	21.1 (20.8 - 21.5)
Combination of specialties	10639	20.3 (19.9 - 20.7)
Obstetrics and gynaecology	4305	8.2 (8.0 - 8.5)
Geriatrics	3845	7.3 (7.1 - 7.6)
Paediatric (including paediatric and neonatal ICU)	2742	5.2 (5.0 - 5.4)
Adult ICU	1351	2.6 (2.4 - 2.7)
Rehabilitation	981	1.9 (1.8 - 2.0)
Unknown	272	0.5 (0.5 - 0.6)
Other specialty	152	0.3 (0.2 - 0.3)
Psychiatrics	39	0.1 (0.1 - 0.1)

5.2.5 Prevalence of invasive device by ward specialty and consultant specialty

Almost 50% of individuals had at least one device *in situ*.

The most prevalent device was peripheral vascular cannula (PVC). The prevalence of PVC use was 38.6% and the prevalence was significantly higher for patients cared for in ICU (69.8%). The prevalence of PVC by ward and consultant specialty is available in Appendix 5 (Table A-5 and Table A-6).

Central vascular catheters (CVC) were present in 5.9% of all patients surveyed; CVC prevalence in ICU wards was 59.3%. The prevalence of CVC by ward and consultant specialty is available in Appendix 5 (Table A-7 and Table A-8).

The overall prevalence of urinary catheter (UC) at the time of the survey was 18.8%; the prevalence on ICU wards was 83.2%. However, both surgical and geriatric ward specialties had UC prevalence of > 20%. The prevalence of UC by ward and consultant specialty is available in Appendix 5 (Table A-9 and Table A-10).

Only 1.7% of patients were intubated (defined as the patient having either a tracheostomy or endotracheal tube *in situ*) on the day of the survey. The prevalence of intubation was 40.5% on ICU. The prevalence of intubation by ward and consultant specialty is available in Appendix 5 (Table A-11 and Table A-12).

5.3 Overall prevalence of HCAI

The overall prevalence of HCAI in all acute care hospitals surveyed was 6.4% (95% CI 4.7 – 8.7%). The prevalence in NHS acute trusts was 6.5% (95% CI 4.8 – 8.9%). Independent sector organisations had significantly lower prevalence of HCAI of 2.2% (95% CI 1.3 – 3.8%). The paediatric HCAI prevalence was 5.4% (95% CI 3.9 – 7.5%), similar to the adult population of 6.5% (95% CI 4.8 – 8.8%) (Table 5-3).

Table 5-3: Overall HCAI prevalence by organisation and population group

	Number of patients surveyed	Number of patients with HCAI	HCAI prevalence
	N	N	% (95% CI)*
Overall organisations	52443	3360	6.4 (4.7 - 8.7)
NHS organisations	50778	3324	6.5 (4.8 - 8.9)
Independent organisations	1665	36	2.2 (1.3 - 3.8)
Adult population	48071	3123	6.5 (4.8 - 8.8)
Paediatric population	4372	237	5.4 (3.9 - 7.5)

* CI determined using mixed effects models

5.3.1 Prevalence of HCAI by SHA region

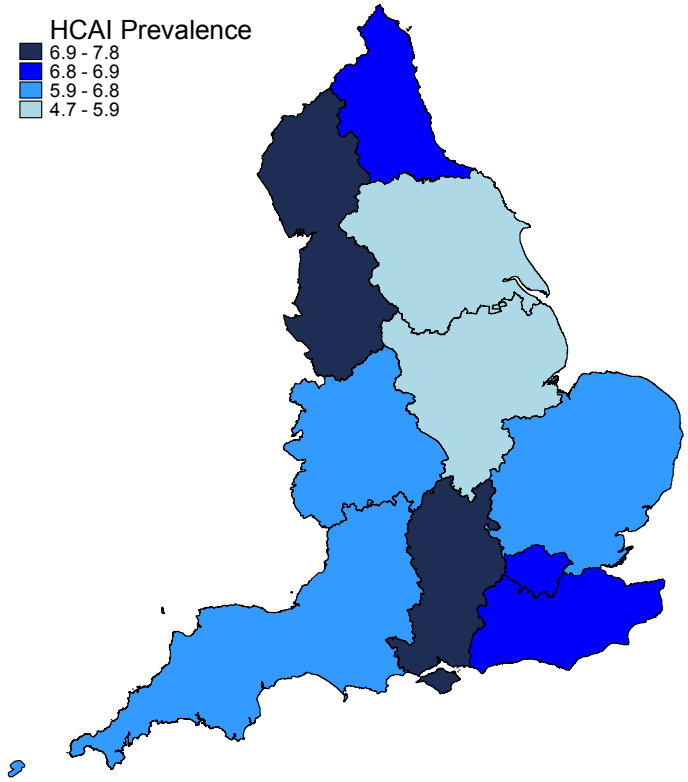
The prevalence of HCAI did not vary significantly across SHA regions (Table 5-4). The regions with the highest prevalence were South Central and North West. East Midlands had the lowest HCAI prevalence. This is shown graphically in Figure 5-2.

Table 5-4: HCAI prevalence by SHA region

SHA region	Number of patients surveyed*	Percent total patients surveyed	Number of patients with HCAI	HCAI prevalence
	N	% (95% CI)*	N	% (95% CI)*
Total**	52443	100.0	3360	6.4 (4.7 - 8.7)
South Central	2045	3.9 (3.6 - 4.2)	647	7.8 (4.7 - 8.8)
North West	8656	16.5 (15.1 - 18.0)	160	7.2 (6.0 - 11.2)
London	9350	17.8 (16.4 - 19.4)	628	6.9 (5.0 - 9.4)
North East	2632	5.0 (4.6 - 5.5)	210	6.9 (5.0 – 10.0)
South East Coast	3048	5.8 (5.3 - 6.3)	182	6.9 (5.0 - 10.1)
South West	6317	12.0 (11.1 - 13.1)	420	6.6 (4.9 - 9.2)
East of England	5161	9.8 (9.0 - 10.7)	339	6.6 (4.8 - 9.1)
West Midlands	6825	13.0 (12.0 - 14.1)	402	5.9 (4.5 - 8.7)
Yorkshire & Humber	4145	7.9 (7.3 - 8.5)	214	5.2 (3.6 - 7.2)
East Midlands	2599	5.0 (4.6 - 5.3)	122	4.7 (3.2 - 6.4)

* determined using mixed effects models
** Independent hospitals were not assigned to a region N=1665

Figure 5-2: HCAI prevalence by SHA region



5.3.2 Prevalence of HCAI by organisation and hospital type

The acute specialist and acute teaching organisation types had the highest HCAI prevalence, 13.2% (95% CI 9.2 – 18.9) and 8.0% (95% CI 6.3 – 10.1) respectively (Table 5-5). HCAI prevalence by ECDC hospital definitions are in Appendix 5, Table A-13.

Table 5-5: HCAI prevalence by organisation type

Organisation type	Number patients surveyed	Percent total patients surveyed (95% CI)	Number of patients with HCAI	HCAI prevalence (95% CI)*
	N	%	N	%
Total	52443	100.0	3360	6.4 (4.7-8.7)
Acute – Specialist	1169	2.2 (1.9 - 2.6)	154	13.2 (9.2 - 18.9)
Acute – Teaching	14500	27.6 (25.7 - 29.7)	1155	8.0 (6.3 - 10.1)
Acute – Large	16411	31.3 (29.0 - 33.7)	964	5.9 (4.4 - 7.8)
Acute – Medium	10340	19.7 (18.0 - 21.6)	579	5.6 (4 - 7.9)
Acute – Small	8358	15.9 (14.4 - 17.7)	472	5.6 (3.9 - 8.2)
Independent	1665	3.2 (2.9 - 3.5)	36	2.2 (1.3 - 3.8)

* CI determined using mixed effects models

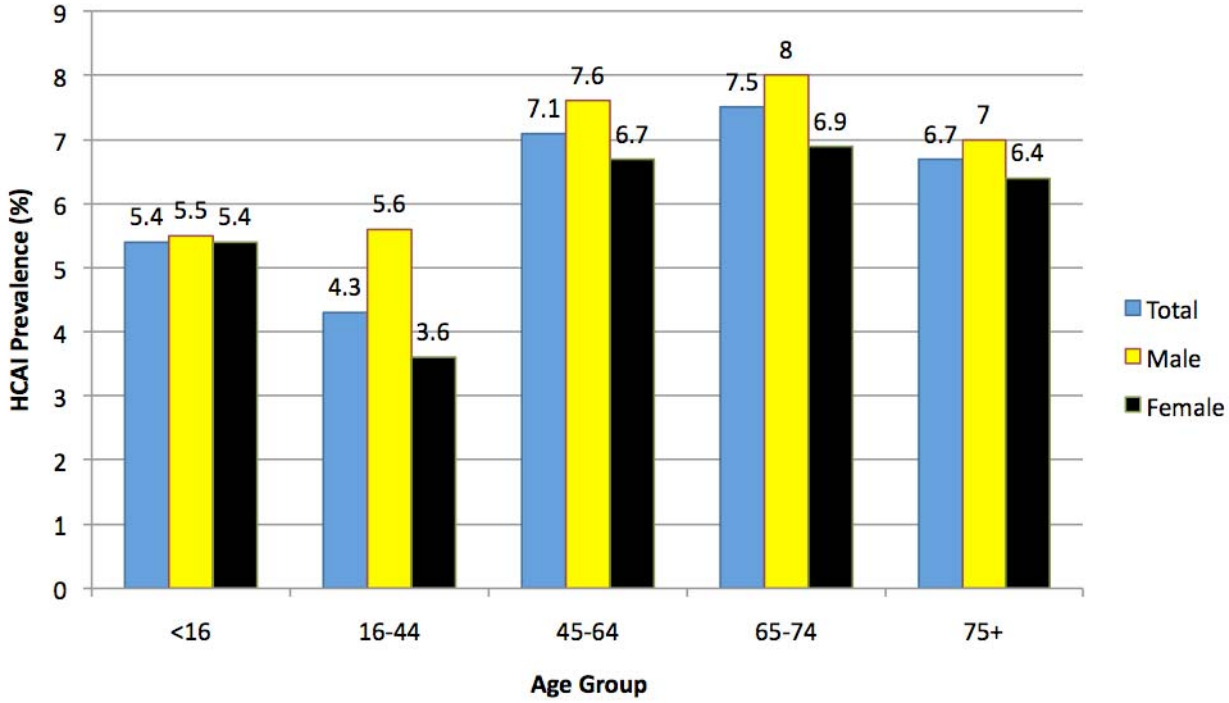
5.3.3 Prevalence of HCAI by intrinsic risk factors

The prevalence of HCAI was highest in those aged 1-23 months, and varied across age categories. The prevalence was significantly higher in male compared with female patients (p<0.001). There was a linear trend with increased HCAI prevalence related to McCabe score (p<0.001). Significantly higher rates of HCAI prevalence were-associated with non-NHSN and NHSN surgery compared with no surgery (p<0.001) (Table 5-6). Figure 5-3 presents the HCAI prevalence by age group and gender.

Table 5-6: Intrinsic risk factors for HCAI

	Number of patients surveyed (N=52, 443)	Percent total patients surveyed	Number of patients with HCAI	HCAI prevalence
	N	% (95% CI	N	% (95% CI)
Age group				
<1 month	2033	3.9 (3.7 - 4.0)	93	4.6 (3.7 - 5.6)
1-23 months	1049	2.0 (1.9 - 2.1)	86	8.2 (6.6 - 10.0)
2-15 years	1068	2.0 (1.9 - 2.2)	46	4.3 (3.2 - 5.7)
16-29 years	3521	6.7 (6.5 - 6.9)	131	3.7 (3.1 - 4.4)
30-49 years	6625	12.6 (12.3 - 12.9)	340	5.1 (4.6 - 5.7)
50-64 years	7881	15.0 (14.7 - 15.4)	579	7.3 (6.8 - 7.9)
65-79 years	14010	26.7 (26.3 - 27.2)	1030	7.4 (6.9 - 7.8)
80+ years	15879	30.3 (29.8 - 30.8)	1036	6.5 (6.1 - 6.9)
Unknown	377	0.7 (0.6 - 0.8)	19	5.0 (3.1 - 7.8)
Gender				
Female	28707	54.7 (54.1 - 55.4)	1697	5.9 (5.6 - 6.2)
Male	23549	44.9 (44.3 - 45.5)	1653	7.0 (6.7 - 7.4)
Unknown	187	0.4 (0.3 - 0.4)	10	5.3 (2.6 - 9.6)
McCabe				
Rapidly fatal	2099	4.0 (3.8 – 4.2)	205	9.8 (8.5 – 11.1)
Ultimately fatal	9178	17.5 (17.1 - 17.9)	777	8.5 (7.9 - 9.1)
Non fatal	26275	50.1 (49.5 - 50.7)	1382	5.3 (5.0 - 5.5)
Unknown	14891	28.4 (27.9 - 28.9)	996	6.7 (6.3 - 7.1)
Surgery				
No surgery	37617	71.7 (71.0 - 72.5)	1910	5.1 (4.9 - 5.3)
Non-NHSN surgery	2547	4.9 (4.7 - 5.0)	205	8.0 (7.0 - 9.2)
NHSN surgery	11066	21.1 (20.7 - 21.5)	1124	10.2 (9.6 - 10.7)
Unknown	1213	2.3 (2.2 - 2.4)	121	10.0 (8.3 - 11.8)

Figure 5-3: HCAI prevalence by age group and gender*



*Age group categories according to the 2006 PPS survey

5.3.4 Prevalence of HCAI by ward specialty and consultant specialty

The highest prevalence of infections occurred in the Intensive Care Unit (ICU) (23.4%) followed by surgical wards (8.0%) (Table 5-2). The HCAI prevalence for each specialist ward and consultant specialty, including sub-categories is described in Appendix 5, Table A-14 and Table A-15 for consultant specialty and Table A-16 for ward specialty).

Table 5-7: Prevalence of HCAI by ward specialty group

Ward specialty group	Number of patients surveyed	Percent total patients surveyed	Number of patients with HCAI	HCAI prevalence
	N	% (95% CI)	N	% (95% CI)
Total	52443	100.0	3360	6.4 (4.7-8.7)
ICU	1351	2.6 (2.3 - 2.8)	316	23.4 (17.3 - 31.8)
Surgery	11088	21.1 (19.4 - 23.1)	893	8.0 (5.9- 11.0)
Other specialty	1133	2.2 (2.0 - 2.4)	82	7.2 (4.9 - 10.7)
Paediatrics	2742	5.2 (4.8 - 5.7)	185	6.7 (4.9 - 9.4)
Combination of specialties	10639	20.3 (18.6 - 22.1)	614	5.8 (4.2 - 7.9)
Geriatrics	3845	7.3 (6.7 – 8.0)	218	5.7 (4.1 - 7.9)
Medicine	17010	32.4 (29.8 - 35.3)	942	5.5 (4.1 - 7.6)
Unknown	291	0.6 (0.5 - 0.6)	13	4.5 (2.4 - 8.36)
Psychiatry	39	<0.1 (0 - 0.1)	*	*
Obstetrics and gynaecology	4305	8.2 (7.5 – 9.0)	96	2.2 (1.5 - 3.2)

*<5 HCAI detected

5.3.5 Characteristics of HCAI

A total of 3,360 individuals were diagnosed with a HCAI. A total of 135 patients were diagnosed with more than one HCAI and 1.04 infections were diagnosed per patient with HCAI.

5.3.6 Distribution of the types of HCAI

The total number of HCAI detected was 3,506. The major categories of HCAI are outlined in Table 5-8 and Figure 5-4. For a detailed breakdown of HCAI by infection subtype see Appendix 5 (Table A-17).

The most frequently identified group of HCAI were from the respiratory tract (n=798): 642 were defined as pneumonia and 156 as other types of lower respiratory tract infection (LRTI). This was the most frequently identified HCAI in ICU – 45.3% of HCAI in ICU were defined as pneumonia or lower respiratory tract infections (Appendix 5, Table A-18).

UTI (n=605) were the second most frequent type of HCAI. This occurred most frequently in the medical and surgical specialties (Appendix 5, Table A-18 and Table A-19).

SSI were the third most frequent infection detected (n=551). More than three quarters of patients with a SSI had surgery performed on this admission episode. SSI occurred most frequently (79.4%) in patients under the care of a surgical consultant. One hundred and fifty two SSI (27.9%) were detected in patients cared for by orthopaedic and trauma consultants. The second largest group of SSI occurred in patients under the care of general surgery (n=99, 18.2%) (Appendix 5, Table A-20 and Table A-21).

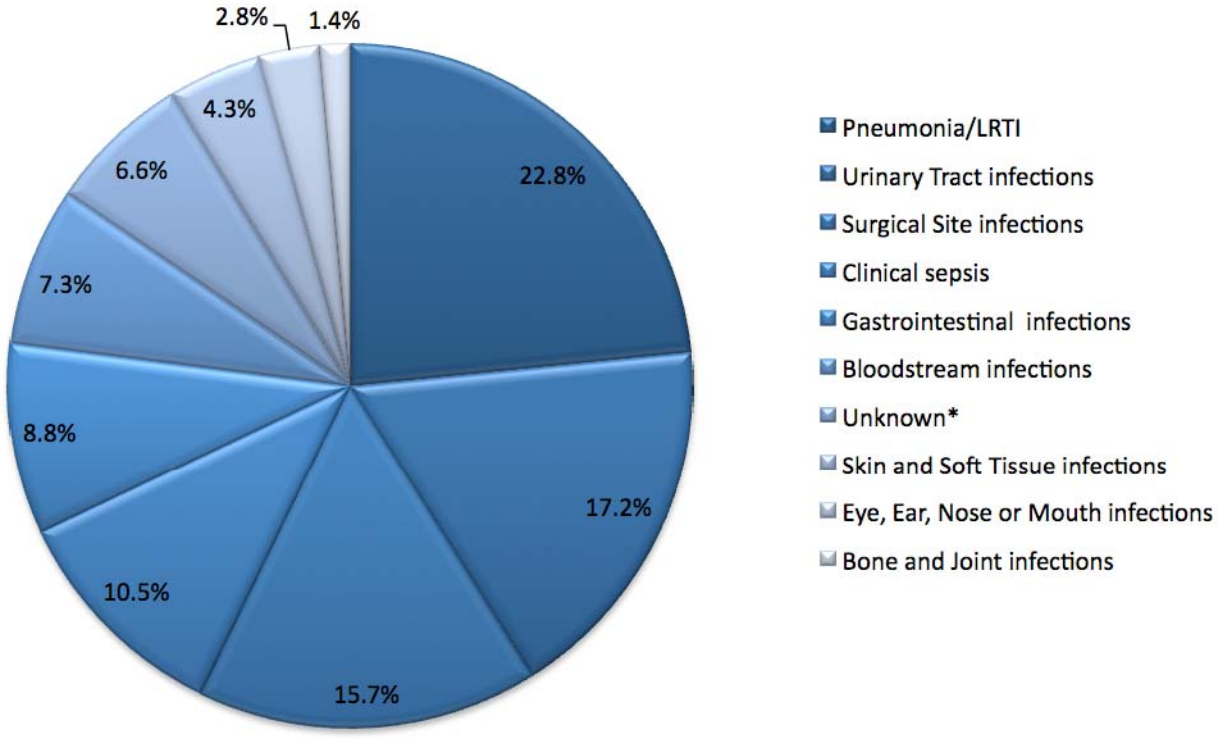
Gastrointestinal infections occurred in 309 patients, of which 62% were *C. difficile* infection (CDI).

Table 5-8: Distribution of HCAI types (by group)

Type of HCAI group	Number of HCAI N	HCAI Prevalence % (95% CI)	Relative percent of HCAI %
Total	3506	-	100.0
Pneumonia/LRTI	798	1.5 (1.4 - 1.6)	22.8
Urinary tract infections	605	1.2 (1.1 - 1.2)	17.2
Surgical site infections	551	1.1 (1.0 - 1.1)	15.7
Clinical sepsis	367	0.7 (0.6 - 0.8)	10.5
Gastrointestinal infections	309	0.6 (0.5 - 0.7)	8.8
Bloodstream infections	255	0.5 (0.4 - 0.5)	7.3
Unknown*	232	0.4 (0.4 - 0.5)	6.6
Skin and soft tissue infections	152	0.3 (0.2 - 0.3)	4.3
Eye, ear, nose or mouth infections	98	0.2 (0.2 - 0.2)	2.8
Bone and joint infections	50	0.1 (0.1 - 0.1)	1.4
Catheter-related infections	26	<0.1 (0.0 - 0.1)	0.7
Cardiovascular system infections	24	<0.1 (0.0 - 0.1)	0.7
Reproductive tract infections	20	<0.1 (0.0 - 0.1)	0.6
Central nervous system infections	19	<0.1 (0.0 - 0.1)	0.5

**Unknown: where the case record was marked with "Has an HAI" =Yes and no details for the HAI were documented*

Figure 5-4: Distribution of HCAI types (by group - top 10)



**Unknown: where the case record was marked with "Has an HAI" =Yes and no details for the HAI were documented*

5.3.7 Sources of bloodstream infections (BSI)

In this survey all BSI, rather than just primary BSI were included (Table 5-9). Two hundred and fifty five BSI were detected. There were 159 BSI defined as primary BSI, 74 attributable to vascular catheters. Thirty eight percent of BSI were determined to be secondary (from another site); most commonly undefined, followed by the urinary tract.

Table 5-9: Source of bloodstream infection (BSI)

Origin of BSI	Number of HCAI	Percent of BSI
	N	%
Total BSI	255	100.0
Primary BSI	**159**	**62.4**
BSI of unknown origin and not stated	**85**	**33.3**
Catheter-related	**74**	**29.1**
Central vascular catheter	64	25.2
Peripheral vascular catheter	10	3.9
Secondary BSI	**96**	**37.6**
Respiratory	12	4.7
UTI	19	7.5
SSI	8	3.1
Gastrointestinal	15	5.9
SSTI	7	2.7
Other (undefined)	35	13.7

5.3.8 Device-associated HCAI

While 74 BSI were directly attributable (by the data collectors) to vascular catheters, 28 additional BSI had a vascular catheter *in situ* in the preceding 48 hours. Therefore in total 64.2% of BSI were associated with a vascular access device. Forty three percent of UTI and 18.5% of respiratory tract infections had an indwelling device present prior to the onset of infection (Table 5-10).

Table 5-10: Number and percentage of device-associated HCAI

Device-associated infections	Number of HCAI	Percent of each HCAI
	N	%
Pneumonia/LRTI	**798**	**100.0**
Intubation within 48 hours before onset	148	18.6
No intubation	518	64.9
Presence of intubation unknown	132	16.5
UTI	**605**	**100.0**
Urinary catheter within 7 days before onset	260	43.0
No urinary catheter	296	48.9
Presence of urinary catheter unknown	49	8.1
BSI, primary	**159**	**100.0**
Vascular access device within 48 hours before onset	102	64.1
No vascular access device	30	18.9
Presence of vascular access device unknown	27	17.0

5.3.9 Onset and origin of HCAI

A total of 668 HCAI were present on admission to hospital. Forty-five percent of HCAI present on admission were related to another healthcare setting rather than the hospital that the patient was in at the time of the survey. The median duration of hospitalisation before the onset of the detected HCAI was 13 days (Table 5-11). Five percent of HCAI were diagnosed in the first two days after admission (day of admission = day 1), which were predominantly respiratory tract infections (26.9%), UTI (15.7%), SSI (11.2%), gastrointestinal infections (9.7%), and BSI (5.2%) (Appendix 5, Table A-22).

Table 5-11: Origin and onset for all HCAI

HCAI and onset date	Number of HCAI	Relative percent of HCAI
	N	%
Total number of HCAI	3506	100.0
HCAI present at admission	**668**	**19.1**
Origin of HCAI at admission:		
Same hospital	368	55.1
Other hospital	155	23.2
Other origin/unknown	145	21.7
HCAI during current hospitalisation	**2533**	**72.2**
HCAI commenced unknown time	**305**	**8.7**
Days in hospital until HCAI onset		
Days until HCAI onset (median) [IQR]	13	[6 - 26]
D1-2	134	5.3
D3-4	303	12.0
D5-7	335	13.2
D8-14	555	21.9
D15-21	319	12.6
≥3w	745	29.4
Unknown	142	5.6

5.3.10 Microbiology and antimicrobial resistance (AMR) data for HCAI

Microbiological confirmation was not required for each HCAI definition. Where microbiological results were not available at the time of the survey these were not recorded. Microbiological results were therefore incomplete. A total of 1,353 (38.6%) of the 3,506 HCAI had 1,526 micro-organisms identified. The proportion of key micro-organisms of public health importance and their resistance to specific antimicrobials where recorded are described in Table 5-12. Enterobacteriaceae were the most frequently reported organisms, implicated in 495 HCAI or 0.9% prevalence in the total survey population; 12.4% of Enterobacteriaceae were third generation cephalosporin resistant. Four Enterobacteriaceae with carbapenem resistance were detected. A total of 237 infections were caused by *S. aureus* and 0.07% prevalence in the survey population had an infection caused by MRSA. *Pseudomonas aeruginosa* were the causative organisms detected in 6.0% of reports. In addition 192 CDI were diagnosed overall, 12.6% of microbiological diagnoses and 0.4% prevalence in the total survey population. This is broken down by HCAI type in Appendix 5, Table A-23.

Table 5-12: Most frequent microbiological organisms[#] identified and resistant strains of common organisms associated with HCAI

Micro-organisms and resistance categories	Number of reports*	Percent of reports*	Percent of total survey population
	N	%	%
N of micro-organisms	1526	100.0	
Enterobacteriaceae	**495**	**32.4**	**0.9**
Enterobacteriaceae, carbapenem and C3G** susceptible	228	14.9	0.4
Enterobacteriaceae, carbapenem susceptible and C3G* resistant	60	3.9	0.1
Enterobacteriaceae, C3G** and carbapenem resistant	4	0.3	<0.1
Enterobacteriaceae, unknown susceptibility	203	13.3	0.4
Staphylococcus aureus	**237**	**15.5**	**0.5**
MSSA	139	9.1	0.3
MRSA	37	2.4	<0.1
S. aureus, unknown susceptibility	61	4.0	0.1
C. difficile infection[#]	**192**	**12.6**	**0.4**
Pseudomonas aeruginosa	**92**	**6.0**	**0.2**
Pseudomonas aeruginosa, carbapenem susceptible	48	3.1	0.1
Pseudomonas aeruginosa, carbapenem resistant	10	0.7	<0.1
Pseudomonas aeruginosa, unknown susceptibility	34	2.2	<0.1
***Enterococcus* spp**	**88**	**5.8**	**0.2**
Glycopeptide susceptible *Enterococcus* spp	38	2.5	0.1
Glycopeptide resistant *Enterococcus* spp (GRE)	9	0.6	<0.1
Enterococcus spp, unknown susceptibility	41	2.7	0.1
***Staphylococci,* other/unknown**	**88**	**5.8**	**0.2**
Other	**334**	**21.9**	**0.6**

*Reports = micro-organism reported in association with HCAI
**C3G - Third generation cephalosporin
#diagnosed through culture and toxin Elisa assay

5.4 Overall prevalence of AMU

The overall prevalence of AMU in all acute care hospitals was 34.7% (95% CI 30.5 - 39.6%). Independent hospitals had significantly higher prevalence of AMU with an overall prevalence of 46.7% (95% CI 41.0 – 53.2%) compared with NHS organisations at 34.3% (95% CI 30.1 - 39.2%).

The AMU prevalence in adults was 35.3 % (95% CI 31.0 - 40.2%), higher, though not significantly different than the paediatric population of 28.7 % (95% CI 24.9 - 33.0%) (Table 5-13).

Table 5-13: Prevalence of AMU by organisation type and population group

	Number of patients surveyed	Number of patients on antimicrobials	Prevalence AMU
	N	N	% (95% CI)*
Overall organisations	52443	18219	34.7 (30.5 - 39.6)
NHS organisations	50778	17442	34.3 (30.1 - 39.2)
Independent organisations	1665	777	46.7 (41.0 - 53.2)
Paediatric survey population	4372	1254	28.7 (24.9 - 33.0)
Adult survey population	48071	16965	35.3 (31.0 - 40.2)

* CI determined using mixed effects models

5.4.1 Prevalence of AMU by SHA region

Prevalence of AM prescribing per SHA is presented in Table 5-14. There was no statistical difference across regions though AMU prevalence was highest in the North East and lowest in the South East Region.

Table 5-14: AMU by SHA

SHA	Number of patients surveyed	Percent total patients surveyed	Number of patients on antimicrobials	AMU Prevalence
	N	% (95% CI)*	N	% (95% CI)*
Total**	52443	100.0	18219	34.7 (30.5 - 39.6)
North East	2632	5.0 (4.8 - 5.2)	1050	39.9 (38.0 - 41.8)
South Central	2045	3.9 (3.7 - 4.1)	762	37.3 (35.2 - 39.4)
East of England	5161	9.8 (9.6 - 10.1)	1922	37.2 (35.9 - 38.6)
London	9350	17.8 (17.5 - 18.2)	3458	37.0 (36.0 - 38.0)
South West	6317	12.0 (11.8 - 12.3)	2226	35.2 (34.1 - 36.4)
West Midlands	6825	13.0 (12.7 - 13.3)	2303	33.7 (32.6 - 34.9)
North West	8656	16.5 (16.2 - 16.9)	2779	32.1 (31.1 - 33.1)
East Midlands	2599	5.0 (4.8 - 5.2)	799	30.7 (29.0 - 32.6)
Yorkshire & Humber	4145	7.9 (7.7 - 8.1)	1252	30.2 (28.8 - 31.6)
South East Coast	3048	5.8 (5.6 - 6.0)	891	29.2 (27.6 - 30.9)

*CI determined using mixed effects models
**Independent hospitals are not assigned to a region N=1665

5.4.2 Prevalence of AMU by organisation type

AMU prevalence varied significantly across organisation type ($p<0.001$). AMU prevalence was highest in independent organisations (46.7%) and acute specialised NHS trusts (44.0%) and lowest in acute large NHS trusts (32.9%) (Table 5-15).

