Point Prevalence Survey of Hospital-Acquired Infections & Antimicrobial Use in European Acute Care Hospitals: May 2012

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Executive Summary

Hospital & Eligible Patient Characteristics

- In May 2012, 50 acute Irish hospitals (42 public and eight private) participated in the voluntary European Centre for Disease Prevention and Control (ECDC) point prevalence survey (PPS) of hospital-acquired infections (HAI) and antimicrobial use (AMU). The breakdown of participating hospitals by type included: 15 primary/general, ten secondary/regional, six tertiary, 11 specialist public, one specialist private and seven other private hospitals
- The average number of acute beds in the 42 public hospitals ranged from 135 to 603, depending on the hospital type. The average proportion of single patient rooms was lowest in public primary hospitals (14.8%) and highest in private hospitals (36.8%)
- One hospital reported having no infection prevention and control nurse (IPCN) and 17 hospitals (34%) reported having no designated infection prevention and control doctor (IPCD). Both public and private hospitals reported having 0.70 IPCN per 100 beds. Private hospitals reported having 0.19 IPCD per 100 beds, which was higher than the 0.11 IPCD/100 beds reported by public hospitals
- Of the 9,030 eligible patients surveyed, there was a slight female preponderance at 53.7%, with 12% of the population aged <16 and 48% aged ≥65 years
- Eighteen percent of patients had undergone surgery since hospital admission and 49% had at least one invasive device *in situ* (e.g., peripheral vascular catheter or urethral catheter)

Hospital-Acquired Infections

- There were 501 active HAI identified in 467 patients. The overall HAI prevalence was 5.2%. The majority of the HAI occurred in patients aged ≥16 years (92.9%)
- The overall HAI prevalence, by hospital type was highest for tertiary hospitals (7.5%) and lowest for private hospitals (2.5%)
- Patients with HAI were more likely to have risk factors, such as surgery since hospital admission and invasive medical devices *in situ,* than the overall eligible population
- The prevalence of HAI was highest in augmented care units [adult and paediatric intensive care units (ICU), neonatal intensive care units (NICU) and high dependency units (HDU)] (16.5%), followed by surgical wards (6.7%). Psychiatric wards and obstetrics/gynaecology wards had the lowest HAI prevalence (1.5%)
- The top four HAI types reported were:
    - Surgical site infection (91 cases; 18.2%)
    - Pneumonia (86 cases; 17.2%)
    - Urinary tract infection (75 cases; 15%)
    - Bloodstream infection (66 cases; 13%)
- Of the bloodstream infections, 28 (42%) were due to infection of an indwelling vascular catheter

- There were 29 patients with *Clostridium difficile* infection, accounting for 5.7% of all HAI

- The most frequent group of pathogens causing HAI were the *Enterobacteriaceae* and of those, one-in-four were resistant to broad spectrum third generation cephalosporins. *Staphylococcus aureus* was the next most frequent pathogen causing HAI, and 37% of *Staphylococcus aureus* was resistant to flucloxacillin (i.e., meticillin-resistant *Staphylococcus aureus* or MRSA)

Antimicrobial Use

- The survey collected information on all patients who were prescribed antimicrobials, not just those being treated for a HAI. There were 3,108 patients who were prescribed 4,532 systemic antimicrobials. The overall AMU prevalence was 34%. The majority of antimicrobial use occurred in patients aged ≥16 years (91%)

- The overall AMU prevalence, by hospital type was highest for tertiary hospitals (37.4%) and lowest for specialist hospitals (20.3%)

- The prevalence of AMU, by ward type was highest in augmented care units [e.g., ICU, NICU, HDU] (50.4%) and lowest in psychiatric units (5.5%)

- The parenteral (i.e., intravenous) route accounted for most prescribed antimicrobials (63%)

- There was a documented indication for the antimicrobial prescription in 3,767 cases (83%). The indication for prescription was for treatment of infection in 78% of cases, surgical antimicrobial prophylaxis in 11% of cases and medical prophylaxis in 8% of cases

- Treatment of community-associated infections represented the majority of antimicrobial prescriptions (69%), followed by hospital-associated infections, which accounted for 29% of prescriptions. The most common infection sites for which antimicrobials were prescribed included; respiratory tract (35%), skin /soft tissue/wound (14%), abdominal (11%) and lower urinary tract infections (7%)

- The majority of surgical antimicrobial prophylaxis (73%) exceeded single-dose and almost half (47%) of surgical antimicrobial prophylaxis was continued beyond 24 hours duration

- Although the indication for prescription of antimicrobials for medical prophylaxis was not specifically recorded, broad spectrum agents including, co-amoxiclav and ciprofloxacin accounted for 8.6% and 4.4% of medical prophylaxis, respectively

- Broad spectrum β lactam-β lactamase inhibitor combination antimicrobials (i.e., co-amoxiclav and piperacillin-tazobactam) together accounted for 35% of prescribed antimicrobials. Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin and olfloxacin) combined ranked fourth (8%) and meropenem ranked tenth (3%) in the top 20 agents prescribed

- For the purposes of reporting, the individual HAI and AMU prevalence results of the 42 acute public hospitals are grouped by HSE administrative region. The individual HAI and AMU prevalence results of the seven private and the one specialist private hospital are grouped separately. Owing to differences in hospital types and case mix, direct comparison of HAI and AMU prevalence in acute hospitals within the same HSE region is not recommended and likewise, direct comparison of HAI and AMU prevalence between private hospitals is not recommended

Future Priorities

1. Ensure all acute hospital staff have been made aware of the local and national results of the 2012 PPS.

2. Provide ongoing education and training for healthcare workers, regarding the importance and impact of HAI and antimicrobial resistance.

3. Improve hand hygiene compliance in all staff.

4. Implement plans to prevent infections associated with medical devices (intravascular catheters, urinary catheters, devices for respiratory tract intubation and prosthetic surgical devices).

5. Monitor and measure infections associated with medical devices and implement prospective surveillance programmes.

6. Implement the core, high impact interventions to promote prudent antimicrobial prescribing.

7. Ensure that frontline healthcare worker staffing levels reflect patient case mix and dependency levels.

8. Ensure that key infection prevention and control, antimicrobial stewardship and surveillance staff are not diverted to tasks outside their designated roles and that activities related to prevention of antimicrobial resistance and HAI are appropriately resourced.

9. Ensure that future strategic developments in Irish healthcare facilities include infrastructure and information technology that support the prevention of HAI and antimicrobial resistance.

10. Plan for periodic repeat prevalence surveys, locally and nationally to monitor and measure improvements in HAI prevalence and antimicrobial prescribing practices.

Plain Language Summary

Background

During May 2012, 50 Irish hospitals took part in a European hospital survey. The survey was coordinated in Ireland by the Health Protection Surveillance Centre (HPSC). The HPSC is the national centre for the surveillance of infections in Ireland. The survey has been carried out in all of the European Union countries.

During April 2012, staff members from the 50 hospitals went to a training day, where they were taught how to perform the survey. The survey was then carried out in each hospital by a team of the hospital's own staff, using the same set of instructions in each hospital across the country. Once the survey was completed, the results from each hospital were collected and checked at the HPSC. The results have been put together to produce this national report for Ireland. The results for every hospital that took part have also been returned to each individual hospital, so they can be used to help the staff to make future plans to further improve patient care.

The survey was done for the following reasons:

1. To count the number of patients with an infection, which may have occurred as a result of being admitted to hospital. A so-called 'hospital-acquired infection' or HAI for short.
2. To count the number of patients in the hospitals who were prescribed antibiotics.
3. To provide the Irish Government, Department of Health, Health Service Executive, the managers, doctors and nurses in all of the hospitals that took part, with information about HAI and antibiotic prescribing in Irish hospitals in 2012. This information is important to plan future ways to reduce the numbers of patients who get HAI and to reduce the chance that antibiotics may be prescribed unnecessarily.
4. To provide members of the public with more information about HAI in Ireland and which types of infections are most commonly seen in Irish hospitals.

The count of the patients with a HAI and the patients prescribed antibiotics is called 'prevalence'. These results provide us with a picture or a snapshot of the number of patients who had a HAI and the number of patients who were prescribed antimicrobials in the Irish hospitals that took part in the survey in May 2012.

Hospital-Acquired Infections (HAI)

During this survey, a HAI was defined as an infection that developed more than two days after a patient was admitted to a hospital, or an infection that developed because of a medical device being inserted or a wound infection that occurred within a defined time limit after an operation. HAI are very important because they can cause harm to patients. Not every HAI can be prevented from happening, but every chance should be taken to prevent HAI, whenever possible.

There were 9,030 patients counted during the survey across 50 Irish hospitals. Of those patients, 467 had a HAI at the time of the survey. This means that the prevalence of HAI across all of the hospitals was 5.2%. There were some hospitals with a HAI prevalence that was higher and other hospitals with a HAI prevalence that was lower than the overall figure of 5.2%. This means that about one-in-twenty patients admitted to Irish hospitals in May 2012 had a HAI. However, because different hospitals may admit different types of patients and have different types of medical and surgical

specialists working within the hospital, it is not possible to directly compare the results of one hospital with those of another hospital.

The most common types of infections reported in the survey were as follows:

1. Surgical site infections, which are also known as wound infections.
2. Pneumonia, which is also known as a chest infection.
3. Urinary tract infections, which may include infections of the bladder or kidneys.
4. Bloodstream infections.
5. Gastrointestinal infections, which may include bowel infections or gastroenteritis.

In this survey, it was found that the patients who had a HAI were more likely to have some of the common 'risk factors' for developing a HAI, when they were compared with the patients who did not have a HAI. Well-known risk factors for developing HAI can include: having had an operation, having a drip or a bladder catheter, being in an intensive care unit, being older or very young in age and receiving antibiotics. Recent antibiotic use can also be a risk factor for developing *Clostridium difficile* diarrhoea. Twenty-nine patients were reported to have *Clostridium difficile* diarrhoea during the survey.

Antibiotics are an extremely important resource for treatment of infections caused by bacteria. There is concern around the world that bacteria are becoming more and more resistant to antibiotics, so they no longer work to treat common infections. This problem is made worse by the fact that there have been very few new types of antibiotics developed to overcome this problem of resistance. It is very important that antibiotics are only used when they are absolutely necessary and that they are not used in the incorrect circumstances, such as to try and treat infections caused by viruses. It is also very important that antibiotics are not used for too long and that the course of treatment is kept as short as possible. During this survey, 17 patients were reported to have HAI caused by meticillin resistant *Staphylococcus aureus* (MRSA), nine patients were reported to have HAI caused by vancomycin resistant enterococci (VRE) and 26 patients were reported to have HAI caused by resistant *Enterobacteriaceae*.

Antibiotic Use

This survey found that of the 9,030 patients who were counted, 3,108 were prescribed antibiotics. This means that the prevalence of antibiotic use across all of the Irish hospitals was 34%. However, because different hospitals may admit different types of patients and have different types of medical and surgical specialists working within the hospital, it is not possible to directly compare the results of one hospital with those of another hospital.

About one-in-three patients who were admitted to Irish hospitals in May 2012 were prescribed an antibiotic. This survey showed that antibiotic prescribing is very common in Irish hospitals. Many patients are admitted to hospital from home because they need to get antibiotic treatment for an infection. Patients who develop an infection whilst in hospital for other reasons (a so-called HAI) will often need antibiotic treatment. The results of the survey show that it is very important to make sure that antibiotic prescribing in hospitals is done properly and that antibiotics are prescribed appropriately. This in turn, will reduce the chances of antibiotic resistant bacteria emerging in our hospitals and preserve the use of antibiotics for treatment of patients in the future.

1.0 Introduction

This report outlines the findings of a national survey conducted in May 2012 to assess the prevalence of HAI and antimicrobial prescribing practices in Irish hospitals.

Hospital-acquired infections (HAI) have the potential to cause harm to patients and in some cases, severe illness and death. The HAI types most likely to cause severe infection or patient mortality include; bloodstream infections (BSI) caused by infected vascular catheters and ventilator-associated pneumonia (VAP).[1] HAI are not an inevitable consequence of healthcare. It has been estimated that up to 70% of vascular-catheter related BSI and 55% of VAP and surgical site infection (SSI) cases may be reasonably prevented.[1]

Many HAI can be prevented, provided every healthcare worker applies simple measures, which include, but are not limited to: consistent compliance with the World Health Organisation (WHO) 'Five moments for hand hygiene', to prevent cross-transmission of pathogens that cause HAI and the use of evidence-based interventions, such as care bundles or quality improvement tools, which may be applied to prevent device-related infections and surgical site infections.[2,3] National Standards for the Prevention and Control of Healthcare-Associated Infections were published by the Health Information and Quality Authority (HIQA) in May 2009 and in June 2012, HIQA published National Standards for Safer Better Healthcare, to describe how a service provides high quality, safe and reliable care through eight themes, relating to quality, safety, capacity and capability.[4,5]

National guidelines for antimicrobial stewardship were published in 2009 and outline a number of core high-impact interventions for antimicrobial stewardship.[6] Antimicrobial consumption is the major driver of antimicrobial resistance. HAI that are caused by antimicrobial resistant organisms, also known as multi-drug resistant organisms (MDRO) [e.g., meticillin resistant *Staphylococcus aureus* (MRSA), vancomycin resistant enterococci (VRE), extended spectrum β lactamase (ESBLs) and carbapenemase-producing *Enterobacteriaceae* (CRE)] are associated with higher healthcare costs, increased length-of-stay and higher mortality than HAI that are caused by antimicrobial-susceptible organisms.[7] It is estimated that 25,000 people die in the European Union (EU) annually from infections caused by MDRO combined, with an associated cost of €1.5 billion.[8] Prior to the introduction of antimicrobials, infectious diseases were a leading cause of mortality. The 'antibiotic era' facilitated many advances in medicine, such as transplantation, chemotherapy and insertion of prosthetic devices. However, increased antimicrobial consumption, coupled with stagnation in discovery of novel antimicrobial agents has led to emergence and worldwide dissemination of MDRO, which are well-described in Ireland and in some cases, are now endemic in Irish hospitals.

In Ireland, hand hygiene compliance audit scores, *C. difficile* infection rates, antimicrobial consumption and antimicrobial resistance in key pathogens causing bloodstream infections are monitored on an ongoing basis by the Health Protection Surveillance Centre (HPSC) (Appendix F – Latest Available HCAI Surveillance Indicators for Ireland). This data demonstrates that despite initial improvements in 2009 and 2010, hospital and community antimicrobial consumption has been increasing, antimicrobial resistance has also been increasing, especially in *Enterobacteriaceae* and enterococci, *C. difficile* infection rates are higher than they should be and hand hygiene compliance audit scores have been gradually increasing, although some groups of healthcare workers fall behind others, with regard to hand hygiene compliance (Source: HPSC).

The results of this survey provide additional information outlining the most prevalent HAI types and further details on antimicrobial prescribing practices in Irish hospitals. This information will be used widely at hospital, regional and national levels to plan future improvement and preventative programmes.

2.0 Methods

A point prevalence survey (PPS) of HAI and antimicrobial use (AMU) took place in Ireland between May 8th and 25th 2012. Fifty acute hospitals volunteered to participate in this study, which was coordinated in Ireland by the HPSC. The survey was conducted across Europe using a standardised protocol devised by the European Centre for Disease Prevention and Control (ECDC) and HAI were defined using standardised European definitions of infection, where available:

- Hospitals in Europe Link for Infection Control through Surveillance (HELICS) HAIICU definitions for bloodstream infection, pneumonia, catheter-related infection and urinary tract infection
- HELICS HAISSI definitions for surgical site infection
- European Society for Clinical Microbiology and Infectious Diseases Study Group on *C. difficile* (ESCMID-ESGCD) definitions for *C. difficile* infection
- German HCAI surveillance network (KISS) definitions for neonatal infections
- US Centers for Disease Control and Prevention (CDC) definitions were used for other infections with no existing European definitions

In December 2011, a multi-disciplinary PPS steering group was convened under the Royal College of Physicians of Ireland (RCPI) Clinical Advisory Group (CAG) for Healthcare-Associated Infections (HCAI) and Antimicrobial Resistance (AMR) (Appendix A). The steering group met on seven occasions between January and November 2012 to plan for the PPS and report on the PPS findings.

Throughout 2012, there was ongoing collaboration between the HPSC and the Public Health Agency (PHA), Northern Ireland with regards to planning of the PPS, preparation of the all-Ireland PPS protocol, training of data collectors, management, analysis and reporting of the 2012 PPS data.

During April 2012, 207 healthcare workers attended one of nine regional training days to learn about the survey protocol and methodology. The schedule of presentations for each training day included; an introductory presentation describing content, completion instructions for the PPS data collection forms, presentations and practical case studies to enable trainees to practice completion of the PPS data collection form (Appendix E). Following attendance at a training day, each participant was forwarded an additional twenty practice case studies along with completed PPS data collection forms. All PPS training materials were posted on a dedicated PPS section of the HPSC website. A practical guide on PPS preparation was also produced and circulated to the nominated PPS team leader of each hospital.

During the PPS, all eligible patients in each hospital were surveyed by a multidisciplinary local PPS team for anonymous demographic details, risk factors, antimicrobial use and the presence of active HAI.

A dedicated PPS e-mail address and telephone helpdesk were established at the HPSC to address any queries that arose before, during and after the PPS. A frequently-asked questions (FAQ) section was also maintained on the HPSC website to address the most commonly encountered queries during the PPS. PPS information leaflets were also prepared for patients and for healthcare workers.

All study documentation related to the PPS, including protocol and data collection forms were posted on a dedicated PPS section of the HPSC website: http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Surveillance/HospitalPointPrevalenceSurveys/2012/

Data Management & Analysis

Data were collected on paper forms (Appendix E) and subsequently entered electronically by hospital staff to an on-line data capture system (Formic Fusion Version 5.4.1). Each participating hospital was provided with password-protected secure remote access to this web-based system to allow electronic data submission.

Once submitted, data were cleaned and quality checks were performed. All hospitals received a summary of submitted data with any inconsistent, missing or potentially inaccurate data highlighted for correction. Example of such possible errors included invalid admission or survey dates and patient ages that did not correspond with the named ward speciality type.

There were 43 patients who were recorded as having a HAI or receiving antimicrobials, but had no HAI or antimicrobial details completed. There were an additional 38 patients who were recorded as having no HAI or receiving no antimicrobials but had details completed. There were also 76 patients for whom either the HAI or antimicrobial questions had not been completed. All of these errors were followed up with the relevant hospital.

Finalised data were analysed using SPSS Version 16.0 (SPSS Inc., Illinois) and STATA Version 11 (STATA Corporation, Texas). The prevalence of HAI, antimicrobial use and device use were calculated with 95% confidence intervals (CI) using Wilson's Score method. Univariate analysis using Chi-squared tests was conducted for categorical risk factors and statistical significance was set as a level of 5% (0.05).

Data Validation

A validation study was conducted to assess the validity and consistency of applying the PPS protocol and definitions. For this purpose, a national PPS validation team (VT) was trained and coordinated by HPSC to act as the "Gold Standard" against which the data collected by the hospital PPS teams could be compared. This team included five members, two national PPS coordinators, two Quality and Patient Safety Auditors and a member of the HSE Healthcare-Associated Infection & Antimicrobial Resistance Clinical Programme.

Participating hospitals were grouped by type and ten were randomly selected to undergo validation. Two members of the VT, including at least one national PPS coordinator, visited each of the ten hospitals and conducted validation on one or two pre-selected wards. The hospital types visited for validation included; Primary (n=2), secondary (n=3), tertiary (n=2), specialist (n=2) and private (n=1).

The VT conducted repeat collection of basic demographic data, HAI data and AMU data for all eligible patients on the selected wards, with exact application of the PPS protocol and case definitions. Data collection by the VT was performed at the same time as the hospital PPS teams, to ensure that the information available to both teams was equal. However, there was no communication or consultation between the hospital and validation teams during data collection.

The sensitivity, specificity and kappa statistic for HAI and antimicrobial identification are presented in Table 2.1. The sensitivity and specificity for 'patient on antimicrobials' were excellent, signifying that the hospital PPS teams were able to correctly identify whether or not a patient was receiving antimicrobials. The kappa value (0.95) indicates a high level of agreement between the VT team and the hospital PPS teams.

The specificity for 'patient has active HAI' was also excellent meaning hospital PPS teams were able to correctly identify when a patient did not have a HAI. Sensitivity for 'patient has active HAI' was lower, indicating that hospital PPS teams were less likely to correctly apply the case definition when identifying a patient with a HAI.

Table 2.1: Validation results for HAI and antimicrobial identification

PPS Data Collection Form Question	Sensitivity	Specificity	Kappa value
Patient on antimicrobials	95.5%	98.9%	0.95
Patients has active HAI	63.3%	99.0%	0.71

3.0 Participating Hospitals

The fifty participating hospitals, classified by hospital type and ownership are presented in Table 3.1. In Ireland, 89% of acute public hospitals participated (42 hospitals). Of the 21 private hospitals listed as members of the Independent Hospitals Association of Ireland, eight (38%) participated in the PPS. See Appendix C for the list of participating hospitals, categorised by hospital type.

For the purposes of data analysis and reporting by hospital type, the 12 specialist hospitals (11 public and one private) have been included together. The single specialist private hospital has not been included in the analysis of the other private hospitals, owing to the difference in case mix.

Table 3.1: Participating hospitals categorised by ownership (continued overleaf)

HSE* REGION	HOSPITAL NAME	HOSPITAL TYPE FOR PPS
HSE DUBLIN NORTH-EAST (DNE)	Beaumont Hospital, Dublin	Tertiary
	Cappagh National Orthopaedic Hospital, Dublin	Specialist
	Cavan General Hospital, Cavan	Primary
	Connolly Hospital, Dublin	Secondary
	Louth County Hospital, Dundalk	Primary
	Our Lady of Lourdes Hospital, Drogheda	Secondary
	Our Lady's Hospital, Navan	Primary
	Rotunda Hospital, Dublin	Specialist
Percentage of acute hospitals in HSE DNE region participating in PPS		**89%**
HSE DUBLIN MID-LEINSTER (DML)	Adelaide, Meath & National Children's Hospital, Tallaght	Tertiary
	Children's University Hospital, Temple Street	Specialist
	Coombe Women and Infants University Hospital	Specialist
	Midland Regional Hospital, Mullingar	Secondary
	Midland Regional Hospital, Portlaoise	Secondary
	Midland Regional Hospital, Tullamore	Secondary
	Naas General Hospital, Naas	Primary
	National Maternity Hospital, Holles Street	Specialist
	Our Lady's Children's Hospital, Crumlin	Specialist
	Royal Victoria Eye & Ear Hospital, Dublin	Specialist
	St. Columcille's Hospital, Loughlinstown	Primary
	St. James's Hospital, Dublin	Tertiary
	St. Luke's Hospital, Rathgar	Specialist
	St. Michael's Hospital, Dun Laoghaire	Primary
	St. Vincent's University Hospital	Tertiary
Percentage of acute hospitals in HSE DML region participating in PPS		**100%**

*HSE – Health Service Executive

HSE REGION	HOSPITAL NAME	HOSPITAL TYPE FOR PPS
HSE WEST	Galway University Hospitals	Tertiary
	Letterkenny General Hospital	Secondary
	Mid-Western Regional Hospital, Dooradoyle	Tertiary
	Mid-Western Regional Hospital, Ennis	Primary
	Mid-Western Regional Hospital, Nenagh	Primary
	Mid-Western Regional Maternity Hospital	Specialist
	Mid-Western Regional Orthopaedic Hospital, Croom	Specialist
	Portiuncula Hospital, Ballinasloe	Secondary
	Roscommon County Hospital	Primary
	Sligo General Hospital	Secondary
	St. John's Hospital, Limerick	Primary
Percentage of acute hospitals in HSE West region participating in PPS		**92%**
HSE SOUTH	Kerry General Hospital	Primary
	Lourdes Orthopaedic Hospital, Kilcreene	Specialist
	Mercy University Hospital, Cork	Secondary
	South Infirmary-Victoria Hospital, Cork	Primary
	South Tipperary General Hospital, Clonmel	Primary
	St. Luke's General Hospital, Kilkenny	Primary
	Waterford Regional Hospital	Secondary
	Wexford General Hospital	Primary
Percentage of acute hospitals in HSE South region participating in PPS		**73%**
PRIVATE HOSPITALS	Bon Secours, Cork	Private
	Bon Secours, Galway	Private
	Bon Secours, Dublin	Private
	Bon Secours, Tralee	Private
	Galway Clinic, Doughiska	Private
	Mater Private Hospital	Private
	UPMC Beacon Hospital, Dublin	Private
	St. Patrick's University Hospital^	Specialist
Percentage of private hospitals participating in PPS		**38%**
TOTAL NUMBER OF PARTICIPATING HOSPITALS		**50**

*HSE – Health Service Executive

^ For the purpose of data analysis, St. Patrick's University Hospital is included in the specialist hospital category along with the 11 public specialist hospitals.