Table 5-15: AMU by organisation type

Organisation type	Number of patients surveyed	Percent total patients surveyed	Number of patients on antimicrobials	AMU Prevalence
	N	% (95% CI)*	N	% (95% CI)*
Total	52443	100.0	18219	34.7 (30.6 - 39.5)
Independent	1665	3.2 (2. - 3.5)	777	46.7 (41.0 - 53.2)
Acute – Specialist	1169	2.2 (1.9 - 2.6)	514	44.0 (36.8 - 52.6)
Acute – Teaching	14500	27.6 (25.7 - 29.7)	5262	36.3 (32.5 - 40.5)
Acute – Medium	10340	19.7 (18.0 - 21.6)	3484	33.7 (29.3 - 38.7)
Acute – Small	8358	15.9 (14.4 - 17.7)	2775	33.2 (28.5 - 38.7)
Acute – Large	16411	31.3 (29.0 - 33.7)	5407	32.9 (29.2 - 37.1)

*CI determined using mixed effects models

5.4.3 Prevalence of AMU by intrinsic risk factors

The prevalence of AMU was greatest in the 2-15 years age category (44.7%) and lowest in the <1 month age category (18.2%) and varied significantly across age group, though not with a linear trend. The prevalence of AMU was significantly greater in the male survey population (p<0.001).

AMU prevalence was greatest in the rapidly fatal patients (40.9%) and lowest in the non-fatal category (33.1%). AMU prevalence was greatest in patients who had non-NHSN surgery (41.3%) (Table 5-16).

Table 5-16: Prevalence of AMU by intrinsic risk factors

Age group	Number of patients surveyed	Percent total patients surveyed	Number patients with AMU	AMU prevalence
	N (52,443)	% (95% CI)	N (3,360)	% (95% CI)
<1 month	2033	3.9 (3.7 - 4.0)	370	18.2 (16.5 - 19.9)
1-23 months	1049	2.0 (1.9 - 2.1)	324	30.9 (28.1 - 33.8)
2-15 years	1068	2.0 (1.9 - 2.2)	477	44.7 (41.7 - 47.7)
16-29 years	3521	6.7 (6.5 - 6.9)	1212	34.4 (32.9 - 36.0)
30-49 years	6625	12.6 (12.3 - 12.9)	2428	36.6 (35.5 - 37.8)
50-64 years	7881	15.0 (14.7 - 15.4)	3151	40.0 (38.9 - 41.1)
65-79 years	14010	26.7 (26.3 - 27.2)	5148	36.7 (35.9 - 37.5)
80+ years	15879	30.3 (29.8 - 30.8)	5025	31.6 (30.9 - 32.4)
Unknown	377	0.7 (0.6 - 0.8)	84	22.3 (18.2 - 26.8)
Gender				
Female	28707	54.7 (54.1 - 55.4)	9448	32.9 (32.4 - 33.5)
Male	23549	44.9 (44.3 - 45.5)	8713	37.0 (36.4 - 37.6)
Unknown	187	0.4 (0.3 - 0.4)	58	31.0 (24.5 - 38.2)
McCabe				
Non fatal	26275	50.1 (49.5 - 50.7)	8696	33.1 (32.5 - 33.7)
Ultimately fatal	9178	17.5 (17.1 - 17.9)	3609	39.3 (38.3 - 40.3)
Rapidly fatal	2099	4.0 (3.8 - 4.2)	858	40.9 (38.8 - 43.0)
Unknown	14891	28.4 (27.9 - 28.9)	5056	34.0 (33.2 - 34.7)
Surgery				
No surgery	2547	4.9 (4.7 - 5.0)	1029	40.4 (38.0 - 42.9)
Non-NHSN surgery	11066	21.1 (20.7 - 21.5)	4571	41.3 (40.1 - 42.5)
NHSN surgery	1213	2.3 (2.2 - 2.4)	464	38.3 (34.9 - 41.9)
Unknown	37617	71.7 (71.0 - 72.5)	12155	32.3 (31.7 - 32.9)

5.4.4 AMU by ward specialty and consultant specialty

Prevalence of AMU varied across ward specialties. It was greatest in the ICU (60.8%) and lowest in psychiatry (12.8%). AMU prevalence in geriatric wards was 28.6% (Table 5-17). The breakdown of AMU by consultant specialty is in Appendix 5, Table A-25.

Table 5-17: AMU by ward specialty*

Ward specialty	Number patients surveyed	Percent total patients surveyed	Number of patients on antimicrobials	AMU Prevalence
	N	% (95% CI)*	N	% (95% CI)*
Total	52443	100.0	18219	34.7 (30.6 - 39.5)
ICU	1351	2.6 (2.3 - 2.8)	830	60.8 (53.2 - 70.9)
Combination of specialties	10639	20.3 (18.6 - 22.1)	4196	39.4 (34.8 - 44.8)
Paediatrics	2742	5.2 (4.8 - 5.7)	1006	37.0 (31.9 - 42.3)
Surgery	11088	21.1 (19.4 - 23.1)	3998	36.1 (31.6 - 41.2)
Medicine	17010	32.4 (29.8 - 35.3)	5960	35.0 (30.7 – 40.0)
Unknown	291	0.6 (0.5 - 0.6)	100	34.4 (27.3 - 43.2)
Geriatrics	3845	7.3 (6.7 – 8.0)	1104	28.6 (24.9 - 33.0)
Other specialty	1133	2.2 (2.0 - 2.4)	222	19.6 (16.2 - 23.7)
O and G	4305	8.2 (7.5 – 9.0)	798	18.5 (16.0 - 21.4)
Psychiatry	39	<0.1 (0.05 - 0.1)	5	12.8 (5.3 – 31.0)

* CI determined using mixed effects models

5.4.5 Characteristics of prescribed antimicrobials

The total number of antimicrobials prescribed was 25,942 in 18,219 (34.7%) patients or 1.42 per patient on antimicrobials.

5.4.6 Distribution of antimicrobials by indication and quality indicators

Antimicrobials were most frequently prescribed in patients receiving treatment for a community-acquired infection (53.0%). Surgical prophylaxis was the indication of AMU in 13.2% of prescriptions; almost one third of surgical prophylaxis was prescribed for greater than one day. Most antimicrobials had the reason for treatment recorded in the clinical patient notes (84.7%) (Table 5-18).

Table 5-18: Distribution of antimicrobials prescribed by indication and quality indicators

	Number of antimicrobials	Relative percent of antimicrobials
	N	%
Total on antimicrobials	25942	100.0
Indication for AMU		
Treatment intention	19411	74.8
Community infection (CI)	13746	53.0
Hospital infection (HI)	5248	20.2
Other healthcare-ass. infection (LI)	417	1.6
Surgical prophylaxis	3412	13.2
Single dose (S1)	1635	6.3
One day (S2)	740	2.9
>1 day (S3)	1037	4.1
Medical prophylaxis	2059	7.9
Unknown/ Other	1060	4.1
Route of administration		
Parenteral	14525	56.0
Oral	10448	40.3
Unknown/ other	969	3.7
Reason in notes		
Yes	21984	84.7
No	2747	10.6
Unknown	1211	4.7

5.4.7 Prevalence of AMU by community and hospital acquired infections

The majority of antimicrobials were prescribed for respiratory tract infections (n=5877), predominantly originating in the community (n=4438). The second most common reasons for AMU was in skin, soft tissue, bone and joint infections (n=2635) (Table 5-19). A full breakdown of AMU by community and hospital acquired diagnosis see Appendix 5, Table A-26.

Table 5-19: AMU by diagnosis – community-acquired infection (CAI) and hospital-acquired infection (HAI)

Title	Total diagnoses	Percent diagnoses	CAI	Percent CAI	HAI	Percent HAI
	N	%	N	%	N	%
Total number of diagnosis for AMU	18994	100.0	13746	100.0	5248	100.0
Respiratory tract	5877	30.9	4438	32.3	1439	27.4
Skin/soft tissue/bone/joint	3600	19.0	2635	19.2	965	18.4
Clinical sepsis	2658	14.0	1639	11.9	1019	19.4
Urinary tract	2603	13.7	1877	13.7	726	13.8
Gastrointestinal system	2438	12.8	1770	12.9	668	12.7
Eye/ear/nose/throat	541	2.8	380	2.8	161	3.1
Missing/Unknown	458	2.4	364	2.6	94	1.8
Genitourinary system	313	1.6	243	1.8	70	1.3
Cardiovascular system	277	1.5	222	1.6	55	1.0
Central nervous system	229	1.2	178	1.3	51	1.0

The distribution of antimicrobials prescribed for respiratory tract infections, UTI, gastrointestinal infections and clinical sepsis (both community acquired and hospital acquired) are detailed in Appendix 5 (Table A-29 and Figure A-2 for respiratory tract infections, Table A-30 and Figure A-3 for urinary tract, Table A-31 and Figure A-4 for gastrointestinal infections, and Table A-32 and Figure A-5 for clinical sepsis).

5.4.8 Distribution of AMU by type of treatment

The top 20 AM prescribed included 82.3% of all antimicrobials (see Appendix 5,

Table A-27 for a full list of the AM groups prescribed). One hundred and twenty nine AM agents were in use in acute care hospitals during the PPS. Table 5-20 show the top 20 AM prescribed by clinical treatment, surgical prophylaxis and medical prophylaxis, (for a full breakdown of antimicrobials by treatment intention see Appendix 5, Table A-28). Only one cephalosporin (second generation, cefuroxime) remains in the top 20 antimicrobials prescribed. This was prescribed predominantly for surgical prophylaxis (71% of total cefuroxime prescribed was for surgical prophylaxis). Beta-lactams with an enzyme inhibitor were the most frequently prescribed antimicrobials documented in this PPS: co-amoxiclav (n=3,579) or Piperacillin/tazobactam (n=2,262). However meropenem, a broad spectrum beta lactam and often regarded as the last resort beta-lactam agent, was the ninth most frequently prescribed antibiotic.

Table 5-20: Top 20 AM by treatment intention

Name of Antimicrobial	Total	% Total	Treatment intention (TI)	% TI Total	Surgical Prophylaxis (SP)	% SP Total	Medical Prophylaxis (MP)	% MP Total
	N	%	N	%	N	%	N	%
Total	25942	100.0	19411	100.0	3412	100.0	2059	100.0
Co-amoxiclav	3579	13.8	2674	13.8	703	20.60	107	5.2
Piperacillin/tazobactam	2262	8.7	2111	10.9	54	1.6	44	2.1
Flucloxacillin	1906	7.3	1366	7.0	457	13.4	46	2.2
Gentamicin	1566	6.0	815	4.2	583	17.1	126	6.1
Clarithromycin	1245	4.8	1190	6.1	8	0.2	21	1.0
Metronidazole (parenteral)	1230	4.7	907	4.7	270	7.9	23	1.1
Amoxicillin	1159	4.5	1062	5.5	50	1.5	31	1.5
Trimethoprim	1080	4.2	932	4.8	19	0.6	108	5.2
Meropenem	1021	3.9	961	5.0	10	0.3	25	1.2
Cefuroxime	895	3.5	234	1.2	634	18.6	20	1.0
Benzylpenicillin	848	3.3	686	3.5	49	1.4	86	4.2
Metronidazole (oral, rectal)	755	2.9	619	3.2	64	1.9	40	1.9
Ciprofloxacin	707	2.7	556	2.9	38	1.1	91	4.4
Doxycycline	631	2.4	582	3.0	7	0.2	21	1.0
Teicoplanin	612	2.4	374	1.9	201	5.9	20	1.0
Vancomycin (parenteral)	562	2.2	508	2.6	36	1.1	10	0.5
Fluconazole	463	1.8	278	1.4	14	0.4	159	7.7
Nitrofurantoin	348	1.3	281	1.4	2	0.1	57	2.8
Rifampicin	265	1.0	255	1.3	0	<0.1	4	0.2
Clindamycin	259	1.0	239	1.2	15	0.4	2	0.1

5.5 Overall prevalence of HCAI, Paediatrics

Paediatric patients were defined as those aged < 16 years, whether on an adult or paediatric ward. There were 4,372 paediatric patients surveyed and 237 were determined to have a HCAI. The prevalence of HCAI in the paediatric survey population surveyed was 5.4% (95% CI 3.9 – 7.5%). Only seven paediatric patients were surveyed in independent hospitals. The prevalence of HCAI was highest in paediatric ICU (11 HCAI detected in 75 patients surveyed, 14.7%) and neonatal ICU (72 HCAI detected in 75 patients surveyed, 13.1%). Neonates who were on postnatal wards (n=1225) – 'well babies' – had a very low HCAI prevalence (2.4%). The HCAI prevalence in paediatrics, excluding the 'well babies' was 6.6%.

5.5.1 Geographical distribution of HCAI, paediatrics

London and the North West SHA regions contributed more than 40% of patients to the paediatric survey population. There were no significant regional differences in the proportions of paediatric patients with a HCAI (Table 5-21).

Table 5-21: HCAI prevalence per region – paediatrics

SHA region	Number of patients surveyed	Percent total surveyed	Number of patients with HCAI	Percent has HCAI
	N	% (95% CI)	N	% (95% CI)
Total#	4372	100.0	237	5.4 (3.9 – 7.5)
South Central	224	5.1 (4.5 - 5.8)	27	12.1 (8.1 - 17.1)
East of England	380	8.7 (7.8 - 9.6)	29	7.6 (5.2 - 10.8)
North West	761	17.4 (16.2 - 18.7)	48	6.3 (4.7 - 8.3)
London	1008	23.1 (21.7 - 24.5)	62	6.2 (4.7 - 7.8)
South West	539	12.3 (11.3 - 13.4)	25	4.6 (3.0 - 6.8)
West Midlands	433	9.9 (9.0 - 10.9)	16	3.7 (2.1 - 5.9)
East Midlands	190	4.3 (3.7 - 5.0)	7	3.7 (1.5 - 7.4)
South East Cost	248	5.7 (5.0 - 6.4)	8	3.2 (1.4 - 6.3)
Yorkshire & Humber	386	8.8 (8.0 - 9.8)	12	3.1 (1.6 - 5.4)
North East	196	4.5 (3.9 - 5.2)	*	* (0.3 - 4.4)

Independent hospitals were not assigned to a region N=7
*<5 HCAI detected

5.5.2 Prevalence of HCAI by organisation and hospital type, paediatrics

Specialist NHS organisations had the highest prevalence rates (21.9%) of HCAI detected, though the population size in this group is small and the confidence intervals extremely wide (Table 5-22). A breakdown of HCAI prevalence for paediatric patients by hospital type is presented in Appendix 5 Table A-33.

Table 5-22: HCAI prevalence by organisation type – paediatrics

Organisation Type	Number of patient surveyed	Percent total surveyed	Number patients with HCAI	Prevalence of HCAI
	N	% **(95% CI)***	N	% **(95% CI)***
Total	4372	100.0	237	5.4 (2.7 - 11.7)
Acute – Specialist	73	1.7 (1.1 - 2.5)	16	21.9 (10.5 - 46.9)
Acute – Teaching	1473	33.7 (27.5 - 41.4)	127	8.6 (5.0 - 15.3)
Acute – Medium	874	20.0 (14.9 - 26.9)	31	3.5 (1.4 - 9.4)
Acute – Large	1264	28.9 (22.3 - 37.6)	41	3.2 (1.2 - 8.5)
Acute – Small	681	15.6 (11.1 - 21.9)	22	3.2 (1.1 - 9.4)
Independent	7	0.2 (0.1 - 0.5)	**	**

*CI determined using mixed effects models
**<5 HCAI detected

5.5.3 Prevalence of HCAI by intrinsic factors, paediatrics

The prevalence of HCAI was highest in those aged 1-23 months, though not significantly different across age groups. The prevalence was similar in male compared with female paediatric patients. There was no statistical difference in HCAI prevalence related McCabe score detected in the paediatric population, although there was a large number of missing variables and small numbers in the ultimately and rapidly fatal categories. Higher rates of HCAI prevalence were associated with non-NHSN and NHSN surgery compared with no surgery, although these were not statistically different in the paediatric population surveyed (Table 5-23).

Table 5-23: HCAI prevalence by age group and gender – paediatrics

	Number of patients surveyed	Percent of total surveyed (95% CI)	Number of patients with HCAI	HCAI prevalence (95% CI)
	N	%	N	%
Age group				
<1 month - 'well-babies'*	1225	28.0 (26.5 - 48.6)	29	2.4 (1.6 – 3.4)
<1 month - other neonates	808	18.5 (17.2 – 19.8)	64	7.9 (6.2 – 10.0)
1-23 months	1049	24.0 (22.6 - 25.5)	86	8.2 (6.6 - 10.0)
2-15 years	1068	24.4 (23.0 - 25.9)	46	4.3 (3.2 - 5.7)
Unknown	222	5.1 (4.7 - 5.5)	12	9.4 (5.0 - 15.9)
Gender				
Female	2062	47.2 (45.1 - 49.2)	111	5.4 (4.4 - 6.4)
Male	2292	52.4 (50.3 - 54.6)	126	5.5 (4.6 - 6.5)
Unknown	18	0.4 (0.2 - 0.7)	0	0.0 (0.0 - 18.5)
McCabe				
Non fatal	2907	66.5 (64.1 - 69.0)	125	4.3 (3.6 - 5.1)
Ultimately fatal	81	1.9 (1.5 - 2.3)	19	23.5 (14.8 - 34.2)
Rapidly fatal	17	0.4 (0.2 - 0.6)	2	11.8 (1.5 - 36.4)
Unknown	1367	31.3 (29.6 - 33.0)	91	6.7 (5.4 - 8.1)
Surgery				
No Surgery	3821	87.4 (84.6 - 90.2)	184	4.8 (4.2 - 5.5)
Non-NHSN Surgery	102	2.3 (1.9 - 2.8)	7	6.9 (2.8 - 13.6)
NHSN Surgery	374	8.6 (7.7 - 9.5)	39	10.4 (7.5 - 14.0)
Unknown	75	1.7 (1.3 - 2.2)	7	9.3 (3.8 - 18.3)

*`well-babies`: babies with mothers on postnatal wards

5.5.4 Characteristics of HCAIs, paediatrics

Two hundred and thirty seven individuals were diagnosed with 251 HCAI in the paediatric population surveyed. There were 1.06 HCAI per patient diagnosed with infection.

5.5.5 Distribution of the types of HCAI, paediatrics

The most common HCAI diagnosed in the paediatric survey population was clinical sepsis (n=101) (Table 5-24). Pneumonia/LRTI and BSI were the next most frequent infections observed (n=40 and n=30 respectively).

Table 5-24: Distribution of HCAI group – paediatrics

Type of HCAI Group	Number of HCAI	Proportion HCAI	Relative percent
	N	% (95% CI)	%
Total	251	5.7 (5.1 - 6.5)	100.0
Clinical sepsis	101	2.3 (1.9 - 2.8)	40.2
Pneumonia/LRTI	40	0.9 (0.7 - 1.2)	15.9
Bloodstream infections	38	0.9 (0.6 - 1.2)	15.1
Unknown	18	0.4 (0.2 - 0.7)	7.2
Surgical site infections	17	0.4 (0.2 - 0.6)	6.8
Skin and soft tissue infections	12	0.3 (0.1 - 0.5)	4.8
Gastrointestinal infections	11	0.3 (0.1 - 0.5)	4.4
Eye, ear, nose or mouth infections	6	0.1 (0.1 - 0.3)	2.4
Catheter-related infections w/o BSI	4	0.1 (0.0 - 0.2)	1.6
Central nervous system infections	2	<0.1 (0.0 - 0.2)	0.8
Urinary tract infections	2	<0.1 (0.0 - 0.2)	0.8

5.5.6 Sources of BSI, paediatrics

A total of 38 BSI identified in the paediatric survey population were identified in the survey. The sources of these BSI are described in Appendix 5, Table A-34. The majority (n=28) were of unknown origin.

5.5.7 Onset and origin of HCAI, paediatrics

A total of 66 (26.3%) HCAI were present on admission to hospital in the paediatric survey population. Of the HCAI present on admission to hospital, 60.6% were related to the hospital where the survey was performed. The median duration in hospital before HCAI onset was 13 days. Just over 10% were detected within the first two days of admission (Table 5-25).

Table 5-25: Origin and onset for all HCAI – paediatrics

HCAI and onset date	Number of HCAI	Relative percent of HCAI
	N	%
Total number of HCAI	251	100.0
HCAI present at admission	66	26.3
Origin of HCAI at admission:		
Same hospital	40	60.6
Other hospital	19	28.8
Other origin/unknown	7	10.6
HCAI during current hospitalisation	159	63.3
HCAI commenced unknown time	26	10.4
Days until HCAI onset (median) [IQR]	13	[5 - 33]
D1-2	17	10.7
D3-4	13	8.2
D5-7	17	10.7
D8-14	28	17.6
D15-21	13	8.2
≥3w	52	32.7
Missing	19	11.9

5.5.8 Device-associated HCAI, paediatrics

In the paediatric survey population, intubation before onset was associated with pneumonia/LRTI in 35.0% of patients; 57.1% of BSI were associated with vascular access devices. Two UTI were diagnosed in the paediatric survey population, neither associated with urinary catheters (Table 5-26).

Table 5-26: Device-associated HCAI – paediatrics

Device-associated infections:	Number of HCAI	Percent of each HCAI
	N	%
Pneumonia/LRTI	**40**	**100.0**
Intubation within 48h before onset	14	35.0
No intubation	21	52.5
Presence of intubation unknown	5	12.5
UTI	**2**	**100.0**
Urinary catheter within 7d before onset	0	0.0
No urinary catheter	2	100.0
Presence of urinary catheter unknown	0	0.0
BSI, primary	**35**	**100.0**
Vascular access device within 48h before onset	20	57.1
No vascular access device	8	22.9
Presence of vascular access device unknown	7	20.0

5.5.9 Microbiology and AM resistance (AMR) data for HCAI, paediatrics

Twenty nine percent of HCAI had an associated micro-organism reported with 78 micro-organisms identified. The most frequent organisms identified in paediatrics were also Enterobacteriaceae (24.4%), followed by *S. aureus* (19.3%). No CDI or MRSA were detected at the time of the survey in the paediatric population surveyed. The numbers of HCAI with organisms and resistance data reported in this survey population were very small and the prevalence of these organisms in this survey population cannot be inferred (for detailed see Appendix 5, Table A-35.)

5.6 Overall prevalence of AMU, paediatrics

Of the 4,372 paediatric patients surveyed, 1,254 patients received an AM. The overall prevalence of AM prescribing in the paediatric survey population was 28.7% (95% CI 27.3 - 30.0).

5.6.1 Prevalence of AMU by SHA region and organisation type, paediatrics

AM prescribing in the paediatric survey population is presented by SHA in Table 5-27. There was no significant variability in AMU in the paediatric survey population according to SHA region.

Table 5-27: Number of patients on AM by SHA – paediatrics

SHA region	Number of patients surveyed	Percent of total patients surveyed (95% CI)	Number of patients on antimicrobials	AMU prevalence (95% CI)
	N	%	N	%
Total	4365	100.0	1254	28.7 (27.3 - 30.0)
South Central	224	5.1 (4.5 - 5.8)	75	33.5 (27.3 - 40.1)
East of England	380	8.7 (7.8 - 9.6)	126	33.2 (28.4 - 38.1)
London	1008	23.1 (21.7 - 24.5)	318	31.5 (28.7 - 34.5)
North East	196	4.5 (3.9 - 5.2)	60	30.6 (24.2 - 37.6)
North West	761	17.4 (16.2 - 18.7)	227	29.8 (26.6 - 33.2)
South West	539	12.3 (11.3 - 13.4)	148	27.5 (23.7 - 31.4)
South East Coast	248	5.7 (5.0 - 6.4)	65	26.2 (20.8 - 32.1)
East Midlands	190	4.3 (3.7 - 5.0)	49	25.8 (19.7 - 32.6)
West Midlands	433	9.9 (9.0 - 10.9)	99	22.9 (19.0 - 27.1)
Yorkshire & Humber	386	8.8 (8.0 - 9.8)	84	21.8 (17.7 - 26.2)

Specialised hospitals had a higher prevalence of AMU compared with other hospital and organisation types (Table 5-28). For results classified by ECDC classification see Appendix 5, Table A-33.

Table 5-28: AMU by hospital type (ERIC) – paediatrics

Organisation type	Number of patients surveyed	Percent of total patients surveyed (95% CI)	Number of patients on antimicrobials	AMU prevalence (95% CI)
	N	%	N	%
Total	4372	100.0	1254	28.7 (27.3 - 30.0)
Acute – Specialist	73	1.7 (1.3 - 2.1)	36	49.3 (37.4 - 61.3)
Independent	7	0.2 (0.1 - 0.3)	3	42.9 (9.9 - 81.6)
Acute – Teaching	1473	33.7 (32.0 - 35.5)	510	34.6 (32.2 - 37.1)
Acute – Medium	874	20.0 (18.7 - 21.4)	248	28.4 (25.4 - 31.5)
Acute – Large	1264	28.9 (27.3 - 30.6)	301	23.8 (21.5 - 26.3)
Acute – Small	681	15.6 (14.4 - 16.8)	156	22.9 (19.8 - 26.3)

5.6.2 Prevalence of AMU by intrinsic factors, paediatrics

AMU increased with age in the paediatric category from 18.2% in the neonatal age category, 30.9% in 1-23 months old and 44.7% in 2-15 years. Only a small number of paediatric patients were classified as having an ultimately fatal or rapidly fatal disease though these two groups had higher AMU. Both non-NHSN (47.1%) and NHSN surgery (45.2%) increased the AMU compared with no surgery (26.5%) in the paediatric survey population.

5.6.3 Characteristics of antimicrobials prescribed, paediatrics

Two thousand and twenty-eight antimicrobials were prescribed in 1,254 patients. For those prescribed antimicrobials, 1.61 AM were prescribed per patient.

5.6.4 Distribution of antimicrobials prescribed by indication and quality indicators, paediatrics

The most common indication for AMU in paediatrics was community-acquired infection (n=1,421) (Table 5-29). Surgical prophylaxis was prescribed in 123 individuals, and in almost 50% of surgical prophylaxis prescriptions reported this was continued for greater than one day. The indication for the AM was recorded in 87.8% of prescriptions.

Table 5-29: Distribution of AMU indication and quality indicators – paediatrics

Title	Number on antimicrobials N	Relative percent of antimicrobials %
Total on antimicrobials	2028	100.0
Indication for AM use		
Treatment intention	1421	70.1
Community acquired infection (CAI)	946	46.6
Hospital acquired infection (HAI)	454	22.4
Other healthcare-ass. infection (LI)	21	1.0
Surgical prophylaxis	123	6.1
Single dose (S1)	35	1.7
One day (S2)	28	1.4
>1 day (S3)	60	3.0
Medical prophylaxis	384	18.9
Unknown	52	2.6
Route of administration		
Parenteral	1505	74.2
Oral	423	20.9
Other/unknown	100	4.9
Reason in notes		
Yes	1781	87.8
No	129	6.4
Unknown	118	5.8

5.6.5 Distribution of antimicrobials used by community and hospital treatment indication, paediatrics

The majority of antimicrobials prescribed to paediatric patients were for clinical sepsis (42.2%). The second most common reason for AMU was respiratory tract infections (22.8%), followed by skin, soft tissue, bone and joint infection (12.1%). A full breakdown of AMU by community and hospital acquired diagnosis is available in Appendix 5, Table A-38.

Table 5-30: Distribution of antimicrobials used by community-acquired infection (CAI) and hospital-acquired infection (HAI) treatment indication – paediatrics

	Total diagnoses	% Total diagnoses	CAI	Percent CAI	HAI	Percent HAI
	N	%	N	%	N	%
Total number of diagnosis by AMU	1400	100.0	946	100.0	454	100.0
Clinical sepsis	591	42.2	299	31.6	292	64.3
Respiratory tract	319	22.8	256	27.1	63	13.9
Skin/soft tissue/bone/joint	170	12.1	130	13.7	40	8.8
Gastro-intestinal system	96	6.9	69	7.3	27	5.9
Eye/ear/nose/throat	68	4.9	54	5.7	14	3.1
Urinary tract	64	4.6	61	6.4	3	0.7
Central nervous system	33	2.4	30	3.2	3	0.7
Missing/Unknown	33	2.4	26	2.7	7	1.5
Cardiovascular system	13	0.9	8	0.8	5	1.1
Genitourinary system	13	0.9	13	1.4	0	0.0

The distribution of antimicrobials prescribed for respiratory tract infections, UTI, gastrointestinal infections and clinical sepsis (both community acquired and hospital acquired) are detailed in Appendix 5 (Table A-39 and Figure A-6 for respiratory tract infections, Table A-39 and Figure A-7 for UTI, Table A-41 and Figure A-8 for gastrointestinal infections, and Table A-42 and Figure A-9 for clinical sepsis).

5.6.6 Distribution of antimicrobials by type of treatment, paediatrics

Table 5-31 shows the top 20 AM prescribed by treatment intention (for a full breakdown of AM by treatment intention see Appendix 5, Table A-38). Seventy-one different AM agents were used in the paediatric survey population. Four cephalosporins were recorded in the top 20 of the paediatric population, resulting in a cephalosporin use prevalence of 16.6% in paediatrics. Meropenem was the 13th most frequently prescribed AM in paediatrics (2.1%) overall.

Table 5-31: Top 20 antimicrobials by treatment intention - paediatrics

Name of antimicrobial	Total	% Total	Treatment indication (TI)	% TI Total	Surgical prophylaxis (SP)	% SP Total	Medical prophylaxis (MP)	% MP Total
	N	%	N	%	N	%	N	%
Total	2028	100.0	1421	100.0	123	100.0	384	100.0
Gentamicin	274	13.5	183	12.9	7	5.7	65	16.9
Benzylpenicillin	246	12.1	158	11.1	8	6.5	62	16.1
Co-amoxiclav	168	8.3	116	8.2	41	33.3	10	2.6
Flucloxacillin	159	7.8	120	8.4	15	12.2	20	5.2
Cefotaxime	155	7.6	123	8.7	2	1.6	22	5.7
Ceftriaxone	97	4.8	88	6.2	2	1.6	5	1.3
Amoxicillin	81	4.0	68	4.8	3	2.4	8	2.1
Piperacillin/ tazobactam	68	3.4	61	4.3	1	0.8	2	0.5
Vancomycin (P*)	65	3.2	60	4.2	2	1.6	3	0.8
Metronidazole (P*)	56	2.8	41	2.9	12	9.8	1	0.3
Cefuroxime	49	2.4	36	2.5	11	8.9	2	0.5
Tobramycin	46	2.3	35	2.5	0	0.0	11	2.9
Meropenem	43	2.1	39	2.7	0	0.0	4	1.0
Ceftazidime	40	2.0	32	2.3	0	0.0	7	1.8
Teicoplanin	37	1.8	29	2.0	3	2.4	4	1.0
Clarithromycin	34	1.7	31	2.2	0	0.0	2	0.5
Azithromycin	33	1.6	20	1.4	2	1.6	10	2.6
Trimethoprim	31	1.5	4	0.3	1	0.8	26	6.8
Erythromycin	26	1.3	12	0.8	0	0.0	7	1.8
Ciprofloxacin	24	1.2	20	1.4	0	0.0	4	1.0

*Parenteral

6.0 Discussion

The aims of this survey were to determine the burden of HCAI and AMU and to identify priority areas for the future. There are significant limitations to prevalence surveys related to methodological issues of cross-sectional data, validity and reliability of case definitions and their use and microbiological availability. Despite these limitations, which are discussed below, the results highlight valuable areas for future priorities.

6.1 HCAI prevalence

6.1.1 Summary of key findings

The overall prevalence of HCAI in all acute care hospitals surveyed was 6.4% (95% CI 4.7 – 8.7%). Independent hospitals had significantly lower prevalence of HCAI of 2.2% compared with NHS organisations (95% CI 1.3 – 3.8%). The prevalence of HCAI in the paediatric survey population was similar to the adult survey population at 5.4% (95% CI 3.9 – 7.5%) especially when the 'well babies' were excluded (6.6%). Overall, acute specialist and acute teaching trusts had higher HCAI prevalence (13.2% and 8.0% respectively) than other acute trusts (Acute – Small 5.7%, Acute – Medium 5.6% and Acute – Large 5.9%).

The prevalence of HCAI was highest in those patients aged 1-23 months (8.2%), followed by patients aged 65-79 years (7.4%) and 50-64 years (7.3%). The overall prevalence in paediatrics is reduced by the 'well baby' cohort - babies who are on postnatal wards (n=1,269) who have very short lengths of stay and have low rates of infection (2.4%). Excluding the 'well babies' from the paediatric survey population, resulted in HCAI prevalence in paediatrics of 6.6%.

HCAI prevalence was highest in patients in ICU (adult 23.4%, paediatric 14.7% and neonatal 13.1%). While those patients in the ICU had the highest prevalence of HCAI, they only accounted for 9.4% of the total HCAI detected.

Overall, 3,360 patients were diagnosed with an active HCAI and 135 patients had more than one HCAI. The six most common types of HCAI caused 82.3% of all infections observed: pneumonia/ LRTI (22.8%), UTI (17.2%), SSI (15.7%), clinical sepsis (10.5%), gastrointestinal infections (8.8%), and BSI (7.3%). The seven types of HCAI infection which were greatest in number are shown in Figure 6-1. In the paediatric survey population, clinical sepsis (40.2%) was the leading HCAI detected and UTI were extremely rare (<0.1%).

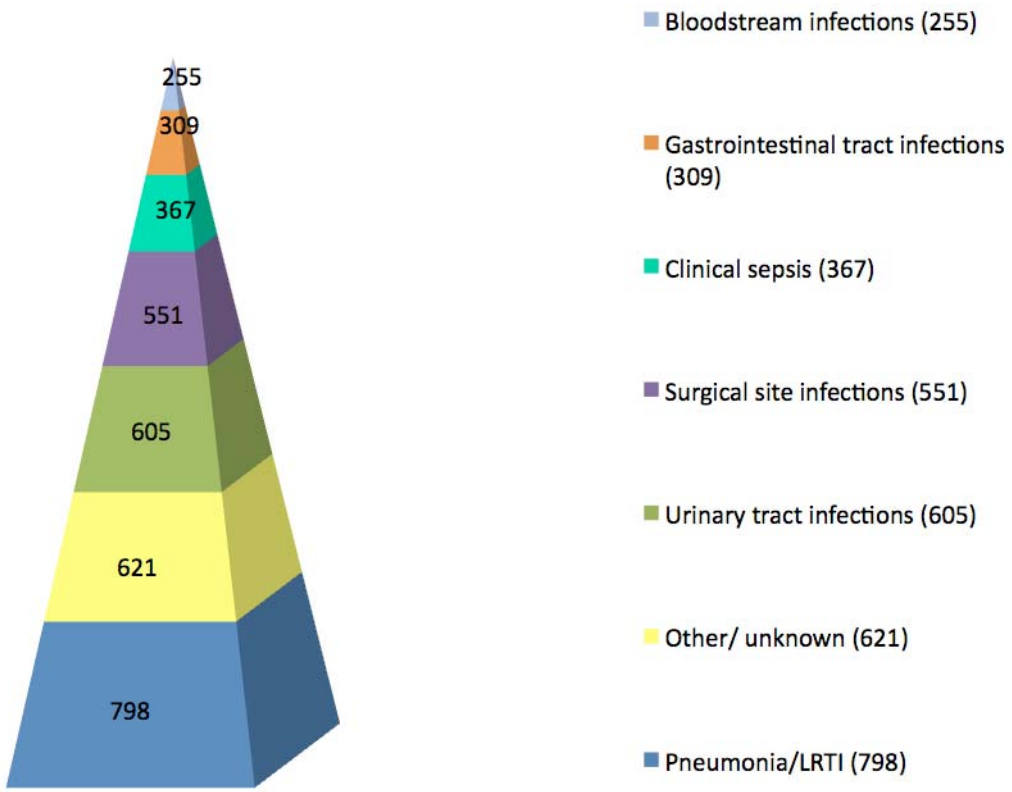
The majority of HCAI developed during the patients stay in the hospital conducting the survey (72.2%). Nineteen percent of HCAI were present on admission to hospital and almost half of these HCAI were related to another healthcare setting, rather than the survey hospital. Only 5.3% of HCAI were detected in the first two days of admission. The majority of HCAI (29.4%) were identified in patients with prolonged lengths of stays.

Half of hospitalised patients had an invasive device *in situ* at the time of the survey. Peripheral vascular cannula (either arterial or venous) was the most common device present in 38.6% of patients. The prevalence of urinary catheters was 18.8%. The prevalence of patients intubated on the day of survey was 1.7% of all survey patients

(either with a tracheostomy or endotracheal tube). Devices were most prevalent on the ICU.

Enterobacteriaceae were the most frequently reported organism causing infection; the prevalence in the total population of a HCAI considered to be caused by Enterobacteriaceae was 0.9%. Fifteen percent of these were reported as third generation cephalosporin resistant indicating the likely presence of extended spectrum beta-lactamase (ESBL) producing organism. Less than 0.1% of the total survey population had an infection caused by MRSA and 0.4% had CDI detected.

Figure 6-1: HCAI pyramid - number of infections in each category (Total BSI=255: MSSA BSI=38, MRSA BSI=2 SA, unknown susceptibility=7)



*Unknown infections were where the case record was marked with “Has an HAI= yes” and no details for the HCAI were documented.

6.1.2 Comparison with previous surveys

Comparing prevalence surveys is not without difficulty and has been well described.[9, 10, 12, 20, 29-31] The overall prevalence of HCAI has reduced from 8.2% in 2006 to 6.4% in 2011; however, the confidence intervals overlap in the two surveys (Appendix 6 provides a summary of the differences between the 2006 and 2011 PPS). The difference in the HCAI prevalence reported may be the result of hospital self-selection with different organisations participating. The independent sector contributed 3.2% of survey patients and the paediatric survey population a further 8.3%; excluding these populations, who were not surveyed previously, does not significantly alter the overall HCAI prevalence. In addition, the surveys were carried out during different seasons with the current survey carried out in Autumn (September to November 2011) and the 2006 survey carried out in late Spring (February to May 2006), which may have affected the prevalence of seasonal pathogens (e.g. norovirus, *C. difficile*). The proportion of acute beds surveyed in 2006 was 59.6% (based on occupied beds in 2006/7) and in 2011 was 53.7% (based on occupied beds in 2010/11).

In all four HCAI prevalence surveys carried out in England, the hospitals have participated voluntarily. However, on this occasion, all hospital sizes, all patients residing in acute care hospitals including psychiatric and paediatric patients, and hospitals from the independent sector were included. In comparison, the 2006 survey included NHS hospitals with greater than 50 adult acute care inpatients beds only.

Independent sector organisations participated in this survey for the first time and there are some important issues to highlight between these organisations and NHS trusts. The independent sector hospitals have a much smaller inpatient bed base with a primarily elective patient mix; and much of their activity is conducted as day cases. These hospitals are geographically diverse with a constantly changing list of facilities and sites. Many of the sicker patients may be transferred to NHS organisations for further care in NHS intensive care facilities. In addition there is a potential risk for reduced case ascertainment as the individuals performing the survey in independent sector organisations may not have been supported by physicians or pharmacists.

Over five years considerable changes have occurred in NHS organisations in England. Mergers of organisations are more frequent, resulting in larger more complex organisations, with multiple hospital sites. Nationally reported data[28] show reduced hospital lengths of stay (LOS) (median LOS was 2 days in 2006/7 and 1 day in 2010/11) and different case mix (for example, increased day cases from 4,373,390 in 2006/7 to 5,691,706 in 2010/11). This means that hospitals may have more HCAI arising in the community than in hospitals. While the HCAI definition utilised for the 2011 PPS captured some of these, it may have not detected other HCAI related to a previous day case or short hospital stay.

In the 2006 PPS, there was a linear relationship between age and HCAI prevalence, which is not the case in the 2011 PPS. In the adult survey population, the highest HCAI prevalence occurs in the 65-74 year old age group (7.5%) whereas in the 2006 survey the highest prevalence occurred in the over 75 years group (9.7%). There are a number of demographic changes between these two surveys: the proportion of patients aged over 65 years old is lower in this survey compared with the last survey (57% compared with 66%) and the proportion of patients recorded as being cared for on a geriatric ward (7.3%

compared with 13.1%) has also reduced. This suggests that the older population is less represented in this survey, potentially through earlier discharge and admission avoidance schemes that are now in place for this population in many NHS trusts. The 2006 PPS may also have collected more data on this group as individual hospitals could sample wards within their hospital (50% of patients from specialties with >40 beds but all from specialties with <20 beds) compared with this occasion where all hospital beds were included. However, as the proportion with HCAI is lower, it may also represent a specialist area where trusts have focussed and emphasised infection prevention and control practices within their organisations. This also serves to highlight the differences in the survey populations and to highlight that there may be other potential unmeasured characteristics, which has resulted in different HCAI prevalence estimates between the two surveys.

The prevalence of devices is lower in this survey compared with the 2006 PPS: peripheral vascular catheter 38.6% compared with 61.7%, central vascular catheter 5.9% versus 7.3%, urinary catheter 18.8% versus 31.6% and mechanical ventilation 5.6% versus intubation 1.7% (a proportion of intubated patients will not be mechanically ventilated). While this may be related to progress related to improving device use and the impact of the High Impact Interventions (HII), it may also be related to the oversampling described above, where patients were more likely to be included from smaller clinical areas such as ICU.

The second prevalence survey (1993/4) used alternative HCAI definitions[32] and therefore there is likely to be reduced comparability of the 1993/4 survey with the 2006 and 2011 prevalence surveys. The HCAI definitions used in both the 2006 and 2011 surveys are more comparable. While some HCAI definitions have changed an ECDC funded concordance study indicated good concordance between the CDC definitions for BSI and pneumonia used in 2006 and the HELICS definitions for these infections used in 2011.[33] Despite the methodological differences, the top three infections remain remarkably similar across the three surveillance periods (Table 6-1).

Table 6-1: Comparisons of proportions of HCAI types from England prevalence surveys 1993/4, 2006 and 2011, presented in 2011 descending order

Type of HCAI	1993/4 %	2006 %	2011 %
Pneumonia/LRTI	22.9	19.9	22.8
UTI	23.2	19.7	17.2
SSI	11.9	13.8	15.7
Clinical sepsis	4.8	1.2	10.5
Gastrointestinal system/includes intra-abdominal infection	7.3	22.0	8.8
Primary BSI	6.2	6.8	4.5
Unknown**	n/a*	n/a*	6.6
Skin and soft tissue	9.6	10.5	4.3
Secondary BSI	n/a*	n/a*	2.9
Eyes, ENT or mouth	5.3	2.9	2.8
Bone and joint	1.4	1.2	1.4
Cardiovascular system	n/a*	1.1	0.7
Vascular devices/ catheter related infection	4.3	n/a*	0.7
Reproductive tract	0.9	0.6	0.6
Central nervous system	0.6	0.3	0.5
Other	1.6	n/a*	n/a*
Total	**100**	**100**	**100**

*N/A – category not collected in that PPS
**Unknown infections (2011) were where the case record was marked with “Has an HAI= yes” and no details for the HCAI were documented

In the 2011 survey, pneumonia and LRTI combined were the largest burden of HCAI (22.8%) which is essentially unchanged over the three surveys. While UTI appear to have reduced between 2006 and 2011, this is likely to be artefactual and related to a difference in definitions. The 2006 survey included asymptomatic bacteruria as part of the urinary infections; the 2011 PPS included only symptomatic UTI. A reduction in primary BSI was observed between the two surveys which was likely to be related to reductions in MRSA bacteraemias. Twenty-two percent of primary BSI were MRSA in 2006 compared with only 1.3% in the current PPS. Skin and soft tissue infections (SSTI) have also reduced from 10.5% to 4.3% again reflecting the proportion caused by MRSA: in 2006, 49.1% were determined to be caused by MRSA compared with only 17.9% in this survey, close to a three-fold reduction. An increase in clinical sepsis has occurred between this survey and the last survey. This is likely to be related to an additional clinical sepsis definition included in this survey that in particular allowed HCAI sepsis data to be gathered from both the paediatric and adult population, where there was clinical evidence of infection with no positive microbiology. Forty percent of HCAI in the paediatric population were defined as clinical sepsis. Gastrointestinal infections have declined from 22.0% to 8.8% between 2006 and 2011; this is related to the control of CDI between the two surveys (five fold reduction in CDI prevalence between 2006 and 2011).

The evaluation of the effects of interventions in between the third and fourth PPS surveys are likely to be more meaningful for interventions where important improvement can be

expected (e.g. control of an epidemic of specific HCAI). The microbiological data was determined in a similar fashion in both 2006 and 2011, with only data that was available at the time of the surveys being collected. Significant reductions in MRSA bacteraemia and CDI are clearly observed between the 2006 and 2011 PPS. There has been an 18-fold decline in overall MRSA infections (1.3% to <0.1%) and a five fold decline in CDI (2.0% to 0.4%) between the two surveys. SSTI and primary BSI are lower in the 2011 PPS suggesting that the combined efforts of staff in hospitals to reduce MRSA bacteraemia have potentially reduced other clinical MRSA infections as well. However further vigilance is required to combat HCAI and improve patient safety in NHS acute trusts. In 2006, microbiological data was only collected in relation to MRSA, C difficile and Norovirus. The 2011 survey collected all available microbiology. Turning the spotlight on Enterobacteriaceae is a priority, as they are now the leading causative organisms in HCAI. The resistance in Enterobacteriaceae is higher in the PPS than reported in UK incidence surveillance (14% compared with 9%)[34] which may suggest a longer inpatient stay for individuals infected with multi-drug resistant organisms potentially related to reduced oral options, and an increased burden of HCAI caused by multi-drug resistant organisms in acute hospitals.

6.2 AMU prevalence

6.2.1 Summary of key results

Prevalence of AMU was highest in the London SHA region (37%) and lowest in the South East Coast SHA (29.2%). Independent sector organisations used more antimicrobials (46.7%) than NHS organisations (35.8%).

Paediatric patients, especially those between 2-15 years had more AMU (44.7%) than other age groups. The paediatric survey population receiving antimicrobials may be over represented in the hospital survey population as in general their lengths of stay are shorter than adult survey populations. The lowest proportion of AMU in adults was in the >80 years age group, suggesting the focus on reducing antimicrobials in this population, particularly to prevent CDI, has had an effect.[35]

AMU was greatest in ICU at 61.4%, significantly higher than other specialties. However this is likely to reflect the complex patient group in this specialty area.

The total numbers of antimicrobials prescribed in the survey were 25,942 in 18,219 (34.7%) patients which equates to 1.42 antimicrobials per patient on antimicrobials.

The most frequent AM indication was for community acquired infection (53%). Surgical prophylaxis accounted for 13.2% of all AMU, and 30% of this was for greater than one day. The majority of antimicrobials were prescribed for respiratory tract infections (30.9%). The second most common reason for AMU was for skin, soft tissues, and bone and joint infections (18%).

The top 20 antimicrobials prescribed encompassed 82% of all AMU. A total of 129 AM agents were used during this PPS. This suggests that there is frequent use of the common agents with much diversity of use for the other agents. Within this category, there was only one cephalosporin (second generation, cefuroxime, 3.5%), prescribed predominantly for surgical prophylaxis. However, meropenem, a broad spectrum beta-lactam and often

regarded as the last resort beta-lactam agent was the ninth most frequently prescribed antimicrobial overall. In the paediatric survey population, there were four cephalosporins in the top 20 representing 16.8% of the total AMU.

6.2.2 Comparisons with previous surveys

No previous national prevalence surveys on AMU have been carried out in England. In the 2006 HCAI survey,[23] 33.3% of individuals surveyed were on at least one AM. This is essentially unchanged five years later, where 34.7% of individuals were recorded as receiving an AM. This is in contrast with the 2009 European Surveillance of AM Consumption (ESAC) PPS where the overall prevalence of AM prescribing was 29%.[9]

The proportion of individuals on antimicrobials for a HCAI was less in England compared with both 2009 ESAC survey[36] and 2010 Wales survey[37] (20.2% versus 30.7% and 32.3%). The proportion of AMU for surgical prophylaxis in this survey was higher than the results reported in ESAC 2009 (13.2% versus 8.8%). This may reflect intrinsic differences in the types of patients included in different surveys, but it merits further exploration.

In line with Department of Health guidance recommending a shift away from fluoroquinolone and cephalosporin use to minimise the risk of CDI, low levels of these antimicrobials were observed in this survey. There are no universally agreed definitions as to high, medium and low risk antibiotics for causing CDI[38]. However in a recent paper by Mullane and colleagues[38], the authors used published literature and expert opinion, to divide antimicrobials into three risk groups. Using their risk classification, 35.1% of top 20 AMU in this PPS were low risk, 50.0% were medium risk and only 14.9% were high risk.[38] The most common high risk AM was meropenem.

The reason for AMU was recorded in 84.7% of patients' notes. This is much higher than the previous ESAC survey[36] of 59.4%, however there is still room for improvement. There are currently no targets for recording the reason for AM prescribing in patients' notes in England. But where this approach has been introduced in Scotland it has increased the proportion where the reason for AMU is documented in the patients' notes to 93% [39] from 76% in their 2009 survey.[36]

Parenteral AMU was found to be lower than the previous ESAC report [36](56% compared with 66%) but higher than the 2010 Wales PPS (46%)[37]. Seventy-four percent of paediatric patients were on a parenteral AM, higher than the overall survey population, suggesting that in this population, early discharge once conversion to oral agents occurs. The UK has traditionally had lower parenteral AM utilisation compared with Europe, again in line with national guidelines relating to parenteral to oral switches as early as possible. However, it is likely that the prevalence of parenteral use could be further reduced in English hospitals.

6.3 Limitations

The complex nature and heterogeneity of hospital/organisation clusters and the fact that this is a voluntary selection of hospitals require these preliminary data to be interpreted with caution. The confidence intervals for the sub-strata are wide and in many cases overlapping suggesting large variability in HCAI and AMU across organisations. Further models will need to be fitted to determine the overall prevalence for England, with adjustment for organisation type and size, as well as case mix including specialties, age and gender.

Independent sector organisations participated in this survey for the first time and there are some important differences between these organisations and NHS trusts such as smaller inpatient bed number, elective patient mix and predominance of day cases. Many of the sicker patients may be transferred to NHS organisations for further care in NHS intensive care facilities. In addition there is a potential risk for reduced case ascertainment as the individuals performing the survey in independent sector organisations may not have been supported by physicians or pharmacists

Prevalence surveys are cross-sectional and therefore lead to possible bias towards identifying HCAI and AMU for those infections with a longer duration of illness and longer inpatient stays. This may have led to an overestimation in these patient groups; however as the objective of this survey was to estimate the burden (total prevalence) of HCAI, the result is valid in this context.

A detailed discussion of the limitations of this 2011 prevalence survey have been outlined in Appendix 7 including:

- Overestimation and misclassification of surgical prophylaxis of greater than one day.
- Validity and reliability of case definitions.
- Comparison between the 2011 survey and previous PPS where alternative definitions have been used.
- Underestimation of the burden of HCAI as day cases and regular attenders are not included in the survey.
- Organisations participated in this survey on a voluntary basis and therefore data remains anonymous. This may have led to incomplete data collection and possibly under reporting of HCAI and AMU.

6.4 Priority areas for the future

Each participating organisation was provided with their individual results. The purpose of this was to assist hospital teams in identifying priorities for local HCAI surveillance; and ward and clinical specialties for focused infection prevention and control and AM stewardship interventions in their own organisation.

Identification of future national policy priorities should be based on the ability to prevent particular HCAI and improve antimicrobial prescribing. The evidence from this PPS points to a number of key areas that require consideration. This section serves to highlight some potential priorities that should be considered at both hospital and national level.

6.4.1 HCAI

The proportion of preventable HCAI is unknown though it is estimated to be between 25-40% based on work from the SENIC study conducted in the United States more than 20 years ago.[40] The Department of Health has focused on the 'care bundle' approach to prevent HCAI in line with published literature and the High Impact Interventions (HII) developed and disseminated follow this methodology.[41] It is important that professional bodies, and organisations as well as infection prevention and control staff assist in the dissemination and utilisation of these HII by all clinical staff.

It is not possible to maintain incidence (continuous) surveillance on all areas and consideration of the particular areas for targeted incidence surveillance or repeated prevalence surveys needs careful thought. Previously it has been determined that areas of high risk, high volume, and high cost benefit most from HCAI surveillance.[19]

HCAI were most frequently observed in ICU where the most vulnerable patients are cared for with devices required for their management. Approximately 10% of total HCAI occur in the survey population in ICU and it is likely that this population continues to have higher risks for infection when discharged to general wards related to ongoing device use. HII and audits associated with devices are likely to be particularly important for reducing HCAI in this patient population. Enhancement of current clinical ICU networks for the purposes of HCAI and AMU surveillance should be considered.

Respiratory tract infections (pneumonia and LRTI) were the most frequent HCAI detected in this survey and almost one in five patients with this infection were intubated in the 48 hours preceding the infection onset with the majority of these patients being cared for on an ICU. Pneumonia surveillance is notoriously difficult to perform, and validations of the definitions have been particularly problematic.[42, 43] The introduction of ventilator-associated pneumonia surveillance may allow the true magnitude of this problem to be determined and promote the development of interventions designed to reduce this important HCAI. Education and training of ward medical staff on modifiable risk factors for pneumonia prevention should be prioritised (for example, reducing sedation, minimising antacid drugs, adequate physiotherapy and mobilisation, appropriate mouth hygiene).

UTI were the second most frequent HCAI detected in this survey. Over 40% of individuals with a UTI had a urinary catheter *in situ* in the preceding seven days. This suggests driving

down urinary catheter use may be a key determinant in reducing UTI. The NHS Operating Framework 2012/13 [44] has confirmed the future use of the 'Safety Thermometer' which incentivises via Commissioning for Quality and Innovation (CQUINs) the reduction in catheter-associated UTI (CAUTI). Public reporting of CAUTI may assist organisational learning and promote best practice. Further education and training materials on urinary catheter indications, insertion technique and ongoing care should be a priority.

The third most frequent HCAI detected was SSI. Hospitals should be encouraged to perform more continuous SSI surveillance of their high risk specialties and develop interventions to reduce these important and potentially very preventable HCAI.
The HPA runs a national surgical site surveillance service (SISS), which is mandatory for certain orthopaedic procedures but has voluntary participation for many other categories.[45] SSI rates in the HPA national surveillance scheme vary between <1% (for orthopaedic procedures) to greater than 10% (large bowel surgery). [45]. This PPS serves to highlight the importance of SSI in orthopaedic specialties, with the largest proportion of SSI detected under the care of this specialty. This suggests that despite the low incidence rate of SSI in orthopaedic specialties, these HCAI cause considerable morbidity and burden on hospitals.

It is important to note that the prevalence of MRSA related HCAI and CDI have reduced dramatically since the last survey. Enterobacteriaceae are now the most frequent organisms detected in relation to HCAI. Further work to control the presence and prevent potential transmission of third generation cephalosporin resistant Enterobacteriaceae in hospitals needs to occur. Interventions designed to reduce the prevalence of HCAI related to this group of micro-organisms should be highlighted as a priority area for research development.

SUMMARY OF HCAI PRIORITIES:

1. Sustained education of clinical staff on the methods of prevention of HCAI.
2. Development of learning tools for the prevention of healthcare-associated pneumonia.
3. Assessment of competency for device insertion – urinary catheter, central and peripheral vascular catheters - should be regularly undertaken and be reviewed at each new healthcare setting or site.
4. Guidance on the prevention and control of Enterobacteriaceae within healthcare settings.
5. Increased surveillance on surgical site infections, especially in surgical specialties where a high prevalence was detected.
6. Development of standardised incidence surveillance methodology for pneumonia and catheter-associated UTI.
7. Public benchmarking and incidence surveillance in ICU – particularly ventilator-associated pneumonia.
8. Public reporting of organisations device prevalence to assist in reducing device use and shortening duration of use.

6.4.2 AMU

AMU and misuse is regarded as a major driver for the development of resistance in micro-organisms[46] and their use can predispose to other HCAI, for example CDI. National guidelines intending to drive down antibiotic use associated with CDI have been successful; cephalosporins and fluoroquinolones were only a small proportion of antimicrobials prescribed in this survey. However the high prevalence of meropenem use is of concern and national guidelines on the use of meropenem should be developed.

AMU in English hospitals/organisations is higher than our European peers, as determined from ESAC data.[36] Continued development of England's AM stewardship should occur and the development of competencies and organisational requirements, similar to the development of the DIPC role should be considered.

No AM consumption data for acute NHS trusts is publically available for benchmarking in England, unlike our counterparts in Scotland and Wales [36, 37]. There should be continued pressure to release hospital AM prescribing information into the public domain to allow AM consumption data to be monitored over time. This would highlight deviations from national guidelines and policies at a hospital level and potentially allow or greater consistency in AMU between hospitals.

The Scottish Antimicrobial Management Group have developed a national target relating to the documentation of AM indication in clinical notes and by using this indicator they have improved the documentation from approximately 80% of AM prescribed documented in the notes to nearly 95%. [39] Further efforts with the ARHAI antimicrobial prescribing sub-committee will be required to develop national quality indicators for AMU in England.

Without electronic prescribing frequent local prevalence surveys would appear to be an efficient way of assessing AMU against nationally set quality indicators e.g. the documentation of indication for AMU, parenteral versus oral use and proportions of antimicrobials prescribed.

SUMMARY OF ANTIMICROBIAL PRIORITIES:

1. Development of guidelines for important broad spectrum antimicrobials, for example, meropenem.
2. Development of antimicrobial stewardship and prescribing competencies.
3. Public reporting of antimicrobial consumption data for each hospital, with case mix stratification.
4. Improvement in the documentation of antimicrobial indication in clinical notes (either electronic or paper).
5. Education of clinical staff to ensure they document an accurate reason for antimicrobial prescribing, for example, altering the indication from surgical prophylaxis to treatment when indicated.
6. Developing of AMU national quality indicators for benchmarking across organisations in England.