4.0 Results

4.1 Participant Feedback

Following the PPS, the nominated team leaders were asked to provide feedback regarding their PPS experience. Sixteen team leaders reported that 95% of data collectors had attended a training day. On average, data collection took 80 hours per hospital (range 11-180) and there were five data collectors per hospital (range 3-8). The majority of PPS team leaders felt there were sufficient numbers of data collectors and that the protocol, forms and web entry were easy to use. The majority agreed that hospital management and ward staff were supportive and helpful in completing PPS data. The majority felt that there was insufficient clerical support for data entry. All participants providing PPS feedback stated they would be interested in participating in a future PPS.

4.2 Characteristics of Participating Hospitals

4.2.1 Hospital Characteristics

Fifty acute hospitals (42 public, seven private and one specialist private) participated in the PPS. The 42 acute public hospitals were categorised as primary or general (15), secondary or regional (10), tertiary (6) and specialist (11).

The specialist category included 11 public hospitals and one private hospital and the following hospital types; maternity (4), orthopaedic (3), paediatric (2), oncology (1), combined ophthalmology and otorhinolaryngology (1) and psychiatric (1).

A total of 9,030 patients on 510 wards in 50 acute hospitals were included. Public hospitals accounted for 7,898 patients (87%) and private hospitals for 1,132 patients (13%).

Each participating hospital's PPS team leader provided additional demographic and activity data by completion of the Hospital Form (Form B) [Appendix E] Tables 4.1 to 4.4 present additional data provided by participating hospitals.

For the purpose of this survey, a bay with six beds could be defined as one patient room. Thus, the number of patient rooms does not equate to the number of acute beds.

A single patient room is defined a room housing one bed. Taking the average number of acute hospital beds and the average number of single rooms, by hospital type, the average proportion of single rooms was lowest in primary hospitals (15%), followed by secondary hospitals (18%) and tertiary hospitals (23%). Specialist hospitals (35%) and private hospitals (37%) had higher proportions of single rooms.

One hospital reported having no infection prevention and control nurse (IPCN). Overall, both public and private hospitals reported having 0.70 whole time equivalent (WTE) IPCN per 100 beds.

An infection prevention and control doctor (IPCD) may be defined as a nominated doctor with specialist training and responsibility for infection prevention and control tasks, work planning and surveillance systems. Seventeen Irish hospitals (34%) reported having no nominated IPCD. Overall, public hospitals reported having 0.11 of a WTE IPCD per 100 beds and private hospitals reported having 0.19 WTE IPCD per 100 beds.

Table 4.1: Participating hospitals; Overall demographic and activity data

Hospitals	Number of Participating Hospitals	Average Number of Acute Beds	Average Number of Admissions	Average Number of Patient Days	Average Length-of-Stay (LOS)	Number of Wards Surveyed	Number of Patients Surveyed
Public Hospitals	42	226	13,664	73,903	5.7	451	7,898
Private Hospitals	8	170	8,070	47,918	8.4	59	1,132
Overall	**50**	**217**	**12,769**	**69,746**	**6.1**	**510**	**9,030**

Table 4.2: Participating hospitals; Overall infection prevention and control resources

Hospitals (Number)	Average Number of Patient Rooms	Average Number of Single Rooms	Average Number of WTE IPCN	Number of WTE IPCN per 100 Inpatient beds	Average Number of WTE IPCD	Number of WTE IPCD per 100 Inpatient Beds
Public Hospitals (42)	86	47	1.71	0.70	0.26	0.11
Private Hospitals (8)	109	76	1.37	0.70	0.38	0.19
Overall (50)	**90**	**51**	**1.65**	**0.70**	**0.28**	**0.12**

WTE: Whole time equivalent; IPCN: Infection Prevention and Control Nurse; IPCD: Infection Prevention and Control Doctor

Table 4.3: Participating hospitals; demographic and activity data, by hospital type

Hospital Type	Number of Participating Hospitals	Average Number of Acute Beds	Average Number of Admissions	Average Number of Patient Days	Average Length of Stay	Number of Wards Surveyed	Number of Patients Surveyed
Primary	15	135	9,856	45,785	5.2	108	1,624
Secondary	10	251	15,267	82,011	5.6	124	2,100
Tertiary	6	603	24,544	204,529	8.7	159	3,080
Specialist^	12	137	10,745	39,069	7.4	70	1,379
Private	7	152	8,821	40,628	4.6	49	847

Primary = general hospital, secondary = regional hospital

^ For the purpose of data analysis by hospital type, the private specialist hospital has been included in the specialist hospital category along with the 11 public specialist hospitals. Of the 1,379 patients in specialist hospitals, 1,094 were in 11 public hospitals and 285 were in one private hospital. The private specialist hospital has not been included in the private hospital category.

Table 4.4: Participating hospitals; infection prevention and control resources, by hospital type

Hospital Type (Number)	Average Number Patient Rooms	Average Number of Single Rooms	Average Number of WTE IPCN	Number of WTE IPCN per 100 Inpatient beds	Average Number of WTE IPCD	Number of WTE IPCD per 100 Inpatient Beds
Primary (15)	43	20	1.29	0.91	0.20	0.14
Secondary (10)	92	46	1.74	0.64	0.31	0.11
Tertiary (6)	244	139	3.58	0.54	0.37	0.06
Specialist (12)^	69	48	1.14	0.80	0.23	0.16
Private (7)	90	56	1.51	0.85	0.41	0.23

WTE: Whole time equivalent; IPCN: Infection Prevention and Control Nurse; IPCD: Infection Prevention and Control Doctor

Primary = general hospital, secondary = regional hospital

^ For the purpose of data analysis by hospital type, the private specialist hospital has been included in the specialist hospital category along with the 11 public specialist hospitals. Thus, the private specialist hospital has not been included in the private hospital category.

4.2.2 Ward Characteristics

Table 4.5 describes the number of wards surveyed, categorised by ward specialty. General medical wards accounted for 157 (30.8%) and general surgical for 57 (19%) wards. Augmented care (adult and paediatric intensive care units, high dependency units, neonatal intensive care units and special care baby units) accounted for 70 (13.7%) wards.

Table 4.5: Number of surveyed wards, by ward specialty

Ward Specialty	Wards	
	N	%
General Medical	157	30.8
General Surgical+	97	19.0
Augmented Care*	70	13.7
Other Specialty	51	10.0
Obstetrics/Gynaecology	35	6.9
Mixed Specialty^	34	6.7
Paediatrics	32	6.3
Psychiatric	19	3.7
Rehabilitation	9	1.8
Care of the Elderly	6	1.2
Total	510	100

+ Includes paediatric surgical wards
***** Includes adult, paediatric and neonatal intensive care units, paediatric high dependency units and special care baby units
^ Mixed ward specialty chosen when two main sub-specialties accounted for majority of patients on the ward

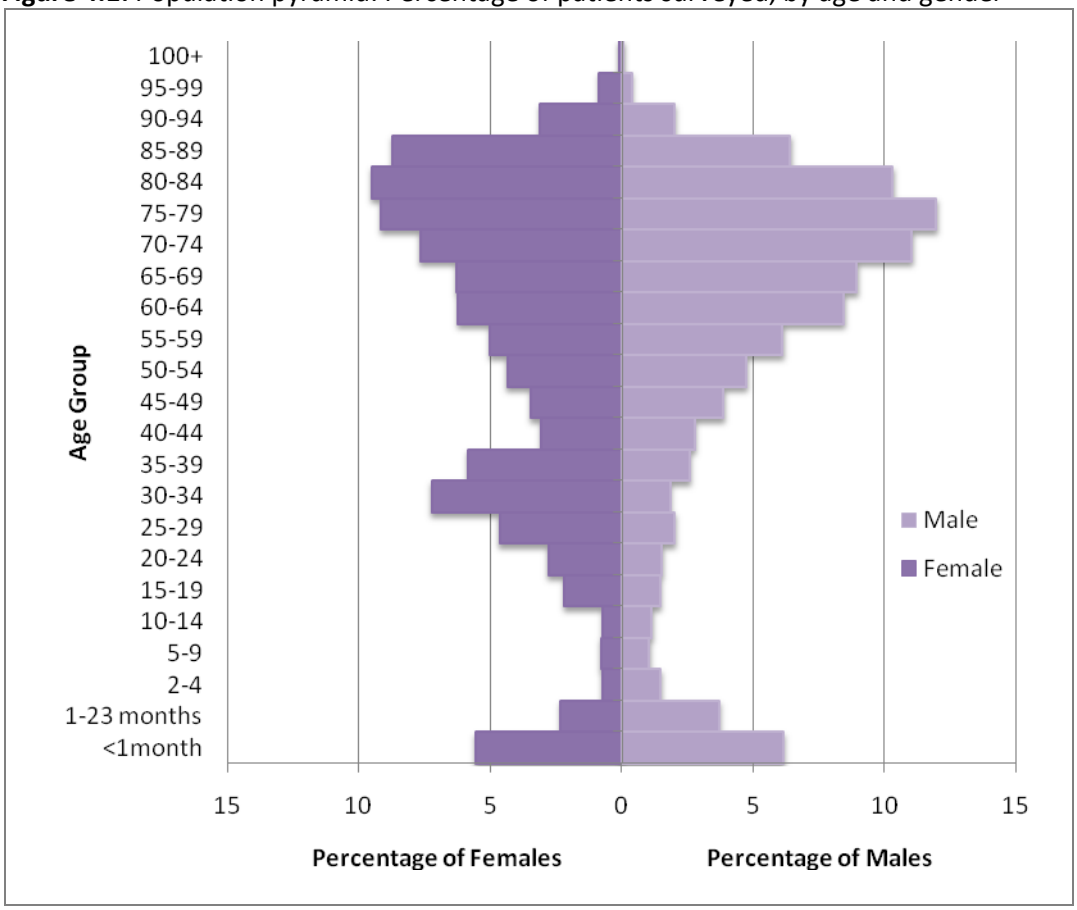
4.3 Characteristics of the Patient Population

4.3.1 Demographics of Patients Surveyed

Data was gathered on 9,030 eligible patients, 53.7% females, with a median age of 63 years (inter-quartile range [IQR] 36-77 years). Patient age and gender distribution is presented as a population pyramid in Figure 4.1. Females accounted for a higher proportion of patients aged between 15 and 44 years and also those aged over 80 years. The median age of males was higher than that of females [65 years (IQR 43-77) versus 61 years (IQR 33-78)].

Forty-eight percent (n=4,330) of the survey population were aged ≥65 years. Twelve percent (n=1,092) were aged <16 years and of those, 73% (n=793) were aged under two years.

Figure 4.1: Population pyramid: Percentage of patients surveyed, by age and gender



4.3.2 Patient Location by Ward and Admitting Consultant Specialty

Over half of the eligible patient population (n=5,022; 55.6%) were admitted to medical and surgical wards (Table 4.6). Further analysis of the HAI & AMU prevalence, by ward specialty and admitting consultant specialty is outlined in Appendix D.

Table 4.6: Number of patients surveyed, by ward specialty

Ward Specialty	Patients	
	N	%
Medical	3,042	33.7
Surgical+	1,980	21.9
Obstetrics/Gynaecology	1,017	11.3
Other Specialty	819	9.1
Mixed Specialty ^	587	6.5
Psychiatric	456	5.0
Augmented Care*	419	4.6
Paediatrics	407	4.5
Care of the Elderly	161	1.8
Rehabilitation	142	1.6
Total	9,030	100

+ Includes patients on paediatric surgical wards
^ Mixed ward specialty chosen when two main sub-specialties accounted for majority of patients on the ward.
***** Includes patients in adult, paediatric and neonatal intensive care units, paediatric high dependency units and special care baby units

Table 4.7 describes the number of patients by admitting consultant specialty. Nearly half of all patients were under the care of a medical consultant (46.0%) and just over one quarter were under the care of a surgical consultant (26.0%).

Table 4.7: Number of patients surveyed, by admitting consultant specialty

Consultant Specialty	Patients	
	N	%
Medical	4,157	46.0
Surgical	2,346	26.0
Obstetrics/Gynaecology	887	9.8
Paediatrics	642	7.1
Psychiatric	460	5.1
Care of the Elderly	376	4.2
Intensive Care (Neonatal)	120	1.3
Rehabilitation	17	0.2
Other Specialty	25	0.3
Total	9,030	100

4.3.3 Patient Risk Factors for HAI

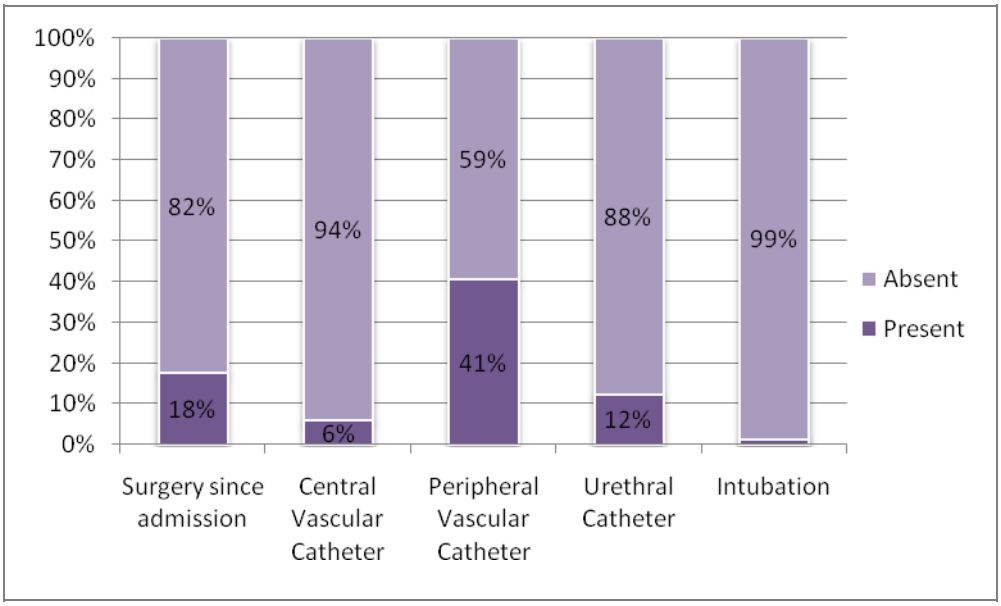
Risk factors for HAI in the eligible patient population are described in Figure 4.2. Of the 9,030 eligible patients, 1,591 (18%; 95% CI 16.8-18.4) had a history of a surgical procedure since admission to the participating hospital and 4,428 patients (49%) had at least one invasive device *in situ*. The intensive care unit (ICU) accounted for the highest rate of device utilisation, with 67.8% of ICU patients having at least one invasive device *in situ*, followed by 61.0% of patients in surgical wards and 59.7% of patients in paediatric wards.

A peripheral vascular catheter (PVC) was documented in 3,679 patients [prevalence 41% (95% CI 39.7-41.8)]. PVC prevalence was highest in paediatric wards (57.0%) followed by surgical wards (52.1%) and ICU (50.1%). A central vascular catheter (CVC) was documented in 544 patients [prevalence 6% (95% CI 5.6-6.5)]. CVC prevalence was highest in ICU (33.4%) followed by surgical (6.0%) and medical wards (5.9%).

A urethral catheter was documented in 1,119 patients [prevalence 12% (95% CI 11.7-13.1)]. The prevalence of urethral catheters was higher in males (14.3%) than females (10.7%) and by location, was highest in ICU (39.6%) followed by surgical (16.5%) and care of the elderly wards (14.3%).

Intubation of the respiratory tract (endotracheal tube or tracheostomy), with or without mechanical ventilation was recorded for 127 patients [prevalence 1% (95% CI 1.1-1.7)]. Within ICU, 24.1% of patients were intubated versus ≤0.5% of patients admitted to all other ward specialties.

Figure 4.2: Percentage of patients surveyed, by history of surgery since admission and device utilisation



Eligible patients were categorised using the McCabe Score, a subjective patient score assigned on severity of the underlying medical condition(s) (Table 4.8).[9] The majority (73.9%) of patients were deemed to have a 'non-fatal prognosis' (life expectancy greater than five years), 21.7% were deemed to have an 'ultimately fatal or life-limiting prognosis' (life expectancy between one and four years) and 3.4% were deemed to have a 'rapidly fatal or end-of-life prognosis' (life expectancy less than one year). The disease prognosis was reported 'not known' for 91 patients.

Table 4.8: Number of patients surveyed, by McCabe Score

Disease Prognosis	Patients	
	N	%
Non-fatal	6,673	73.9
Ultimately fatal	1,955	21.7
Rapidly fatal	311	3.4
Not known	91	1.0

4.4 Hospital-Acquired Infections (HAI)

The PPS HAI results should be reviewed and interpreted in conjunction with the HAI definitions used in this survey. They are available in the PPS All Ireland Protocol Version 1.3 [Appendix B pages 60 – 85], which may be accessed on the HPSC website:

http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Surveillance/PointPrevalenceSurvey/2012/Protocol/

4.4.1 Overall Prevalence of Hospital-Acquired Infections

Of the 9,030 eligible patients, 467 were classified as having an active HAI, resulting in a HAI prevalence of 5.2% (95% CI 4.7-5.6). Overall, 501 active HAI were identified, which equates to 1.07 HAI per infected patient. At the time of survey, 32 patients had two active HAI and one patient had three active HAI (Table 4.9).

Table 4.9: Number of HAI per patient

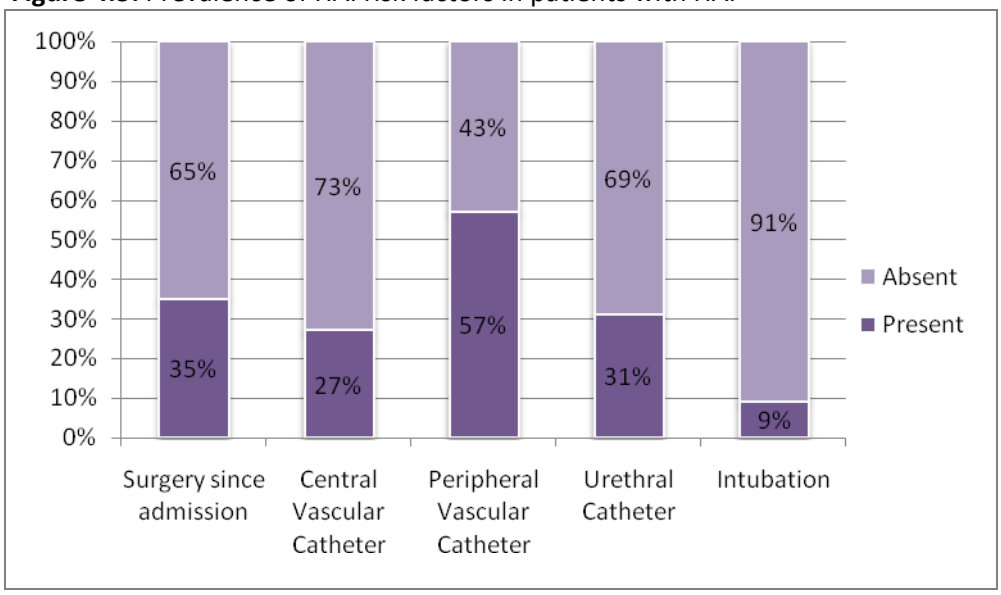
Number of HAI reported per patient	Patients	
	N	%
0	8,563	94.8
1	434	4.8
2	32	0.4
3	1	0.0
Total	9,030	100

The breakdown of HAI prevalence, by hospital type and for each of the 50 participating hospitals is provided in Section 4.7.

4.4.2 HAI Patient Risk Factors

A greater proportion of the 467 patients with active HAI had a history of surgery since admission to the participating hospital in comparison with the overall cohort of 9,030 eligible patients (35% versus 18%). The prevalence of invasive device utilisation was also greater for all devices across the HAI patient cohort than the overall eligible patient cohort [peripheral vascular catheter (PVC): 57 versus 41%, central vascular catheter (CVC): 27 versus 6%, urethral catheterisation 31% versus 12% and respiratory tract intubation 9 versus 1%]

Figure 4.3: Prevalence of HAI risk factors in patients with HAI



4.4.3 HAI Prevalence by Gender, Age and McCabe Score

The prevalence of HAI by gender, age and McCabe score, with univariate odds ratio (OR) analysis is presented in Table 4.10.

Of the 467 patients with HAI, males accounted for 244 (52.2%). However, the HAI prevalence was significantly higher in males (5.8%) when compared with females (4.6%) [OR=1.29, 95% CI 1.07-1.55; p=0.008].

The vast majority of patients with HAI (92.9%; n=434) were aged ≥16 years. The remaining 33 patients with HAI (7.1%) were aged 0 to 15 years. The highest prevalence of HAI was recorded for patients aged 50-64 years (6.2%) and 65-79 years (6.1%). There was a significant association between patient age and HAI prevalence (p<0.001), with HAI prevalence significantly lower in the <1 month, 2-15 years and 16-29 years age groups when compared with the 80+ years age group. There were no significant differences in HAI prevalence between the 1-23 months, 30-49 years, 50-64 years and 65-79 years age groups when compared with the 80+ age group.

The underlying disease prognosis, as measured by the McCabe score, was also significantly associated with HAI prevalence (p<0.001). The odds ratio increased with the severity of the McCabe score. The highest HAI prevalence was reported for patients with a 'rapidly fatal' McCabe score (10.9%; 95% CI 7.9-14.9).