7.0 Conclusions

Prevalence surveys such as this allow for large-scale collection of data from organisations over a shorter timeframe than incidence surveillance and provide estimates on the burden of HCAI and AMU. This is the first time that data on both HCAI and AMU has been collected simultaneously, increasing the efficiency of the survey and fostering collaboration across infection prevention and control and AM stewardship teams.

The complex nature and heterogeneity of hospital/organisation clusters and the fact that this is a voluntary selection of hospitals require these preliminary data to be interpreted with caution. The confidence intervals for the sub-strata are wide and in many cases overlapping, suggesting large variability in HCAI and AMU across organisations. Further models will need to be fitted to determine the overall prevalence for England, with adjustment for organisation type and size, as well as case mix including specialties, age and gender.

Repeated prevalence surveys are useful, despite changes in organisations over time, to determine changes in the overall epidemiology of HCAI and AMU. They are useful for monitoring the effectiveness of infection prevention and control programmes and to determine the high risk areas for HCAI and AMU within hospitals.

This survey has demonstrated that national policies for the control of the MRSA and CDI have clearly shown rewards. There has been an 18-fold decline in overall MRSA infections (1.3% to 0.1%) and a five-fold decline in CDI (2.0% to 0.4%) between the 2006 and 2011 surveys. This focus should remain.

The evidence from this survey points to a number of key priorities that need careful consideration by individual healthcare organisations, professional bodies and ARHAI. Further prevalence surveys of both HCAI and AMU will remain important to measure the impact from new policies, guidance and interventions in future years.

8.0 References

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9.0 Appendix 1 – List of hospitals that provided data for the national report and wished to be acknowledged – alphabetical order

Aintree University Hospital NHS Foundation Trust
Airedale NHS Foundation Trust
Ashford & St. Peter's Hospitals NHS Foundation Trust
Barnet and Chase Farm Hospitals NHS Trust
Barnsley Hospital NHS Foundation Trust
Barts and the London NHS Trust
BMI Healthcare
Bradford Teaching Hospitals NHS Foundation Trust
Brighton and Sussex University Hospitals NHS
Buckinghamshire Hospitals NHS Trust
Bupa Cromwell Hospital
Cambridge University Hospital NHS Foundation Trust (Addenbrooke's Hospital and the Rosie Hospital)
Central Manchester University Hospitals NHS Foundation Trust
Chelsea and Westminster Hospital Foundation Trust
Christie NHS Foundation Trust
City Hospitals Sunderland NHS Foundation Trust
Colchester Hospital University NHS Foundation Trust
Countess of Chester
County Durham and Darlington Foundation Trust
Croydon Health Services NHS Trust
Doncaster and Bassetlaw Hospitals NHS Foundation Trust
Dorset County Hospital NHS Foundation Trust
Dudley Group NHS Foundation Trust.(Russells Hall Hospital)
East and North Hertfordshire NHS Trust
East Lancashire Hospitals NHS Trust.
East Sussex Healthcare NHS Trust
Epsom & St Helier University Hospitals NHS Trust
George Eliot Hospital NHS Trust
Gloucestershire Hospitals NHS Foundation Trust
Great Western Hospitals NHS Foundation Trust
Harrogate and District NHS Foundation Trust (Harrogate District Hospital)
Heart of England Foundation Trust
Hinchingbrooke Hospital NHS Trust.
Homerton University Hospital NHS Foundation Trust
Hull and East Yorkshire Hospitals NHS Trust
Imperial College Healthcare NHS Trust

Isle of Wight NHS Trust (St Mary's Hospital)
Kettering General Hospital Foundation Trust
Kingston Hospital NHS Trust
Lancashire Teaching Hospitals NHS Foundation Trust
Lewisham Healthcare NHS Trust (University Hospital Lewisham)
Mid Cheshire Hospital Foundation Trust
Mid Essex Hospital Services NHS Trust
Musgrove Park Hospital, Taunton and Somerset NHS Foundation Trust.
Newcastle Upon Tyne Hospitals NHS Trust
Newham University Hospital Trust
Norfolk and Norwich University Hospital NHS Foundation Trust
North Bristol NHS Trust
North Devon Healthcare NHS Trust (North Devon District Hospital)
North Middlesex University Hospital NHS Trust
North Tees and Hartlepool NHS Foundation Trust
Northampton General Hospital NHS Trust
Nuffield Health Hospitals
Papworth Hospital NHS Foundation Trust
Pennine Acute NHS Trust (Royal Oldham Hospital)
Peterborough and Stamford Hospitals NHS Foundation Trust
Plymouth Hospitals NHS Trust.
Poole Hospital NHS Foundation Trust
Queen Victoria Hospital NHS Foundation Trust
Ramsay Health Care UK
Robert Jones and Agnes Hunt Orthopaedic Hospital
Royal Bolton Foundation Trust
Royal Brompton & Harefield NHS Foundation Trust
Royal Cornwall Hospitals Trust
Royal Devon and Exeter Foundation Trust
Royal Free London NHS Foundation Trust
Royal Liverpool & Broadgreen University Hospitals NHS Trust
Royal Marsden NHS Foundation Trust
Royal Wolverhampton Hospitals NHS Trust
Sandwell and West Birmingham NHS Trust
Sherwood Forest Hospitals NHS Foundation Trust
Shrewsbury and Telford Hospital NHS Trust
South London Healthcare NHS Trust
South Tees NHS Foundation Trust
South Tyneside NHS Foundation Trust
St. George's Healthcare NHS Trust
Stockport NHS Foundation Trust
Surrey and Sussex Healthcare NHS Trust
Tameside Hospital NHS Foundation Trust

Trafford Healthcare NHS Trust
UKSH Emersons Green NHS Treatment Centre
UKSH Peninsula NHS Treatment Centre
UKSH Shepton Mallet NHS Treatment Centre
United Lincolnshire Hospitals NHS Trust
University College London NHS Foundation Trust
University Hospital of North Staffordshire NHS Trust
University Hospital South Manchester Foundation Trust
University Hospitals Birmingham NHS Trust
University Hospitals Bristol Foundation NHS Trust
University Hospitals of Morecambe Bay Foundation NHS Trust
University Hospitals Southampton NHS Foundation Trust
Walsall Healthcare NHS Trust
Walton Centre NHS Foundation Trust
Watford General Hospital/West Hertfordshire Hospitals NHS Trust
West Suffolk Hospital Trust (Bury St Edmunds, Suffolk)
Weston Area Health NHS Trust
Whipps Cross University Hospital NHS Trust
Whittington Health NHS Trust
Winchester & Eastleigh Healthcare NHS Trust
Wirral University Teaching Hospital NHS Foundation Trust
Worcestershire Acute Hospitals NHS Trust
Wrightington, Wigan and Leigh NHS Foundation Trust
Wye Valley NHS Trust (Hereford County Hospital)
York Teaching Hospitals NHS Foundation Trust

10.0 Appendix 2 – PPS England Steering Group members

Name	Organisation
Professor Jonathan Cooke, consultant pharmacist	British Society for Antimicrobial Chemotherapy/ARHAI (to 19 January 2012)
Professor Barry Cookson, consultant microbiologist	Director, Laboratory of Healthcare Associated Infections, HPA Healthcare Infection Society (from 9 December 2012)
Ms Tracey Cooper, infection control nurse consultant	President Infection Prevention Society
Dr Adam Fraise, consultant microbiologist and infection control doctor	Healthcare Infection Society (to16 November 2011)
Dr Susan Hopkins, healthcare epidemiologist, consultant in infectious diseases and microbiology Lead national coordinator England	Consultant healthcare epidemiologist, HPA
Professor Anthony Kessel, public health consultant – chair	Director of public health strategy and medical director, HPA
Dr Bharat Patel, consultant microbiologist	Regional microbiologist, HPA
Dr Mark Reacher, epidemiologist	Regional epidemiologist, HPA
Dr Mike Sharland, consultant in paediatric infectious siseaes	Chair Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infections (ARHAI)
Ms Karen Shaw, national coordinator England	Healthcare epidemiologist, Healthcare Associated Infection, Antimicrobial Resistance and Stewardship Programme Lead
Dr Elizabeth Sheridan, consultant microbiologist	Director, Healthcare Associated Infection and Antimicrobial Resistance Department, HPA
Ms Lisa Simpson, project cfficer	HCAI and AMRS Programme Manager/Secretariat
Dr Louise Teare, consultant microbiologist and infection control doctor	British Infection Association
Ms Sally Wellsteed	Department of Health

11.0 Appendix 3 – glossary of terms

Term	Definition
AmpC	AmpC beta-lactamases are cephalosporinases that are capable of hydrolyzing all beta-lactams and are resistant to beta lactamase inhibitors.
Antibiotic	A drug that destroys or inhibits the growth of bacteria. The action of the drug may be selective against certain bacteria.
Antimicrobial stewardship	Antimicrobial stewardship is a key component of a multifaceted approach to preventing emergence of antimicrobial resistance. Good antimicrobial stewardship involves selecting an appropriate drug and optimising its dose and duration to cure an infection while minimising toxicity and conditions for selection of resistant bacterial strains.
Antimicrobials	An antimicrobial is a drug that selectively destroys or inhibits the growth of micro-organisms. [Tuberculosis and antiviral treatments were excluded from this survey.]
Bacteraemia	The presence of bacteria in the bloodstream.
Carbapenemase	Carbapenemases, enzymes that hydrolyze (destroy) carbapenems and other beta-lactam antibiotics, especially in members of Enterobacteriaceae family are increasing worldwide and an emerging threat.
Carbapenems	Carbapenems are broad-spectrum beta-lactam antibiotics, in many cases the last effective antibiotic against multiple resistant Gram negative bacterial infections.
Catheter or cannula	A tubular flexible device passed through body channels (e.g. artery, vein, or urethra) for the withdrawal or introduction of fluids.
Clostridium difficile	A toxin producing bacterium which can cause severe diarrhoea or enterocolitis. This most commonly occurs following a course of antibiotics which has disturbed the normal bacterial flora of the patient's gut.
Confidence interval	The meaning of the term ‘confidence interval’ is that, if confidence intervals are constructed across many separate data analyses of repeated (and possibly different) experiments, the proportion of such intervals that contain the true value of the parameter will be within the confidence interval given.
95% Confidence interval (95% CI)	If you repeated a survey 100 times, 95 of your results would lie between the confidence interval given.
Covariance	A statistical measure of the variance of two random variables that are observed or measured in the same mean time period. This measure is equal to the product of the deviations of corresponding values of the two variables from their respective means.
Denominator	The population considered to be at risk. For example the total number of patients in the survey.
Director of Infection Prevention and Control (DIPC)	The DIPC is a highly visible, senior authoritative individual who has executive authority and responsibility for ensuring strategies are implemented to prevent avoidable HCAIs at all levels in the organisation and provides assurance to the Board that systems are in place and correct policies and procedures are adhered to, across the organisation, to ensure safe and effective healthcare.

Term	Definition
Enterobacteriaceae	A family of Gram negative bacilli that contains many species of bacteria that normally inhabit the intestines. Enterobacteriaceae, that are commonly part of the normal intestinal tract flora, are referred to as coliforms.
Enterococcus	A bacterium which normally colonises the human bowel.
Extended-Spectrum Beta-Lactamases (ESBL)	Extended-Spectrum Beta-Lactamases (ESBL) are enzymes produced by bacteria making them resistant to penicillins and cephalosporins. Resistance to third- generation cephalosporins in E. coli (and other Enterobacteriaceae) is a broad indicator of the occurrence of ESBLs.
HCAI (HCAI)	An infection acquired via the provision of healthcare in either a hospital or community setting.
Hospital-acquired infection	An infection that was neither present nor incubating at the time of the patient's admission (normally seen more than 48 hours after admission to hospital).
Incidence	The number of new events/episodes of a disease that occur in a population in a given time period.
Infection	Invasion and multiplication of harmful micro organisms in body tissues.
Intravascular device	Device (cannula or catheter) inserted into a vein or artery.
McCabe Score	Classification of the severity of underlying medical conditions. Categories included: Non-fatal disease (expected survival at least 5 years); Ultimately fatal disease (between 1 year and 5 years); Rapidly fatal disease (expected death within 1 year); unknown. Full definition see page 7 of the Definitions and Code Book (Part 2 Appendix 2.)
Micro-organism	An organism that is too small to be seen by the naked eye. Micro-organisms include bacteria, fungi, protozoa and viruses.
MRSA (Meticillin resistant *Staphylococcus aureus)*	A strain of *Staphylococcus aureus* that is resistant to meticillin and other penicillin and cephalosporin antibiotics.
MSSA (Meticillin sensitive *Staphylococcus aureus)*	A strain of *Staphylococcus aureus* that is sensitive to meticillin.
NHSN and non-NHSN Surgery	Lists of surgical procedures that fall under the National Healthcare Safety Network (NHSN) were found on page 50-54 of the long codebook. Some surgical procedures were not in this list and were classified as non-NHSN (examples on non-NHSN surgery are on page 55 of the long codebook). These were procedures where the incision was not entirely closed oat procedure's end (i.e. if wires or tubes extrude through the incision).
Normal flora	The micro-organisms that normally live in or, on the body, and contribute to normal health. When antimicrobial agents are used to treat infections, there are changes to the normal flora which may reduce their ability to treat the infection.
Prevalence	The total number of cases of a specific disease in existence in a given population at a certain time.
Prophylaxis	Any means taken to prevent infectious disease. For example, immunisation, or giving antibiotics when patients undergo surgery.

Term	Definition
Reliability	Measure of repeatability (and agreement) of HCAI diagnosis by different data collectors.
Surgery	Surgery is defined as a procedure, where an incision is made (not just a needle puncture) with breach of mucosa and/or skin- not necessarily in the operating theatre.
Surveillance	The systematic collection of data from the population at risk, the identification of infections using consistent definitions, the analysis of these data and the dissemination of the results to those who collected the data, those responsible for care of the patients and those responsible for prevention and control measures.
Surveillance	Systematic collection of data from the population at risk, identification of infections using consistent definitions, analysis of these data and dissemination of the results to those responsible for the care of the patients and to those responsible for implementation of prevention and central measures.
Third generation cephalosporins	Third-generation cephalosporins have a broad spectrum of activity and further increased activity against Gram negative organisms.
Validity	Validity refers to the extent to which a concept, conclusion or measurement is correct and corresponds accurately to a defined gold standard. In the survey, validity refers to the measure of ability of the data collector to distinguish who has a HCAI and who has not.

12.0 Appendix 4 – Epidemiology of HCAI in England

In England, HCAI and AMR surveillance is collated and fed back to hospitals by the HPA. Mandatory surveillance schemes include:

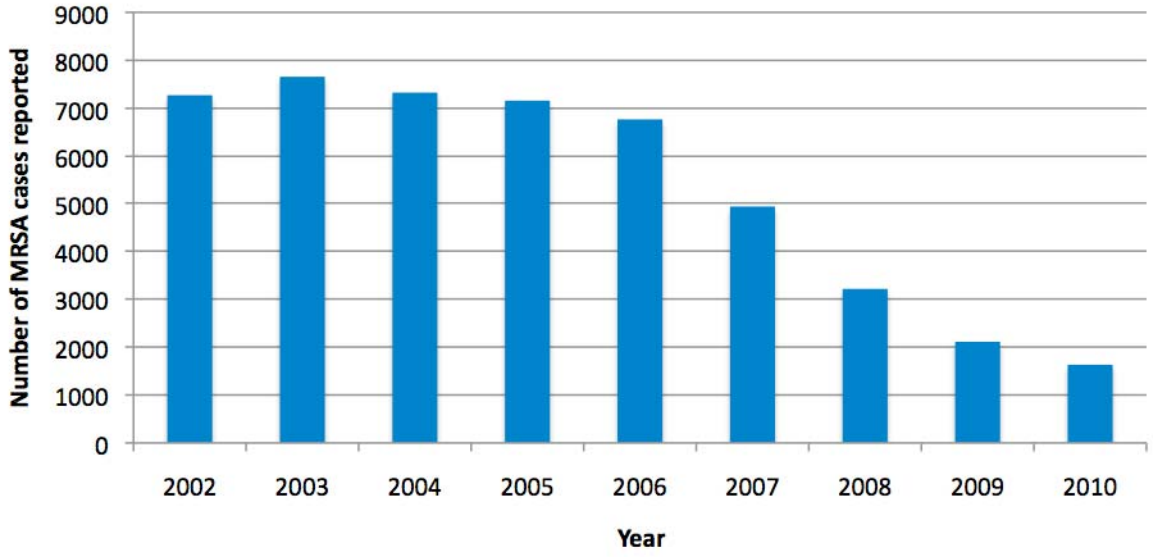
- *Staphylococcus aureus* – meticillin-resistant *S. aureus* (MRSA) and meticillin-sensitive *S. aureus* (MSSA) bacteraemias.
- *Escherichia coli (E. coli)* bacteraemias.
- Glycopeptide-resistant *Enterococcus* (GRE) bacteraemias.
- *Clostridium difficile* infection (CDI).
- Orthopaedic surgical site infection (SSI).

Voluntary surveillance schemes also exist for other SSI from NHS trusts and independent sector reports of MRSA bacteraemia, CDI and SSI. Micro-organisms and their resistance profiles are monitored via a voluntary microbiology laboratory reporting system.

MRSA

Bacteraemias due to MRSA have been decreasing year on year since 2004 and continue to fall in England (Figure 12-1). Mandatory surveillance was extended to enhanced surveillance of MSSA bacteraemia in January 2011.

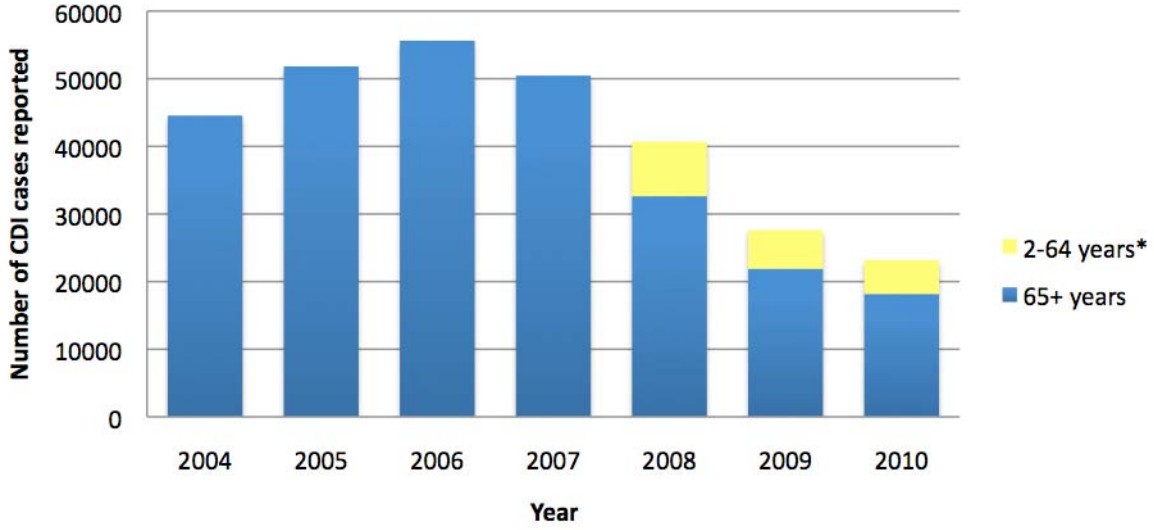
Figure 12-1: Trends in number of MRSA bacteraemia, England (2002 to 2010) (Mandatory reporting only)



CDI

The number of reports of CDI fallen from their peak in 2006 in the over 65 year old population. The number of cases has also declined in the 2-64 year olds since 2008 when mandatory reporting of CDI in this age group was introduced (Figure 12-2).

Figure 12-2: Trend in CDI, England (2004 to 2010) (Mandatory Reporting only)



* Note that mandatory surveillance of CDI in those aged <65 years commenced in 2008

E. coli bacteraemia and resistance in Enterobacteriaceae

The voluntary surveillance of laboratory reports of *E. coli* bacteraemias over the last 15 years indicates a year on year increase in the number of these infections. Mandatory surveillance was extended to include enhanced surveillance of *E. coli* bacteraemia in June 2011 and in the first 6 months of reporting, the number of reports received from the NHS was 16,277.

The proportion of *E. coli* isolates from the UK reported to EARSS-NET that were resistant to third generation cephalosporins in 2010 was 9%. Less than 1% of resistant isolates in Enterobacteriaceae are carbapenemase resistant in the UK.[34]

Surgical site infections

In England, the Surveillance of Surgical Site Infections Service (SSIS) was established in 1997. The number of participating hospitals has increased over time, further boosted by the implementation of mandatory surveillance in orthopaedic categories in April 2004.

Data on all SSI operations reported to the HPA (April 2006 to March 2011) is presented in Table 12-1. Enterobacteriaceae were the predominant cause of infection in 2010-11 accounting for 31% of all micro-organisms. *S. aureus* was the second most frequent micro-organism (27% of the total), MRSA was 6% overall and 23 % of all *S. aureus* infections.[45]

Table 12-1: Cumulative SSI incidence by surgical category, NHS hospitals in England, April 2006-March 2011

	Number of operations where surveillance performed	Number of hospitals who carried out surveillance in this category	Total number of inpatient and readmission SSI	Incidence rate of inpatient and readmission SSI	95% CI
	N	N	N	%	%
Abdominal hysterectomy	5,388	31	80	1.5	1.2-1.8
Bile duct, liver and pancreatic surgery	1,559	6	126	8.1	6.8-9.6
Breast*	1,484	8	17	1.2	0.7-1.8
Cardiac (non-CABG)*	1,286	5	13	1.0	0.5-1.7
Cholecystectomy	619	5	11	1.8	0.9-3.2
Coronary artery bypass graft (CABG)	26,468	22	1,172	4.4	4.2-4.7
Cranial*	557	2	5	0.9	0.3-2.1
Gastric	1,093	10	48	4.4	3.3-5.8
Hip prosthesis	150,149	201	1,169	0.8	0.7-0.8
Knee prosthesis	162,728	196	895	0.6	0.5-0.6
Limb amputation	2,538	23	126	5.0	4.2-5.9
Large bowel	13,534	44	1,370	10.1	9.6-10.6
Reduction of long bone fracture‡	7,580	32	104	1.4	1.1-1.7
Repair of neck of femur‡	39,830	120	647	1.6	1.5-1.8
Small bowel	2,902	19	196	6.8	5.9-7.7
Spinal ‡	13,166	22	126	1.0	0.8-1.1
Vascular	7,798	36	221	2.8	2.5-3.2
Total	**438,679**	**237**	**6,326**		

*From April 2012 ‡ From July 2008

13.0 Appendix 5 – additional tables and figures

List of tables in Appendix 5

List of figures in Appendix 5

Table A-1: Advantages and disadvantages of incidence and prevalence surveillance

	Incidence surveillance	Prevalence surveillance
Advantages	• Collection of prospective data over a long period of time allows robust datasets/epidemiology of HCAI. • Useful for evaluating infection prevention and control programmes. • Collection of data on inpatients allows detection of HCAI at time of their development: signs and symptoms and risk factors can be collected. • Internationally recognised definitions are usually used for incidence surveillance (CDC definitions). • Individual exposure to risk factors can be recorded and analysed over time. • Known as the gold standard methodology for surveillance (gives confidence in the public as they can view results of mandatory surveillance of organisms with a high profile).	• Collection of data at one point or period in time allows a timely collection of data without having to follow-up patients over time. • Repeated prevalence surveys using the same methodology are valuable for monitoring infection prevention and control programmes. • Collection of data over a shorter period of time is more cost effective as staff does not have to follow patients up over time. • Less interruption to ward because data collection on each ward is limited to one day. • Prevalence of risk factors in population surveyed can be given. • Identification of high-risk areas that can lead to important changes for infection prevention and control programmes and training priorities.
Disadvantages	• Continuous prospective surveillance - frequent visits to the ward to collect data which requires dedicated staff time. • Increased staff time and therefore increased costs of conducting surveillance. • Potential for more interruptions on the ward as the data collector will need to continuously visit the ward to collect data. • Most hospitals can only focus on those organisms with a high profile/media and public interest because of the resources required to carry out incidence surveillance. • Potential for incidence surveillance to be politically driven.	• Surveillance takes place at one point or period in time giving a snapshot view of HCAI rather than the bigger picture over a prolonged period. • Relationship between HCAI and risk factors not easily established. • Data collection takes place on each ward at one point in time and microbiology results are often not available. • Possible bias towards patients who are in hospital for longer periods of time. • Where prevalence surveys are voluntary need to explore representativeness and generalisability of results.

Table A-2: Participating and non-participating trusts by SHA region

SHA region	Did not participate N(%)	Participated N(%)	Total N(%)	p value*
Total	68 (100)	99(100)	167 (100)	p=0.7
North West	11 (16.2)	18 (18.2)	29 (17.4)	
London	10 (14.7)	19 (19.2)	29 (17.4)	
Yorkshire	8 (11.8)	7 (7.1)	15 (9.0)	
West Midlands	7 (10.3)	12 (12.1)	19 (11.4)	
East of England	7 (10.3)	11 (11.1)	18 (10.8)	
South Central	7 (10.3)	4 (4.0)	11 (6.6)	
South East Coast	6 (8.8)	6 (6.1)	12 (7.2)	
South West	6 (8.8)	12 (12.1)	18 (10.8)	
East Midlands	4 (5.9)	4 (4.0)	8 (4.8)	
North East	2 (2.9)	6 (6.1)	8 (4.8)	

* Chi-squared

*according to ERIC 2010/11

according to PPS hospital submitted data

Figure A-1: Proportion of regional acute beds surveyed in England

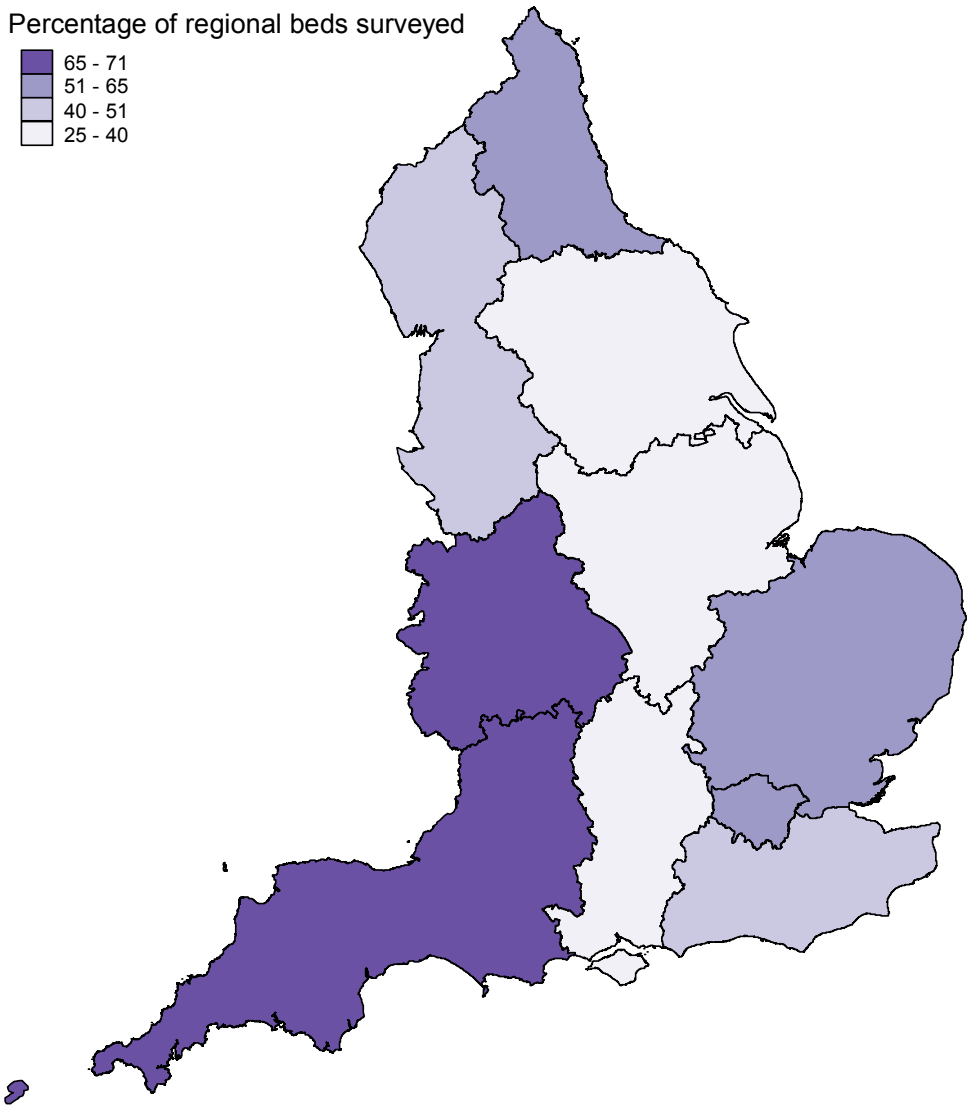


Table A-3: McCabe score and type of surgery in all patients surveyed, all

Risk factor	Category	Number of patients	Percent
		N	% (95% CI)
McCabe score			
	Rapidly fatal	2099	4.0 (3.8 – 4.2)
	Ultimately fatal	9178	17.5 (17.1 - 17.9)
	Non fatal	26275	50.1 (49.5 - 50.7)
	Unknown	14891	28.4 (27.9 - 28.9)
	Total	52443	100.0
Type of surgery since admission to hospital			
	No surgery	37617	71.7 (71.0 - 72.5)
	Non-NHSN surgery	2547	4.9 (4.7 - 5.0)
	NHSN surgery	11066	21.1 (20.7 - 21.5)
	Unknown	1213	2.3 (2.2 - 2.4)
	Total	52443	100.0

Table A-4: Number of patients surveyed by gender and consultant specialty, all

Consultant specialty	Number of patients surveyed	Male	Percent male	Female	Percent female
	N	N	% (95% CI)	N	% (95% CI)
Total*	**52443**	**23549**	**100.0**	**28707**	**100.0**
Medical	22043	10776	45.8 (44.9 - 46.6)	11182	39.0 (38.2 - 39.7)
Surgical	16164	7777	33.0 (32.3 - 33.8)	8344	29.1 (28.4 - 29.7)
Geriatrics	4757	1820	7.7 (7.4 - 8.1)	2914	10.2 (9.8 - 10.5)
Paediatrics	4042	2127	9.0 (8.7 - 9.4)	1899	6.6 (6.3 - 6.9)
Obstetrics and gynaecology	3300	na#	0.0 (0.0 - 0.0)	3300	11.5 (11.1 - 11.9)
Rehabilitation	874	407	1.7 (1.6 - 1.9)	458	1.6 (1.5 - 1.7)
Intensive care medicine	571	339	1.4 (1.3 - 1.6)	232	0.8 (0.7 - 0.9)
Combination of specialties	336	156	0.7 (0.6 - 0.8)	178	0.6 (0.5 - 0.7)
Other specialty	172	76	0.3 (0.3 - 0.4)	94	0.3 (0.3 - 0.4)
Unknown	141	60	0.3 (0.2 - 0.3)	74	0.3 (0.2 - 0.3)
Psychiatrics	43	11	<0.1(0.0 - 0.1)	32	0.1 (0.1 - 0.2)

*No gender recorded n=187 #na=not applicable

Table A-5: Prevalence of peripheral vascular catheterisation by ward specialty, all

Ward specialty group	Number of patients with PVC by ward specialty	Number of patients with PVC *in situ*	Proportion of total with PVC *in situ*	Prevalence PVC *in situ*
	N	N	% (95% CI)	% (95% CI)
Total	**52443**	**20237**	**38.6 (38.1 - 39.1)**	**38.6 (38.2 - 39.0)**
ICU	1351	943	1.8 (1.7 - 1.9)	69.8 (67.3 - 72.2)
Unknown	291	131	0.2 (0.2 - 0.3)	45.0 (39.2 - 50.9)
Combination of specialties	10639	4745	9.0 (8.8 - 9.3)	44.6 (43.7 - 45.6)
Surgery	11088	4888	9.3 (9.1 - 9.6)	44.1 (43.2 - 45.0)
Paediatrics	2742	1076	2.1 (1.9 - 2.2)	39.2 (37.4 - 41.1)
Medicine	17010	6475	12.3 (12.0 - 12.7)	38.1 (37.3 - 38.8)
Geriatrics	3845	881	1.7 (1.6 - 1.8)	22.9 (21.6 - 24.3)
Obstetrics and gynaecology	4305	952	1.8 (1.7 - 1.9)	22.1 (20.9 - 23.4)
Other specialty	1133	146	0.3 (0.2 - 0.3)	12.9 (11.0 - 15.0)
psychiatry	39	0	0	0

Table A-6: Prevalence of peripheral vascular catheterisation by consultant specialty, all

Consultant specialty group	Number of patients with PVC by consultant specialty	Number of patients with PVC *in situ*	Proportion of total with PVC *in situ*	Prevalence PVC *in situ*
	N	N	% (95% CI)	% (95% CI)
Total	**52443**	**20237**	**38.6 (38.1 - 39.1)**	**38.6 (38.2 - 39.0)**
ICU	571	371	0.7 (0.6 - 0.8)	65.0 (60.9 - 68.9)
Surgery	16164	7550	14.4 (14.1 - 14.7)	46.7 (45.9 - 47.5)
Combination of specialties	336	147	0.3 (0.2 - 0.3)	43.8 (38.4 - 49.2)
Medicine	22043	8613	16.4 (16.1 - 16.8)	39.1 (38.4 - 39.7)
Unknown	141	53	0.1 (0.1 - 0.1)	37.6 (29.6 - 46.1)
Obstetrics and gynaecology	3300	1034	2.0 (1.9 - 2.1)	31.3 (29.8 - 32.9)
Paediatrics	4042	1159	2.2 (2.1 - 2.3)	28.7 (27.3 - 30.1)
Geriatrics	4757	1161	2.2 (2.1 - 2.3)	24.4 (23.2 - 25.7)
Other specialty	1046	149	0.3 (0.2 - 0.3)	14.2 (12.2 - 16.5)
Psychiatry	43	0	0	0

Table A-7: Prevalence of central vascular catheterisation by ward specialty, all

Ward specialty group	Number of patients with CVC by ward specialty	Number of patients with CVC *in situ*	Proportion of total with CVC *in situ*	Prevalence CVC *in situ*
	N	N	% (95% CI)	% (95% CI)
Total	**52443**	**3095**	**5.9 (5.7 - 6.1)**	**5.9 (5.7 - 6.1)**
ICU	1351	801	1.5 (1.4 - 1.6)	59.3 (56.6 - 61.9)
Paediatrics	2742	356	0.7 (0.6 - 0.8)	13.0 (11.7 - 14.3)
Unknown	291	19	<0.1 (0.0 - 0.1)	6.5 (4.0 - 10.0)
Medicine	17010	856	1.6 (1.5 - 1.7)	5.0 (4.7 - 5.4)
Combination of specialties	10639	495	0.9 (0.9 - 1.0)	4.7 (4.3 - 5.1)
Surgery	11088	484	0.9 (0.8 - 1.0)	4.4 (4.0 - 4.8)
Other specialty	1133	36	0.1 (0.0 - 0.1)	3.2 (2.2 - 4.4)
Geriatrics	3845	34	0.1 (0.0 - 0.1)	0.9 (0.6 - 1.2)
Obstetrics and gynaecology	4305	14	<0.1 (0.0 - 0.0)	0.3 (0.2 - 0.5)
Psychiatry	39	0	0	0

Table A-8: Prevalence of central vascular catheterisation by consultant specialty, all

Consultant specialty group	Number of patients with CVC by ward specialty	Number of patients with CVC *in situ*	Proportion of total with CVC *in situ*	Prevalence CVC *in situ*
	N	N	% (95% CI)	% (95% CI)
Total	**52443**	**3095**	**5.9 (5.7 - 6.1)**	**5.9 (5.7 - 6.1)**
ICU	571	313	0.6 (0.5 - 0.7)	54.8 (50.6 - 59.0)
Unknown	141	31	0.1 (0.0 - 0.1)	22.0 (15.5 - 29.7)
Paediatrics	4042	356	0.7 (0.6 - 0.8)	8.8 (8.0 - 9.7)
Surgery	16164	1001	1.9 (1.8 - 2.0)	6.2 (5.8 - 6.6)
Medicine	22043	1274	2.4 (2.3 - 2.6)	5.8 (5.5 - 6.1)
Other specialty	1046	47	0.1 (0.1 - 0.1)	4.5 (3.3 - 5.9)
Combination of specialties	336	12	0.0 (0.0 - 0.0)	3.6 (1.9 - 6.2)
Geriatrics	4757	45	0.1 (0.1 - 0.1)	0.9 (0.7 - 1.3)
Obstetrics and gynaecology	3300	16	<0.1 (0.0 - 0.0)	0.5 (0.3 - 0.8)
Psychiatry	43	0	0	0

Table A-9: Prevalence of urinary catheterisation (UC) by ward specialty, all

Ward specialty group	Number of patients with UC by ward specialty	Number of patients with UC *in situ*	Proportion of total with UC *in situ*	Prevalence UC *in situ*
	N	N	% (95% CI)	% (95% CI)
Total	**52443**	**9839**	**18.8 (18.4 - 19.1)**	**18.8 (18.4 - 19.1)**
ICU	1351	1124	2.1 (2.0 - 2.3)	83.2 (81.1 - 85.2)
Obstetrics and gynaecology	4305	339	0.6 (0.6 - 0.7)	7.9 (7.1 - 8.7)
Surgery	11088	2540	4.8 (4.7 - 5.0)	22.9 (22.1 - 23.7)
Unknown	291	64	0.1 (0.1 - 0.2)	22.0 (17.4 - 27.2)
Geriatrics	3845	839	1.6 (1.5 - 1.7)	21.8 (20.5 - 23.2)
Other specialty	1133	217	0.4 (0.4 - 0.5)	19.2 (16.9 - 21.6)
Combination of specialties	10639	2013	3.8 (3.7 - 4.0)	18.9 (18.2 - 19.7)
Medicine	17010	2657	5.1 (4.9 - 5.3)	15.6 (15.1 - 16.2)
Paediatrics	2742	46	0.1 (0.1 - 0.1)	1.7 (1.2 - 2.2)
Psychiatry	39	0	0	0

Table A-10: Prevalence of urinary catheterisation by consultant specialty, all

Consultant specialty group	Number of patients with UC by ward specialty	Number of patients with UC *in situ*	Proportion of total with UC *in situ*	Prevalence UC *in situ*
	N	N	% (95% CI)	% (95% CI)
Total	**52443**	**9839**	**18.8 (18.4 - 19.1)**	**18.8 (18.4 - 19.1)**
ICU	571	452	0.9 (0.8 - 0.9)	79.2 (75.6 - 82.4)
Surgery	16164	4000	7.6 (7.4 - 7.9)	24.7 (24.1 - 25.4)
Geriatrics	4757	1024	2.0 (1.8 - 2.1)	21.5 (20.4 - 22.7)
Other specialty	1046	198	0.4 (0.3 - 0.4)	18.9 (16.6 - 21.4)
Medicine	22043	3625	6.9 (6.7 - 7.1)	16.4 (16.0 - 16.9)
Obstetrics and gynaecology	3300	440	0.8 (0.8 - 0.9)	13.3 (12.2 - 14.5)
Unknown	141	18	<0.1 (0.0 - 0.1)	12.8 (7.7 - 19.4)
Combination of specialties	336	41	0.1 (0.1 - 0.1)	12.2 (8.9 - 16.2)
Paediatrics	4042	41	0.1 (0.1 - 0.1)	1.0 (0.7 - 1.4)
Psychiatry	43	0	0	0

Table A-11: Prevalence of intubation by ward specialty, all

Ward specialty group	Number of patients intubated by ward specialty	Number of patients intubated	Proportion of total patients intubated	Prevalence intubation
	N	N	% (95% CI)	% (95% CI)
Total	**52443**	**911**	**1.7 (1.6 - 1.9)**	**1.7 (1.6 - 1.9)**
ICU	1351	547	1.0 (1.0 - 1.1)	40.5 (37.9 - 43.2)
Paediatrics	2742	143	0.3 (0.2 - 0.3)	5.2 (4.4 - 6.1)
Combination of specialties	10639	81	0.2 (0.1 - 0.2)	0.8 (0.6 - 0.9)
Surgery	11088	83	0.2 (0.1 - 0.2)	0.7 (0.6 - 0.9)
Medicine	17010	44	0.1 (0.1 - 0.1)	0.3 (0.2 - 0.3)
Obstetrics and gynaecology	4305	8	<0.1 (0.0 - 0.0)	0.2 (0.1 - 0.4)
Other specialty	1133	2	<0.1 (0.0 - 0.0)	0.2 (0.0 - 0.6)
Geriatrics	3845	3	<0.1 (0.0 - 0.0)	0.1 (0.0 - 0.2)
Psychiatry	39	0	0	0
Unknown	291	0	0	0

Table A-12: Prevalence of intubation by consultant specialty, all

Consultant specialty group	Number of patients intubated by ward specialty	Number of patients intubated	Proportion of total patients intubated	Prevalence intubation
	N	N	% (95% CI)	% (95% CI)
Total	**52443**	**911**	**1.7 (1.6 - 1.9)**	**1.7 (1.6 - 1.9)**
ICU	571	217	0.4 (0.4 - 0.5)	38.0 (34.0 - 42.1)
Paediatrics	4042	143	0.3 (0.2 - 0.3)	3.5 (3.0 - 4.2)
Surgery	16164	330	0.6 (0.6 - 0.7)	2.0 (1.8 - 2.3)
Medicine	22043	193	0.4 (0.3 - 0.4)	0.9 (0.8 - 1.0)
Unknown	141	1	<0.1 (0.0 - 0.0)	0.7 (0.0 - 3.9)
Obstetrics and gynaecology	3300	11	<0.1 (0.0 - 0.0)	0.3 (0.2 - 0.6)
Other specialty	1046	3	<0.1 (0.0 - 0.0)	0.3 (0.1 - 0.8)
Geriatrics	4757	12	<0.1 (0.0 - 0.0)	0.3 (0.1 - 0.4)
Combination of specialties	336	1	<0.1 (0.0 - 0.0)	0.3 (0.0 - 1.6)
Psychiatry	43	0	0	0

Table A-13: HCAI prevalence by hospital type (ECDC), all

Hospital type	Number of patients surveyed	Percent total patients surveyed	Number of patients with HCAI	Prevalence of HCAI
	N	% (95% CI)	N	% (95% CI)
Total	52443	100.0	3360	6.4 (4.7-8.8)
Specialised	1879	3.6	206	11.0 (9.5 - 12.4)
Tertiary	14221	27.1	1121	7.9 (7.4 - 8.3)
Secondary	20920	39.9	1247	6.0 (5.7 - 6.3)
Primary	15423	29.4	786	5.1 (4.8 - 5.4)

Table A-14: Prevalence of HCAI by consultant specialty group, all

Consultant specialty group	Number of patients surveyed	Percent total patients surveyed	Number of patients with HCAI	Prevalence of HCAI
	N	% (95% CI)	N	% (95% CI)
Total	52443	100.0	3360	6.4 (4.7 - 8.8)
Surgery	16164	30.8	1325	8.2 (6.1 - 11.2)
Other specialty	1046	2.0	81	7.7 (5.3 - 11.4)
Geriatrics	4757	9.1	273	5.7 (4.1 - 8.0)
Medicine	22043	42.0	1232	5.6 (4.1 - 7.6)
Paediatrics	4042	7.7	216	5.3 (3.9 - 7.4)
Combination of specialties	336	0.6	15	4.5 (2.3 - 7.9)
ICU	571	1.1	132	23.1 (16.7 - 32.2)
Unknown	141	0.3	*	*
Obstetrics and gynaecology	3300	6.3	81	2.5 (1.7 - 3.6)
Psychiatry	43	0.1	*	*

***< 5 patients with HCAI**

Table A-15: HCAI Prevalence by consultant specialty – all

Consultant specialty	Number of patients surveyed N	Percent total patients surveyed %	Number of patients with HCAI N	Prevalence of HCAI %
Total	52443	100.0	3360	6.4
Specialised ICU	97	0.2	27	27.8
Mixed (polyvalent) ICU, general intensive	284	0.5	71	25.0
Surgical ICU	68	0.1	14	20.6
Haematology	721	1.4	128	17.8
Medical ICU	80	0.2	14	17.5
Transplantation surgery	114	0.2	18	15.8
Surgery for cancer	153	0.3	24	15.7
Dermatology	45	0.1	7	15.6
Cardio surgery	570	1.1	84	14.7

Consultant specialty	Number of patients surveyed N	Percent total patients surveyed %	Number of patients with HCAI N	Prevalence of HCAI %
Burns care	76	0.1	11	14.5
Other ICU	42	0.1	6	14.3
Neonatal ICU	499	1.0	69	13.8
Paediatric ICU	74	0.1	10	13.5
Cardiovascular surgery	31	0.1	*	*
Digestive tract surgery	1193	2.3	148	12.4
Other surgery	186	0.4	23	12.4
Hepatology	148	0.3	16	10.8
Thoracic surgery	224	0.4	23	10.3
Neurosurgery	820	1.6	81	9.9
Nephrology	747	1.4	71	9.5
Paediatric general surgery	165	0.3	15	9.1
Oncology	970	1.8	86	8.9
Orthopaedics and surgical traumatology	1633	3.1	144	8.8
Vascular surgery	790	1.5	69	8.7
Rehabilitation	874	1.7	69	7.9
General surgery	3847	7.3	301	7.8
Other specialty	172	0.3	12	7.0
Orthopaedics	3960	7.6	256	6.5
Traumatology	299	0.6	19	6.4
Urology	1132	2.2	68	6.0
Respiratory (Thoracic) Medicine	2318	4.4	137	5.9
Geriatrics, care for the elderly	4757	9.1	273	5.7
Gastroenterology	1993	3.8	110	5.5
Neonatology	1053	2.0	55	5.2
Maxillo-facial surgery	115	0.2	6	5.2
Infectious diseases	177	0.3	9	5.1
Other medical	1092	2.1	54	4.9
Endocrinology	815	1.6	40	4.9
Rheumatology	124	0.2	6	4.8
Neurology	854	1.6	41	4.8
Stomatology Dentistry	21	0.0	*	*
ENT	469	0.9	22	4.7
Plastic and reconstructive surgery	451	0.9	21	4.7
Cardiology	2493	4.8	114	4.6
Gynaecology	955	1.8	43	4.5
Combination of specialties	336	0.6	15	4.5
General medicine	9521	18.2	413	4.3
Paediatrics general, not specialised	2251	4.3	67	3.0

Consultant specialty	Number of patients surveyed N	Percent total patients surveyed %	Number of patients with HCAI N	Prevalence of HCAI %
Unknown	141	0.3	*	*
Ophthalmology	80	0.2	*	*
Psychiatrics	43	0.1	*	*
Obstetrics/Maternity	2345	4.5	38	1.6
Medical traumatology	25	0.0	*	*

***< 5 patients with HCAI**

Table A-16: HCAI prevalence by ward specialty – all

Ward specialty	Number of patients surveyed N	Percent total patients surveyed %	Number of patients with HCAI N	Prevalence of HCAI %
Total	52443	100.0	3360	6.4
Surgical ICU	49	0.1	15	30.6
Unknown	19	<0.1	5	26.3
Specialised ICU	233	0.4	56	24.0
Other ICU	21	0.0	5	23.8
Mixed (polyvalent) ICU, general intensive	1000	1.9	232	23.2
Dermatology	10	0.0	*	*
Medical ICU	48	0.1	8	16.7
Haematology	536	1.0	83	15.5
Burns care	53	0.1	8	15.1
Surgery for cancer	94	0.2	14	14.9
Paediatric ICU	75	0.1	11	14.7
Neonatal ICU	550	1.0	72	13.1
Cardio surgery	420	0.8	54	12.9
Digestive tract surgery	543	1.0	62	11.4
Other surgery	122	0.2	13	10.7
Oncology	693	1.3	73	10.5
Thoracic surgery	77	0.1	8	10.4
Paediatric general surgery	128	0.2	12	9.4
Nephrology	578	1.1	51	8.8
Other specialty	152	0.3	13	8.6
Neurosurgery	685	1.3	58	8.5
Orthopaedics and surgical traumatology	1489	2.8	126	8.5
ENT	175	0.3	14	8.0
General surgery	3384	6.5	262	7.7
Transplantation surgery	40	0.1	*	*
Traumatology	245	0.5	18	7.3
Vascular surgery	441	0.8	32	7.3
Cardiovascular surgery	42	0.1	*	*
Rehabilitation	981	1.9	69	7.0

Ward specialty	Number of patients surveyed N	Percent total patients surveyed %	Number of patients with HCAI N	Prevalence of HCAI %
Orthopaedics	2570	4.9	177	6.9
Endocrinology	239	0.5	16	6.7
Respiratory (thoracic) Medicine	1674	3.2	109	6.5
Neonatology	691	1.3	44	6.4
Urology	473	0.9	30	6.3
Infectious diseases	146	0.3	9	6.2
Combination of specialties	10639	20.3	614	5.8
Gastroenterology	1618	3.1	92	5.7
Geriatrics, care for the elderly	3845	7.3	218	5.7
Other medical	1151	2.2	64	5.6
Plastic and reconstructive surgery	186	0.4	10	5.4
Neurology	612	1.2	30	4.9
Cardiology	2023	3.9	91	4.5
General medicine	7716	14.7	322	4.2
Gynaecology	618	1.2	22	3.6
Paediatrics general, not specialised	1298	2.5	46	3.5
Ophthalmology	31	0.1	*	*
Unknown	272	0.5	8	2.9
Psychiatrics	39	0.1	*	*
Obstetrics/Maternity	3687	7.0	74	2.0
Maxillo-facial surgery	18	<0.1	*	*
Hepatology	14	<0.1	*	*

***< 5 patients with HCAI**

Table A-17: Number of HCAI by type of infection – all

HCAI	Number of HCAI	Prevalence of HCAI (95% CI)	Relative percent
	N	%	%
Total	3506	6.7 (6.5 - 6.9)	100.0
Bloodstream infections (BSI)	255	0.5 (0.4 - 0.5)	7.3
Bone and joint infections	50	0.1 (0.1 - 0.1)	1.4
Cardio-vascular system infections	24	<0.1 (0.0 - 0.1)	0.7
Catheter-related infections w/o BSI	26	<0.1 (0.0 - 0.1)	0.7
Central nervous system infections	19	<0.1 (0.0 - 0.1)	0.5
Eye, ear, nose or mouth infections	98	0.2 (0.2 - 0.2)	2.8
Upper respiratory tract, pharyngitis, laryngitis, epiglottitis	4	<0.1 (0.0 - 0.1)	0.1
Gastrointestinal infections	309	0.6 (0.5 - 0.7)	8.8
Clostridium difficile infection (CDI)	191	0.4 (0.3 - 0.4)	5.4
Gastroenteritis (GE) (excluding CDI)	23	<0.1 (0.0 - 0.1)	0.7
Gastrointestinal tract, excl. GE, CDI	24	<0.1 (0.0 - 0.1)	0.7
Pneumonia/Lower respiratory tract infection (LRTI)	798	1.5 (1.4 - 1.6)	22.8
Pneumonia – clinical signs of pneumonia without microbiology	498	0.9 (0.9 - 1.0)	14.2
Pneumonia in neonates	14	<0.1 (0.0 - 0.1)	0.4
Pneumonia, category not stated	7	<0.1 (0.0 - 0.1)	0.2
Pneumonia, clinical + microbiological diagnosis	12	<0.1 (0.0 - 0.1)	0.3
Pneumonia, clinical + positive culture from deep specimen	21	<0.1 (0.0 - 0.1)	0.6
Pneumonia, clinical + positive culture from contaminated deep specimen	10	<0.1 (0.0 - 0.1)	0.3
Pneumonia, clinical + positive sputum culture	80	0.2 (0.1 - 0.2)	2.3
Reproductive tract infections	20	<0.1 (0.0 - 0.1)	0.6
Skin and soft tissue infections	152	0.3 (0.2 - 0.3)	4.3
Surgical site infections	551	1.1 (1.0 - 1.1)	15.7
Surgical site infection, Deep incisional	174	0.3 (0.3 - 0.4)	5.0
Surgical site infection, Organ/Space	134	0.3 (0.2 - 0.3)	3.8
Surgical site infection, Superficial incisional	237	0.5 (0.4 - 0.5)	6.8
Surgical site infection, category not stated	6	<0.1 (0.0 - 0.1)	0.2
Clinical sepsis	367	0.7 (0.6 - 0.8)	10.5
Clinical sepsis in adults and children	292	0.6 (0.5 - 0.6)	8.3
Urinary tract infections	604	1.2 (1.1 - 1.2)	17.2
Unknown	232	0.4 (0.4 - 0.5)	6.6

Table A-18: Number of HCAI by infection type and specialty group – summarised, all

Specialty group	Pneumonia /LRTI	Relative percent Pneumonia/ LRTI	UTI	Relative percent UTI	SSI	Relative percent SSI	GI	Relative percent GI	BSI	Relative percent BSI
	N	%	N	%	N	%	N	%	N	%
Total HCAI	**798**	**100.0**	**605**	**100.0**	**367**	**100.0**	**309**	**100.0**	**255**	**100.0**
Medicine	331	41.5	267	44.1	132	36.0	148	47.9	106	41.6
Surgery	274	34.3	201	33.2	81	22.1	90	29.1	83	32.5
Geriatrics	71	8.9	87	14.4	19	5.2	34	11.0	11	4.3
Paediatrics	38	4.8	2	0.3	98	26.7	11	3.6	33	12.9
ICU	61	7.6	1	0.2	19	5.2	13	4.2	13	5.1
Other specialty	14	1.8	30	5.0	7	1.9	7	2.3	5	2.0
O and G	6	0.8	12	2.0	8	2.2	5	1.6	3	1.2
Combination of specialties	2	0.3	5	0.8	3	0.8	1	0.3	0	0.0
Unknown	1	0.1	0	0.0	0	0.0	0	0.0	1	0.4

LRTI = lower respiratory tract infection UTI = urinary tract infection SSI= surgical site infection GI = gastrointestinal infection BSI = bloodstream infection

Table A-19: Number of HCAI by infection type and specialty group – detailed specialty groups, all

Specialty group	Pneumonia/ LRTI	Relative percent	UTI	Relative percent	SSI	Relative percent	GI	Relative percent	BSI	Relative percent
	N	%	N	%	N	%	N	%	N	%
Total HCAI	**798**	**100.0**	**605**	**100.0**	**367**	**100.0**	**309**	**100.0**	**255**	**100.0**
General medicine	120	15.0	123	20.3	24	6.5	64	20.7	20	7.8
Geriatrics, care for the elderly	71	8.9	87	14.4	19	5.2	34	11.0	11	4.3
General surgery	54	6.8	39	6.4	25	6.8	37	12.0	22	8.6
Orthopaedics	51	6.4	43	7.1	6	1.6	4	1.3	6	2.4
Respiratory (Thoracic) Medicine	66	8.3	22	3.6	7	1.9	7	2.3	5	2.0
Haematology	15	1.9	8	1.3	40	10.9	10	3.2	28	11.0
Digestive tract surgery	43	5.4	14	2.3	12	3.3	18	5.8	11	4.3
Gastroenterology	22	2.8	24	4.0	9	2.5	24	7.8	10	3.9
Cardiology	30	3.8	22	3.6	14	3.8	6	1.9	6	2.4
Oncology	17	2.1	21	3.5	14	3.8	4	1.3	14	5.5
Neonatal ICU	10	1.3	0	0.0	41	11.2	2	0.6	10	3.9
Orthopaedics and surgical traumatology	25	3.1	23	3.8	5	1.4	4	1.3	3	1.2
Nephrology	16	2.0	10	1.7	11	3.0	10	3.2	12	4.7
Rehabilitation	14	1.8	29	4.8	3	0.8	6	1.9	2	0.8
Paediatrics general, not specialised	13	1.6	1	0.2	30	8.2	4	1.3	5	2.0
Cardio surgery	25	3.1	9	1.5	6	1.6	3	1.0	9	3.5
Mixed (polyvalent) ICU, general intensive	23	2.9	1	0.2	9	2.5	9	2.9	10	3.9
Neonatology	8	1.0	1	0.2	23	6.3	4	1.3	15	5.9

Specialty group	Pneumonia/ LRTI	Relative percent	UTI	Relative percent	SSI	Relative percent	GI	Relative percent	BSI	Relative percent
	N	%	N	%	N	%	N	%	N	%
Urology	0	0.0	31	5.1	5	1.4	7	2.3	6	2.4
Other medical	19	2.4	16	2.6	2	0.5	4	1.3	4	1.6
Vascular surgery	17	2.1	10	1.7	4	1.1	4	1.3	4	1.6
Neurosurgery	13	1.6	9	1.5	3	0.8	2	0.6	10	3.9
Neurology	11	1.4	10	1.7	5	1.4	4	1.3	2	0.8
Endocrinology	8	1.0	8	1.3	4	1.1	4	1.3	0	0.0
Gynaecology	4	0.5	7	1.2	5	1.4	4	1.3	2	0.8
Specialised ICU	17	2.1	0	0.	2	0.5	0	0.0	2	0.8
Other surgery	5	0.6	4	0.7	2	0.5	6	1.9	1	0.4
Transplantation surgery	8	1.0	3	0.5	2	0.5	1	0.3	3	1.2
Thoracic surgery	7	0.9	3	0.5	4	1.1	0	0.0	2	0.8
Medical ICU	9	1.1	0	0.0	2	0.5	3	1.0	1	0.4
Hepatology	5	0.6	2	0.3	1	0.3	5	1.6	1	0.4
Surgical ICU	10	1.3	0	0.0	4	1.1	0	0.0	0	0.0
Traumatology	6	0.8	4	0.7	2	0.5	0	0.0	1	0.4
Surgery for cancer	7	0.9	0	0.0	2	0.5	3	1.0	1	0.4
Obstetrics/Maternity	2	0.3	5	0.8	3	0.8	1	0.3	1	0.4
Combination of specialties	2	0.3	5	0.8	3	0.8	1	0.3	0	0.0
Other specialty	0	0.0	1	0.2	4	1.1	1	0.3	3	1.2
ENT	5	0.6	2	0.3	1	0.3	0	0.0	1	0.4
Burns care	3	0.4	2	0.3	0	0.0	1	0.3	2	0.8
Paediatric general surgery	3	0.4	0	0.0	2	0.5	1	0.3	2	0.8
Paediatric ICU	4	0.5	0	0.0	2	0.5	0	0.0	1	0.4
Infectious diseases	0	0.0	0	0.0	0	0.0	4	1.3%	2	0.8