Table 4.10: HAI prevalence, by gender, age and McCabe score

Risk Factor	Category	Number of Patients	Number of Patients with HAI	HAI Prevalence (%)	95% CI		Odds Ratio	Odds Ratio 95% CI		P-value
					Lower	Upper		Lower	Upper	
Gender	Male	4,180	244	5.8	5.2	6.6	1.29	1.07	1.55	0.008
	Female*	4,850	223	4.6	4.0	5.2	1	-	-	
Age Group	<1 month	526	16	3.0	1.9	4.9	0.51	0.30	0.87	<0.001
	1-23 months	267	9	3.4	1.8	6.3	0.57	0.28	1.13	
	2-15 years	299	8	2.7	1.4	5.2	0.45	0.22	0.92	
	16-29 years	636	14	2.2	1.3	3.7	0.37	0.21	0.64	
	30-49 years	1,411	65	4.6	3.6	5.8	0.78	0.57	1.07	
	50-64 years	1,561	97	6.2	5.1	7.5	1.08	0.81	1.43	
	65-79 years	2,453	149	6.1	5.2	7.1	1.05	0.81	1.35	
	80+ years*	1,877	109	5.8	4.8	7.0	1	-	-	
McCabe Score	Non-fatal*	6,673	270	4.0	3.6	4.5	1	-	-	<0.001
	Ultimately fatal	1,955	157	8.0	6.9	9.3	2.07	1.69	2.54	
	Rapidly fatal	311	34	10.9	7.9	14.9	2.91	2.00	4.24	
	Not known	91	6	6.6	3.1	13.6	1.67	0.73	3.87	

* Reference group for odds ratio calculation

4.4.4 HAI Prevalence by Ward Specialty and Admitting Consultant Specialty

The prevalence of HAI by ward specialty is shown in Table 4.11. HAI prevalence was highest in augmented care units [adult and paediatric ICUs, high dependency units, neonatal ICUs and special care baby units] (16.5%) followed by mixed specialty wards (7.3%) and surgical wards (6.7%). Psychiatric wards (1.5%) and obstetrics and gynaecology wards (1.1%) had the lowest HAI prevalence.

Table 4.11: HAI prevalence, by ward specialty

Ward Specialty	Total Number of Patients	Number of patients with HAI	HAI Prevalence (%)	95% Confidence Interval
Augmented Care*	419	69	16.5	13.2 - 20.3
Mixed Specialty^	587	43	7.3	5.5 - 9.7
Surgical+	1,981	133	6.7	5.7 - 7.9
Rehabilitation	142	8	5.6	2.9 - 10.7
Medical	3,042	146	4.8	4.1 - 5.6
Care of the Elderly	161	7	4.3	2.1 - 8.7
Other Specialty	819	33	4.0	2.9 - 5.6
Paediatrics	406	10	2.5	1.3 - 4.5
Psychiatric	465	7	1.5	0.7 - 3.1
Obstetrics/Gynaecology	1,017	11	1.1	0.6 - 1.9
Total	**9,030**	**467**	**5.2**	**4.7 - 5.6**

***** Includes patients in adult, paediatric and neonatal intensive care units, paediatric high dependency units and special care baby units

^ Mixed ward specialty chosen when two main sub-specialties accounted for majority of patients on the ward.

+ Includes patients on paediatric surgical wards

The prevalence of HAI by admitting consultant specialty is shown in Table 4.12. The highest HAI prevalence (24%) was recorded for the category 'other specialty' which included 25 patients, 18 of whom were specifically recorded as being admitted under the care of a consultant in intensive care medicine, one was admitted under a consultant in paediatric intensive care medicine and the remaining six patients were admitted under the category of 'other consultants – not specified'. All six HAI recorded in this category occurred in the patients admitted under a consultant in intensive care medicine. In Ireland, the majority of paediatric and adult patients admitted to augmented care units tend not to be admitted under the care of a named consultant in intensive care medicine. Rather, such patients tend to be admitted under the care of a medical or surgical consultant.

The HAI prevalence for patients admitted under the care of a neonatologist was 10%. The HAI prevalence for 2,346 patients admitted under a surgical consultant was 8.1% (95% CI 7.1-9.3) and for 4,157 patients admitted under a medical consultant, the HAI prevalence was 5.1% (95% CI 4.5-5.8).

Table 4.12: HAI prevalence, by admitting consultant specialty

Consultant Specialty	Total Number of Patients	Number of Patients with HAI	HAI Prevalence (%)	95% Confidence Interval
Other Specialty	25	6	24.0	11.5 - 43.4
Intensive Care (Neonatal)	120	12	10.0	5.8 - 16.7
Surgical	2,346	190	8.1	7.1 - 9.3
Rehabilitation	17	1	5.9	1.0 - 27.0
Medical	4,157	212	5.1	4.5 - 5.8
Care of the Elderly	376	14	3.7	2.2 - 6.2
Obstetrics/Gynaecology	887	16	1.8	1.1 - 2.9
Psychiatric	460	7	1.5	0.7 - 3.1
Paediatrics	642	9	1.4	0.7 - 2.6
Total	**9030**	**467**	**5.2**	**4.7 - 5.6**

4.4.5 HAI Prevalence by Surgery and Length-of-Admission Prior to HAI Onset

Of the 9,030 eligible patients, 1,591 (18%) were documented as having a history of surgery since admission to the participating hospital. During the PPS, surgical procedures could be classified into two categories:

1. **National Healthcare Safety Network (NHSN) Operative Procedures:** Classified by the US Centers for Disease Control & Prevention (CDC).[10] A NHSN procedure takes place during a single trip to the operating room, where a surgeon makes at least one incision through the skin or mucous membrane, including laparoscopic approach, and closes the incision before the patient leaves the operating room.
2. **Non-NHSN Operative Procedures:** Operative procedures which do not meet the definition of an NHSN procedure. For example, transurethral resection of the prostate, operation where wound healing is by secondary intention, external ventricular drain or hysteroscopic removal of fibroids.

The prevalence of all HAI for patients who had undergone a NHSN operative procedure was higher than that of patients who had undergone a non-NHSN operative procedure (11.5 versus 5.9%) (Table 4.13).

Table 4.13: HAI prevalence, by history of surgery since admission

Risk Factor	Category	Number of Patients	Number of Patients with HAI	HAI Prevalence (%)	95% CI		Odds Ratio	Odds Ratio 95% CI		P-value
					Lower	Upper		Lower	Upper	
Surgery since admission	No Surgery*	7,439	302	4.1	3.6	4.5	1	-	-	
	NHSN surgery	1,268	146	11.5	9.9	13.4	3.08	2.50	3.78	<0.001
	Non-NHSN surgery	323	19	5.9	3.8	9.0	1.48	0.92	2.38	

* Reference group for odds ratio calculation

The length-of-admission was also significantly associated with HAI prevalence (p<0.001). Patients who were admitted for four to seven days by the time of survey or HAI onset date had a lower HAI prevalence than patients who were admitted for 15 to 21 days by the time of survey or HAI onset date (5.1% versus 11.4%). Beyond 22 days of admission, the HAI prevalence declined to 7.3% (Table 4.14).

Table 4.14: HAI prevalence, by length-of-admission prior to date of survey or HAI onset

Risk Factor	Category	Number of Patients	Number of Patients with HAI	HAI Prevalence (%)	95% CI		Odds Ratio	Odds Ratio 95% CI		P-value
					Lower	Upper		Lower	Upper	
Length of admission (prior to PPS/HAI onset)	1-3 days*	2,993	47	1.6	1.2	2.1	1	-	-	
	4-7 days	2,075	105	5.1	4.2	6.1	3.34	2.36	4.74	
	8-14 days	1,511	113	7.5	6.3	8.9	5.07	3.58	7.16	<0.001
	15-21 days	590	67	11.4	9.0	14.2	8.03	5.47	11.79	
	22+ days	1,861	135	7.3	6.2	8.5	4.9	3.50	6.87	

* Reference group for odds ratio calculation

4.4.6 Onset and Origin of HAI

Table 4.15 and Figure 4.4 describe the patient's location when the signs or symptoms of the HAI began (onset). Table 4.15 and Figure 4.5 describe where the patient acquired the HAI (origin).

Of the 501 active HAI, 119 (24%) were already evident upon admission of the patient to the current hospital (i.e. HAI onset prior to current hospital admission). Of the 119 HAI with onset prior to admission to the current hospital, 53 (45%) had origin in the current hospital (i.e. HAI related to a prior admission to the current hospital, which developed subsequent to discharge from the current hospital) and 66 (55%) had origin in another facility [57 acute hospital, 9 non-acute hospital], (i.e., HAI related to a prior admission to another hospital, which developed either in or subsequent to discharge from that hospital). Of the 501 active HAI, 68 (14%) were attributable to a hospital other than the participating hospital

Table 4.15: Number and percentage of HAI, by onset and origin

Origin of HAI	HAI Present at Admission		Total N (%)
	Yes (%)	No (%)	
Current hospital	53 (12)	380 (88)	433 (86)
Other acute hospital	57 (97)	2 (3)	59 (12)
Other non-acute hospital	9 (100)	0 (0)	9 (2)
Total	**119 (24)**	**382 (76)**	**501**

Figure 4.4: Percentage of HAI, by HAI onset

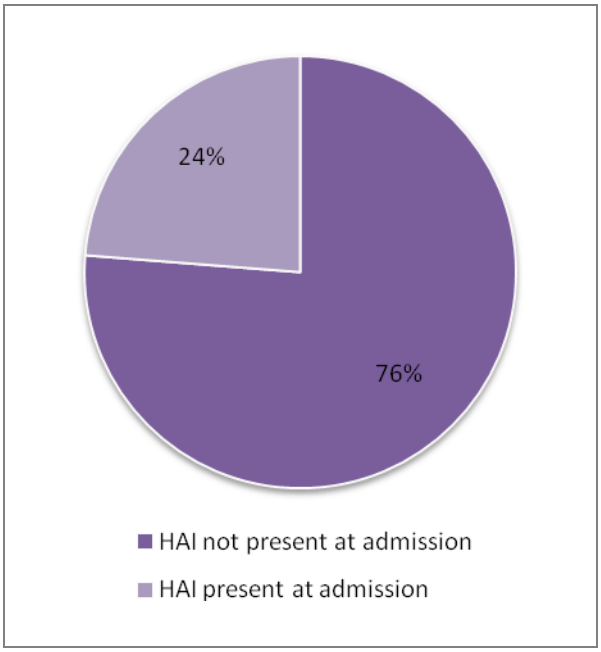
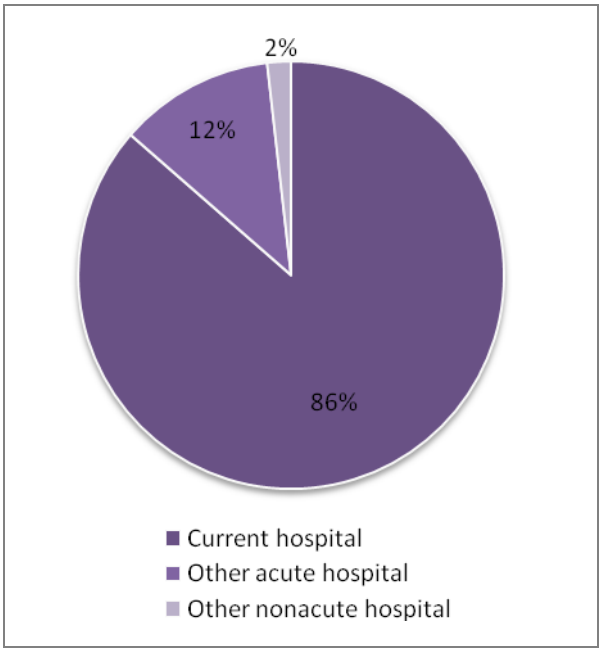


Figure 4.5: Percentage of HAI, by HAI origin



4.4.7 Distribution of HAI by Type

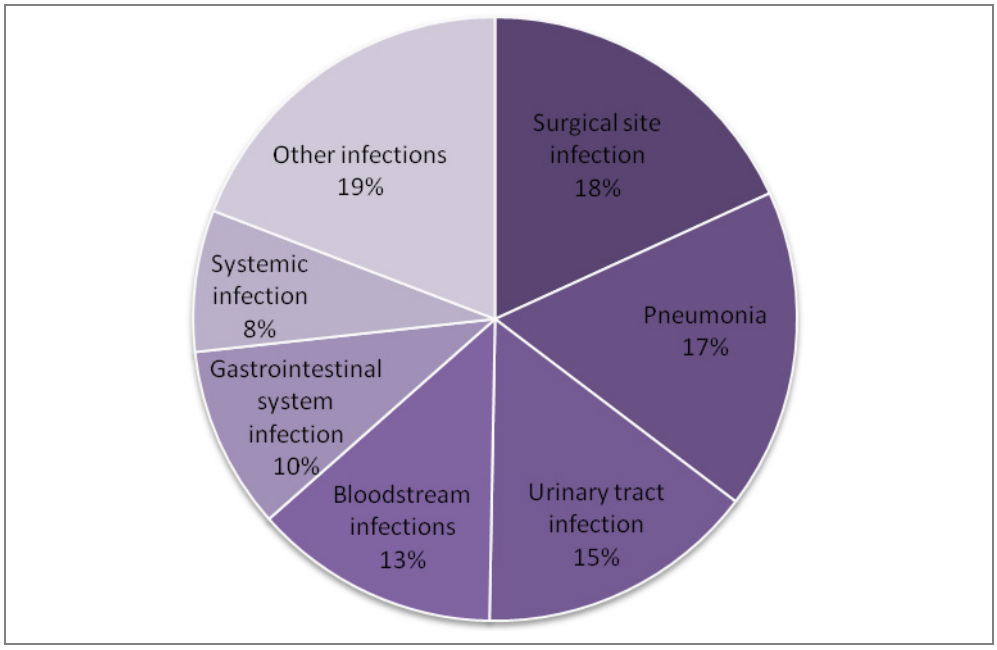
Table 4.16 and Figure 4.6 present the distribution of the 501 active HAI encountered during the PPS. The most common infections were surgical site infections and pneumonia.

Table 4.16: Number, percentage and prevalence of HAI, by HAI type

Rank Order	HAI Infection Site	HAI		
		N	%	Prevalence (%)
1	Surgical site infections	91	18.2	1.0
2	Pneumonia	86	17.2	1.0
3	Urinary tract infections	75	15.0	0.8
4	Bloodstream infections	66	13.2	0.7
5	Gastrointestinal system infections	49	9.8	0.5
6	Systemic infections	38	7.6	0.4
7	Eye, ear, nose, throat or mouth infections	23	4.6	0.3
8	Bone and joint infections	19	3.8	0.2
9	Skin and soft tissue infections	16	3.1	0.2
10	Neonatal specific infections	14	2.8	2.7*
11	Reproductive tract infections	7	1.4	0.1
12	Lower respiratory tract infections	7	1.4	0.1
13	Catheter-related infections	5	1.0	0.1
14	Central nervous system infections	3	0.6	<0.1
15	Cardiovascular system infections	2	0.4	<0.1
	Total	501	100	

*Prevalence of neonatal specific infections in the 526 surveyed patients who were ≤4 weeks old.

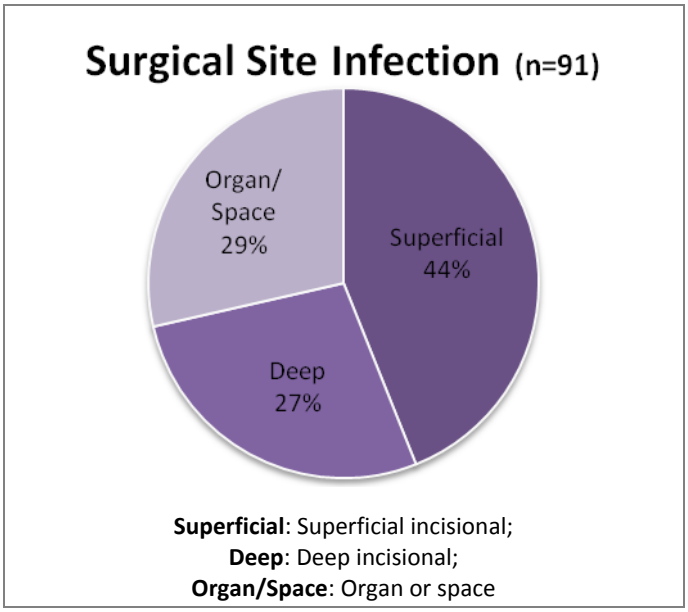
Figure 4.6: Percentage of HAI, by HAI type



Surgical Site Infection (SSI)

The most frequent HAI reported was surgical site infection (SSI), with 91 (18%) cases. Of the SSI, 44% were classified as superficial incisional and 56% were classified as either deep incisional or organ/space SSI (Figure 4.7).

Figure 4.7: Percentage of SSI, by type

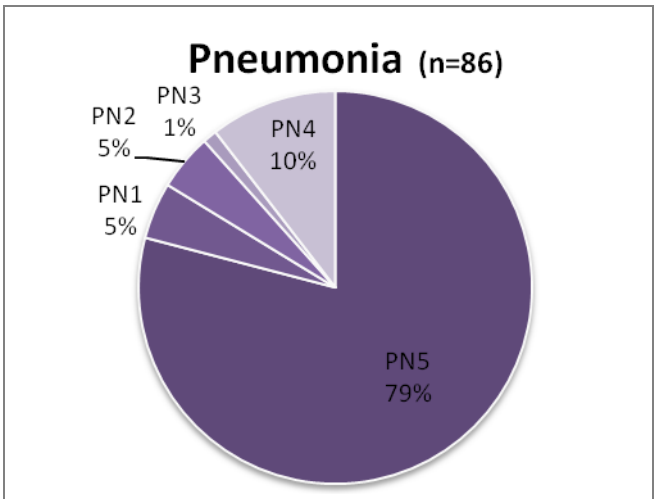


Superficial: Superficial incisional;
Deep: Deep incisional;
Organ/Space: Organ or space

Pneumonia (PN)

Pneumonia (PN) was the second most common HAI, with 86 (17%) cases reported. Whilst patients with pneumonia were required to meet strict radiological and clinical criteria, in accordance with the case definition, 79% of hospital-acquired pneumonia cases were not microbiologically confirmed. Of the 86 pneumonia cases, 17 (20%) were associated with intubation of the respiratory tract. Figure 4.8 illustrates the classification of PN types. Table 4.17 demonstrates the percentage of PN cases associated with intubation.

Figure 4.8: Percentage of pneumonia, by type

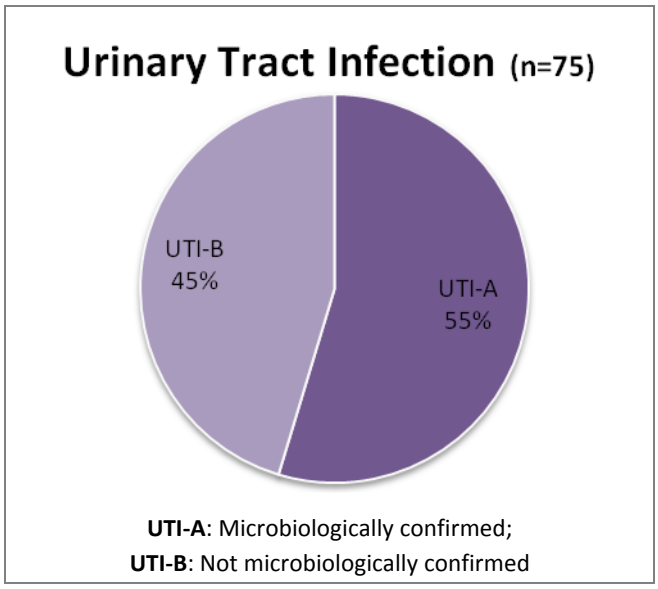


PN1: Protected sample + quantitative culture; **PN2**: Non-protected sample + quantitative sample; **PN3**: Alternative microbiological criteria; **PN4**: Sputum bacteriology or non-quantitative ETA; **PN5**: No microbiology

Urinary Tract Infection (UTI)

Urinary tract infection (UTI) was the third most common HAI, with 75 cases (15%) reported. Just over half of the UTI (55%) were microbiologically confirmed. Of the 75 UTI cases, 31 (41%) were associated with the presence of a urinary catheter. Figure 4.9 illustrates the distribution of UTI, where UTI-A is microbiologically confirmed and UTI-B is not microbiologically confirmed. Table 4.17 demonstrates the percentage of UTI cases associated with presence of a urinary catheter.

Figure 4.9: Percentage of UTI, by type



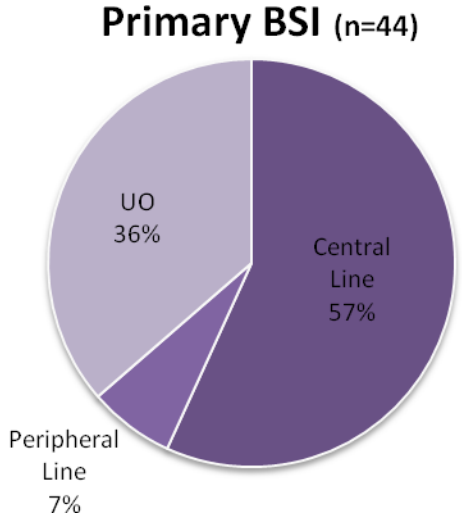
Bloodstream Infection (BSI)

The fourth most commonly encountered HAI was bloodstream infection (BSI), of which there were 66 cases (13%). BSI may be classified as primary BSI (which may be due to an infected vascular catheter/line or of unknown origin, where no source is identifiable) or secondary BSI, which may be further classified based on the underlying infection site. Of the 66 BSI, 44 (67%) were classified as primary BSI, 21 (32%) as BSI arising secondary to infection elsewhere in the body and for one BSI (1%), there was no additional information available to enable determination of the underlying source.

- Figure 4.10 illustrates the breakdown of primary BSI and Table 4.17 demonstrates the percentage of primary BSI cases associated with presence of an indwelling vascular catheter. Of the 44 primary BSI, 36 (82%) occurred in the presence of an indwelling vascular catheter, with the vascular catheter implicated as the source of the primary BSI in 28 (64%) cases. Of the 28 vascular catheter related BSI, 25 were due to central line infection (57% of primary BSI) and three were due to peripheral line infection (7% of primary BSI). For the remaining 16 primary BSI (36%), an underlying source was not identified upon review of the patient's healthcare record and relevant microbiology results. Eight of those patients had documentation of an indwelling vascular catheter, but there was no clinical or microbiological evidence linking the vascular catheter to the patient's bloodstream infection.

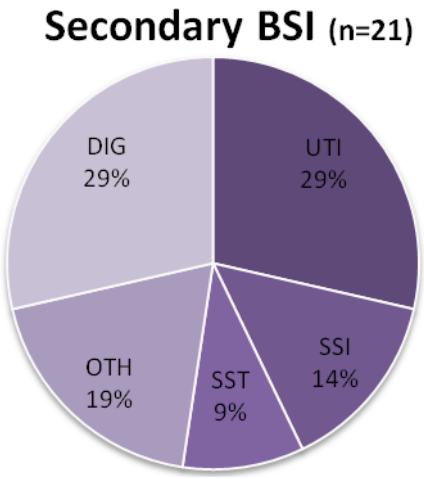
- Figure 4.11 illustrates the breakdown of secondary BSI. Of the 21 secondary BSI, equal proportions arose as a consequence of either digestive tract infection or urinary tract infection [6 cases (29%) for each] and three secondary BSI cases (14%) were detected as a consequence of surgical site infection.

Figure 4.10: Percentage of primary BSI, by origin



Central line: Central vascular catheter infection;
Peripheral line: Peripheral vascular catheter infection;
UO: Primary BSI of unknown origin

Figure 4.11: Percentage of secondary BSI, by origin



Secondary to:
DIG: Digestive tract infection; **UTI**: Urinary tract infection;
SSI: Surgical site infection; **SST**: Skin/soft tissue infection;
OTH: Other infection; **UNK**: Unknown source

Table 4.17: Number and percentage of device-associated HAI

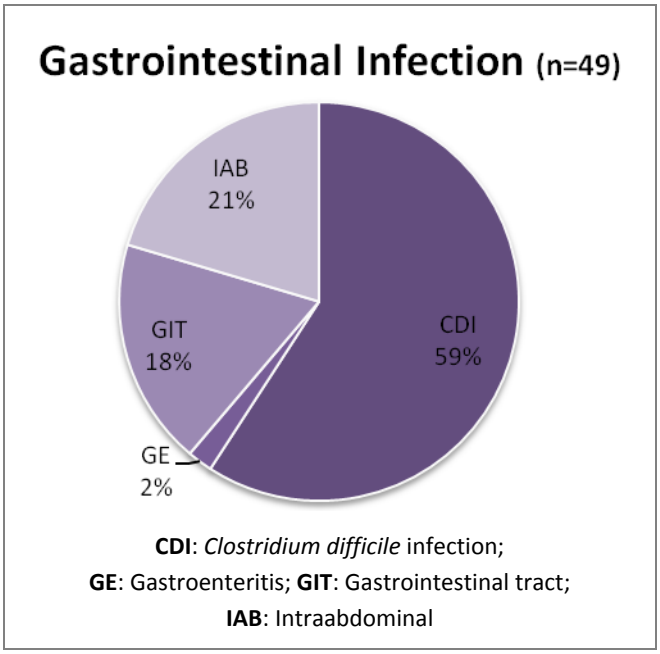
HAI Type	HAI	
	N	%
Pneumonia:		
Respiratory tract intubation present	17	20
Respiratory tract intubation absent	69	80
Total	**86**	**100**
Urinary tract infection:		
Urinary catheterisation present	31	41
Urinary catheterisation absent	44	59
Total	**75**	**100**
Primary blood stream infection:		
Vascular catheter present*	36	82
Vascular catheter absent	8	18
Total	**44**	**100**

*A vascular catheter was documented as the underlying source for 28 of the primary BSI. For the remaining 8 primary BSI, where a vascular catheter was present, the vascular catheter was not the underlying source of infection.

Gastrointestinal Infections

Gastrointestinal (GI) infections were the fifth most common HAI, with 49 cases (10%) reported. Of those, *Clostridium difficile* infections (CDI) accounted for the majority, with 29 cases (59%) reported. Therefore, CDI accounted for 5.7% of all HAI in the PPS. There was one case of hospital-acquired gastroenteritis, which was microbiologically confirmed to be due to rotavirus. There were no microbiologically-confirmed cases of norovirus infection reported. During the PPS, the national level of norovirus activity was reported to be at low-to-medium levels. PPS data collection teams were advised to exclude wards from data collection in the event of an ongoing outbreak of norovirus infection. Of note, one hospital reported a norovirus outbreak during the PPS. Within that hospital, one ward was excluded from PPS data collection. Figure 4.12 illustrates the breakdown of GI infections.

Figure 4.12: Percentage of gastrointestinal infections, by type



CDI: *Clostridium difficile* infection;
GE: Gastroenteritis; **GIT**: Gastrointestinal tract;
IAB: Intraabdominal

4.5 Microbiology and Key Antimicrobial Resistance Markers

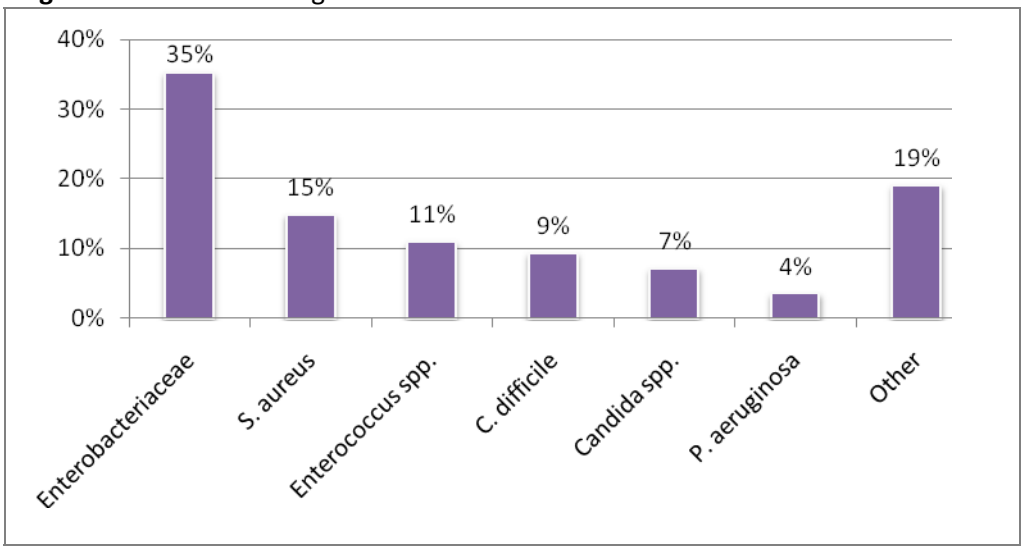
The PPS microbiology and antimicrobial resistance results should be reviewed and interpreted in conjunction with the definitions used in this survey. They are available in the PPS All Ireland Protocol Version 1.3 [Appendix A – Tables 8 & 9 (pages 55 – 59)], which may be accessed on the HPSC website:

http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Surveillance/PointPrevalenceSurvey/2012/Protocol/

4.5.1 Microbiology and Antimicrobial Resistance Data

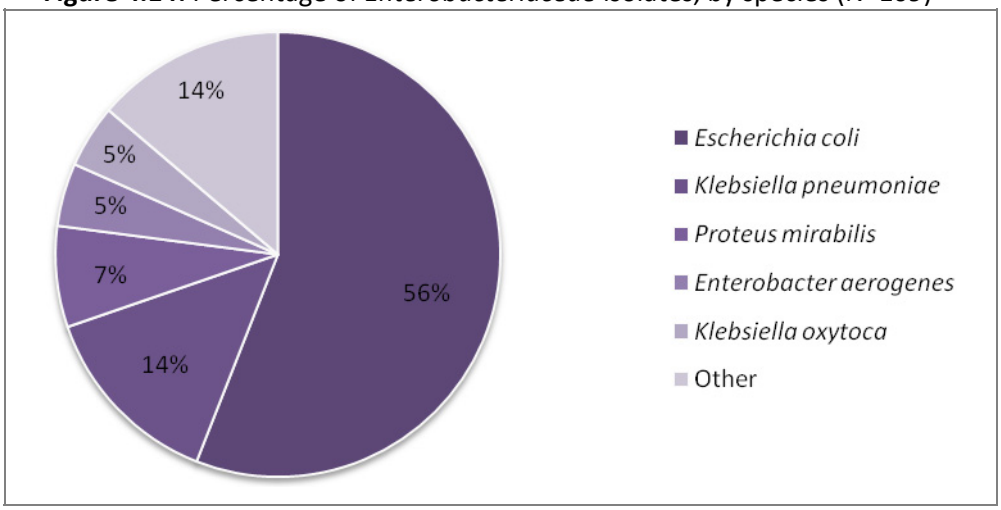
Of the 501 active HAI identified, positive microbiology results were available for 261 (52%) with a total of 310 microorganisms identified from relevant specimens sent to the microbiology laboratory. Figure 4.13 illustrates the microorganism distribution and Figure 4.15 illustrates microorganism breakdown by key antimicrobial resistance markers.

Figure 4.13: HAI microorganism distribution



Of the 310 microorganisms, *Enterobacteriaceae* were the most frequently detected (n=109; 35%). *Enterobacteriaceae* is the term used to describe groups of Gram-negative bacilli, which are associated with the gastrointestinal tract of humans and animals and related bacteria that occur in the environment. Of the *Enterobacteriaceae*, *Escherichia coli* (n=61; 56%), *Klebsiella pneumoniae* (n=15; 14%) and *Proteus mirabilis* (n=8; 7%) were most commonly isolated (Figure 4.14). The majority of *Enterobacteriaceae* (60%) retained susceptibility to third generation cephalosporins (3GC) and carbapenems (Figure 4.15). However, 3GC resistance was reported in 27 (25%) and carbapenem resistance in two (2%) *Enterobacteriaceae* isolated from clinical specimens. There were 26 patients with HAI caused by resistant *Enterobacteriaceae.*

Figure 4.14: Percentage of *Enterobacteriaceae* isolates, by species (N=109)

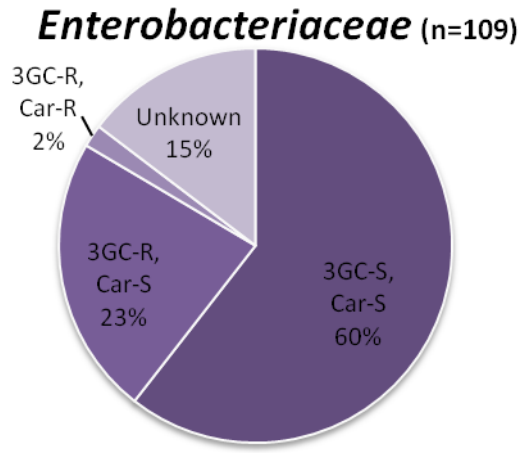


Staphylococcus aureus was the second most frequent pathogen detected (n=46; 15%). The majority of *S. aureus* causing HAI (59%) retained susceptibility to flucloxacillin (MSSA). However, over one third (37%) of *S. aureus* causing HAI were reported as flucloxacillin resistant (MRSA). There were 17 patients with HAI caused by MRSA.

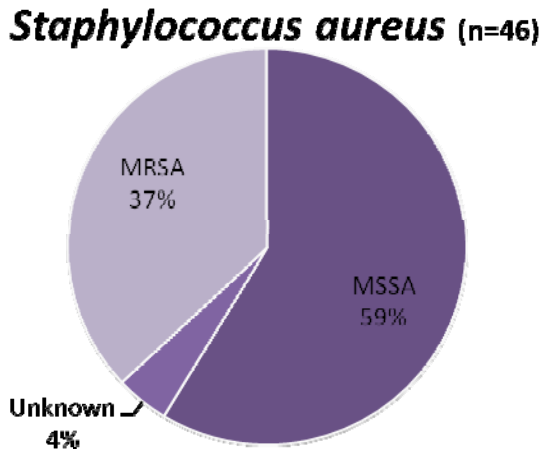
The third most frequent pathogen reported in the survey were enterococci (n=34; 11%). Of the enterococci, just over one-in-four (26%) were reported as resistant to glycopeptides (vancomycin resistant enterococci/VRE). There were nine patients with HAI caused by VRE.

Of the 310 microorganisms, *Clostridium difficile* accounted for 29 (9%).

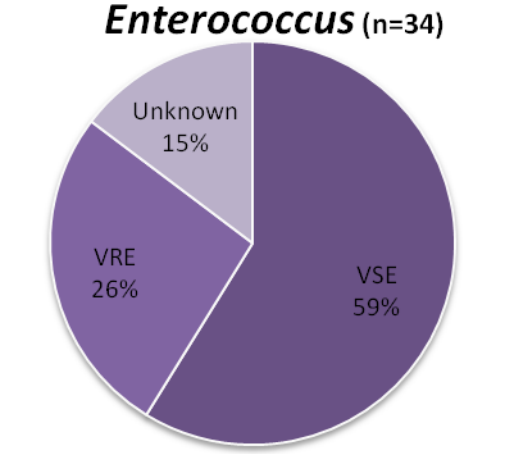
Figure 4.15: Microorganism breakdown, by key antimicrobial resistance markers



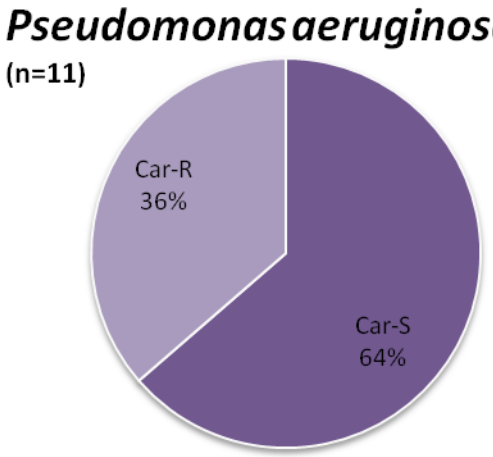
3GC-S: Third generation cephalosporin sensitive;
3GC-R: Third generation cephalosporin resistant;
Car-S: Carbapenem sensitive;
Car-R: Carbapenem resistant



MSSA: Flucloxacillin sensitive;
MRSA: Flucloxacillin resistant



VSE: Vancomycin teicoplanin glycopeptide sensitive;
VRE: Vancomycin teicoplanin glycopeptide resistant



Car-S: Carbapenem sensitive;
Car-R: Carbapenem resistant

4.5.2 Causative Pathogens of the Most Common HAI Types

Surgical site infections: Of the 91 SSI, positive microbiology results were reported for 55 (60%). *S. aureus* was the most common pathogen isolated (20; 26%) followed by *Enterococcus spp.* (13; 17%) and *E. coli* (7; 9%).

Pneumonia: Of the 86 PN cases, positive microbiology results were reported for 17 (20%), with *E. coli* (5; 22%) and *Pseudomonas aeruginosa* (3; 13%) the most common pathogens isolated.

Urinary tract infections: Of the 75 UTIs, positive microbiology results were reported for 48 (64%), with *E. coli* (26; 54%), *Klebsiella spp.* (5; 10%) and *Proteus mirabilis* (5; 10%) the most common pathogens isolated.

Bloodstream infections: Of the 66 BSI, the causative pathogen was reported for 63 (95%). *S. aureus* (13; 19%), *E. coli* (11; 16%) and coagulase negative staphylococci (9; 13%) were the most common pathogens isolated.

***Clostridium difficile* infection**: All 29 cases of *Clostridium difficile* infection were microbiologically confirmed.

4.6 Antimicrobial Use

The PPS antimicrobial use results should also be reviewed and interpreted in conjunction with the methodology and definitions used in this survey. They are available in the PPS All Ireland Protocol Version 1.3 [Section 4.6.4 (pages 32 – 36) and Appendix A: Tables 4 & 5 (pages 50 – 52)], which may be accessed on the HPSC website:

http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Surveillance/PointPrevalenceSurvey/2012/Protocol/

4.6.1 Overall Prevalence of Antimicrobial Use

Of the 9,030 eligible patients, 3,108 were classified as receiving systemic antimicrobials, resulting in an antimicrobial use (AMU) prevalence of 34% (95% CI 33.4%-35.4%). Overall, 4,532 antimicrobials were prescribed (antibacterials = 4,369, antifungals = 163), equating to 1.5 antimicrobials per patient. At the time of survey, 894 patients were prescribed two antimicrobials and 223 patients were prescribed three or more antimicrobials (Table 4.18).

Table 4.18: Number of antimicrobials prescribed per patient

Number of antimicrobials prescribed per patient	Patients	
	N	%
0	5,922	65.6
1	1,991	22.0
2	894	9.9
3	158	1.8
4	46	0.5
5	19	0.2
Total	9,030	100

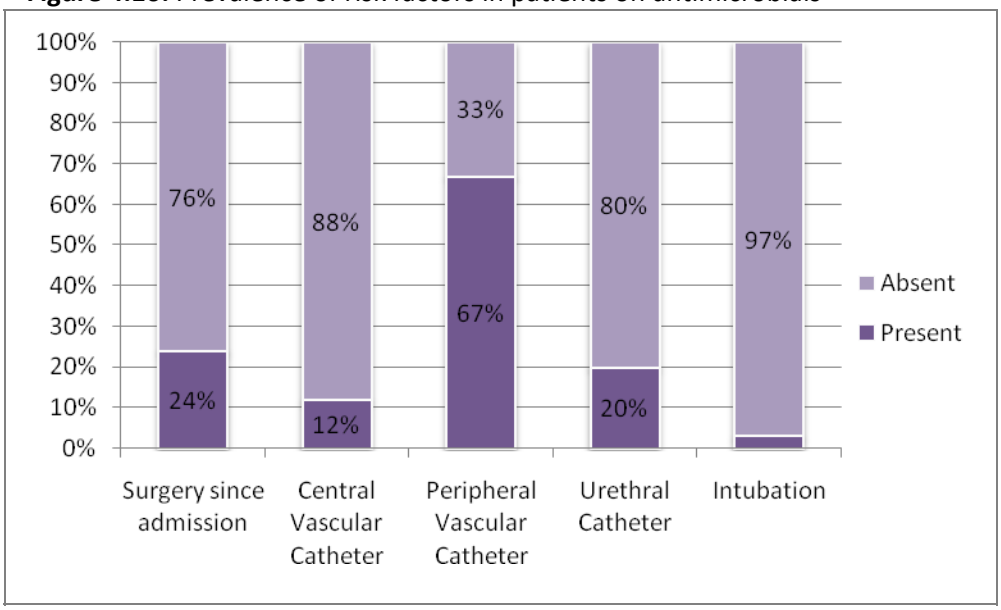
The breakdown of antimicrobial use prevalence, by hospital type and for each of the 50 participating hospitals is provided in Section 4.7.

4.6.2 Antimicrobial Use Patient Risk Factors

Figure 4.16 illustrates the prevalence of risk factors in patients prescribed antimicrobials. A greater proportion of the 3,108 patients receiving antimicrobials had a history of surgery since admission to the participating hospital, in comparison with the overall cohort of 9,030 eligible patients (24% versus 18%). The patients with a history of surgery since admission were prescribed 1,098 antimicrobials, of which; 563 (51%) were for treatment of infection, 451 (41%) for surgical antimicrobial prophylaxis and 84 (8%) for other indications.

The prevalence of invasive device utilisation was also greater for all devices across the antimicrobial use patient cohort than the overall eligible patient cohort [peripheral vascular catheter (PVC); 67 versus 41%, central vascular catheter (CVC); 12 versus 6%, urethral catheterisation; 20% versus 12% and respiratory tract intubation; 3 versus 1%]. It should be noted that as 63% of antimicrobials were administered via the parenteral route, the presence of an intravascular catheter may also have been for administration of antimicrobials rather than solely as a risk factor for the patient being prescribed antimicrobials.

Figure 4.16: Prevalence of risk factors in patients on antimicrobials



4.6.3 Antimicrobial Use Prevalence, by Gender, Age and McCabe Score

The prevalence of antimicrobial use by gender, age and McCabe Score, with univariate odds ratio (OR) analysis is presented in Table 4.19.

Of the 3,108 patients receiving antimicrobials, females accounted for 1,605 (52%). However, the antimicrobial use prevalence was significantly higher in males (36.0%) when compared with females (33.1%; p= 0.004).

The vast majority of patients receiving antimicrobials (91%; n=2,838) were aged ≥16 years. The remaining 270 patients (9%) were aged 0 to 15 years. Overall, the highest prevalence of antimicrobial use was recorded for patients aged between two and 15 years (41.8%). In the adult population, the antimicrobial use prevalence was highest in the group aged 65 to 79 years (38.9%).

The underlying disease prognosis, as measured by the McCabe score, was also significantly associated with antimicrobial use prevalence (p<0.001). The odds ratio increased with the severity of the McCabe score. The highest antimicrobial use prevalence was reported for patients with a 'rapidly fatal' McCabe score (49.5%; 95% CI 44.0-55.0).

Table 4.19: Antimicrobial use prevalence, by gender, age and McCabe score

Risk Factor	Category	Number of Patients	Number of Patients with AMU	AMU Prevalence (%)	95% CI		Odds Ratio	Odds Ratio 95% CI		P-value
					Lower	Upper		Lower	Upper	
Gender	Male	4,180	1,503	36.0	34.5	37.4	1.14	1.04	1.24	0.004
	Female*	4,850	1,605	33.1	31.8	34.4	-	-	-	
Age Group	<1 month	526	62	11.8	9.3	14.8	0.24	0.18	0.32	<0.001
	1-23 months	267	83	31.1	25.8	36.9	0.82	0.62	1.08	
	2-15 years	299	125	41.8	36.4	47.5	1.30	1.01	1.67	
	16-29 years	636	204	32.1	28.6	35.8	0.85	0.71	1.03	
	30-49 years	1,411	430	30.5	28.1	32.9	0.79	0.68	0.92	
	50-64 years	1,561	583	37.3	35.0	39.8	1.08	0.94	1.24	
	65-79 years	2,453	953	38.9	36.9	40.8	1.15	1.02	1.30	
	80+ years*	1,877	668	35.6	33.5	37.8	-	-	-	
McCabe Score	Non-fatal*	6,673	2,087	31.3	30.2	32.4	-	-	-	<0.001
	Ultimately fatal	1,955	842	43.1	40.9	45.3	1.66	1.50	1.84	
	Rapidly fatal	311	154	49.5	44.0	55.0	2.16	1.72	2.71	
	Not known	91	25	27.5	19.4	37.4	0.83	0.52	1.32	

* Reference group for odds ratio calculation

4.6.4 Antimicrobial Use Prevalence, by Ward Specialty and Admitting Consultant Specialty

The prevalence of antimicrobial use by ward specialty is shown in Table 4.20. Antimicrobial use prevalence was highest in augmented care units [adult and paediatric ICUs, high dependency units, neonatal ICUs and special care baby units] (50.4%), followed by mixed specialty (46.2%) and surgical wards (40.5%). The lowest antimicrobial use prevalence was recorded in psychiatric wards (5.5%).

The prevalence of antimicrobial use by admitting consultant specialty is shown in Table 4.21. The highest antimicrobial use prevalence, at 44.5% (95% CI 42.5-46.5), was recorded for the 2,346 patients admitted under the care of a surgical consultant, followed by 38.2% (95% CI 36.7-39.6) antimicrobial use prevalence for the 4,157 patients admitted under the care of a medical consultant.