Specialty group	Pneumonia/ LRTI	Relative percent	UTI	Relative percent	SSI	Relative percent	GI	Relative percent	BSI	Relative percent
	N	%	N	%	N	%	N	%	N	%
Plastic and reconstructive surgery	3	0.4	2	0.3	1	0.3	0	0.0	0	0.0
Rheumatology	1	0.1	1	0.2	0	0.0	1	0.3	2	0.8
Other ICU	2	0.3	0	0.0	2	0.5	1	0.3	0	0.0
Maxillo-facial surgery	0	0.0	3	0.5	0	0.0	0	0.0	1	0.4
Dermatology	1	0.1	0	0.0	1	0.3	1	0.3	0	0.0
Cardiovascular surgery	2	0.3	0	0.0	1	0.3	0	0.0	0	0.0
Unknown	1	0.1	0	0.0	0	0.0	0	0.0	1	0.4

LRTI = lower respiratory tract infection UTI = urinary tract infection SSI= surgical site infection GI = gastrointestinal infection BSI = bloodstream infection

Table A-20: Number of SSI by infection type by specialty group – summarised, all

Specialty group	Total SSI	Relative percent	SSI-Superficial	Relative percent	SSI-Deep	Relative percent	SSI-Organ space	Relative percent
	N	%	N	%	N	%	N	%
Total SSI	545	100.0	237	100.0	174	100.0	134	100.0
Surgery	433	79.4	193	81.4	133	76.4	107	79.9
Medicine	48	8.8	16	6.8	20	11.5	12	9.0
O and G	30	5.5	14	5.9	9	5.2	7	5.2
Paediatrics	13	2.4	4	1.7	7	4.0	2	1.5
ICU	11	2.0	3	1.3	3	1.7	5	3.7
Geriatrics	5	0.9	3	1.3	2	1.1	0	0.0
Other specialty	3	0.6	2	0.8	0	0.0	1	0.7
Unknown	1	0.2	1	0.4	0	0.0	0	0.0
Combination of specialties	1	0.2	1	0.4	0	0.0	0	0.0

Table A-21: Number of SSI by infection type by specialty group – detailed specialty groups, all

Specialty group	Total	Relative percent	SSI-Superficial	Relative percent	SSI-Deep	Relative percent	SSI-Organ space	Relative percent
	N	%	N	%	N	%	N	%
Total SSI	545	100.0	237	100.0	174	100.0	134	100
General surgery	99	18.2	43	18.1	20	11.5	36	26.9
Orthopaedics	89	16.3	37	15.6	37	21.3	15	11.2
Orthopaedics and surgical traumatology	63	11.6	26	11	31	17.8	6	4.5
Digestive tract surgery	40	7.3	18	7.6	8	4.6	14	10.4
Cardio surgery	28	5.1	13	5.5	14	8.0	1	0.7
Neurosurgery	25	4.6	7	3.0	5	2.9	13	9.7
Vascular surgery	21	3.9	9	3.8	9	5.2	3	2.2
Gynaecology	17	3.1	5	2.1	5	2.9	7	5.2
Urology	16	2.9	9	3.8	2	1.1	5	3.7
Cardiology	13	2.4	3	1.3	9	5.2	1	0.7
Obstetrics/Maternity	13	2.4	9	3.8	4	2.3	0	0.0
General medicine	12	2.2	6	2.5	4	2.3	2	1.5
Plastic and reconstructive surgery	11	2.0	9	3.8	0	0.0	2	1.5
Surgery for cancer	11	2.0	2	0.8	1	0.6	8	6.0
ENT	9	1.7	7	3.0	2	1.1	0	0.0
Mixed (polyvalent) ICU, general intensive	8	1.5	1	0.4	3	1.7	4	3.0
Paediatrics general, not specialised	6	1.1	2	0.8	4	2.3	0	0.0
Other surgery	6	1.1	3	1.3	1	0.6	2	1.5
Respiratory (Thoracic) Medicine	5	0.9	2	0.8	2	1.1	1	0.7
Geriatrics, care for the elderly	5	0.9	3	1.3	2	1.1	0	0.0
Gastroenterology	5	0.9	1	0.4	1	0.6	3	2.2
Nephrology	5	0.9	3	1.3	0	0.0	2	1.5
Transplantation surgery	4	0.7	2	0.8	1	0.6	1	0.7

Specialty group	Total	Relative percent	SSI-Superficial	Relative percent	SSI-Deep	Relative percent	SSI-Organ space	Relative percent
	N	%	N	%	N	%	N	%
Thoracic surgery	3	0.6	2	0.8	0	0.0	1	0.7
Traumatology	3	0.6	2	0.8	1	0.6	0	0.0
Specialised ICU	3	0.6	2	0.8	0	0.0	1	0.7
Paediatric general surgery	2	0.4	0	0.0	1	0.6	1	0.7
Neonatal ICU	2	0.4	0	0.0	1	0.6	1	0.7
Paediatric ICU	2	0.4	1	0.4	1	0.6	0	0.0
Burns care	2	0.4	2	0.8	0	0.0	0	0.0
Other specialty	2	0.4	2	0.8	0	0.0	0	0.0
Maxillo-facial surgery	2	0.4	1	0.4	1	0.6	0	0.0
Dermatology	2	0.4	0	0.0	1	0.6	1	0.7
Combination of specialties	1	0.2	1	0.4	0	0.0	0	0.0
Endocrinology	1	0.2	0	0.0	0	0.0	1	0.7
Infectious diseases	1	0.2	0	0.0	0	0.0	1	0.7
Neonatology	1	0.2	1	0.4	0	0.0	0	0.0
Haematology	1	0.2	0	0.0	1	0.6	0	0.0
Hepatology	1	0.2	0	0.0	1	0.6	0	0.0
Oncology	1	0.2	1	0.4	0	0.0	0	0.0
Rehabilitation	1	0.2	0	0.0	0	0.0	1	0.7
UNKNOWN	1	0.2	1	0.4	0	0.0	0	0.0
Neurology	1	0.2	0	0.0	1	0.6	0	0.0
Stomatology dentistry	1	0.2	1	0.4	0	0.0	0	0.0

Table A-22: Onset of infection by the most frequent types of HCAI, all

HCAI type	Total number of HCAI	Median number of days to onset [IQR]
	N	N
Total	3506	12 [6-25]
Urinary tract infections	605	14 [6-29]
BSI	255	14 [8-28]
Gastrointestinal infections	309	14 [7-28]
Pneumonia/ LRTI	798	10 [5-23]
Surgical site infections	551	12 [6-23]

Table A-23: Microbiological organisms and resistance associated with types of HCAI, all

Micro-organisms and resistance categories	Pneumonia		SSI		UTI		BSI		Gastrointestinal		Other	
	N	%	N	%	N	%	N	%	N	%	N	%
Number of HAI total	**798**		**551**						**310**		**782**	
N of micro-organisms	**88**	**11.0%**	**177**	**32.1%**	**211**	**34.9%**	**146**	**57.3%**		**67.4%**	**123**	**15.7%**
Enterobacteriaceae	**55**	**49.1%**	**88**	**40.6%**	**172**	**78.5%**	**83**	**53.6%**	**12**	**5.6%**	**35**	**26.2%**
Enterobacteriaceae, carbapenem and C3G** susceptible	24	21.4%	44	**605** 20.3%	92	**255** 42.0%	41	**209** 26.5%	6	2.8%	21	15.7%
Enterobacteriaceae, carbapenem susceptible and C3G* resistant	9	8.0%	11	5.1%	16	7.3%	19	12.3%	1	0.5%	4	3.0%
Enterobacteriaceae, C3G** and carbapenem resistant	5	4.5%	5	2.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Enterobacteriaceae, unknown susceptibility	17	15.2%	28	12.9%	64	29.2%	23	14.8%	5	2.4%	10	7.5%
Staphylococcus aureus	**29**	**26.0%**	**83**	**38.2%**	**1**	**0.5%**	**47**	**30.3%**	**195**	**91.6%**	**76**	**56.7%**
MSSA	18	16.1%	46	21.2%	1	0.5%	38	24.5%	1	0.5%	35	26.1%
MRSA	5	4.5%	9	4.1%	0	0.0%	2	1.3%	0	0.0%	21	15.7%
S. aureus, unknown susceptibility	6	5.4%	28	12.9%	0	0.0%	7	4.5%	0	0.0%	20	14.9%
C. difficile infection[#]	**0**	**0.0%**	**0**	**0.0%**	**0**	**0.0%**	**0**	**0.0%**	**194**	**91.1%**	**0**	**0.0%**
Pseudomonas aeruginosa	**31**	**27.7%**	**25**	**11.5%**	**19**	**8.7%**	**7**	**4.5%**	**0**	**0.0%**	**10**	**7.5%**
Pseudomonas aeruginosa, carbapenem susceptible	16	14.3%	12	5.5%	11	5.0%	3	1.9%	0	0.0%	6	4.5%
Pseudomonas aeruginosa, carbapenem resistant	5	4.5%	5	2.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Pseudomonas aeruginosa, unknown susceptibility	10	8.9%	8	3.7%	8	3.7%	4	2.6%	0	0.0%	4	3.0%
***Enterococcus* spp**	**2**	**1.8%**	**26**	**11.9%**	**25**	**11.4%**	**16**	**10.3%**	**6**	**2.8%**	**13**	**9.6%**
Glycopeptide susceptible *Enterococcus* spp	1	0.9%	9	4.1%	12	5.5%	9	5.8%	2	0.9%	5	3.7%
Glycopeptide resistant *Enterococcus* spp (GRE)	0	0.0%	2	0.9%	2	0.9%	3	1.9%	1	0.5%	1	0.7%
Enterococcus spp, unknown susceptibility	1	0.9%	15	6.9%	11	5.0%	4	2.6%	3	1.4%	7	5.2%
***Staphylococci,* other/unknown**	**1**	**0.5%**	**30**	**8.8%**	**3**	**1.0%**	**38**	**15.4%**		**0.4%**	**15**	**7.7%**
Other	**81**	**39.7%**	**85**	**24.9%**	**48**	**15.9%**	**50**	**20.3%**	**26**	**10.9%**	**44**	**22.6%**

#diagnosed through culture and toxin ELISA assay

1

Table A-24: AMU by hospital type, all

Hospital type	Number of patients surveyed	Percent total	Number of patients on antimicrobials	AMU prevalence
	N	% (95% CI)	N	% (95% CI)
Total	52443	100.0	18219	34.7
Specialised	1879	3.6	809	43.1
Tertiary	14221	27.1	5082	35.7
Secondary	20920	39.9	7144	34.2
Primary	15423	29.4	5184	33.6

Table A-25: AMU by consultant specialty, all

Consultant specialty	Number of patients surveyed	Percent total	Number on antimicrobials	AMU prevalence
	N	% (95% CI)	N	% (95% CI)
Total	52443	100.0	18219	34.8 (30.6 - 39.5)
ICU	571	1.1 (1.0 - 1.2)	333	58.3 (49.5 - 68.8)
Unknown	141	0.3 (0.2 - 0.3)	60	44.1 (33.1 - 58.9)
Surgery	16164	30.8 (28.3 - 33.6)	6255	38.7 (34.0- 44.1)
Medicine	22043	42.0 (38.6 - 45.8)	7933	36.0 (31.6 - 41.1)
Combination of specialties	336	0.6 (0.6 - 0.7)	119	35.4 (28.7 - 43.8)
Geriatrics	4757	9.1 (8.3 - 9.9)	1354	28.4 (24.7 - 32.7)
Paediatrics	4042	7.7 (7.1 - 8.4)	1110	27.7 (24.0 - 31.9)
Obstetrics and gynaecology	3300	6.3 (5.8 - 6.9)	831	25.1 (21.6 - 29.1)
Other specialty	1046	2.0 (1.8 - 2.2)	219	20.9 (17.3 - 25.3)
Psychiatry	43	0.1 (0.06 - 0.11)	5	11.6 (4.8 - 28.2)

Table A-26: AM by diagnosis intention – community-acquired infection (CAI) and hospital-acquired infection (HAI), all

Diagnosis	Total number of diagnoses	Percent of total diagnoses	CAI	Percent of CAI	HAI	Percent of HAI
	N	%	N	%	N	%
Total number of diagnosis for AMU	18994	100.0	13746	100.0	5248	100.0
Respiratory tract	5877	30.9	4438	32.3	1439	27.4
Pneumonia	4359	22.9	3095	22.5	1264	24.1
Acute bronchitis/ exacerbations of chronic bronchitis	1518	8.0	1343	9.8	175	3.3
Urinary tract	2603	13.7	1877	13.7	726	13.8
Symptomatic lower UTI	2037	10.7	1410	10.3	627	11.9
Symptomatic upper UTI	531	2.8	448	3.3	83	1.6
Asymptomatic bacteruria	35	0.2	19	0.1	16	0.3
Clinical sepsis	2658	14.0	1639	11.9	1019	19.4
Lab-confirmed bacteraemia	532	2.8	285	2.1	247	4.7
Clinical sepsis (suspected bloodstream infection	1205	6.3	701	5.1	504	9.6
Febrile neutropenia or other form of manifestation	488	2.6	363	2.6	125	2.4
Systemic inflammatory response, no clear anatomic site	219	1.2	131	1.0	88	1.7
Undefined site with no systemic inflammation)	214	1.1	159	1.2	55	1.0
Cardiovascular system	277	1.5	222	1.6	55	1.0
Gastrointestinal (GI) system	2438	12.8	1770	12.9	668	12.7
GI infections e.g. salmonellosis, antibiotic-associated	754	4.0	445	3.2	309	5.9
Intra-abdominal sepsis including hepatobiliary	1684	8.9	1325	9.6	359	6.8
Skin/soft tissue/bone/joint	3600	19.0	2635	19.2	965	18.4
Cellulitis, wound, deep soft tissue not involving bone	2939	15.5	2122	15.4	817	15.6
Septic arthritis osteomyelitis	661	3.5	513	3.7	148	2.8
Central nervous system	229	1.2	178	1.3	51	1.0
Eye/ear/nose/throat	541	2.8	380	2.8	161	3.1
Endophthalmitis and similar	36	0.2	26	0.2	10	0.2
Infections of ear, mouth, nose, throat or larynx)	505	2.7	354	2.6	151	2.9
Genitourinary system	313	1.6	243	1.8	70	1.3
Obstetric or gynaecological infections, women	262	1.4	198	1.4	64	1.2
Prostatitis, epididymoorchitis, men	51	0.3	45	0.3	6	0.1
Missing/Unknown	458	2.4	364	2.6	94	1.8

Table A-27: AM group prescribed in descending order, all

Name of antimicrobial group	Total number of antimicrobials	Relative percent of AM
	N	%
Total	**25942**	**100**
Combinations of penicillins, incl. beta-lactamase inhibitors	5987	23.1
Beta-lactamase resistant penicillins	1907	7.4
Other aminoglycosides	1770	6.8
Macrolides	1643	6.3
Penicillins with extended spectrum	1272	4.9
Imidazole derivatives	1236	4.8
Glycopeptide antibacterials	1176	4.5
Beta-lactamase sensitive penicillins	1163	4.5
Carbapenems	1159	4.5
Trimethoprim and derivatives	1080	4.2
Second-generation cephalosporins	909	3.5
Fluoroquinolones	855	3.3
Nitroimidazole derivatives	757	2.9
Tetracyclines	705	2.7
Triazole derivatives	636	2.5
Third-generation cephalosporins	535	2.1
Intestinal antiinfectives, antibiotics	428	1.6
Unknown	365	1.4
Nitrofuran derivatives	348	1.3
Antimycobacterials, antibiotics	265	1.0
Lincosamides	259	1.0
First-generation cephalosporins	258	1.0
Combinations of sulfonamides and trimethoprim, incl. derivatives	215	0.8
Combinations of antibacterials	171	0.7
Other antibacterials	134	0.5
Other/ unknown	131	0.5
Short-acting sulfonamides	111	0.4
Polymyxins	90	0.3
Antimycotics, antibiotics	78	0.3
Other antimycotics for systemic use	67	0.3
Steroid antibacterials	66	0.3
Beta-lactamase inhibitors	39	0.2
Monobactams	37	0.1
Intermediate-acting sulfonamides	35	0.1
Amphenicols	34	0.1
Long-acting sulfonamides	8	<0.1
Streptomycins	5	<0.1
Antifungals for systemic use	5	<0.1
Fourth-generation cephalosporins	2	<0.1
Streptogramins	1	<0.1

Table A-28: Antimicrobials prescribed by treatment indication, all

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%	N	%	N	%
Total	25942	100.0	19411	100.0	3412	100.0	2059	100.0
Co-amoxiclav	3579	13.8	2674	13.8	703	20.6	107	5.2
Piperacillin/tazobactam	2262	8.7	2111	10.9	54	1.6	44	2.1
Flucloxacillin	1906	7.3	1366	7.0	457	13.4	46	2.2
Gentamicin	1566	6.0	815	4.2	583	17.1	126	6.1
Clarithromycin	1245	4.8	1190	6.1	8	0.2	21	1
Metronidazole (parenteral)	1230	4.7	907	4.7	270	7.9	23	1.1
Amoxicillin	1159	4.5	1062	5.5	50	1.5	31	1.5
Trimethoprim	1080	4.2	932	4.8	19	0.6	108	5.2
Meropenem	1021	3.9	961	5.0	10	0.3	25	1.2
Cefuroxime	895	3.5	234	1.2	634	18.6	20	1
Benzylpenicillin	848	3.3	686	3.5	49	1.4	86	4.2
Metronidazole (oral, rectal)	755	2.9	619	3.2	64	1.9	40	1.9
Ciprofloxacin	707	2.7	556	2.9	38	1.1	91	4.4
Doxycycline	631	2.4	582	3.0	7	0.2	21	1
Teicoplanin	612	2.4	374	1.9	201	5.9	20	1
Vancomycin (parenteral)	562	2.2	508	2.6	36	1.1	10	0.5
Fluconazole	463	1.8	278	1.4	14	0.4	159	7.7
Unknown	365	1.4	0	0	0	0	0	0
Nitrofurantoin	348	1.3	281	1.4	2	0.1	57	2.8
Rifampicin	265	1.0	255	1.3	0	0	4	0.2

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%	N	%	N	%
Clindamycin	259	1.0	239	1.2	15	0.4	2	0.1
Erythromycin	227	0.9	98	0.5	14	0.4	54	2.6
Cefalexin	218	0.8	137	0.7	25	0.7	48	2.3
Cefotaxime	207	0.8	164	0.8	13	0.4	22	1.1
Vancomycin (oral)	199	0.8	188	1	1	<0.1	7	0.3
Ceftriaxone	194	0.7	179	0.9	4	0.1	6	0.3
Sulfamethoxazole and trimethoprim	174	0.7	33	0.2	3	0.1	137	6.7
Azithromycin	171	0.7	71	0.4	4	0.1	91	4.4
Nystatin	162	0.6	118	0.6	1	<0.1	34	1.7
Combinations of beta-lactamase sensitive penicillins	158	0.6	114	0.6	27	0.8	11	0.5
Penicillins, combinations with other antibacterials	148	0.6	83	0.4	6	0.2	55	2.7
Tobramycin	125	0.5	107	0.6	2	0.1	16	0.8
Phenoxymethylpenicillin	125	0.5	38	0.2	1	<0.1	84	4.1
Ceftazidime	122	0.5	111	0.6	0	0	10	0.5
Ertapenem	114	0.4	104	0.5	6	0.2	3	0.1
Levofloxacin	113	0.4	105	0.5	0	0	6	0.3
Combinations of short-acting sulfonamides	109	0.4	17	0.1	0	0	91	4.4
Combinations of penicillins	108	0.4	83	0.4	21	0.6	2	0.1
Itraconazole	106	0.4	12	0.1	0	0	91	4.4
Linezolid	97	0.4	91	0.5	2	0.1	1	0

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%	N	%	N	%
Colistin (injection, infusion)	83	0.3	50	0.3	1	<0.1	28	1.4
Amphotericin B (parenteral)	78	0.3	57	0.3	0	0	21	1
Amikacin	77	0.3	68	0.4	1	<0.1	3	0.1
Fusidic acid	66	0.3	63	0.3	0	0	2	0.1
Caspofungin	61	0.2	52	0.3	0	0	4	0.2
Voriconazole	53	0.2	32	0.2	0	0	20	1
Ethambutol	48	0.2	46	0.2	0	0	1	0
Isoniazid	47	0.2	36	0.2	0	0	10	0.5
Piperacillin	43	0.2	41	0.2	1	<0.1	0	0
Pivmecillinam	41	0.2	38	0.2	0	0	2	0.1
Sulbactam	39	0.2	19	0.1	17	0.5	0	0
Aztreonam	37	0.1	34	0.2	0	0	2	0.1
Chloramphenicol	34	0.1	32	0.2	0	0	0	0
Ampicillin and enzyme inhibitor	34	0.1	27	0.1	5	0.1	0	0
Pyrazinamide	33	0.1	33	0.2	0	0	0	0
Combinations of intermediate-acting sulfonamides	32	0.1	10	0.1	1	<0.1	21	1
Colistin (oral)	29	0.1	7	<0.1	1	<0.1	20	1
Cefradine	28	0.1	12	0.1	9	0.3	6	0.3
Tigecycline	28	0.1	23	0.1	1	<0.1	0	0
Daptomycin	28	0.1	26	0.1	0	0	2	0.1
Imipenem and enzyme	24	0.1	23	0.1	0	0	0	0

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%	N	%	N	%
inhibitor								
Benzathine benzylpenicillin	23	0.1	18	0.1	2	0.1	3	0.1
Moxifloxacin	19	0.1	17	0.1	1	0	1	<0.1
Rifaximin	17	0.1	7	<0.1	0	0	3	0.1
Sulfametrole and trimethoprim	17	0.1	3	<0.1	0	0	13	0.6
Cefaclor	14	0.1	5	<0.1	8	0.2	0	0
Oxytetracycline	14	0.1	5	<0.1	0	0	6	0.3
Posaconazole	14	0.1	8	<0.1	0	0	5	0.2
Lymecycline	14	0.1	7	<0.1	0	0	5	0.2
Sulfadiazine and trimethoprim	13	0.1	1	<0.1	0	0	12	0.6
Neomycin (oral)	13	0.1	1	<0.1	1	<0.1	10	0.5
Minocycline	12	<0.1	6	<0.1	0	0	4	0.2
Cefuroxime, combinations with other antibacterials	12	<0.1	3	<0.1	9	0.3	0	0
Sulfonamides, combinations with other antibacterials (excl. trimethoprim)	11	<0.1	5	<0.1	0	0	6	0.3
Norfloxacin	10	<0.1	2	<0.1	1	<0.1	7	0.3
Fosfomycin	8	<0.1	7	<0.1	0	0	0	0
Amphotericin B (oral)	8	<0.1	5	<0.1	0	0	3	0.1
Sulfamoxole and trimethoprim	8	<0.1	2	<0.1	0	0	6	0.3

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%	N	%	N	%
Combinations of penicillins with extended spectrum	7	<0.1	5	<0.1	0	0	2	0.1
Combinations of long-acting sulfonamides	7	<0.1	3	<0.1	0	0	4	0.2
Polymyxin B	7	<0.1	5	<0.1	0	0	2	0.1
Ceftriaxone, combinations	6	<0.1	4	<0.1	2	0.1	0	0
Ampicillin	6	<0.1	2	<0.1	2	0.1	1	0
Temocillin	6	<0.1	6	<0.1	0	0	0	0
Ofloxacin	6	<0.1	6	<0.1	0	0	0	0
Streptomycin (parenteral)	5	<0.1	5	<0.1	0	0	0	0
Terbinafine	5	<0.1	5	<0.1	0	0	0	0
Ampicillin, combinations	4	<0.1	3	<0.1	0	0	1	<0.1
Benzathine phenoxymethylpenicillin	4	<0.1	3	<0.1	0	0	1	<0.1
Miconazole	4	<0.1	3	<0.1	0	0	0	0
Anidulafungin	4	<0.1	3	<0.1	0	0	0	0
Penamecillin	4	<0.1	1	<0.1	0	0	3	0.1
Demeclocycline	4	<0.1	0	<0.1	0	0	1	<0.1
Ceftizoxime	4	<0.1	3	<0.1	1	<0.1	0	0
Ticarcillin and enzyme inhibitor	4	<0.1	4	<0.1	0	0	0	0
Cefatrizine	3	<0.1	2	<0.1	1	<0.1	0	0
Cefroxadine	3	<0.1	1	<0.1	1	<0.1	1	<0.1
Pivampicillin	2	<0.1	2	<0.1	0	0	0	0

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%	N	%	N	%
Cefixime	2	<0.1	2	<0.1	0	0	0	0
Cefadroxil	2	<0.1	1	<0.1	1	<0.1	0	0
Telavancin	2	<0.1	2	<0.1	0	0	0	0
Cefpirome	2	<0.1	2	<0.1	0	0	0	0
Cefazolin	2	<0.1	2	<0.1	0	0	0	0
Neomycin (injection, infusion)	2	<0.1	1	<0.1	0	0	1	<0.1
Sulfadiazine	2	<0.1	2	<0.1	0	0	0	0
Tetracycline	2	<0.1	1	<0.1	0	0	0	0
Cefaloridine	2	<0.1	2	<0.1	0	0	0	0
Tinidazole (oral, rectal)	2	<0.1	1	<0.1	0	0	1	<0.1
Dicloxacillin	1	<0.1	1	<0.1	0	0	0	0
Clometocillin	1	<0.1	1	<0.1	0	0	0	0
Bacitracin	1	<0.1	1	<0.1	0	0	0	0
Biapenem	1	<0.1	1	<0.1	0	0	0	0
Sulfamerazine and trimethoprim	1	<0.1	0	<0.1	0	0	1	<0.1
Ticarcillin	1	<0.1	1	<0.1	0	0	0	0
Tinidazole (parenteral)	1	<0.1	0	<0.1	1	<0.1	0	0
Sulfaisodimidine	1	<0.1	1	<0.1	0	0	0	0
Epicillin	1	<0.1	1	<0.1	0	0	0	0
Sulfamethoxazole	1	<0.1	0	<0.1	0	0	1	<0.1
Sulfadiazine and tetroxoprim	1	<0.1	0	<0.1	0	0	1	<0.1
Nitroxoline	1	<0.1	1	<0.1	0	0	0	0

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%	N	%	N	%
Sulfamethizole	1	<0.1	1	<0.1	0	0	0	0
Doripenem	1	<0.1	1	<0.1	0	0	0	0
Talampicillin	1	<0.1	1	<0.1	0	0	0	0
Mezlocillin	1	<0.1	1	<0.1	0	0	0	0
Sulfadimidine and trimethoprim	1	<0.1	0	<0.1	0	0	1	<0.1
Flucytosine	1	<0.1	1	<0.1	0	0	0	0
Ketoconazole	1	<0.1	0	<0.1	0	0	0	0
Pristinamycin	1	<0.1	1	<0.1	0	0	0	0
Sulfadimethoxine	1	<0.1	0	<0.1	0	0	1	<0.1
Micafungin	1	<0.1	1	<0.1	0	0	0	0

Table A-29: Distribution of antimicrobials prescribed for respiratory tract infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI), all

AM	Total number of antimicrobial	Relative percent	HAI	HAI Relative percent	CAI	CAI Relative percent
	N	%	N	%	N	%
Total	**5892**	**100.0**	**1439**	**100.0**	**4437**	**100.0**
Co-amoxiclav	1086	18.2	222	15.4	841	19.0
Clarithromycin	986	16.5	80	5.6	880	19.8
Piperacillin/ tazobactam	915	15.3	421	29.3	475	10.7
Amoxicillin	561	9.4	60	4.2	496	11.2
Doxycycline	447	7.5	93	6.5	347	7.8
Meropenem	281	4.7	112	7.8	167	3.8
Benzylpenicillin	139	2.3	13	0.9	122	2.7
Gentamicin	121	2.0	57	4.0	61	1.4
Metronidazole (parenteral)	107	1.8	42	2.9	61	1.4
Vancomycin (parenteral)	85	1.4	42	2.9	42	0.9

Figure A-2: Top 10 antimicrobials for respiratory tract infection by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI)