Table 4.20: Antimicrobial use prevalence, by ward specialty

Ward Specialty	Number of Patients	Number of Patients Receiving Antimicrobials	Prevalence (%)	95% Confidence Interval
Augmented Care*	419	211	50.4	45.6 - 55.1
Mixed Specialty^	587	271	46.2	42.2 – 50.2
Surgical+	1,981	802	40.5	38.4 - 42.7
Other Specialty	819	330	40.3	37.0 – 43.7
Paediatrics	406	153	37.7	33.1 - 42.5
Medical	3,042	1,110	36.5	34.8 - 38.2
Care of the Elderly	161	31	19.3	13.9 - 26.0
Obstetrics/Gynaecology	1,017	159	15.6	13.5 - 18.0
Rehabilitation	142	16	11.3	7.1 – 17.5
Psychiatric	456	25	5.5	3.7 – 8.0
Total	**9,030**	**3,108**	**34.0**	**33.4 - 35.4**

***** Includes patients in adult, paediatric and neonatal intensive care units, paediatric high dependency units and special care baby units

^ Mixed ward specialty chosen when two main sub-specialties accounted for majority of patients on the ward

\+ Includes patients on paediatric surgical wards

Table 4.21: Antimicrobial use prevalence, by admitting consultant specialty

Consultant Specialty	Number of Patients	Number of Patients Receiving Antimicrobials	Prevalence (%)	95% Confidence Interval
Surgical	2,346	1,043	44.5	42.5 - 46.5
Medical	4,157	1,586	38.2	36.7 - 39.6
Care of the Elderly	376	86	22.9	18.9 - 27.4
Obstetrics/Gynaecology	887	196	22.1	19.5 - 24.9
Intensive Care (Neonatal)	120	25	20.8	14.5 - 28.9
Paediatrics	642	129	20.1	17.2 - 23.4
Rehabilitation	17	1	5.9	1.0 - 27.0
Psychiatric	460	25	5.4	3.7 - 7.9
Other	25	17	68.0	48.4 - 82.8
Total	**9,030**	**3,108**	**34.0**	**33.4 - 35.4**

4.6.5 Route of Administration of Antimicrobial

The route of administration of the 4,532 prescribed antimicrobials is described in Table 4.22. The majority (n=2,855; 63%) were administered via the parenteral (i.e., intravenous) route.

Table 4.22: Number and percentage of antimicrobials, by route of administration

Route of Administration	Antimicrobials Prescribed	
	N	%
Parenteral	2,855	63.0
Enteral	1,657	36.6
Inhalation	20	0.4
Total	4,532	100

4.6.6 Documentation of Indication and Compliance with Local Policy

For 3,767 of 4,532 antimicrobial prescriptions (83%), the indication was documented in the patient's healthcare record and/or medication chart (Figure 4.17).

Of the 4,532 prescriptions, the choice of prescribed agent was deemed assessable against a local prescribing policy for 3,258 (72%).

The circumstances in which a prescription may be deemed non-assessable include:

- There is no local prescribing policy available for that indication
- The patient has a documented antimicrobial allergy which prevents them being prescribed the recommended agent
- The indication for prescription is for medical prophylaxis or use of erythromycin as a pro-kinetic agent
- The antimicrobial has been advised on advice from a clinical microbiologist or infectious diseases (ID) physician
- The reason for the prescription cannot be determined from review of the patient's notes and discussion with staff caring for the patient or the information is missing from the ward

Of the 3,258 assessable prescriptions, 877 (27%) were deemed to be non-compliant with the local prescribing policy. Figure 4.18 demonstrates the breakdown of the 3,258 assessable prescriptions.

Figure 4.17: Documented indication for the prescribed antimicrobial

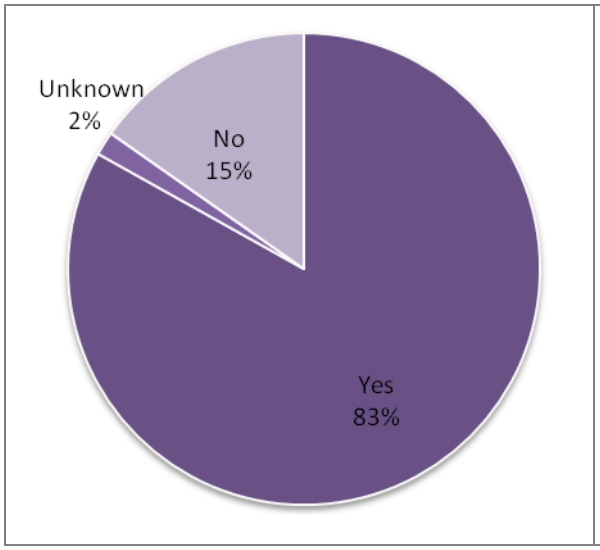
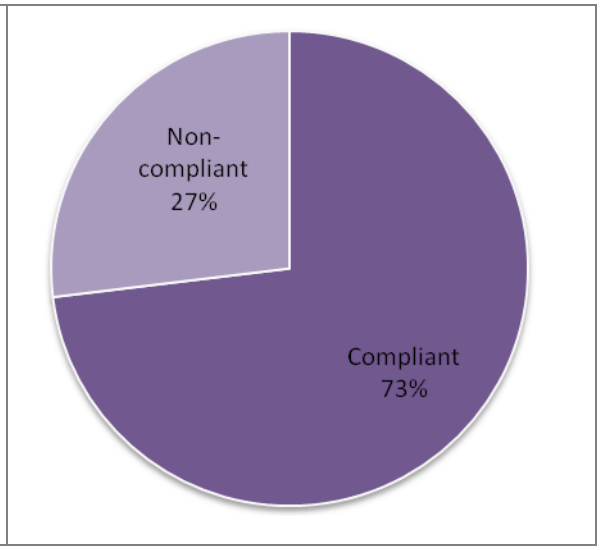


Figure 4.18: Percentage of assessable prescriptions, compliant with local prescribing policy (n=3,258)



4.6.7 Description of Prescribed Antibacterials

The 20 most commonly prescribed agents collectively accounted for over 90% of all antimicrobials prescribed (3,982). The most commonly prescribed antibacterial class was the β lactam/β lactamase inhibitor combination agents (co-amoxiclav and piperacillin-tazobactam) which together accounted for 1,553 (35%) antibacterial prescriptions. Table 4.23 demonstrates the breakdown of the 4,369 prescribed antibacterials.

Table 4.23: Number and percentage of prescribed antibacterials

Rank Order	Antibacterial Agent	Antibacterials Prescribed	
		N	%
1	Co-amoxiclav	974	22
2	Piperacillin-tazobactam	579	13
3	Metronidazole	359	8
4	Ciprofloxacin	287	7
5	Clarithromycin	242	6
6	Flucloxacillin	242	6
7	Gentamicin	208	5
8	Cefuroxime	182	4
9	Vancomycin	174	4
10	Meropenem	130	3
11	Benzylpenicillin	123	3
12	Trimethoprim	63	1
13	Cefotaxime	59	1
14	Nitrofurantoin	56	1
15	Amoxicillin	55	1
16	Trimethoprim & sulphamethoxazole (co-trimoxazole)	55	1
17	Levofloxacin	54	1
18	Linezolid	51	1
19	Clindamycin	49	1
20	Erythromycin	40	1
21	Other agents	387	9
	Total	4,369	100

4.6.8 Description of Prescribed Antifungals

Table 4.24 demonstrates the breakdown of the 163 prescribed antifungals.

Table 4.24: Number and percentage of prescribed antifungals

Rank Order	Antifungal Agent	Antifungals Prescribed	
		N	%
1	Fluconazole	68	42
2	Nystatin	39	24
3	Caspofungin	22	13
4	Amphotericin B	15	9
5	Posaconazole	8	5
6	Anidulafungin	7	4
7	Voriconazole	4	2
	Total	163	100

4.6.9 Indication for Antimicrobial Prescribing

Table 4.25 describes the prescriber's indication for the antimicrobial prescribed. The majority of prescriptions (n=3,526; 78%) were for the treatment of infection. Surgical antimicrobial prophylaxis accounted for 508 prescriptions (11%) and medical prophylaxis for 361 prescriptions (8%).

Table 4.25: Number and percentage of antimicrobials, by prescriber's indication

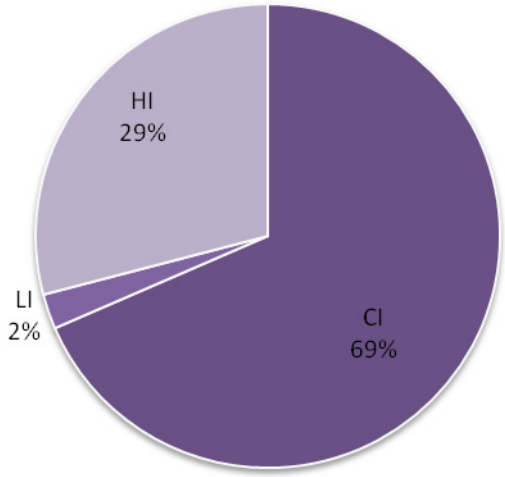
Prescriber's Indication	Antimicrobials Prescribed	
	N	%
Treatment of infection	3,526	78
Surgical antimicrobial prophylaxis	508	11
Medical prophylaxis	361	8
Other	38	1
Unknown	99	2
Total	4,532	100

4.6.10 Antimicrobials Prescribed for Treatment of Infection

Of the 3,526 prescriptions for treatment of infection, the majority were for treatment of community-associated infections (2,415 prescriptions; 69%) followed by hospital-associated infections (1,025 prescriptions; 29%) and long-term care facility-associated infections (86 prescriptions; 2%) (Figure 4.19).

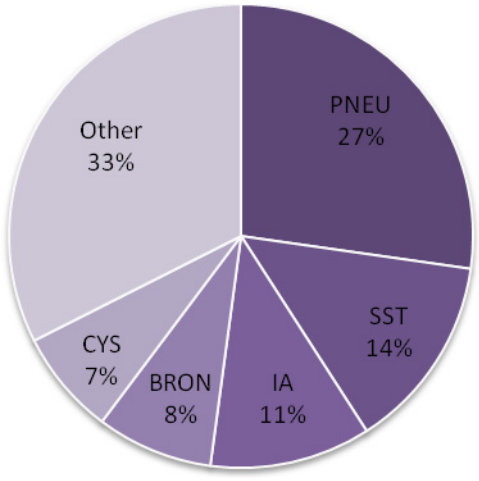
The prescriber's diagnosis or suspected site for the infection being treated was also recorded (Figure 4.20). The respiratory tract accounted for 1,247 (35%) prescriptions [pneumonia 961 (27%) and bronchitis 286 (8%)], skin, wound or soft tissue infections for 481 (14%), intra-abdominal infection for 396 (11%) and cystitis/urinary tract infection for 258 (7%) prescriptions.

Figure 4.19: Percentage of antimicrobials prescribed for treatment of infection, by origin of infection (N=3,526)



CI: Community-associated infection;
LI: Infection associated with long-term care facility;
HI: Hospital-associated infection

Figure 4.20: Percentage of antimicrobials prescribed for treatment of infection, by site of infection (N=3,526)



PNEU: Pneumonia; **SST**: Skin and soft tissue infection;
IA: Intraabdominal infection; **BRON**: Bronchitis;
CYS: Cystitis or symptomatic lower urinary tract infection

Figures 4.21 to 4.24 and Table 4.26 demonstrate the most common agents (number and cumulative percentage) used to treat the most common infection types, as diagnosed by prescribers.

Figure 4.21: Number and cumulative percentage of antimicrobials prescribed to treat respiratory infections, including pneumonia and bronchitis (N=1,247)

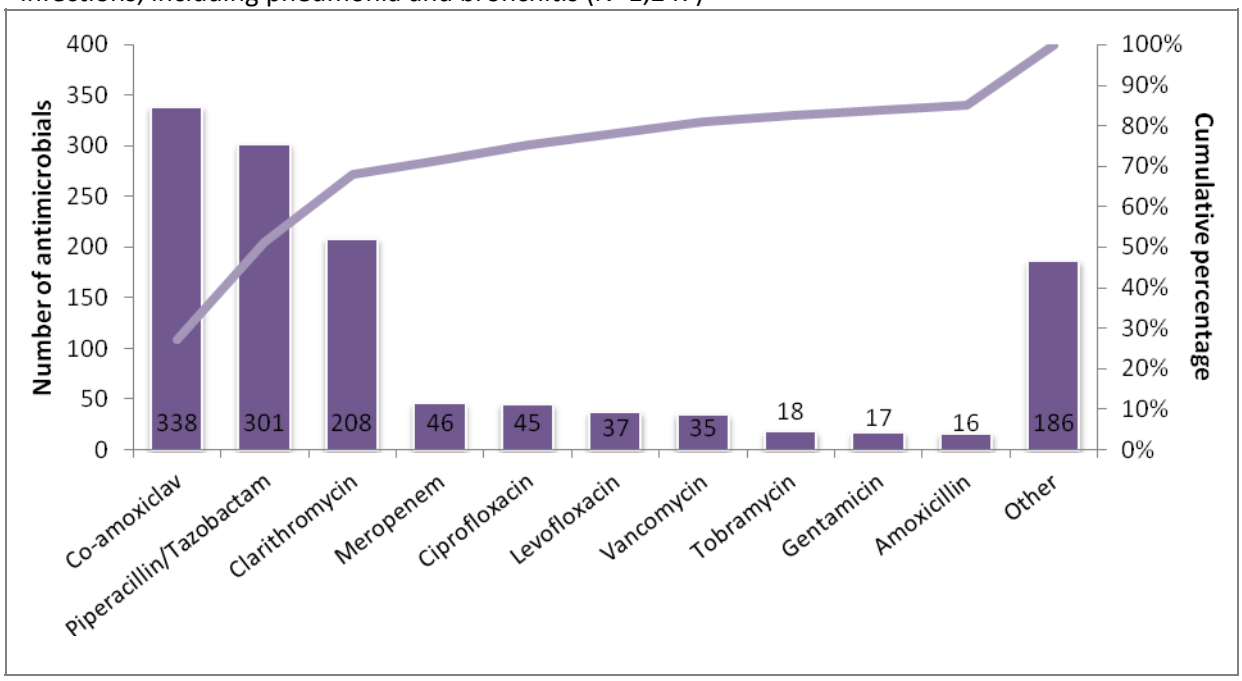


Figure 4.22: Number and cumulative percentage of antimicrobials prescribed to treat skin and soft tissue infections, including cellulitis, wound and deep soft tissue infections (N=481)

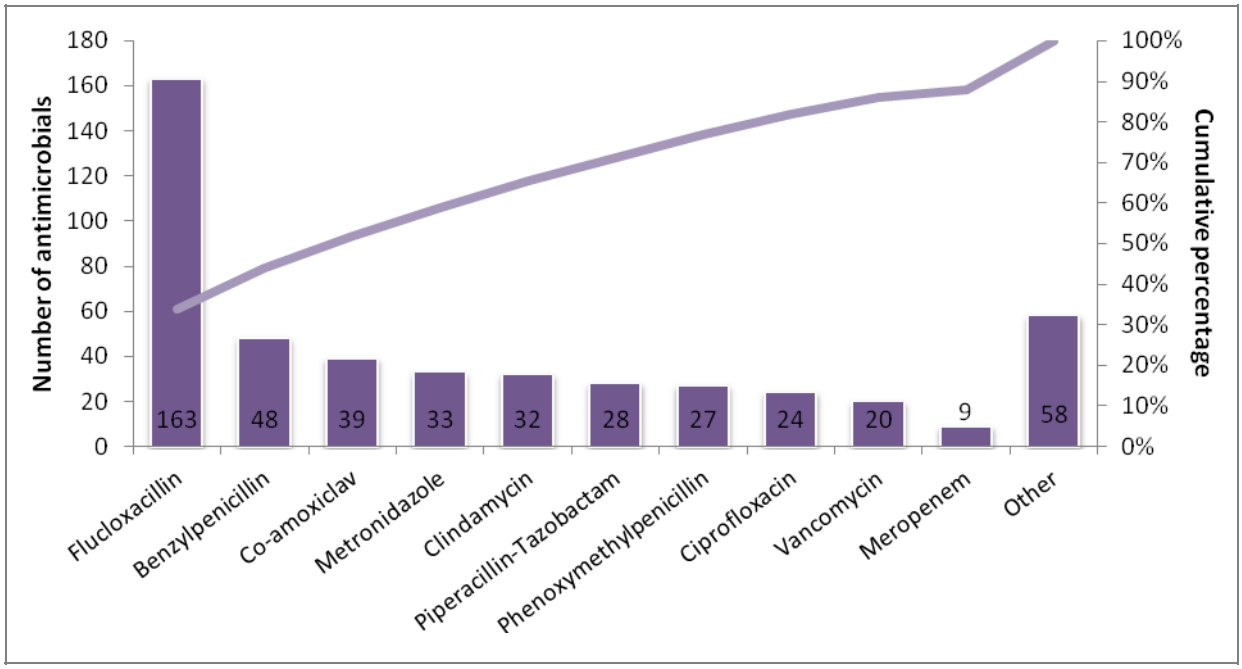


Figure 4.23: Number and cumulative percentage of antimicrobials prescribed to treat intra-abdominal infections (N=396)

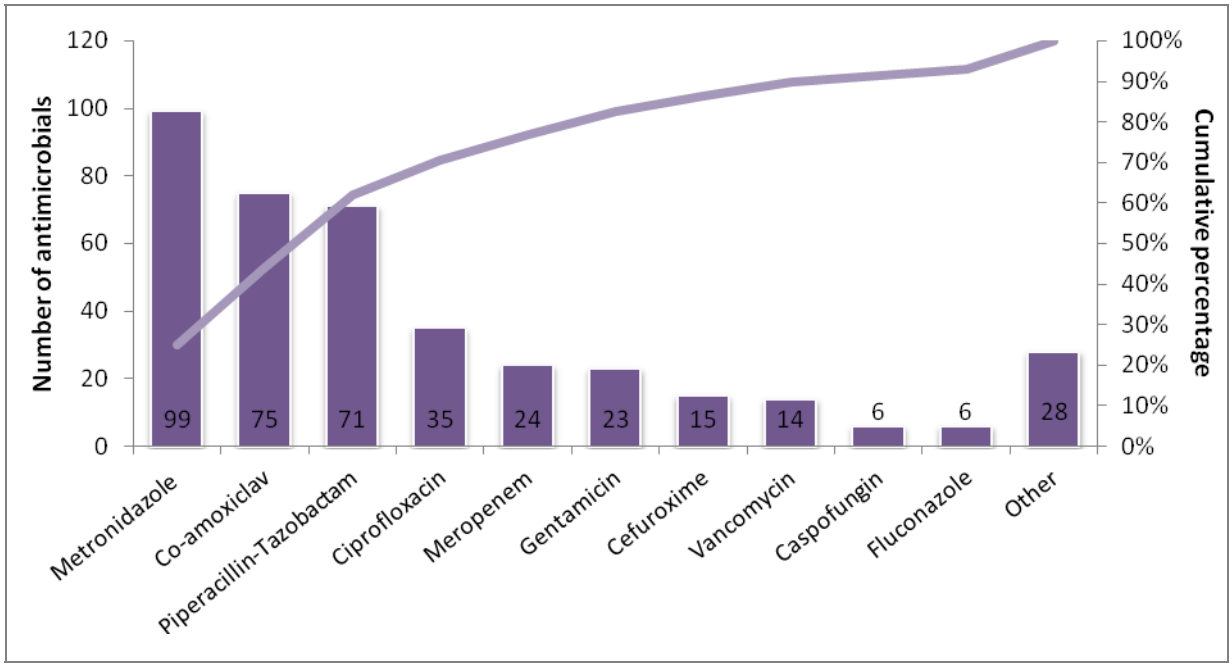


Figure 4.24: Number and cumulative percentage of antimicrobials prescribed to treat cystitis or symptomatic lower urinary tract infections (N=258)

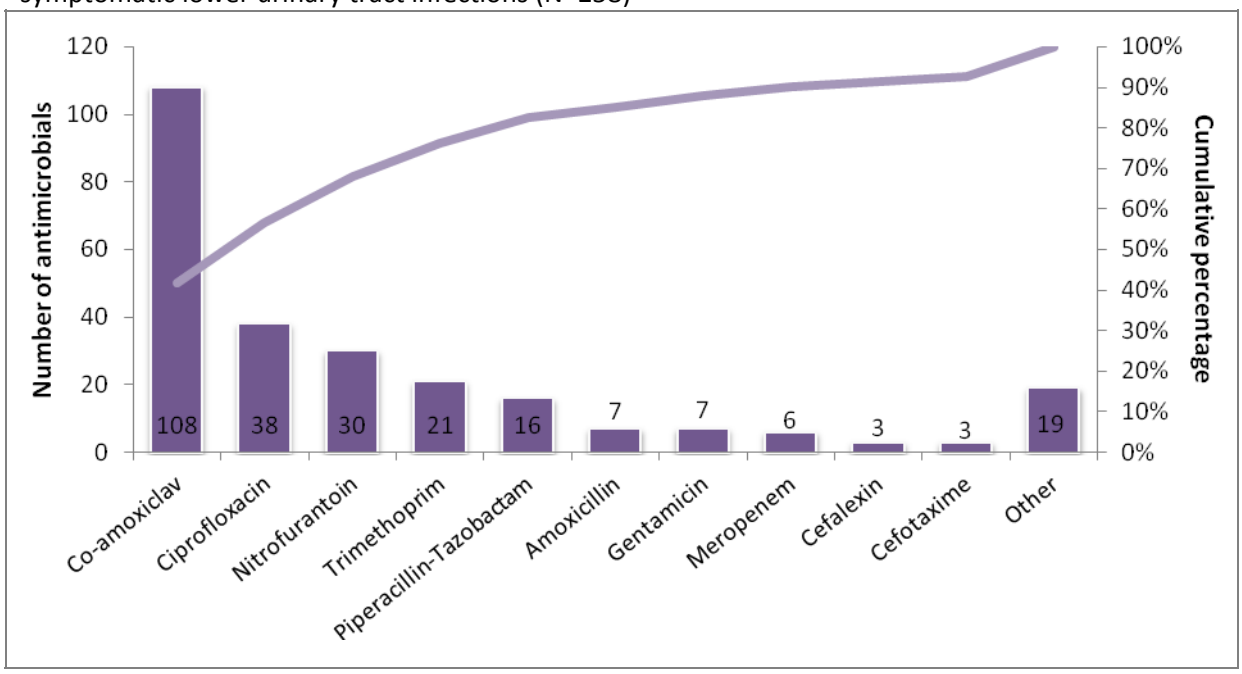


Table 4.26: Number and percentage of antimicrobials prescribed for treatment of common infection types

Diagnosis/Site of Infection being Treated	Antimicrobial Agent	Antimicrobial Prescribed	
		N	%
Respiratory	Co-amoxiclav	338	27.1
	Piperacillin-tazobactam	301	24.1
	Clarithromycin	208	16.7
	Meropenem	46	3.7
	Ciprofloxacin	45	3.6
	Levofloxacin	37	3.0
	Vancomycin	35	2.8
	Tobramycin	18	1.4
	Gentamicin	17	1.4
	Amoxicillin	16	1.3
	Other	186	14.9
	Total	**1,247**	**100**
Skin and soft tissue infection	Flucloxacillin	163	33.9
	Benzylpenicillin	48	10.0
	Co-amoxiclav	39	8.1
	Metronidazole	33	6.9
	Clindamycin	32	6.7
	Piperacillin-tazobactam	28	5.8
	Phenoxymethylpenicillin	27	5.6
	Ciprofloxacin	24	5.0
	Vancomycin	20	4.2
	Meropenem	9	1.9
	Other	58	12.1
	Total	**481**	**100**
Intra-abdominal infection	Metronidazole	99	25.0
	Co-amoxiclav	75	18.9
	Piperacillin-tazobactam	71	17.9
	Ciprofloxacin	35	8.8
	Meropenem	24	6.1
	Gentamicin	23	5.8
	Cefuroxime	15	3.8
	Vancomycin	14	3.5
	Caspofungin	6	1.5
	Fluconazole	6	1.5
	Other	28	7.1
	Total	**396**	**100**
Cystitis or symptomatic lower urinary tract infection	Co-amoxiclav	108	41.9
	Ciprofloxacin	38	14.7
	Nitrofurantoin	30	11.6
	Trimethoprim	21	8.1
	Piperacillin-tazobactam	16	6.2
	Amoxicillin	7	2.7
	Gentamicin	7	2.7
	Meropenem	6	2.3
	Cefalexin	3	1.2
	Cefotaxime	3	1.2
	Other	19	7.4
	Total	**258**	**100**

4.6.11 Surgical Antimicrobial Prophylaxis

Surgical antimicrobial prophylaxis accounted for 508 (11%) prescriptions, with just 138 of those (27%) single-dose prescriptions. In this survey, 370 (73%) surgical antimicrobial prophylaxis prescriptions exceeded one dose, and of those 237 (47% of overall) exceeded 24 hours duration (Figure 4.25). Table 4.27 demonstrates the antimicrobial agents prescribed by name, number and percentage.

Figure 4.25: Duration of surgical antimicrobial prophylaxis (N=508)

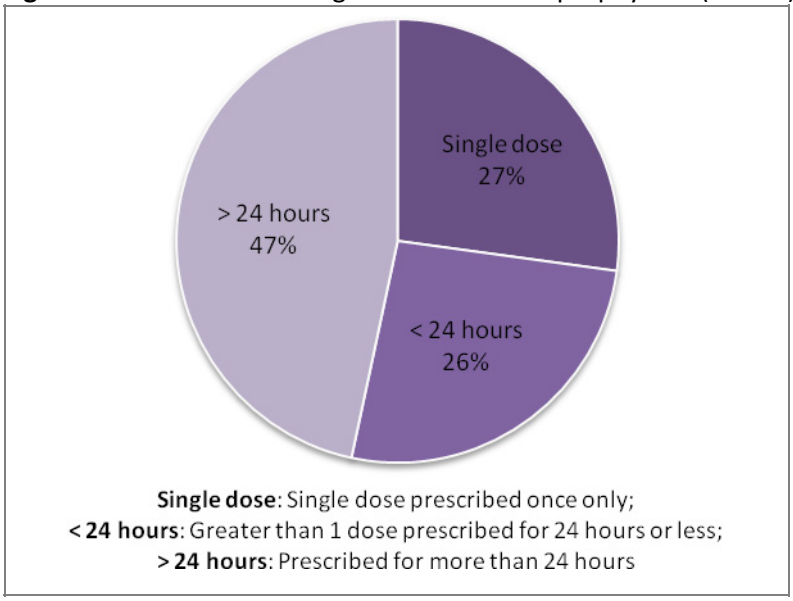


Table 4.27: Agents prescribed for surgical antimicrobial prophylaxis

Rank Order	Antimicrobial Agent	Antimicrobials Prescribed	
		N	%
1	Co-amoxiclav	199	39.2
2	Cefuroxime	134	26.4
3	Metronidazole	56	11.0
4	Gentamicin	30	5.9
5	Ciprofloxacin	26	5.1
6	Vancomycin	14	2.8
7	Teicoplanin	7	1.4
8	Amoxicillin	5	1.0
9	Flucloxacillin	5	1.0
10	Piperacillin-tazobactam	5	1.0
11	Others	27	5.3
	Total	508	100

4.6.12 Medical Prophylaxis

Medical prophylaxis accounted for 361 (8%) prescriptions. Table 4.28 demonstrates the antimicrobial agents prescribed as medical prophylaxis by name, number and percentage. The indication for medical prophylaxis was not recorded during the PPS. The broad spectrum agents, co-amoxiclav accounted for 8.6% and ciprofloxacin for 4.4% of medical prophylaxis, respectively.

Table 4.28: Agents prescribed for medical prophylaxis

Rank Order	Antimicrobial Agent	Antimicrobials Prescribed	
		N	%
1	Trimethoprim & sulphamethoxazole (co-trimoxazole)	42	11.6
2	Trimethoprim	32	8.9
3	Co-amoxiclav	31	8.6
4	Gentamicin	30	8.3
5	Benzylpenicillin	23	6.4
6	Nitrofurantoin	21	5.8
7	Nystatin	20	5.5
8	Azithromycin	17	4.7
9	Ciprofloxacin	16	4.4
10	Erythromycin	12	3.3
11	Others	117	32.4
	Total	361	100

4.7 Prevalence of HAI and Antimicrobial Use, by Hospital Type and Participating Hospitals

Fifty acute hospitals (42 public, seven private and one private specialist) participated in the survey. The overall HAI prevalence for the 42 public hospitals was over twice that in the eight private hospitals (5.6 versus 2.1%). The overall antimicrobial use prevalence for the 42 acute public hospitals was 35.2% versus 29.2% for the eight private hospitals (Table 4.29).

Table 4.30, Figures 4.26 and 4.27 demonstrate the prevalence of HAI and antimicrobial use by hospital type. For the purposes of HAI and AMU analysis by hospital type, the 11 specialist public and one specialist private hospital have been grouped together. The specialist private hospital has not been included in the analysis of the private hospitals. The HAI prevalence was highest in tertiary hospitals (7.5%) and lowest in private hospitals (2.5%). The prevalence of antimicrobial use was quite similar across primary, secondary, tertiary and private hospitals and was lowest in specialist hospitals (20.3%).

Despite having a lower prevalence of HAI, the prevalence of antimicrobial use was higher for the seven private hospitals (37.3%) compared to the overall prevalence (34.0%). However, private hospitals had a higher percentage of patients on surgical wards (35%) in comparison to public hospitals (21%), a factor which may have contributed to the higher prevalence of antimicrobial use in private hospitals.

Table 4.31 demonstrates the prevalence of HAI and antimicrobial use by participating hospital. The HAI prevalence by participating hospital has been further broken down into the overall HAI prevalence and the prevalence of HAI acquired in the participating hospital.

For the purposes of reporting, 42 public hospitals are grouped by HSE administrative region and eight private hospitals are grouped separately. Direct comparison of HAI and AMU prevalence in acute hospitals within the same HSE region is not recommended, owing to differences in hospital type and case mix. Likewise, direct comparison of HAI and AMU prevalence between private hospitals is not recommended. Inter-hospital comparisons between similar hospital types should be undertaken with caution, as individual hospitals have differing patient case mix and workloads. For example, elective admissions only versus both elective and emergency admissions, predominance of day surgery versus major cardiothoracic surgery, admissions to an on-site critical care unit versus no on-site critical care unit etc. Such factors will have significant impact on the prevalence of HAI and AMU within an individual hospital and limit the validity of inter-hospital comparisons.

Table 4.29: Participating hospitals; overall prevalence of HAI and antimicrobial use

Hospitals	Number of Participating Hospitals	Number of Eligible Patients	HAI Prevalence (%)	95% Confidence Interval (%)	Antimicrobial Use Prevalence (%)	95% Confidence Interval (%)
Public Hospitals	42	7,898	5.6	5.1 – 6.1	35.2	34.1 – 36.2
Private Hospitals	8	1,132	2.1	1.4 – 3.1	29.2	26.7 – 32.0
Overall	50	9,030	5.2	4.7 – 5.6	34.0	33.4 – 35.4

Table 4.30: Participating hospitals; prevalence of HAI and antimicrobial use, by hospital type

Hospital Type	Number of Participating Hospitals	Number of Eligible Patients	HAI Prevalence (%)	95% Confidence Interval (%)	Antimicrobial Use Prevalence (%)	95% Confidence Interval (%)
Primary	15	1,624	5.1	4.1 - 6.3	36.9	34.6 - 39.3
Secondary	10	2,100	3.9	3.2 – 4.8	36.2	34.2 – 38.3
Tertiary	6	3,080	7.5	6.6 – 8.5	37.4	35.7 – 39.2
Specialist^	12	1,379	3.6	2.8 – 4.7	20.3	18.3 – 22.5
Private	7	847	2.5	1.6 – 3.8	37.3	34.1 – 40.6

^ For the purpose of data analysis by hospital type, the private specialist hospital has been included in the specialist hospital category along with the 11 public specialist hospitals. Of the 1,379 patients in specialist hospitals, 1,094 were in 11 public hospitals and 285 were in one private hospital. Thus, the private specialist hospital has not been included in the private hospital category

Figure 4.26: HAI prevalence box plots, by hospital type

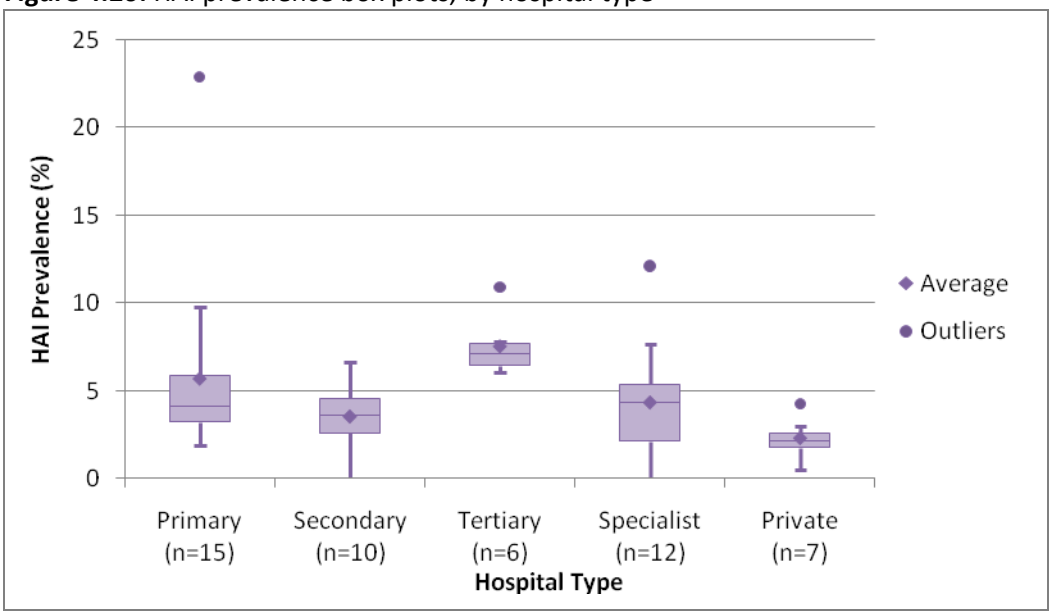


Figure 4.27: Antimicrobial use prevalence box plots, by hospital type

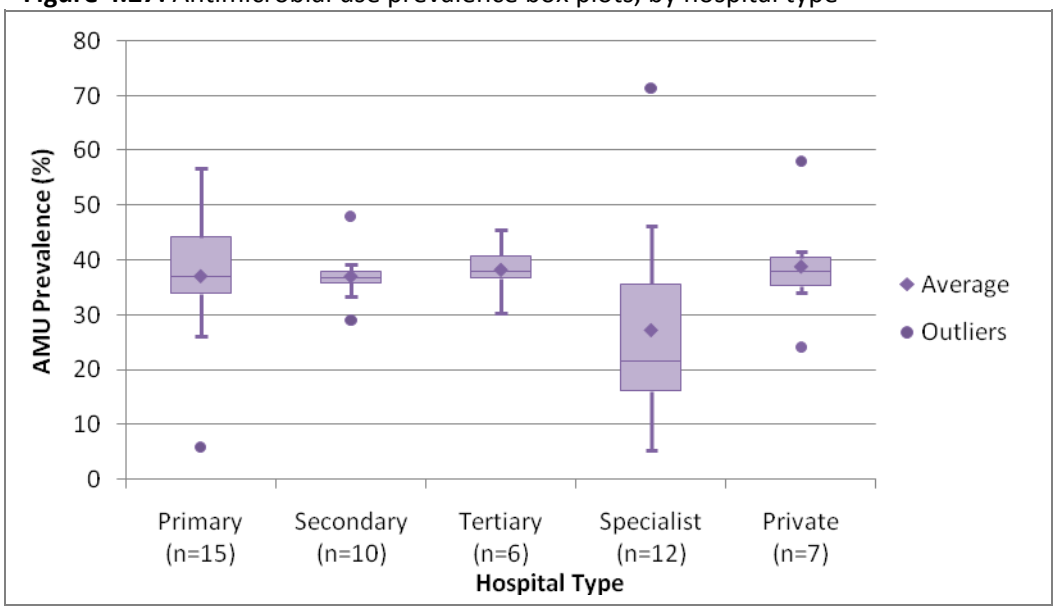


Table 4.31: Prevalence of HAI and antimicrobial use, by participating hospital (continued overleaf)

HSE REGION	HOSPITAL NAME	NUMBER OF ELIGIBLE PATIENTS	HAI PREVALENCE				ANTIMICROBIAL USE PREVALENCE	
			All HAI		Current Hospital*			
			N	%	N	%	N	%
HSE DUBLIN NORTH-EAST	Beaumont Hospital, Dublin	558	61	10.9%	57	10.2%	208	37.3%
	Cappagh National Orthopaedic Hospital, Dublin	26	2	7.7%	2	7.7%	9	34.6%
	Cavan General Hospital, Cavan	206	7	3.4%	7	3.4%	76	36.9%
	Connolly Hospital, Dublin	189	6	3.2%	6	3.2%	69	36.5%
	Louth County Hospital, Dundalk	33	1	3.0%	1	3.0%	2	6.1%
	Our Lady of Lourdes Hospital, Drogheda	340	14	4.1%	13	3.8%	126	37.1%
	Our Lady's Hospital, Navan	105	2	1.9%	2	1.9%	32	30.5%
	Rotunda Hospital, Dublin	196	9	4.6%	9	4.6%	37	18.9%
	TOTAL FOR HSE DUBLIN NORTH-EAST	**1,653**	**102**	**6.2%**	**97**	**5.9%**	**559**	**33.8%**
HSE DUBLIN MID-LEINSTER	Adelaide, Meath & National Children's Hospital, Tallaght	496	30	6.0%	27	5.4%	192	38.7%
	Children's University Hospital, Temple Street	72	4	5.6%	3	4.2%	27	37.5%
	Coombe Women's and Infant's University Hospital	197	8	4.1%	7	3.6%	43	21.8%
	Midland Regional Hospital, Mullingar	186	6	3.2%	5	2.7%	73	39.2%
	Midland Regional Hospital, Portlaoise	108	0	0.0%	0	0.0%	39	36.1%
	Midland Regional Hospital, Tullamore	152	6	3.9%	6	3.9%	73	48.0%
	Naas General Hospital, Naas	169	10	5.9%	10	5.9%	83	49.1%
	National Maternity Hospital, Holles Street	171	4	2.3%	2	1.2%	31	18.1%
	Our Lady's Children's Hospital, Crumlin	151	8	5.3%	6	4.0%	70	46.4%
	Royal Victoria Eye & Ear Hospital, Dublin	20	1	5.0%	1	5.0%	7	35.0%
	St. Columcille's Hospital, Loughlinstown	104	6	5.8%	5	4.8%	38	36.5%
	St. James's Hospital, Dublin	727	46	6.3%	38	5.2%	218	30.0%
	St. Luke's Hospital, Rathgar	66	8	12.1%	8	12.1%	14	21.2%
	St. Michael's Hospital, Dun Laoghaire	67	3	4.5%	3	4.5%	26	38.8%
	St. Vincent's University Hospital	354	26	7.3%	20	5.6%	129	36.4%
	TOTAL FOR HSE DUBLIN MID-LEINSTER	**3,040**	**166**	**5.5%**	**141**	**4.6%**	**1,063**	**35.0%**

*HAI which were acquired in the current hospital

HSE REGION	HOSPITAL NAME	NUMBER OF ELIGIBLE PATIENTS	HAI PREVALENCE				ANTIMICROBIAL USE PREVALENCE	
			All HAI		Current Hospital*			
			No.	%	No.	%	No.	%
HSE WEST	Galway University Hospitals	600	41	6.8%	38	6.3%	249	41.5%
	Letterkenny General Hospital	293	7	2.4%	6	2.0%	105	35.8%
	Mid-Western Regional Hospital, Dooradoyle	345	27	7.8%	22	6.4%	157	45.5%
	Mid-Western Regional Hospital, Ennis	51	3	5.9%	2	3.9%	24	47.1%
	Mid-Western Regional Hospital, Nenagh	49	2	4.1%	1	2.0%	17	34.7%
	Mid-Western Regional Maternity Hospital	149	2	1.3%	2	1.3%	15	10.1%
	Mid-Western Regional Orthopaedic Hospital, Croom	32	1	3.1%	1	3.1%	2	6.3%
	Portiuncula Hospital, Ballinasloe	136	3	2.2%	3	2.2%	52	38.2%
	Roscommon County Hospital	48	11	22.9%	6	12.5%	20	41.7%
	Sligo General Hospital	191	9	4.7%	9	4.7%	64	33.5%
	St. John's Hospital, Limerick	37	1	2.7%	0	0.0%	21	56.8%
	TOTAL FOR HSE WEST	**1,931**	**107**	**5.5%**	**90**	**4.7%**	**726**	**37.6%**
HSE SOUTH	Kerry General Hospital	221	9	4.1%	9	4.1%	58	26.2%
	Lourdes Orthopaedic Hospital, Kilcreene	14	0	0.0%	0	0.0%	10	71.4%
	Mercy University Hospital, Cork	158	8	5.1%	6	3.8%	58	36.7%
	South Infirmary-Victoria Hospital, Cork	91	5	5.5%	2	2.2%	34	37.4%
	South Tipperary General Hospital, Clonmel	139	14	10.1%	12	8.6%	65	46.8%
	St. Luke's General Hospital, Kilkenny	148	3	2.0%	3	2.0%	49	33.1%
	Waterford Regional Hospital	347	23	6.6%	20	5.8%	101	29.1%
	Wexford General Hospital	156	6	3.8%	5	3.2%	54	34.6%
	TOTAL FOR HSE SOUTH	**1,274**	**68**	**5.3%**	**57**	**4.5%**	**429**	**33.7%**
PRIVATE HOSPITALS	Bon Secours, Cork	199	6	3.0%	6	3.0%	48	24.1%
	Bon Secours, Galway	48	1	2.1%	1	2.1%	20	41.7%
	Bon Secours, Dublin	101	2	2.0%	1	1.0%	37	36.6%
	Bon Secours, Tralee	89	1	1.1%	0	0.0%	35	39.3%
	Galway Clinic, Doughiska	141	6	4.3%	6	4.3%	48	34.0%
	Mater Private Hospital	140	3	2.1%	3	2.1%	53	37.9%
	UPMC Beacon Hospital, Dublin	129	2	1.6%	2	1.6%	75	58.1%
	TOTAL FOR PRIVATE HOSPITALS	**847**	**21**	**2.5%**	**19**	**2.2%**	**316**	**37.3%**
	St. Patrick's University Hospital – private specialist hospital	285	3	1.1%	3	1.1%	15	5.3%
TOTAL FOR ALL PARTICIPATING HOSPITALS		**9,030**	**467**	**5.2%**	**407**	**4.5%**	**3,108**	**34.0%**

*HAI which were acquired in the current hospital

5.0 Previous Prevalence Surveys

5.1 Hospital Infection Society (HIS): Third Prevalence Survey of Healthcare-Associated Infections in Acute Hospitals – 2006

In 2006, 44 acute hospitals in Ireland participated in the Hospital Infection Society (HIS) Third Prevalence Survey of Healthcare-Associated Infections.[11,12] In 2012, 38 of those 44 acute hospitals went on to participate in the first ECDC PPS of HAI and AMU. An additional 12 hospitals also participated in 2012, giving a total of 50 acute hospitals.

Direct comparison of the results of the 2006 and 2012 surveys is not possible, owing to differences in survey methodology and the use of different definitions for some of the most commonly reported infections (pneumonia, bloodstream infections and urinary tract infections). Table 5.1 describes the major differences between the 2006 and 2012 point prevalence surveys, which prevent direct comparison of results between the two surveys.

Table 5.1: Methodological differences between the 2006 and 2012 point prevalence surveys

PPS PROTOCOL	2006	2012
Patient sampling strategy	Hospital size ≤200 beds: All patients surveyed Hospital size >200 beds: At least 80% of patients surveyed	All eligible patients surveyed
PPS timeline	National survey conducted over 12 weeks between February and May 2006	National survey conducted over three weeks during May 2012
PPS data collectors	Local infection prevention and control team and external data collectors completed survey within a hospital	Local multi-disciplinary PPS team completed survey within a hospital No external data collectors
Patient inclusion and exclusion criteria	1. Patients aged <15 years excluded 2. Acute psychiatric patients excluded 3. Admitted patients in emergency department (ED), day ward, acute medical assessment unit excluded	1. No age limitations on eligible patients 2. Acute psychiatric patients could be included 3. Admitted patients in ED, day ward, acute medical assessment unit included
Origin of HCAI	Infections acquired in hospital other than participating hospital excluded	All HAI included, regardless of location where HAI acquired
Infection definitions: **1. Pneumonia (PN)**	US CDC case definition	ECDC HELICS case definition
2. Urinary tract infection (UTI)	US CDC case definition (included asymptomatic bacteriuria)	ECDC HELICS case definition (excluded asymptomatic bacteriuria)
3. Bloodstream infection (BSI)	▪ US CDC – Primary BSI ▪ BSI secondary to other HCAI could also be recorded but were not reported as separate HCAI	ECDC HELICS case definition included primary and secondary BSI, with secondary BSI reported as separate HAI
4. Systemic Infection – Clinical Sepsis (SYS-CSEP)	Not included in 2006 PPS	Included in 2012 PPS – For use as a last resort definition where no other potential focus for HAI exists
Questionnaire items:	Indwelling urinary catheter *in situ* at time of survey **or** in previous seven days Mechanical ventilation at time of survey **or** in previous seven days Surgery within last 30 days (no implant) **or** implant surgery within previous year	Urethral catheter *in situ* at time of survey Respiratory tract intubation (with or without mechanical ventilation) at time of survey. Not comparable with 2006 Surgery since admission. Not comparable with 2006
Positive microbiology and key antimicrobial resistance markers	If HCAI caused by meticillin resistant *S. aureus* (MRSA), this could be recorded Active *C. difficile* diarrhoea could be recorded	All relevant positive microbiology results recorded for each HAI Antimicrobial resistance markers recorded for key pathogens
Antimicrobial Use	Only two questions regarding antibiotic use: 1. Patient currently receiving systemic antibiotics – Yes/No 2. IV antibiotics – Yes/No	Section of patient form dedicated to systemic antimicrobial use: agent, route, prescriber's indication, diagnosis site, documented indication, compliance with local policy

In 2006, 7,541 patients were surveyed, 369 of whom were reported to have at least one healthcare-associated infection, giving a national prevalence of 4.9%. In total, 386 infections were identified. Table 5.2 describes the prevalence of comparable patient risk factors in 2006 and 2012. Table 5.3 describes the breakdown of infections by type, as reported in the 2006 and 2012 prevalence surveys.