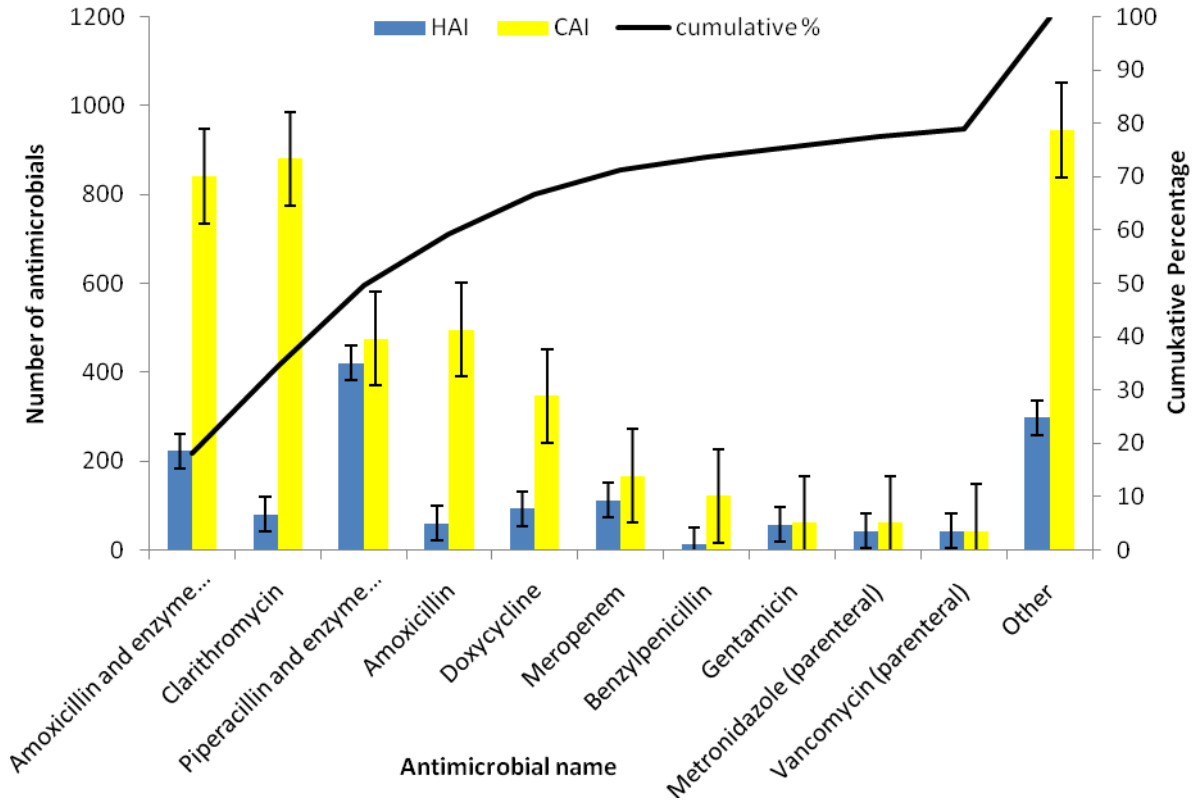


Table A-30: Distribution of antimicrobials prescribed for urinary tract infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI), all

AM	Total number of antimicrobials	Relative percent	HAI	HAI Relative percent	CAI	CAI Relative percent
	N	%	N	%	N	%
Total	2662	100.0	725	100.0	1877	100.0
Trimethoprim	863	32.4	278	38.3	567	30.2
Co-amoxiclav	486	18.3	100	13.8	377	20.1
Nitrofurantoin	272	10.2	88	12.1	177	9.4
Piperacillin/ tazobactam	165	6.2	29	4.0	130	6.9
Gentamicin	140	5.3	22	3.0	116	6.2
Amoxicillin	136	5.1	35	4.8	98	5.2
Ciprofloxacin	128	4.8	41	5.7	83	4.4
Meropenem	97	3.6	29	4.0	67	3.6
Cefalexin	75	2.8	21	2.9	52	2.8
Cefuroxime	25	0.9	3	0.4	21	1.1

Figure A-3: Top 10 antimicrobials for urinary tract infection by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI)

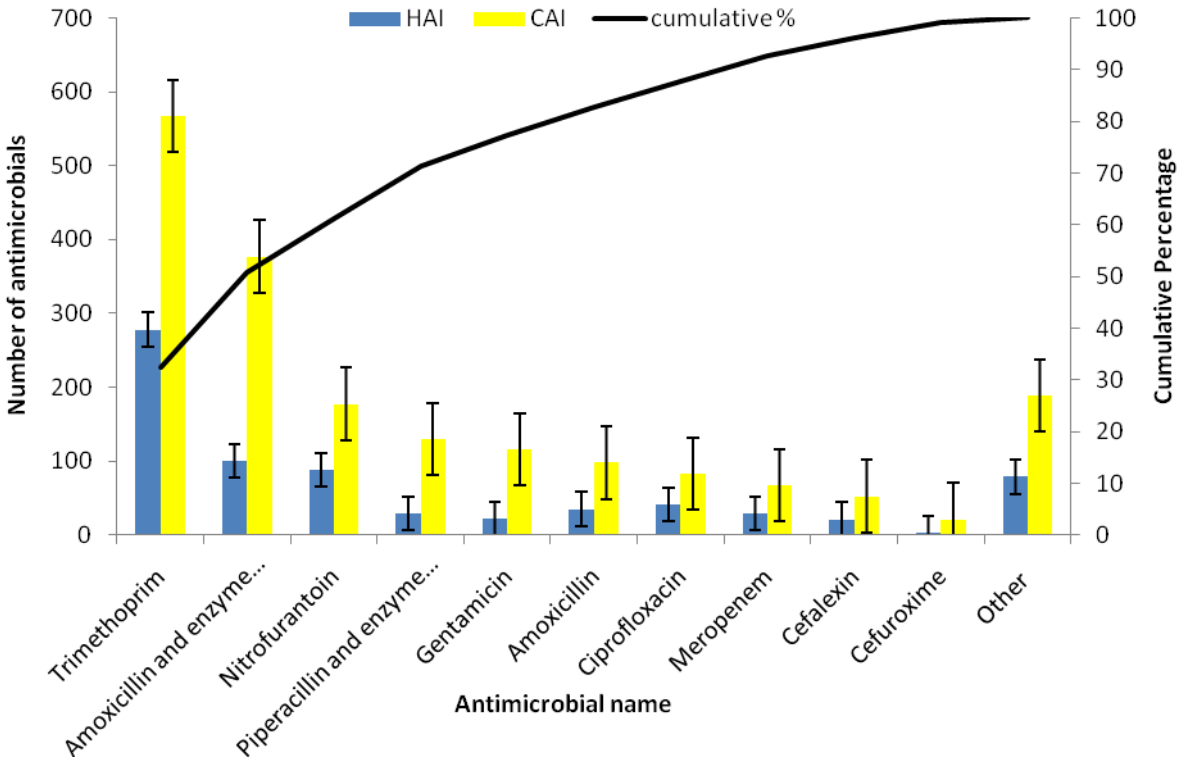


Table A-31: Distribution of antimicrobials prescribed for gastrointestinal infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI), all

AM	Total number of antimicrobials	Relative percent	HAI	HAI Relative percent	CAI	CAI Relative percent
	N	%	N	%	N	%
Metronidazole (parenteral)	417	17.0	76	11.4	337	19.0
Other antimicrobial	396	15.8	118	16.9	271	15.6
Metronidazole (oral, rectal)	317	12.9	136	20.4	180	10.2
Piperacillin/ tazobactam	309	12.6	86	12.9	219	12.4
Co-amoxiclav	288	11.7	29	4.3	257	14.5
Vancomycin (oral)	175	7.1	120	18.0	54	3.1
Gentamicin	144	5.9	25	3.7	119	6.7
Meropenem	115	4.7	46	6.9	69	3.9
Ciprofloxacin	108	4.4	19	2.8	89	5.0
Amoxicillin	105	4.3	6	0.9	99	5.6
Cefuroxime	84	3.4	7	1.0	76	4.3

Figure A-4: Top 10 antimicrobials for gastrointestinal infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI)

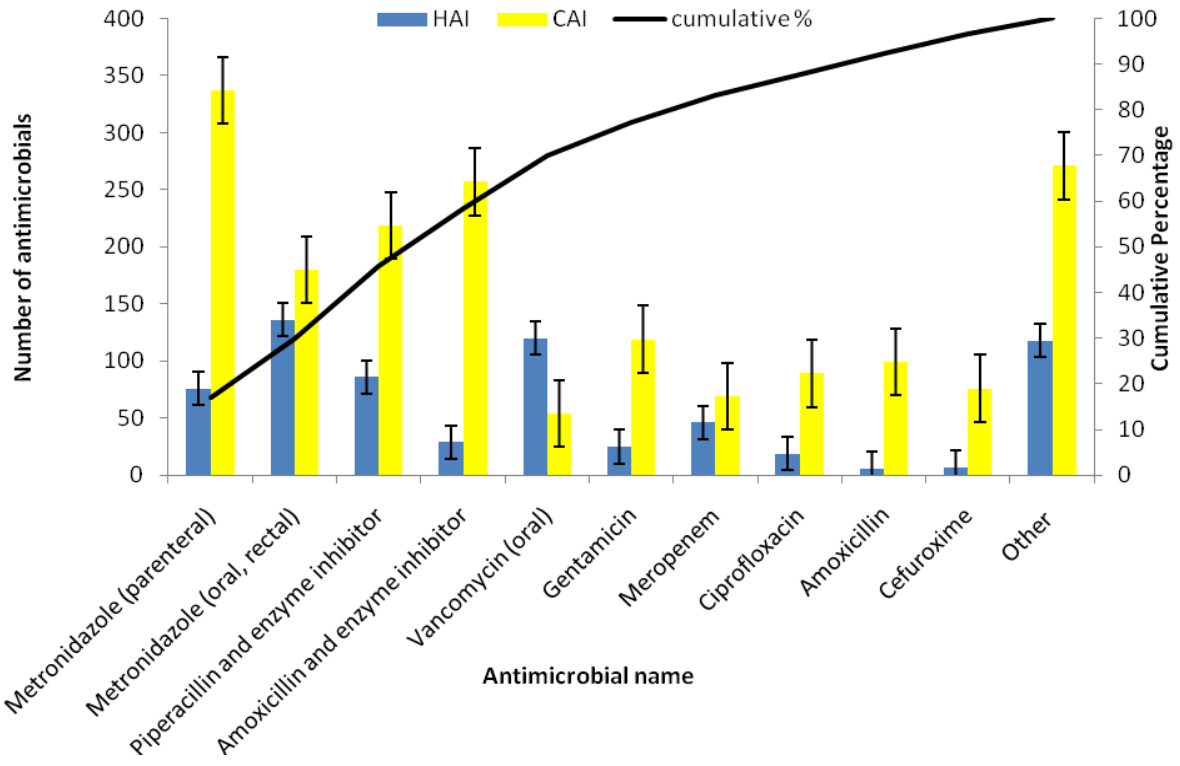


Table A-32: Distribution of antimicrobials prescribed for clinical sepsis by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI), all

AM	Total number of antimicrobials	Relative percent	HAI	HAI Relative percent	CAI	CAI Relative percent
	N	%	N	%	N	%
Total	2725	100.0	1019	100.0	1639	100.0
Piperacillin/ tazobactam	495	18.2	172	16.9	304	18.5
Meropenem	288	10.6	131	12.9	151	9.2
Gentamicin	281	10.3	117	11.5	157	9.6
Co-amoxiclav	269	9.9	74	7.3	187	11.4
Vancomycin (parenteral)	155	5.7	79	7.8	72	4.4
Benzylpenicillin	129	4.7	48	4.7	80	4.9
Flucloxacillin	124	4.6	51	5.0	70	4.3
Teicoplanin	105	3.9	56	5.5	44	2.7
Metronidazole (parenteral)	83	3.0	24	2.4	59	3.6
Amoxicillin	82	3.0	20	2.0	61	3.7

Figure A-5: Top 10 antimicrobials for clinical sepsis by indication: hospital acquired infection (HAI) and community acquired indication (CAI), all

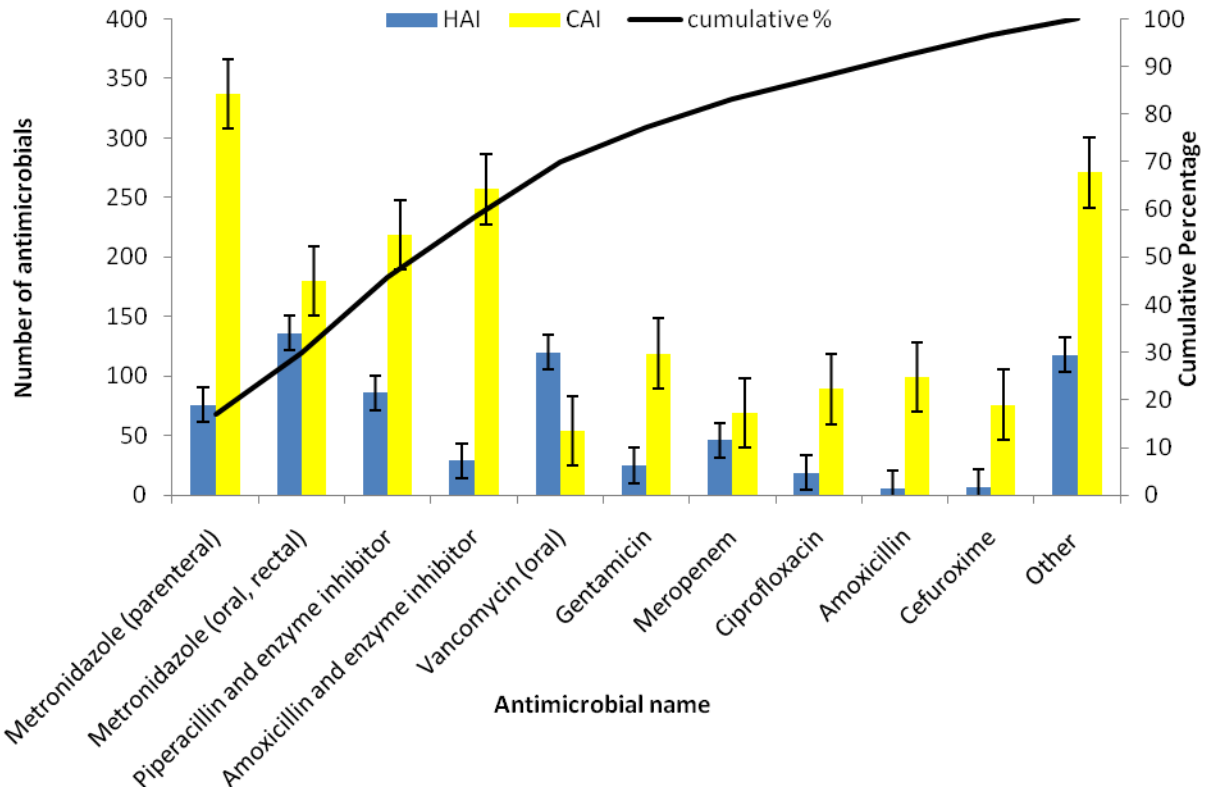


Table A-33: HCAI prevalence by hospital type (ECDC) – paediatrics

Hospital type	Number of patients surveyed	Percent of total patients surveyed	Number of patients with HCAI	Prevalence of HCAI %
	N	% (95% CI)	N	% (95% CI)
Total	4372	100.0	237	5.4 (2.7 – 11.7)
Specialised	375	8.6 (7.7 - 9.5)	50	13.3 (10.1 - 17.2)
Tertiary	1134	25.9 (24.4 - 27.5)	85	7.5 (6.0 - 9.2)
Secondary	1739	39.8 (37.9 - 41.7)	63	3.6 (2.8 - 4.6)
Primary	1124	25.7 (24.2 - 27.3)	39	3.5 (2.5 - 4.7)

Table A-34: Number and percent of sources of bloodstream infection (BSI) – Paediatrics

BSI origin	Number of BSI	Relative percent of BSI
	N	%
Primary BSI	**38**	**100.0**
BSI of unknown origin and not stated	**18**	**47.4**
Catheter-related	**10**	**26.3**
Central Vascular Catheter	8	21.1
Peripheral Vascular Catheter	2	5.3
Secondary BSI	**3**	**7.9**
Respiratory	0	0.0
UTI	0	0.0
SSI	1	2.6
Gastrointestinal	2	5.3
SSTI	0	0.0
Other (undefined)	0	0.0

Table A-35: Microbiological organisms and resistance associated with types of HCAI – paediatrics

Micro-organism	Total	Percent of total	Pneumonia/ LRTI	Percent Pneumonia/LRTI	SSI	Percent SSI	UTI	Percent UTI	BSI	Percent BSI	GI	Percent GI	Other	Percent Other
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
N of HAI, all	234		40		17		2		38		11		126	
N of HAI with micro-organisms, all	73	31.2	11	27.5	6	35.3	1	50	34	89.5	1	9.1	20	15.9
N of micro-organisms	78	100	11	100	10	100	1	100	35	100	1	100	20	100
Enterobacteriaceae														
Enterobacteriaceae, susceptible to C3G	11	14.1	1	9.1	1	10	0	0	5	14.3	0	0	4	20
Enterobacteriaceae, C3G resistant		1.3	0	0	0	0	0	0	1	2.9	0	0	0	0
Enterobacteriaceae, unknown susceptibility	7	9	2	18.2	2	20	1	100	2	5.7	0	0	0	0
S. aureus														
MSSA	13	16.7	0	0	2	20	0	0	6	17.1	0	0	5	25
S. aureus, unknown susceptibility	2	2.6	1	9.1	0	0	0	0	1	2.9	0	0	0	0
Enterococcus spp														
Enterococcus spp, unknown susceptibility	2	2.6	0	0	1	10	0	0	1	2.9	0	0	0	0
Pseudomonas aeruginosa														
Pseudomonas aeruginosa, carbapenem susceptible	2	2.6	0	0	1	10	0	0	0	0	0	0	1	5
Pseudomonas aeruginosa, unknown susceptibility	4	5.1	2	18.2	0	0	0	0	2	5.7	0	0	0	0
Other	23	29.5	4	36.4	3	30	0	0	6	17.1	1	100	9	45
Staphylococci, other/unknown	13	16.7	1	9.1	0	0	0	0	11	31.4	0	0	1	5

LRTI = lower respiratory tract infection UTI = urinary tract infection SSI= surgical site infection GI = gastrointestinal infection BSI = bloodstream infection

Table A-36: AMU by hospital type (ECDC) – paediatrics

Hospital type	Number surveyed	Percent total (95% CI)	Number on antimicrobials	AMU prevalence (95% CI)
Total	4372	100.0	1254	28.7 (27.3 - 30.0)
Specialised	375	8.6 (7.7 - 9.5)	169	45.1 (40.0 - 50.3)
Tertiary	1134	25.9 (24.4 - 27.5)	342	30.2 (27.5 - 32.9)
Primary	1124	25.7 (24.2 - 27.3)	301	26.8 (24.2 - 29.5)
Secondary	1739	39.8 (37.9 - 41.7)	442	25.4 (23.4 - 27.5)

Table A-37: AM groups prescribed – paediatrics

Name of antimicrobials	Total	Percent total
Total	2028	100.0
Other aminoglycosides	340	16.8
Third-generation cephalosporins	297	14.6
Beta-lactamase sensitive penicillins	264	13.0
Combinations of penicillins, incl. beta-lactamase inhibitors	248	12.2
Beta-lactamase resistant penicillins	159	7.8
Glycopeptide antibacterials	102	5.0
Macrolides	93	4.6
Penicillins with extended spectrum	84	4.1
Imidazole derivatives	57	2.8
Second-generation cephalosporins	51	2.5
Carbapenems	44	2.2
Triazole derivatives	39	1.9
Intestinal antiinfectives, antibiotics	31	1.5
Trimethoprim and derivatives	31	1.5
Fluoroquinolones	24	1.2
Nitroimidazole derivatives	23	1.1
Unknown	23	1.1
Combinations of antibacterials	21	1.0
Combinations of sulfonamides and trimethoprim, incl. derivatives	20	1.0
Polymyxins	16	0.8
First-generation cephalosporins	11	0.5
Lincosamides	10	0.5
Antimycotics, antibiotics	10	0.5
Antimycobacterials, antibiotics	5	0.2
Other antimycotics for systemic use	5	0.2
Short-acting sulfonamides	5	0.2
Tetracyclines	3	0.1
Other antibacterials	3	0.1
Nitrofuran derivatives	2	0.1
Amphenicols	2	0.1
Intermediate-acting sulfonamides	1	<0.1
Other/unknown	1	<0.1
Steroid antibacterials	1	<0.1
Long-acting sulfonamides	1	<0.1
Fourth-generation cephalosporins	1	<0.1

Table A-38: Antimicrobials prescribed by treatment indication, paediatrics

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%		N	%	N
Total	2028	100.0	1421	100.0	123	100.0	384	100.0
Gentamicin	274	13.5	183	12.9	7	5.7	65	16.9
Benzylpenicillin	246	12.1	158	11.1	8	6.5	62	16.1
Co-amoxiclav	168	8.3	116	8.2	41	33.3	10	2.6
Flucloxacillin	159	7.8	120	8.4	15	12.2	20	5.2
Cefotaxime	155	7.6	123	8.7	2	1.6	22	5.7
Ceftriaxone	97	4.8	88	6.2	2	1.6	5	1.3
Amoxicillin	81	4.0	68	4.8	3	2.4	8	2.1
Piperacillin/tazobactam	68	3.4	61	4.3	1	0.8	2	0.5
Vancomycin (parenteral)	65	3.2	60	4.2	2	1.6	3	0.8
Metronidazole (P)	56	2.8	41	2.9	12	9.8	1	0.3
Cefuroxime	49	2.4	36	2.5	11	8.9	2	0.5
Tobramycin	46	2.3	35	2.5	0	0.0	11	2.9
Meropenem	43	2.1	39	2.7	0	0.0	4	1.0
Ceftazidime	40	2.0	32	2.3	0	0.0	7	1.8
Teicoplanin	37	1.8	29	2.0	3	2.4	4	1.0
Clarithromycin	34	1.7	31	2.2	0	0.0	2	0.5
Azithromycin	33	1.6	20	1.4	2	1.6	10	2.6
Trimethoprim	31	1.5	4	0.3	1	0.8	26	6.8
Erythromycin	26	1.3	12	0.8	0	0.0	7	1.8
Ciprofloxacin	24	1.2	20	1.4	0	0.0	4	1.0
Metronidazole (O/R)	23	1.1	16	1.1	2	1.6	4	1.0
Fluconazole	23	1.1	11	0.8	1	0.8	11	2.9
Unknown	23	1.1	0	0.0	0	0.0	0	0.0
Nystatin	21	1.0	6	0.4	0	0.0	14	3.6
Penicillins, combinations with other antibacterials	20	1.0	9	0.6	0	0.0	11	2.9
Amikacin	20	1.0	18	1.3	0	0.0	2	0.5
Sulfamethoxazole and trimethoprim	18	0.9	3	0.2	1	0.8	14	3.6
Itraconazole	14	0.7	2	0.1	0	0.0	11	2.9

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%		N	%	N
Colistin (injection, infusion)	14	0.7	6	0.4	1	0.8	7	1.8
Phenoxymethylpenicillin	11	0.5	3	0.2	0	0.0	8	2.1
Amphotericin B (parenteral)	10	0.5	8	0.6	0	0.0	2	0.5
Clindamycin	10	0.5	9	0.6	0	0.0	1	0.3
Cefalexin	9	0.4	6	0.4	1	0.8	2	0.5
Combinations of penicillins	7	0.3	6	0.4	1	0.8	0	0.0
Combinations of beta-lactamase sensitive penicillins	6	0.3	3	0.2	2	1.6	1	0.3
Combinations of short-acting sulfonamides	5	0.2	0	0.0	0	0.0	5	1.3
Colistin (oral)	5	0.2	2	0.1	0	0.0	3	0.8
Rifampicin	5	0.2	5	0.4	0	0.0	0	0.0
Ampicillin and enzyme inhibitor	4	0.2	2	0.1	2	1.6	0	0.0
Caspofungin	4	0.2	3	0.2	0	0.0	1	0.3
Ceftriaxone, combinations	3	0.1	3	0.2	0	0.0	0	0.0
Vancomycin (oral)	3	0.1	2	0.1	0	0.0	1	0.3
Voriconazole	2	0.1	1	0.1	0	0.0	0	0.0
Cefaclor	2	0.1	1	0.1	1	0.8	0	0.0
Cefixime	2	0.1	2	0.1	0	0.0	0	0.0
Linezolid	2	0.1	2	0.1	0	0.0	0	0.0
Lymecycline	2	0.1	0	0.0	0	0.0	2	0.5
Nitrofurantoin	2	0.1	1	0.1	0	0.0	1	0.3
Polymyxin B	2	0.1	1	0.1	0	0.0	1	0.3
Chloramphenicol	2	0.1	2	0.1	0	0.0	0	0.0
Combinations of penicillins with extended	1	0.0	1	0.1	0	0.0	0	0.0

Name of antimicrobial	Total number of antimicrobials		Antimicrobials prescribed for treatment indication		Antimicrobials prescribed for surgical prophylaxis		Antimicrobials prescribed for medical prophylaxis	
	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent	Number of antimicrobials	Relative percent
	N	%	N	%		N	%	N
spectrum								
Neomycin (oral)	1	0.0	0	0.0	0	0.0	0	0.0
Penamecillin	1	0.0	0	0.0	0	0.0	1	0.3
Amphotericin B (oral)	1	0.0	1	0.1	0	0.0	0	0.0
Cefroxadine	1	0.0	0	0.0	0	0.0	1	0.3
Ertapenem	1	0.0	0	0.0	1	0.8	0	0.0
Sulfadimethoxine	1	0.0	0	0.0	0	0.0	1	0.3
Sulfonamides, combinations with other antibacterials (excl. trimethoprim)	1	0.0	1	0.1	0	0.0	0	0.0
Daptomycin	1	0.0	1	0.1	0	0.0	0	0.0
Ampicillin, combinations	1	0.0	1	0.1	0	0.0	0	0.0
Cefpirome	1	0.0	1	0.1	0	0.0	0	0.0
Doxycycline	1	0.0	1	0.1	0	0.0	0	0.0
Miconazole	1	0.0	1	0.1	0	0.0	0	0.0
Sulfamerazine and trimethoprim	1	0.0	0	0.0	0	0.0	1	0.3
Ticarcillin and enzyme inhibitor	1	0.0	1	0.1	0	0.0	0	0.0
Micafungin	1	0.0	1	0.1	0	0.0	0	0.0
Fusidic acid	1	0.0	0	0.0	0	0.0	0	0.0
Ethambutol	1	0.0	0	0.0	0	0.0	1	0.3
Cefatrizine	1	0.0	1	0.1	0	0.0	0	0.0
Sulfadiazine and trimethoprim	1	0.0	0	0.0	0	0.0	1	0.3
Piperacillin	1	0.0	1	0.1	0	0.0	0	0.0
Combinations of intermediate-acting sulfonamides	1	0.0	0	0.0	0	0.0	1	0.3

Table A-39: Distribution of antimicrobials prescribed for respiratory tract infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI) – paediatrics

AM	Total number of antimicrobial	Relative percent	HAI	HAI Relative percent	CAI	CAI Relative percent
	N	%	N	%	N	%
Total	321	100.0	63	100.0	256	100.0
Co-amoxiclav	39	12.1	9	14.3	30	11.7
Tobramycin	33	10.3	0	0.0	33	12.9
Ceftazidime	26	8.1	0	0.0	26	10.2
Amoxicillin	25	7.8	1	1.6	24	9.4
Clarithromycin	25	7.8	3	4.8	22	8.6
Gentamicin	21	6.5	12	19.0	8	3.1
Azithromycin	18	5.6	0	0.0	18	7.0
Cefuroxime	18	5.6	2	3.2	16	6.3
Flucloxacillin	14	4.4	4	6.3	10	3.9

Figure A-6: Top 10 antimicrobials for respiratory tract infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI) – paediatrics

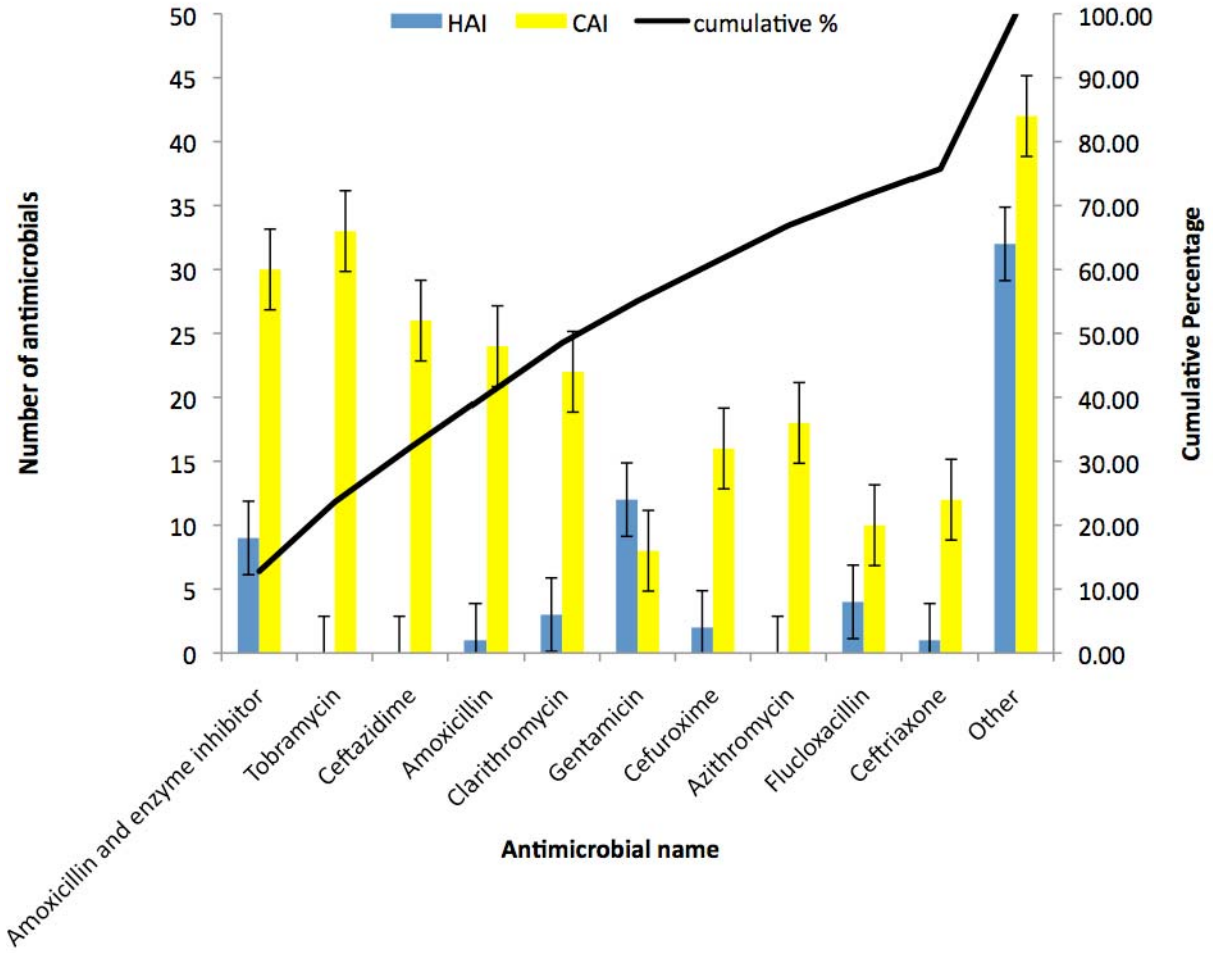


Table A-40: Distribution of antimicrobials prescribed for urinary tract infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI) – paediatrics