Table 5.2: 2006 and 2012 point prevalence surveys: comparable patient risk factor prevalence

	2006	2012
Total number of surveyed patients	7,541	9,030
Total number of patients aged <16 years	6*	1,092
Median age (years) [IQR]	68 [51-79]	63 [36-77]
Number (%) of patients aged ≥65	4,168 (55)	4,330 (48)
Number (%) of patients with peripheral line (PVC) *in situ* at the time of survey	3,024 (40)	3,679 (41)
Number (%) of patients with a central line (CVC) *in situ* at the time of survey	426 (6)	544 (6)
Number (%) of patients with a catheter *in situ* at the time of survey	Urinary catheter 1,134 (15)	Urethral catheter 1,119 (12)

*All six patients were aged 15 years

Table 5.3: 2006 and 2012 point prevalence surveys: breakdown of infection types

HAI Type	2006 PPS			2012 PPS		
	Rank	N	%	Rank	N	%
Surgical site infections	=1	83	21.5	1	91	18.2
Pneumonia	2	65	15.8	2	86	17.2
Urinary tract infections*	=1	83	21.5	3	75	15.0
Bloodstream infections**	4	37	9.6	4	66	13.2
Gastrointestinal system infections	3	45	11.7	5	49	9.8
Systemic infections	11	1	0.3	6	38	7.6
Eye, ear, nose or mouth infections	7	11	2.8	7	23	4.6
Bone and joint infections	9	3	0.8	8	19	3.8
Skin and soft tissue infections	5	36	9.3	9	16	3.1
Neonatal specific infections	NA	NA	NA	10	14	2.8
Other	-	22	5.7	-	24	4.8
Total	-	386	100	-	501	100

*2006 PPS included asymptomatic bacteriuria, which was not included in 2012. Asymptomatic bacteriuria accounted for 31% of UTI in 2006

**2006 PPS included a case definition for primary BSI only. 2012 PPS included one case definition for BSI which enabled classification and reporting of both primary and secondary BSI

For the reasons outlined above, direct comparison of HAI types and HAI prevalence between 2006 and 2012 surveys is not possible.

Data from the 2012 PPS have been stratified in an attempt to provide an estimate of the overall national HAI prevalence for the PPS in 2012 versus 2006, using a similar denominator. The reported infection prevalence in 2006 was 4.9% and the adjusted infection prevalence in 2012 is 5.0% (Table 5.4).

Table 5.4: Estimate of the difference in national HAI prevalence between 2006 and 2012 PPS

Year	Patients included in Original Analysis	Patients included in Revised Analysis	HAI included in Revised Analysis	HAI Prevalence
2006	7,541	NA	NA	4.9%
2012	9,030	7,486*	372**	5.0%

*The revised denominator for 2012 PPS has been calculated by excluding: patients aged ≤15 years of age and acute psychiatric patients. It was not possible to identify admitted patients in ED, day wards or acute medical assessment units from the 2012 patient population. Such patients would have been excluded in the 2006 survey.

** The revised HAI numerator for 2012 PPS has been calculated by excluding HAI in patients aged ≤15 years of age, HAI in acute psychiatric patients and HAI acquired in another hospital.

5.2 European Surveillance of Antimicrobial Consumption (ESAC) Hospitals Care Point Prevalence Surveys

The ESAC coordinated an annual European hospital point prevalence survey of antimicrobial consumption in 2009[13], 2010 [14] and 2011 (Source: HPSC). The annual ESAC survey is coordinated in Ireland by the HPSC and the Irish Antimicrobial Pharmacists Group (IAPG). As the methodology and definitions used in antimicrobial use component of the 2012 PPS were similar to that of the previous ESAC PPS, the findings of previous ESAC surveys conducted in Ireland and the 2012 ECDC PPS are comparable and are demonstrated in Table 5.5.

Table 5.5: Previous ESAC PPS findings compared with ECDC 2012 PPS of AMU

	ESAC 2009 PPS	ESAC 2010 PPS	ESAC 2011 PPS	ECDC 2012 PPS
Number of participating hospitals	21	28	33	50
Number of included patients	5,824	6,414	7,468	9,030
Number of patients receiving systemic antimicrobial therapy	2,000	2,309	2,586	3,108
Median prevalence of antimicrobial use in Ireland	34.3%	36.5%	40.7%	36.6%
Antimicrobials via parenteral route	62.2%	57.4%	59.8%	63.0%
Documented indication for antimicrobial use	75.3%	83.5%	85.3%	83.1%

6.0 Prevalence of HAI and AMU: Republic of Ireland and Neighbouring Countries

England, Scotland and Wales performed the ECDC PPS during Autumn 2011 and published individual national PPS reports in 2012.[15,16,17] Table 6.1 summarises the HAI prevalence and top five HAI reported in England, Scotland, Wales and Republic of Ireland (ROI) and Table 6.2 summarises the AMU prevalence and proportion of antimicrobials prescribed via the parenteral (i.e., intravenous) route and proportion with a documented indication reported in England, Scotland, Wales and ROI.

Northern Ireland performed the ECDC PPS during May and June 2012. The PPS results for Northern Ireland were not published by the time of completion of this report.

- The HAI prevalence in the ROI (5.2%) was lower than that reported by England (6.4%) and higher than that reported by Scotland (4.9%) and Wales (4.3%)
- The top three HAI reported in each country were similar with differences in the rank order of each HAI type. SSI was the most common HAI reported in ROI and Wales, ranking second in Scotland and third in England. PN was the second most common HAI reported in ROI, ranking first in England and third in both Scotland and Wales. UTI was the third most common HAI reported in ROI, ranking first in Scotland and second in both England and Wales
- The AMU prevalence in the ROI (34.0%) was slightly lower than that reported by England (34.7%) and higher than that reported by Scotland (32.3%) and Wales (32.7%)
- The percentage of antimicrobials administered via the parenteral route was highest in ROI (63%) followed by England (56%), Scotland (47.8%) and Wales (47.7%)
- The percentage of antimicrobial prescriptions with a documented indication was highest in Scotland (89.1%), followed by England (84.7%), ROI (83.1%) and Wales (76.1%)

Table 6.1: HAI prevalence and top five HAI reported by neighbouring countries

	ENGLAND[15]	SCOTLAND[16]	WALES[17]	REPUBLIC OF IRELAND
Eligible patients	52,443	11,604	6,588	9,030
Patients with active HAI	3,360	559	282	467
HAI prevalence % (95% CI)	6.4 (4.7 – 8.7)	4.9 (4.4 – 5.4)	4.3 (3.8 – 4.8)	5.2 (4.7 – 5.6)
Number of HAI	3,506	601	299	501
TOP FIVE HAI: NUMBER (%)				
1	**PN** 642 (18.3)	**UTI** 136 (22.6)	**SSI** 71 (23.7)	**SSI** 91 (18.2)
2	**UTI** 605 (17.2)	**SSI** 112 (18.6)	**UTI** 50 (16.7)	**PN** 86 (17.2)
3	**SSI** 551 (15.7)	**PN** 105 (17.5)	**PN** 37 (12.4)	**UTI** 75 (15)
4	**SYS-CSEP** 367 (10.5)	**BSI** 65 (10.8)	**GI** 35 (11.7)	**BSI** 66 (13.2)
5	**GI** 309 (8.8)	**EENT*** 55 (9.2)	**BSI** 33 (11.0)	**GI** 49 (9.8)

*EENT = Eye, Ear, Nose, Throat or Mouth Infection

Table 6.2: Antimicrobial use reported by neighbouring countries

	ENGLAND[15]	SCOTLAND[16]	WALES[17]	REPUBLIC OF IRELAND
Eligible patients	52,443	11,604	6,588	9,030
Patients receiving systemic antimicrobials	18,219	3,728	2,156	3,108
AMU prevalence % (95% CI)	34.7 (30.5 – 39.6)	32.3 (30.9 – 33.8)	32.7 (31.6 – 33.9)	34.0 (33.4 – 35.4)
Number of systemic antimicrobials	25,942	5,664	Not specified in report	4,532
Number via parenteral route (%)	14,525 (56)	2,147 (47.8)	1,466 (47.7)	2,855 (63)
Number with documented indication (%)	21,984 (84.7)	3,912 (89.1)	2,337 (76.1)	3,767 (83.1)

7.0 Discussion

There was excellent participation across Ireland in this voluntary survey with 50 acute hospitals, from both the public and private sector contributing data on 9,030 patients. The number of participating hospitals increased from 44 in the 2006 HIS prevalence survey. The findings of the 2006 and 2012 prevalence surveys cannot be directly compared, as previously described. However, the 2012 ECDC PPS was conducted in accordance with a common protocol, using standardised HAI case definitions across EU Member States, making it the first and largest survey of its kind to be performed in Europe. Ireland's PPS data has been submitted to ECDC for inclusion in the European PPS report, which is expected to be published in the spring of 2013. The ECDC plan that the European PPS should be repeated periodically, using the same methodology to facilitate ongoing measurement of HAI prevalence and antimicrobial prescribing.

Of the 50 participating hospitals, one reported having no infection prevention and control nurse (IPCN). A 2003 survey of acute hospital infection control resources in Ireland reported that ten hospitals (15%) had no IPCN.[18] Seventeen hospitals (34%) reported having no nominated infection prevention and control doctor (IPCD). Hospitals were not requested to provide information regarding antimicrobial pharmacist or surveillance scientist staffing as part of the PPS. These questions should be included in any future point prevalence survey. Information received from the Irish Antimicrobial Pharmacists Group (IAPG) in November 2012, indicates that there are approximately 22.1 whole-time equivalent (WTE) designated antimicrobial pharmacist posts across Irish hospitals, the vast majority of which, are located in public hospitals (96%).

The average proportion of single patient rooms was lowest in public primary or general hospitals (15%) and highest in private hospitals (37%). National infection prevention and control building guidelines for existing and new acute hospitals in Ireland were published in 2009 and recommend that newly-built inpatient accommodation should comprise 100% single-patient rooms. The guidelines also recommend that acute hospitals develop plans to minimise multiple-patient rooms and maximise single-patient rooms over the next decade.[19]

The findings of the 2012 PPS demonstrate the prevalence of some well-described risk factors that place hospitalised patients at higher risk of infection, in comparison with otherwise well individuals in the community setting. Hospital patients who developed infection tended to be older, to have more severe underlying disease prognosis, longer length-of-admission, to have had surgery during the current admission and invasive medical devices *in situ* (e.g., vascular catheters, urethral catheters, intubation of the respiratory tract). The prevalence of HAI was higher in certain clinical areas, such as augmented care units and surgical wards and the HAI prevalence was higher in tertiary hospitals in comparison with other hospital types. Because the individual participating hospitals may have a very different patient case mix and may offer different levels of acuity of care, inter-hospital comparisons are not recommended when interpreting the findings of this survey.

Overall, 14% of the HAI reported in this survey had originated in another hospital. This illustrates that HAI detected in a hospital may not always be attributable to or preventable by that hospital. It is for that reason that the overall HAI prevalence and the HAI prevalence attributable to each participating hospital have been reported in Section 4.7, Table 4.31.

Surgical site infections (SSI) were the most common HAI encountered in this survey. It is likely that this survey has underestimated the true burden of SSI in Ireland, in particular the category of superficial incisional SSI. In the era of increasing day surgery and shorter length-of-postoperative stay, it is likely that many superficial incisional SSI are diagnosed and managed following patient discharge from hospital, either by the patient's general practitioner or via the hospital's outpatient department.

Prevention of SSI is multi-factorial and encompasses pre-, intra- and postoperative-interventions, description of which is beyond the scope of this report. One evidence-based measure to prevent SSI, applicable to certain categories of surgery, is the administration of surgical antimicrobial prophylaxis, within one hour prior to skin incision. There is an increasing body of evidence and international best practice guidelines to support this practice. Indeed, this policy was adopted by the English Department of Health, Advisory Committee on Antimicrobial Resistance and Healthcare-Associated Infections in 2011.[20,21,22] Continuation of surgical antimicrobial prophylaxis may be indicated with a further one-to-two doses administered in the event of significant intra-operative blood loss (over 1.5 litres in an adult) or when a procedure exceeds four hours duration.[20] In Ireland, the majority of prophylaxis administered during the PPS exceeded single dose (73%) and almost half exceeded 24 hours duration (47%). Extended prophylaxis may increase the patient's risk of subsequent *C. difficile* infection and select for colonisation with multi-drug resistant organisms. In the event that a SSI subsequently develops, it may be due to a pathogen which is more resistant and thus, more difficult and costly to treat. Additionally, as prophylaxis is usually given via the intravenous route, extended durations of intravenous administration may increase the risk of infected intravascular devices and wastes valuable nursing time.

The survey did not involve further classification of the surgical procedures for which prophylaxis was administered. Surgical procedures may be classified into the following categories; clean, clean-implant, clean-contaminated and dirty.[20] This classification should be included in future surveys to ensure that antimicrobials administered for 'dirty' surgical procedures are accurately categorised as treatment of infection and not as surgical antimicrobial prophylaxis.

Respiratory tract infections were the number one reason for which prescribers recommended antimicrobials in the PPS (including both community and hospital-acquired pneumonia cases). Pneumonia (PN) was the second most common HAI reported in the PPS, with one-in-five cases associated with intubation of the respiratory tract. Although patients classified as having PN were required to meet specific radiological and clinical criteria, unlike other HAI, the majority of hospital-acquired pneumonia cases were not microbiologically confirmed. Thus, the underlying pathogens and their antimicrobial susceptibility is less certain in such cases. Of the 17 hospital-acquired pneumonia cases with microbiological confirmation, Gram-negative bacilli were the most common causative pathogens. It is likely that the same difficulty with microbiological diagnosis applies for community-acquired pneumonia, although the causative pathogens and their likely antimicrobial susceptibility are more predictable in this scenario. Regardless, hospital-acquired pneumonia presents a challenge with regard to antimicrobial use. Where broad spectrum empiric antimicrobial therapy is chosen, because of the lack of microbiological confirmation, it may be difficult to de-escalate to a narrower spectrum agent to complete the treatment course, due to the absence of a microbiological diagnosis. Indeed, other respiratory conditions may present with radiological signs and clinical symptoms which are not too dissimilar to pneumonia. Therefore, the potential for use of biomarkers, such as procalcitonin to guide discontinuation of antimicrobials warrants further research and consideration.[23]

Bloodstream infections (BSI) ranked fourth most common HAI in Ireland during the PPS. In comparison with neighbouring countries (England, Scotland and Wales), the proportion of BSI that were due to infected vascular catheters was higher in Ireland.[15,16,17] The prevalence of intravascular device use in Ireland was also higher than that of neighbouring countries. BSI are potentially serious infections, which often require lengthy courses of intravenous antimicrobials, may result in metastatic infection to cardiac valves, bones and joints and are associated with patient morbidity and mortality. BSI associated with intravascular catheter infections are potentially preventable via simple measures, which include; avoiding unnecessary use of catheters, inserting and maintaining catheters with care and removing catheters when they are no longer required. These interventions form part of intravascular catheter care bundles, which have already been successfully implemented in many Irish hospitals and are recommended in national guidelines.[3]

During the PPS in Ireland, *Enterobacteriaceae* were the most common pathogens isolated from HAI. Approximately one-in-four *Enterobacteriaceae* causing HAI displayed resistance to third-generation cephalosporins, a marker for the potential production of extended spectrum β lactamases (ESBLs) and multi-drug resistance. This proportion was much higher than that reported from England, where 12% of *Enterobacteriaceae* causing HAI were resistant to third-generation cephalosporins.[15] This finding is also consistent with the observation of increasing resistance in *Enterobacteriaceae* causing BSI in Ireland, which are reported via the European Antimicrobial Resistance Surveillance Network (EARS-Net). Such resistance is a cause for concern as HAI caused by these bacteria are difficult and more expensive to treat and associated with increased patient morbidity and mortality. Indeed, the emergence of carbapenem resistant *Enterobacteriaceae* (CRE) has been reported worldwide over the past decade, and has emerged in Ireland, especially over the past two years.[24,25,26] There are extremely limited treatment options for CRE infections and there will be no new antimicrobials available in the foreseeable future.

In this PPS, 34% of patients were prescribed antimicrobials. Antimicrobial use is a well-known risk factor for antimicrobial resistance. The prevalence of antimicrobial use increased with age and was higher in certain clinical areas (e.g., augmented care units). The prevalence of was highest in tertiary (37.4%) and private hospital types (37.3%). Although this may partly be explained by a higher proportion of surgical patients in private hospitals, it is important that all hospitals ensure that the recommendations on the prudent use of antimicrobials and good prescribing practices from the HIQA National Standards for the Prevention and Control of Healthcare-Associated Infections and the Guidelines for Antimicrobial Stewardship are being implemented locally.[4,6] Data from the IAPG indicates that the antimicrobial pharmacist role has not yet been implemented in the majority of private hospitals in Ireland. The registered nurse prescriber role has been introduced in Ireland in recent years. Antimicrobial agents accounted for approximately 10% of prescriptions by registered nurse prescriber's between January 1st and November 9th 2012 [Source: Director of Nursing and Midwifery (Prescribing)]. The registered nurse prescriber role incorporates a decision-making framework for prescribing.[27] Adaption of such a framework by doctors, specifically for antimicrobial prescribing, may be a useful tool to improve prescribing practices.

In Ireland, the proportion of antimicrobials prescribed via the parenteral (i.e., intravenous) route was 63%, higher than the figures reported from neighbouring countries. Also, broad spectrum agents (co-amoxiclav, piperacillin-tazobactam and ciprofloxacin) accounted for a higher proportion of antimicrobials in Ireland than in neighbouring countries.[15,16,17] The antimicrobial use findings of the 2012 PPS demonstrate that there is room for significant improvement with regard to compliance, documentation and choice of route of administration of antimicrobials.

8.0 Priorities for Implementation

8.1 Immediate Priorities

1. Ensure that the local and national results of the 2012 PPS have been shared with all staff and that each hospital's local results have been reviewed in detail. Local implementation priorities and action plans should be developed, based on individual hospital PPS results and case mix.

2. Ensure that all healthcare workers receive ongoing education and training regarding the importance and impact of healthcare-associated infections and antimicrobial resistance, including preventative strategies outlined below.

3. Improve hand hygiene compliance in all staff. The World Health Organisation (WHO) five moments for hand hygiene should be consistently observed by all staff.[2] Hand hygiene compliance should be audited regularly, with feedback of results to staff.

4. Ensure compliance with the HIQA National Standards for Prevention & Control of Healthcare-Asssociated Infections, specifically Standard 8: 'Invasive medical device-related infections are prevented or reduced'.[4]

    a. Implement routine daily review of intravascular devices on clinical team ward rounds and ensure ongoing audit and improvement with peripheral and central line care bundle compliance, in line with national guidelines for prevention of intravascular catheter related infections.[3]

    b. Implement the recommendations of the national guidelines for the prevention of catheter-associated urinary tract infections, which includes the use of locally-adapted care bundles for management of urinary catheters.[28]

    c. Implement the recommendations of the national guidelines for the prevention of ventilator-associated pneumonia (VAP) in adults, which includes the use of a VAP care bundle.[29]

5. Ensure compliance with the HIQA National Standards for Prevention & Control of Healthcare-Asssociated Infections, specifically Standard 12: 'There are systems in place to reduce and control antimicrobial resistance'.[4]

6. Implement the core, high impact interventions to promote prudent antimicrobial prescribing recommended in the national guidelines for antimicrobial stewardship.[6]

    a. Routine review of suitability for intravenous to oral antimicrobial switch after 48 hours (and daily thereafter) on clinical team ward rounds.

    b. Improve antimicrobial prescribing documentation by all prescribers.

    c. Improve compliance with hospital prescribing policies, including empiric prescribing for infection and surgical antimicrobial prophylaxis. Where policies are not available, they should be developed, based on local case mix.

7. Ensure that frontline healthcare worker staffing levels reflect patient case mix and dependency levels.

8. Ensure that key infection prevention and control, antimicrobial stewardship and surveillance staff are not diverted to tasks outside their designated roles.

9. Educate patients on their role in preventing HAI, including the importance of hand hygiene and care of indwelling medical devices.

8.2 Short-term Priorities – Implement within the Next Year

1. Implement the Royal College of Physicians of Ireland (RCPI) & Royal College of Surgeons in Ireland (RCSI) Antibiotic Care Bundle, once it is launched nationally on November 21st 2012.

2. Introduce the HSE medication prescription and administration record, once it has been launched.

3. Implement the RCSI Surgical Quality Improvement Tool, once it has been launched.

4. Plan for implementation of pilot surgical site infection surveillance programmes, to inform the resources required to develop and implement prospective and ongoing SSI surveillance, based on local case mix and clinical need. Device-related surgical procedures should receive priority for surveillance.

5. Plan for implementation of pilot critical care-acquired infection surveillance programmes, to inform the resources required to develop and implement prospective and ongoing critical care infection surveillance. Bloodstream infection surveillance and device-related infection surveillance (vascular catheter-related infection, ventilator-associated pneumonia and catheter-related urinary tract infections) should be prioritised.

8.3 Medium-to-Longer Term Priorities – Implement within the Next Five Years

1. Ensure that there is round-the-clock access in every hospital to the advice of an infection management specialist (clinical microbiologist, infectious diseases physician) and access to accredited microbiological laboratory services.[4,6]

2. A healthcare environment that promotes HAI prevention practices, including adequate space, isolation capacity and a physical environment conducive to decontamination is a critical component in safe patient care. Single-patient room accommodation capacity should be reviewed within each hospital and plans put in place to minimise multiple-patient room accommodation, in line with national guidelines.[19]

3. Ensure that any hospital information technology (IT) redevelopment plans incorporate modern technology such as; electronic prescribing with prescriber decision support, electronic patient records and laboratory information systems. Such developments have enormous potential to positively impact on suboptimal prescribing practices, medication errors, improve documentation, manage demand on resources and to reduce waste.

4. Ensure that infection prevention and control, healthcare-associated infection surveillance and antimicrobial stewardship staffing and initiatives are resourced appropriately.

5. Develop new and strengthen existing national reference laboratory capacity, to support the ongoing epidemiological surveillance and resistance monitoring of the key pathogens, frequently implicated in HAI, which includes but is not limited to; *Clostridium difficile*, *Enterococcus spp.*, *Enterobacteriaceae* and *Staphylococcus aureus.*[30,31,32]

6. It is anticipated that the national PPS of hospital-acquired infections and antimicrobial use may be repeated in five years.

    a. In the interim, consideration should be given to annual participation in the ESAC Hospitals Care point prevalence survey of antimicrobial use, which is coordinated by the Irish Antimicrobial Pharmacists Group and the Health Protection Surveillance Centre.

    b. In the interim, consideration should be given to performing periodic local mini-prevalence surveys of hospital-acquired infections on selected wards. The protocol and HAI definitions used in the 2012 PPS should be used for conducting repeat local surveys.