AM	Total number of antimicrobial	Relative percent	HAI	HAI Relative percent	CAI	CAI Relative percent
	N	%	N	%	N	%
Total	65	100.0	3	100.0	61	100.0
Cefotaxime	16	24.6	0	0.0	16	26.2
Co-amoxiclav	11	16.9	0	0.0	11	18.0
Ceftriaxone	8	12.3	1	33.3	7	11.5
Ciprofloxacin	5	7.7	0	0.0	4	6.6
Gentamicin	5	7.7	0	0.0	5	8.2
Cefuroxime	4	6.2	0	0.0	4	6.6
Amoxicillin	3	4.6	0	0.0	3	4.9
Trimethoprim	2	3.1	0	0.0	2	3.3
Penicillins, combinations with other antibacterials	1	1.5	0	0.0	1	1.6

Figure A-7: Top 10 antimicrobials for urinary tract infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI) – paediatrics

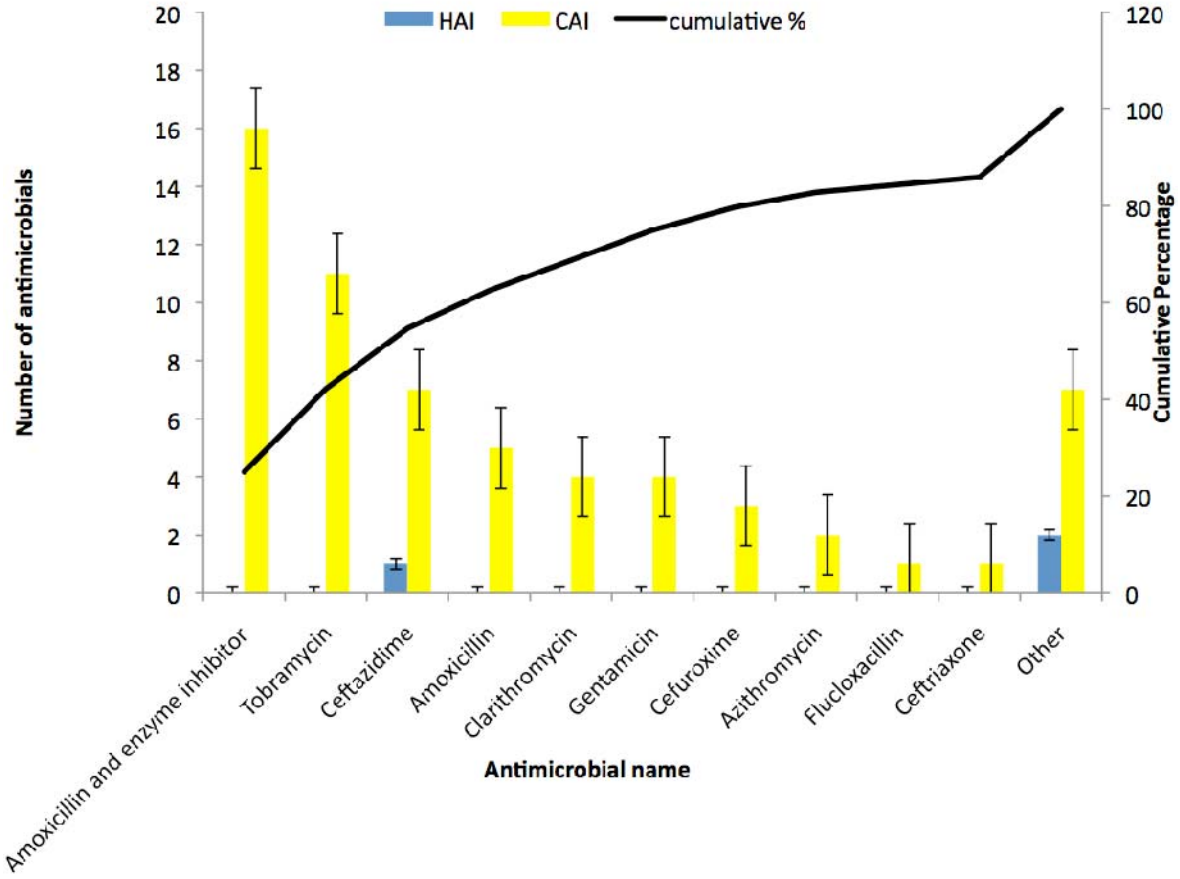


Table A-41: Distribution of antimicrobials prescribed for gastrointestinal infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI) – paediatrics

AM	Total number of antimicrobial	Relative percent	HAI	HAI Relative percent	CAI	CAI Relative percent
	N	%	N	%	N	%
Total	100	100.0	27	100.0	69	100.0
Metronidazole (parenteral)	16	16.0	2	7.4	14	20.3
Gentamicin	13	13.0	6	22.2	7	10.1
Co-amoxiclav	11	11.0	2	7.4	9	13.0
Piperacillin/tazobactam	11	11.0	5	18.5	4	5.8
Metronidazole (oral, rectal)	8	8.0	2	7.4	6	8.7
Vancomycin (parenteral)	6	6.0	2	7.4	2	2.9
Ciprofloxacin	4	4.0	0	0.0	4	5.8
Cefotaxime	4	4.0	1	3.7	3	4.3
Benzylpenicillin	4	4.0	1	3.7	3	4.3
Flucloxacillin	4	4.0	3	11.1	1	1.4

Figure A-8: Top 10 antimicrobials for gastrointestinal infections by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI) – Paediatrics

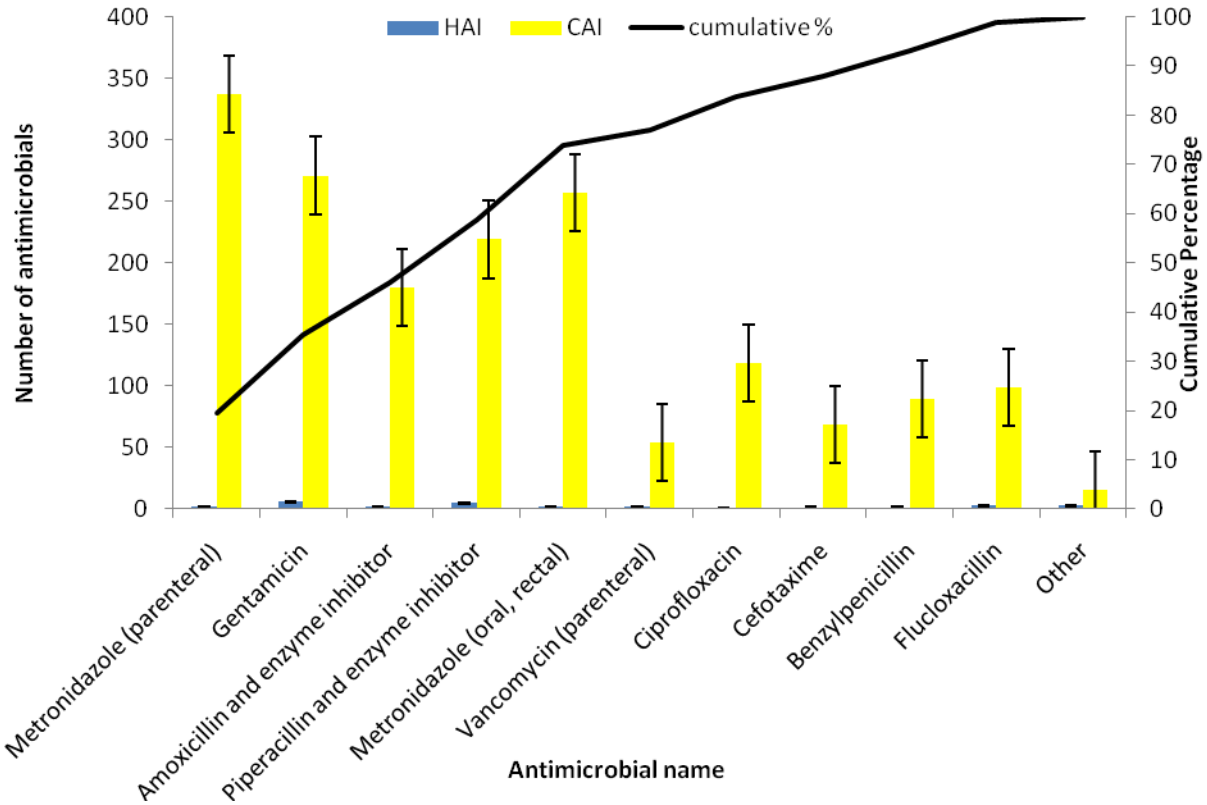
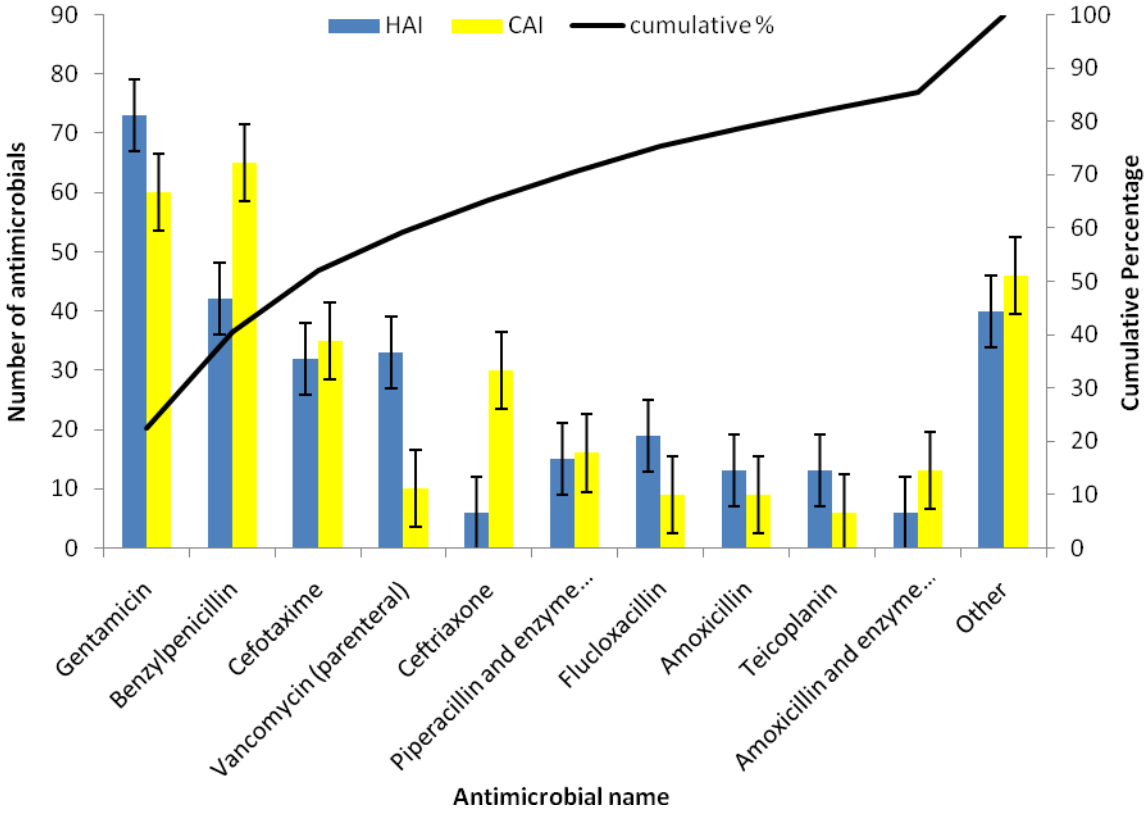


Table A-42: Distribution of antimicrobials prescribed for clinical sepsis by indication: hospital-acquired infection (HAI) and community-acquired indication (CAI) – paediatrics

AM	Total number of antimicrobial	Relative percent	HAI	HAI Relative percent	CAI	CAI Relative percent
	N	%	N	%	N	%
Total	601	100.0	292	100.0	299	100.0
Gentamicin	134	22.3	73	25.0	60	20.1
Benzylpenicillin	108	18.0	42	14.4	65	21.7
Cefotaxime	67	11.1	32	11.0	35	11.7
Vancomycin (parenteral)	45	7.5	33	11.3	10	3.3
Ceftriaxone	36	6.0	6	2.1	30	10.0
Piperacillin/tazobactam	32	5.3	15	5.1	16	5.4
Flucloxacillin	28	4.7	19	6.5	9	3.0
Amoxicillin	22	3.7	13	4.5	9	3.0
Teicoplanin	20	3.3	13	4.5	6	2.0

Figure A-9: Top 10 antimicrobials for clinical sepsis by indication: hospital acquired infection (HAI) and community acquired indication (CAI) – paediatrics



14.0 Appendix 6 – Differences between 2006 and 2011 HCAI PPS

The European PPS used European case definitions where they exist[47, 48] and complemented them by case definitions of the Centres for Disease Control and Prevention (CDC), Atlanta, as used by CDC's National Healthcare Safety Network (NHSN, formerly NNIS)[49]. A study outsourced by ECDC explored the concordance between the two sets of definitions in order to be able to quantify the difference in classification of cases and therefore to allow to correctly interpret (correct) results from PPS studies using different case definitions[33].

The European case definitions used in the 2011 Point Prevalence Survey in England are the following:
- HELICS/IPSE case definitions:
- Surgical site infection [47],
- Pneumonia[48],
- Bloodstream infection [48],
- Central vascular catheter related infection [48],
- Urinary tract infections [48]
- *Clostridium difficile* infection [50]
- Specific neonatal definitions – established by the KISS network [51, 52]:
- Clinically suspected bloodstream infections (clinical sepsis)
- Laboratory-confirmed bloodstream infection
- Laboratory-confirmed bloodstream infection with coagulase-negative staphylococci
- Pneumonia in neonates
- Necrotising enterocolitis

The CDC HCAI case definitions in neonates were replaced by case definitions used in the Neo-KISS system. These definitions were not established at the EU level, but they were preferred by the EU-PPS expert group.

All other case definitions are CDC/NHSN case definitions[49].

Summary of comparisons

Comparisons were been made between the English PPS protocol and codebooks 2011 and the HIS/ICNA Prevalence Survey Protocol 2006 v1.2.1[23] Details of how these difference would impact on the data have been included in Part 1 of the report in the discussion. Not all information has been included but the main differences have been highlighted below.

1. Inclusion/exclusion criteria

2006	2011
NHS trusts with greater than 50 hospital inpatient beds invited to participate. Sampling strategy of selecting 50% of patients from specialties with >40 beds, 20 from specialties with 20-40 beds and all from specialties with <20 beds.	All acute care hospitals in England were invited to participate. No internal hospital patient sampling. All patients in an acute hospital were eligible if they met the criteria.
Rehabilitation patients in acute hospitals	Same

2006	2011
were included unless they were day patients. Rehabilitation wards were excluded.	
Patients on the ward between 9-5pm on the day of the survey were included.	Patients admitted to the ward at ≤ 8am and not discharged from the ward at the time of the survey were included.
Paediatrics and Neonates were excluded.	All paediatrics included. Neonates born before 8am were included.
Psychiatric patients (primary condition) were excluded.	If psychiatric patient was admitted to an acute bed they were included.

2. Training

2006	2011
Coordinators 11 regional coordinators were appointed in each country and trained in all aspects of the survey at an intensive three-day course. The role of the coordinators was to support the hospitals throughout the survey, which included assisting with planning, training, logistical and methodological issues.	 Two national coordinators were dedicated to the delivery of training. The lead national coordinator developed (with colleagues at HPA) the training packages for ECDC. The training package was piloted with leads from each EU country in March 2011. The second national coordinator attended intensive one to one, train the trainer on all aspects of the PPS including how to deliver the training for hospitals. The national PPS team provided daily support for all hospitals throughout the survey.
Hospital staff Training was given to staff likely to be involved in data collection. There were 13 half day symposia at venues across England, Northern Ireland and the Republic of Ireland. Training was conducted separately at each hospital in Wales.	 Training was coordinated by the HPA and delivered in association with the regional epidemiology units by the national coordinators. 10 regional 'Train the Trainer' training days were held in England between June-August 2011. An additional mop up training day was held in London and independent sector hospitals were invited to this day. At each of the training days, the local Health Protection teams also attended.

2006	2011
Validation of training The coordinators also conducted validation studies at the time of the survey. In the Republic of Ireland, the infection prevention and control teams collected data assisted by the coordinators.	**Validation of training** The validation of training in England used the same model as that used in all other countries in Europe and included; - All training was validated on the training day with mini tests throughout the training - All participating trusts were required to attend a training day and submit responses to 2 case studies which 'tested' their understanding of all aspects of the PPS - If trusts did not receive an adequate pass they were required to submit a response to a third case study - All participating trusts received adequate marks in either the first two case studies or the third. - No trust failed the case studies. Scotland (GCU) coordinated the ECDC funded tender for validation. Two English hospitals participated. Full results and final validation recommendations will be published at a later date.
Ongoing support Coordinators provided ongoing support at each of the coordinating centres	A dedicated helpline ppsengland@hpa.org.uk was set up and all participating trusts were encouraged to email their queries via this helpline. All emails were responded to within 24 hours. Telephone help was often requested and given – usually within one working day.

3. Data collection and management – similar data collection criteria – differences below.

2006	2011
Data collected on paper and then scanned and sent to centre in N Ireland. Errors in transcription corrected by N Ireland.	Data collected on paper and then entered into the Helicswin database. This was a free access database used across Europe developed and provided by ECDC.
Data management Completed survey forms were collated and checked for obvious errors and omissions in the hospital at the time of the survey and when possible clarified with hospital staff. Questionnaires were scanned with a small number of validation checks. The scanned data for England, Northern Ireland and Wales was exported to SPSS by the data management team in Belfast and subjected to a systematic series of detailed queries to clean the data. For example, looking for extremes in age, inconsistent answers such as negatives for surgery but a surgery code provided. Data cleaning was carried out independently in the Republic of Ireland.	**Data management** Trusts were responsible for their own data and checking their data entry. Trusts were given a deadline to submit data by the end of November 2011 however the deadline was extended to the end of December 2011. Data were submitted from each trust as an mdb file. Data were exported into excel and data checks were completed on all data For example, cross-checking HCAI numbers, AMU matched, whether there were reasonable figures. All trusts who submitted data were provided with a hospital report and powerpoint presentation with their key data within four weeks of data submission. Reports were in the form of nine key tables of their data. Data checking flagged up a number of possible errors in data entry and all trusts were asked to check their reports/tables to see if the data were correct. All trusts were invited to correct data entry errors and resubmit data by 23 February 2012
Data collection form	
Not collected	Hospital size Number of acute care beds Number of ICU beds
Hospital code provided	Hospital code provided Hospital type (according to ECDC definitions) Primary

2006	2011
	Secondary Tertiary Specialised
Denominators collected for all patients.	Detailed denominator data requested e.g. Total number of beds in included wards Total number of patients in PPS Number of discharges/admission in a year Number of patient days/year Alcoholic hand rub consumption in litres/year Number of patient rooms in hospital Number of single patient rooms in hospital Number of FTE infection control nurses Number of FTE infection control doctors (others in infection prevention and control team)
Surgery within last 30 days with no implant (code) Surgery within last year involving implant (code)	NHS number McCabe score Surgery since admission (NHSN or non-NHSN) No code requested although codes provided,
Devices – similar and in addition the devices were also requested if present in preceding seven days.	Devices – CVC, PVC, UC, intubation In the case definition section there is a linking question for each relevant device and the timelines for the device being in prior to the infection differ to the 2006 survey. i.e. Relevant device insitu – 48 hours before the onset of infection, for UTI – seven days before the onset
Parenteral nutrition Bladder instrumentation	These were not included
Confirmed norovirus Current *C. difficile* infection	These were collected if they met HCAI definition, under microorganisms section.

2006	2011
MRSA causative organisms was the only option for micro-organism	Option for microorganism and resistance patterns for all organisms including *S. aureus.* Limited resistance data was collected.

4. Definition of HCAI

2006	2011
No evidence of the infection incubating at time of admission to hospital unless related to SSI And Active infection is classified as an infection when signs and symptoms are present on the survey date or signs and symptoms were present in the past and the patient is still receiving treatment for that infection on the survey date.	Defined patients admitted with HCAI included (SSI, CDI, 48 hours within discharge) Similar active infection definition
For most bacterial infections this means that the infection usually becomes evident 48 hours after admission Though this could be earlier for those who have had a device or procedure	Onset of symptoms was on day 3 (day of admission = day 1) Same definition

6. Specialty groups

There are differences in the specialists groups that were used in the 2006 survey compared to the 2011 survey. In order to enable comparisons to be made between the two surveys the 2006 PPS rules have been applied to the 2011 data. As some of the specialty groups are not directly comparable between the two years, similar specialty groups have be group together to enable comparisons. The table below shows the main differences between the specialty groups used in 2006 compared to 2011 and the groupings which were made to allow comparison.

2006	2011
Main specialty codes are aligned with the specialties recognised in the European Specialist Medical Qualifications Order 1995 and European Primary and Specialist Dental Qualifications Regulations 1998	Specialty codes provided by ECDC
Colorectal surgery Upper gastrointestinal surgery Hepatobiliary and pancreatic surgery	Digestive tract
Care of the elderly	Geriatrics
Critical care medicine Coronary care unit Surgical high dependency unit Medical high dependency unit.	All categories of intensive care Medicine: Medical ICU Mixed ICU Other ICU Specialised ICU Surgical ICU
Clinical haematology Blood and marrow transplantation	Haematology
Cardiac surgery	Cardio surgery Cardiovascular surgery
Thoracic surgery Cardiothoracic transplantation Cardiothoracic surgery	Thoracic surgery
Genitourinary medicine	Not a specialty group in 2011
Breast surgery	Not a specialty group in 2011
Oral surgery	Not a specialty group in 2011
Clinical immunology	Not a specialty group in 2011
Clinical microbiology	Not a specialty group in 2011
Pain management	Not a specialty group in 2011
Palliative care	Not a specialty group in 2011
Tropical medicine	Not a specialty group in 2011
Not a specialty group in 2006	Surgery for cancer
Not a specialty group in 2006	Combination of specialties
Not a specialty group in 2006	Neonatology

2006	2011
Not a specialty group in 2006	Psychiatrics
Not a specialty group in 2006	Rehabilitation

5. Diagnosis codes for antimicrobial use – there were no antimicrobials collected in the 2006 survey

6. Statistical methods

2006	2011
95% CI for HCAI prevalence were calculated using score method (Wilson 1927). Odds Ratios were reported for each level of each risk factor relative to a reference category with 95% CI calculated using the method of Mietrrinen and Nurminen. Prevalence values and odds ratios reported to within two decimal points whereas all other percentages are shown to within one decimal place.	Single variable analysis was conducted to give an overall description of the data. Binomial or poisson confidential intervals (CI) were determined as appropriate. As multiple observations were from individual hospitals/ organisations, they are both interdependent and clustered. Therefore a linear mixed effects model was applied to the major tables for each section. This allowed the inclusion of both fixed and random effects. Fixed effects lead to the description of the survey population (the average response for England), while random effects allow estimation of organisation specific means and accounted for the heterogeneity in the responses from different organisations. This linear model provides flexibility of modelling variances and covariances in addition to means from a cross sectional regression model

15.0 Appendix 7 – Limitations of Point Prevalence Surveys

Prevalence surveys are cross-sectional and therefore lead to possible bias towards identifying HCAI and AMU data for those infections with a longer duration of illness (e.g. pneumonia) and HCAI or AMU related to procedures with longer inpatient stays (e.g. prosthetic joint replacement) compared with those with shorter durations of illness or inpatient stay (e.g. UTI, caesarian section respectively)[53]. In this PPS, HCAI requiring prolonged treatment are likely to be overestimated as the definition included all individuals who were still on an AM and met the individual case definition at any time since starting an AM. This bias will also be present and observed for the treatment indications in the AMU section as antimicrobials used for a longer durations will be overestimated. However as the objective of this survey was to estimate the burden (total prevalence) of HCAI, the result is valid in this context.

Overestimation is also likely when applied to surgical prophylaxis of greater than one day, which was estimated at 30% of surgical prophylaxis in this PPS. However, as no surgical prophylaxis should last longer than one day, this remains higher than it should be, and is the only method of easily recording in a point prevalence survey, this important AM quality indicator. There is also likely to be some misclassification in the number of patients on surgical prophylaxis as the AM indication is according to how the AM is prescribed or documented and many antimicrobials may have been initially started for surgical prophylaxis and then continued for a recognised treatment indication (e.g. abdominal organ rupture with peritoneal soiling of faeces, open fracture, abscess or collection found at operation etc.). This likely misclassification demonstrates that further education of clinical teams is required to ensure that they update the AMU indication in clinical records if the indication for the AM changes.

Data on duration of exposure to specific risk factors or interventions (particularly devices) cannot be collected in a prevalence survey and accurate assessment or measurement of risk cannot be elucidated. This would require continuous surveillance.

Another limitation of all surveillance methodologies relates to the application of case definitions. The protocol and definitions used in this survey is the same methodology currently being used throughout Europe, which was developed by ECDC and European experts. However, while the same case definitions will be used, many countries will collect other data variables in accordance to their local protocols and translate the ECDC protocol into their local language, which may generate alterations in local hospital protocols and subsequent deviations from definitions.

The validity and reliability in the use of the case definitions is important. A validation study was not conducted for the PPS. There is a significant cost associated with large scale validation related to the number of in-depth chart reviews of those with and without HCAI in order to determine the sensitivity, specificity, positive and negative predictive value related to the case definitions. [42] The validity and reliability is likely to be affected by how well the data collectors were trained in the application of the case definitions. One validation study of intensive care unit surveillance in Germany[43], reported a mean sensitivity of 66%, and mean

specificity of 99.4%. Another validation study in the US[54] determined that the sensitivity varied with the type of infections with sensitivity of 59% for UTI, 68% for pneumonia, and 85% for BSI; corresponding specificity was over 97% for all types of HCAI. The results of the ECDC pilot validation study for PPS will be published shortly alongside recommendations for large scale validation for future PPS.

Prevalence surveys that use alternative definitions need to be interpreted with caution and therefore comparisons between this survey and previous surveys carried out in England are limited.[6] The 2006 PPS used case definitions from the CDC.The current survey uses European case definitions (HELICS), NEO-KISS network definitions for neonates and where definitions for an infection did not exist in Europe, CDC definitions, as recommended by the joint European expert group in January 2009. [47, 48, 50, 51] However, a concordance study was funded by ECDC and conducted by a group of experts from seven European countries who looked at the agreement for BSI and pneumonia comparing European (HELICS) and CDC definitions. The authors concluded that although there are differences between the two definitions they will not compromise comparability of results.[42]

Prevalence surveys in acute hospitals do not take a whole healthcare economy approach and only include HCAI that meet the definition used. The HCAI definition utilised in this survey did not include HCAI that develop in patients who underwent procedures or treatments as day cases, regular attenders (e.g. dialysis) or whose admission was outside the duration in the definition (CDI 28 days, SSI 1 month or 1 year depending on whether a prosthesis was in place, all others 2 days). Therefore this is likely to underestimate the burden of HCAI related to rather than currently residing in acute care hospitals.

We do not report organisation level data in this survey for a number of reasons. This survey was voluntary and anonymous in order to determine the true burden, in hospitals who considered themselves able to devote substantial time to the collection of these data between September and November 2011. Public reporting, especially when it is voluntary, risks incomplete data collection, poor data quality and under-reporting of infections as organisations may fear the consequences of high rates of HCAI or AMU in relation to other organisations. In addition, the prevalence of HCAI and AMU is an estimate only for a single point in time and may not reflect the true prevalence of HCAI or AMU in individual organisations. Results should be interpreted carefully and take into account confidence intervals which are influenced by the hospital size (number of patients) and the frequency of the event (relatively wider intervals for rare events). Even if all patients in the hospital are included in the survey, one should consider that the survey day is only a sample of all possible days in that period. A previous prevalence survey in Spain determined the day of the week to significantly influence the prevalence rate varying from 6.9% on Wednesday to 7.7% on Saturday.[55]

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