Table 8.1 demonstrates some key areas for immediate to short-term improvement, with examples of indicators or measures to track improvement.

Table 8.1: Key improvement areas and indicators to track improvement

Area	Aim	Element	Example of indicator (s)
Focus on prevention of infection associated with vascular catheters/ IV lines	Good line insertion practices	Education and training of staff inserting IV lines	Presence of educational programme (i.e., hand hygiene / IV line insertion / aseptic technique) % staff receiving education
		Central line insertion checklists	% central lines inserted with completed checklist Audit of checklist components
		Improve hand hygiene before aseptic tasks	Hand hygiene audit results (breakdown by 5 moments and staff group)
	Reduce number of IV lines that are no longer required	IV line maintenance care bundle	% wards implementing peripheral IV line bundle
		Implementation of IV to oral antimicrobial switch policy	See below
	Track IV line infection	Root cause/systems analysis of hospital-acquired IV line related bloodstream infections (BSI)	% IV line-related BSI, where root cause analysis performed
		Surveillance of IV-line related BSI	% BSI associated with IV lines IV line associated infection rates
Good antimicrobial stewardship	Improve antimicrobial prescribing	Implement IV to oral switch policy	Audit % prescriptions where IV to oral decision recorded at 48/72 hours
		Implement the RCPI/RCSI antibiotic care bundle, which will be launched on 21st November 2012	Audit compliance with care bundle
		Improve documentation of indication and duration of antimicrobials	Audit % prescription where indication and review date recorded
	Monitor antimicrobial consumption	Antimicrobial consumption surveillance	Hospital antibiotic consumption expressed as defined daily doses per 100 bed days used (DDD/100 BDU)
Surgical site infection	Prevent infection	Implement single dose surgical antimicrobial prophylaxis policy	Audit % prescriptions where surgical prophylaxis is single dose
		Implement RCSI quality improvement tool for prevention of SSI (due to be published late 2012)	Audit of tool elements
		Monitor infection associated with surgery – if no surveillance programme in place, consider pilot	Surgical site infection rates

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10.0 Appendices

Appendix A: PPS Steering Group Membership

- Dr Karen Burns, Consultant Clinical Microbiologist, Health Protection Surveillance Centre (HPSC) & Beaumont Hospital (Chairperson & Report Author)
- Ms Margaret Foley, PPS Data Manager, HPSC (Report Author)
- Ms Sheila Donlon, Infection Prevention & Control Nurse Manager, HPSC (Report Author)
- Ms Siobhan Dowling, Administrative Assistant, HPSC
- Dr Fidelma Fitzpatrick, Consultant Clinical Microbiologist, HPSC, Beaumont Hospital & HSE & RCPI HCAI & AMR Clinical Programme Lead
- Dr Robert Cunney, Consultant Clinical Microbiologist, HPSC & Children's University Hospital
- Ms Margaret Nadin, HSE HCAI & AMR Clinical Programme
- Ms Mary O'Rourke-Keenan, HSE HCAI & AMR Clinical Programme Business Manager
- Mr Myles Houlden, IT Manager, HPSC
- Mr Stephen Murchan, Surveillance Scientist, HPSC
- Ms Anne Marie Meenan, Surveillance Scientist, Coombe Women & Infants University Hospital
- Professor Hilary Humphreys, Consultant Clinical Microbiologist, Beaumont Hospital & Professor of Microbiology, Royal College of Surgeons in Ireland
- Mr John Walsh, Infection Prevention & Control Nurse, Beaumont Hospital
- Ms Mary Mooney, Infection Prevention & Control Nurse, Wexford General Hospital
- Ms Marie T Kehoe, Regional General Manager, QPSD, HSE South
- Ms Siobhan Barrett, Antimicrobial Pharmacist, Midwestern Regional Hospital, Limerick
- Ms Clare MacGabhann, Interim Director of Nursing & Midwifery (Prescribing). Office of the Nursing & Midwifery Services Director
- Ms Annette Cuddy, Assistant Director of Nursing & Midwifery (Prescribing). Office of the Nursing and Midwifery Services Director
- Dr Caroline Fielding, Clinical Microbiology Specialist Registrar, Galway University Hospital
- Dr Sarah Bergin, Clinical Microbiology Specialist Registrar, Cork University Hospital
- Ms Ruth Maher, Head of Monitoring, HSE Quality & Patient Safety Directorate (QPSD)

Appendix B: List of Acronyms

AMR	Antimicrobial Resistance
AMU	Antimicrobial Use
BMT	Bone Marrow Transplant
BSI	Bloodstream Infection
CAG	Clinical Advisory Group
CDC	US Centers for Disease Control and Prevention
CDI	*Clostridium difficile* infection
CRE	Carbapenem Resistant *Enterobacteriaceae*
CVC	Central Vascular Catheter
DML	Dublin Mid-Leinster
DNE	Dublin North-East
EARS-Net	European Antimicrobial Resistance Surveillance Network
ECDC	European Centre for Disease Prevention and Control
ED	Emergency Department
EENT	Eye, Ear, Nose, Throat or Mouth Infection
ESAC	European Surveillance of Antimicrobial Consumption
ESBL	Extended Spectrum β Lactamase
ESCMID-ESGCD	European Society for Clinical Microbiology and Infectious Diseases Study Group on *C. difficile*
EU	European Union
FAQ	Frequently-asked Questions
GI	Gastrointestinal
HAI	Hospital-Acquired Infections
HCAI	Healthcare Associated Infections
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
HIQA	Health Information & Quality Authority
HIS	Hospital Infection Society
HPSC	Health Protection Surveillance Centre
HSE	Health Service Executive
IAPG	Irish Antimicrobial Pharmacists Group
ICU	Intensive Care Unit
ID	Infectious Disease
IPCD	Infection Prevention & Control Doctor
IPCN	Infection Prevention & Control Nurse

IQR	Interquartile Range
KISS	Krankenhaus-Infektions-Surveillance-System, Germany
LOS	Length-of-Stay
MDRO	Multi-Drug Resistant Organisms
MRSA	Meticillin/Flucloxacillin Resistant *Staphylococcus aureus*
MSSA	Meticillin/Flucloxacillin Susceptible *Staphylococcus aureus*
NHSN	National Healthcare Safety Network
OR	Odds Ratio
PHA	Public Health Agency
PN	Pneumonia
PPS	Point Prevalence Survey
PVC	Peripheral Vascular Catheter
RCPI	Royal College of Physicians of Ireland
RCSI	Royal College of Surgeons in Ireland
ROI	Republic of Ireland
SSI	Surgical Site Infection
SYS-CSEP	Systemic Infection – Clinical Sepsis
UTI	Urinary Tract Infection
VAP	Ventilator-Associated Pneumonia
VRE	Vancomycin Resistant Enterococci
VT	Validation Team
WHO	World Health Organisation
WTE	Whole Time Equivalent
3GC	Third-Generation Cephalosporin

Appendix C: List of Participating Hospitals Categorised by Hospital Type

Table A.1: Participating hospitals, by hospital type

NUMBER	PRIMARY	SECONDARY	TERTIARY	SPECIALIST	PRIVATE
1	Cavan General Hospital, Cavan	Connolly Hospital, Dublin	Adelaide, Meath & National Children's Hospital, Tallaght	Cappagh National Orthopaedic Hospital, Dublin	Bon Secours, Cork
2	Kerry General Hospital	Letterkenny General Hospital	Beaumont Hospital, Dublin	Lourdes Orthopaedic Hospital, Kilcreene	Bon Secours, Galway
3	Louth County Hospital, Dundalk	Mercy University Hospital, Cork	Galway University Hospitals	Mid-Western Regional Orthopaedic Hospital, Croom	Bon Secours, Dublin
4	Mid-Western Regional Hospital, Ennis	Midland Regional Hospital, Mullingar	Mid-Western Regional Hospital, Dooradoyle	Coombe Women and Infants University Hospital	Bon Secours, Tralee
5	Mid-Western Regional Hospital, Nenagh	Midland Regional Hospital, Portlaoise	St. James's Hospital, Dublin	Mid-Western Regional Maternity Hospital	Galway Clinic, Doughiska
6	Naas General Hospital, Naas	Midland Regional Hospital, Tullamore	St. Vincent's University Hospital	National Maternity Hospital, Holles Street	Mater Private Hospital
7	Our Lady's Hospital, Navan	Our Lady of Lourdes Hospital, Drogheda		Rotunda Hospital, Dublin	UPMC Beacon Hospital, Dublin
8	Roscommon County Hospital	Portiuncula Hospital, Ballinasloe		Children's University Hospital, Temple Street	
9	South Infirmary-Victoria Hospital, Cork	Sligo General Hospital		Our Lady's Children's Hospital, Crumlin	
10	South Tipperary General Hospital, Clonmel	Waterford Regional Hospital		Royal Victoria Eye & Ear Hospital, Dublin	
11	St. Columcille's Hospital, Loughlinstown			St. Luke's Hospital, Rathgar	
12	St. John's Hospital, Limerick			St. Patrick's University Hospital	
13	St. Luke's General Hospital, Kilkenny				
14	St. Michael's Hospital, Dun Laoghaire				
15	Wexford General Hospital				
TOTALS	15	10	6	12	7

Appendix D: HAI & AMU Prevalence by Ward Specialty and Admitting Consultant Specialty

Table A.2: Number of patients, HAI prevalence and AMU prevalence, by ward specialty

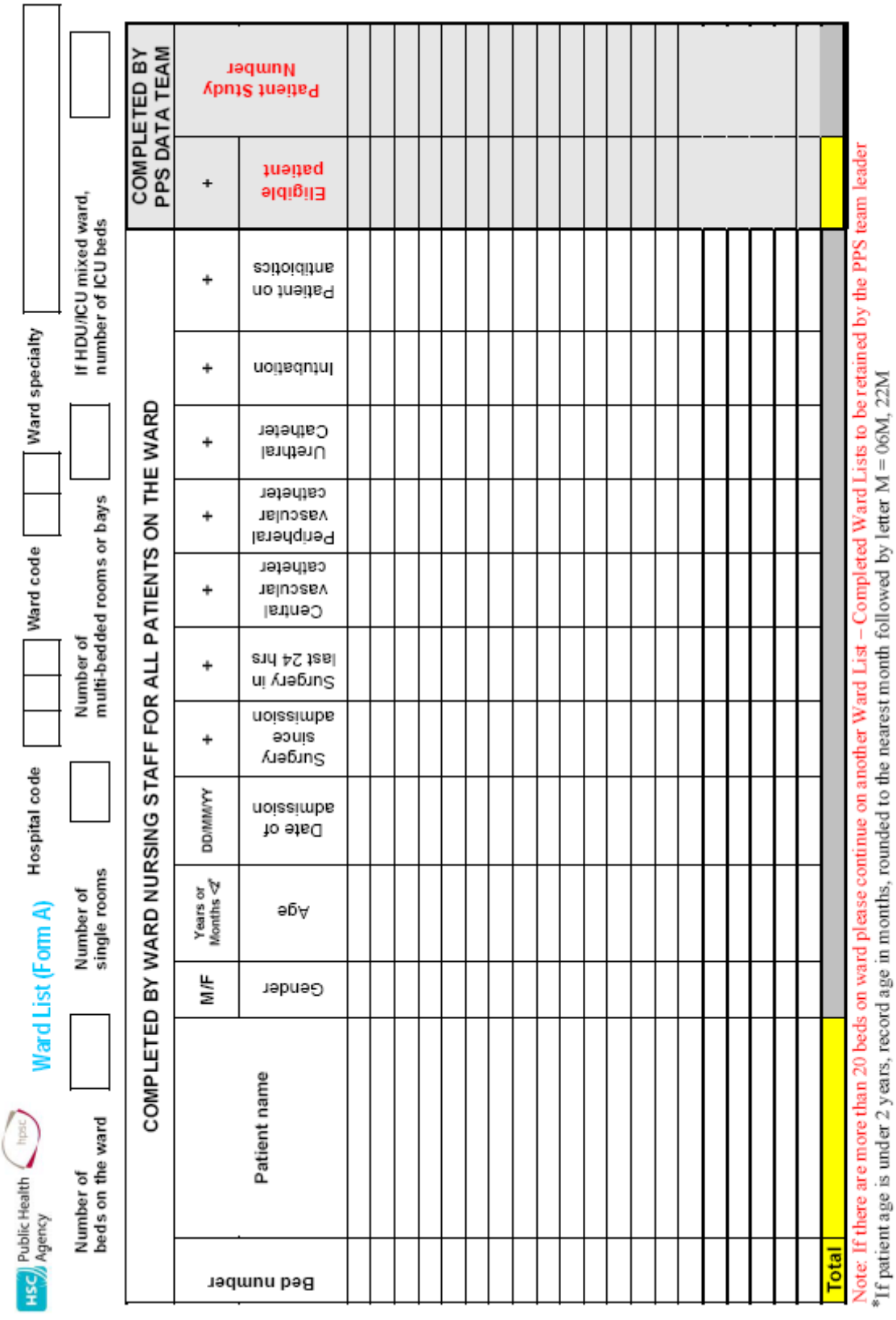
Ward Specialty	Total number of Patients	Number of Patients with HAI	HAI Prevalence (%)	Number of Patients with AMU	AMU Prevalence (%)
Medical	**3,042**	**146**	**4.8**	**1,110**	**36.5**
General medicine	2,490	102	4.1	905	36.3
Cardiology/Coronary care unit	178	8	4.5	58	32.6
Oncology	178	18	10.1	66	37.1
Nephrology	60	6	10.0	22	36.7
Neurology	44	1	2.3	5	11.4
Respiratory	36	1	2.8	18	50.0
Haematology / BMT mix	19	5	26.3	14	73.7
Infectious diseases	11	-	-	6	54.5
Hepatology	11	3	27.3	7	63.6
Haematology	9	2	22.2	7	77.8
Bone marrow transplantation	2	-	-	2	100.0
Other medical	4	-	-	-	-
Surgical	**1,980**	**133**	**6.7**	**802**	**40.5**
General surgery	1,016	75	7.4	472	46.5
Orthopaedics	584	43	7.4	194	33.2
Urology	93	3	3.2	43	46.2
Cardiac surgery	68	4	5.9	16	23.5
Neurosurgery	60	6	10.0	12	20.0
Paediatric general surgery	48	-	-	26	54.2
Burns care	25	1	4.0	8	32.0
ENT	17	1	5.9	8	47.1
Ophthalmology	13	-	-	4	30.8
Transplantation surgery	13	-	-	10	76.9
Vascular surgery	11	-	-	1	9.1
Thoracic surgery	9	-	-	1	11.1
Other surgery	23	-	-	7	30.4
Obstetrics/Gynaecology	**1,017**	**11**	**1.1**	**159**	**15.6**
Obstetrics / Maternity	988	11	1.1	150	15.2
Gynaecology	29	-	-	9	31.0
Augmented Care	**419**	**69**	**16.5**	**211**	**50.4**
Mixed General ICU	151	39	25.8	114	75.5
Medical ICU	2	-	-	1	50.0
Surgical ICU	8	2	25.0	7	87.5
Specialised ICU	18	5	27.8	15	83.3
Neonatal ICU	101	11	10.9	27	26.7
Paediatric ICU	15	4	26.7	9	60.0
Other ICU	124	8	6.5	38	30.6
Paediatrics	**407**	**10**	**2.5**	**153**	**37.6**
General paediatrics	374	7	1.9	145	38.8
Neonatology	33	3	9.1	8	24.2
Psychiatric	**456**	**7**	**1.5**	**25**	**5.5**
Rehabilitation	**142**	**8**	**5.6**	**16**	**11.3**
Care of the elderly	**161**	**7**	**4.3**	**31**	**19.3**
Other specialty	**819**	**33**	**4.0**	**330**	**40.3**
Mixed specialties	**587**	**43**	**7.3**	**271**	**46.2**

Table A.3: Number of patients, HAI prevalence and AMU prevalence, by admitting consultant specialty

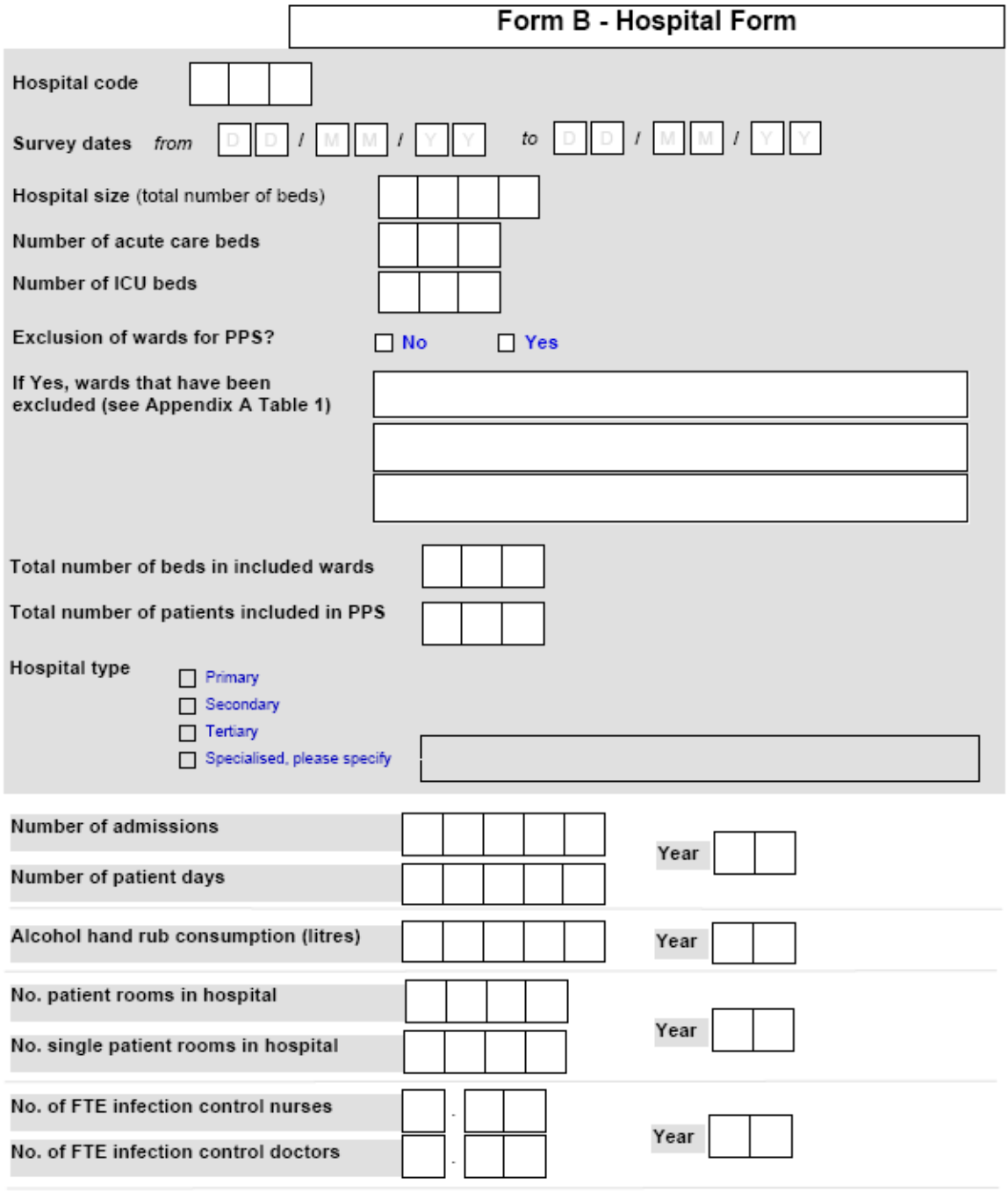
Consultant Specialty	Total number of Patients	Number of Patients with HAI	HAI Prevalence (%)	Number of Patients with AMU	AMU Prevalence (%)
Medical	**4,157**	**212**	**5.1**	**1,586**	**38.2**
General medicine	2,121	88	4.1	809	38.1
Cardiology	355	11	3.1	88	24.8
Respiratory	351	13	3.7	166	47.3
Oncology	313	29	9.3	132	42.2
Gastroenterology	219	7	3.2	78	35.6
Endocrinology	197	10	5.1	70	35.5
Nephrology	134	13	9.7	58	43.3
Rheumatology	127	7	5.5	45	35.4
Neurology	110	3	2.7	16	14.5
Haematology	109	22	20.2	70	64.2
Infectious diseases	27	-	-	15	55.6
Hepatology	24	2	8.3	10	41.7
Haematology / BMT* mix	20	6	30.0	15	75.0
Dermatology	11	-	-	3	27.3
Bone marrow transplantation	2	-	-	2	100.0
Other medical specialty	37	1	2.7	9	24.3
Surgical	**2,346**	**190**	**8.1**	**1,043**	**44.5**
General surgery	840	72	8.6	419	49.9
Orthopaedics	602	49	8.1	209	34.7
Urology	156	6	3.8	79	50.6
Vascular surgery	140	16	11.4	71	50.7
Digestive tract/bowel surgery	135	20	14.8	64	47.4
ENT	122	1	0.8	65	53.3
Neurosurgery	81	9	11.1	19	23.5
Cardiac surgery	70	8	11.4	25	35.7
Plastic and reconstructive surgery	48	4	8.3	28	58.3
Paediatric general surgery	40	1	2.5	22	55.0
Ophthalmology	31	1	3.2	8	25.8
Thoracic surgery	17	1	5.9	5	29.4
Maxillo-facial surgery	15	-	-	7	46.7
Burns care	12	1	8.3	4	33.3
Transplantation surgery	9	-	-	6	66.7
Surgery for cancer	5	-	-	2	40.0
Other surgical specialty	23	1	4.3	10	43.5
Obstetrics/Gynaecology	**887**	**16**	**1.8**	**196**	**22.1**
Obstetrics/Maternity	743	12	1.6	139	18.7
Gynaecology	144	4	2.8	57	39.6
Paediatrics	**642**	**9**	**1.4**	**129**	**20.1**
General paediatric	390	6	1.5	103	26.4
Neonatology	252	3	1.2	26	10.3
Psychiatric	**460**	**7**	**1.5**	**25**	**5.4**
Care of the Elderly	**376**	**14**	**3.7**	**86**	**22.9**
Neonatal Intensive Care	**120**	**12**	**10.0**	**25**	**20.8**
Rehabilitation	**17**	**1**	**5.9**	**1**	**5.9**
Other	**25**	**6**	**24.0**	**17**	**68.0**

Appendix E: PPS Data Collection Forms

Ward List (Form A)



Hospital Form (Form B)



Form B - Hospital Form

Hospital code

Survey dates *from* D D / M M / Y Y *to* D D / M M / Y Y

Hospital size (total number of beds)

Number of acute care beds

Number of ICU beds

Exclusion of wards for PPS? ☐ No ☐ Yes

If Yes, wards that have been excluded (see Appendix A Table 1)

Total number of beds in included wards

Total number of patients included in PPS

Hospital type

☐ Primary
☐ Secondary
☐ Tertiary
☐ Specialised, please specify

Number of admissions — Year

Number of patient days

Alcohol hand rub consumption (litres) — Year

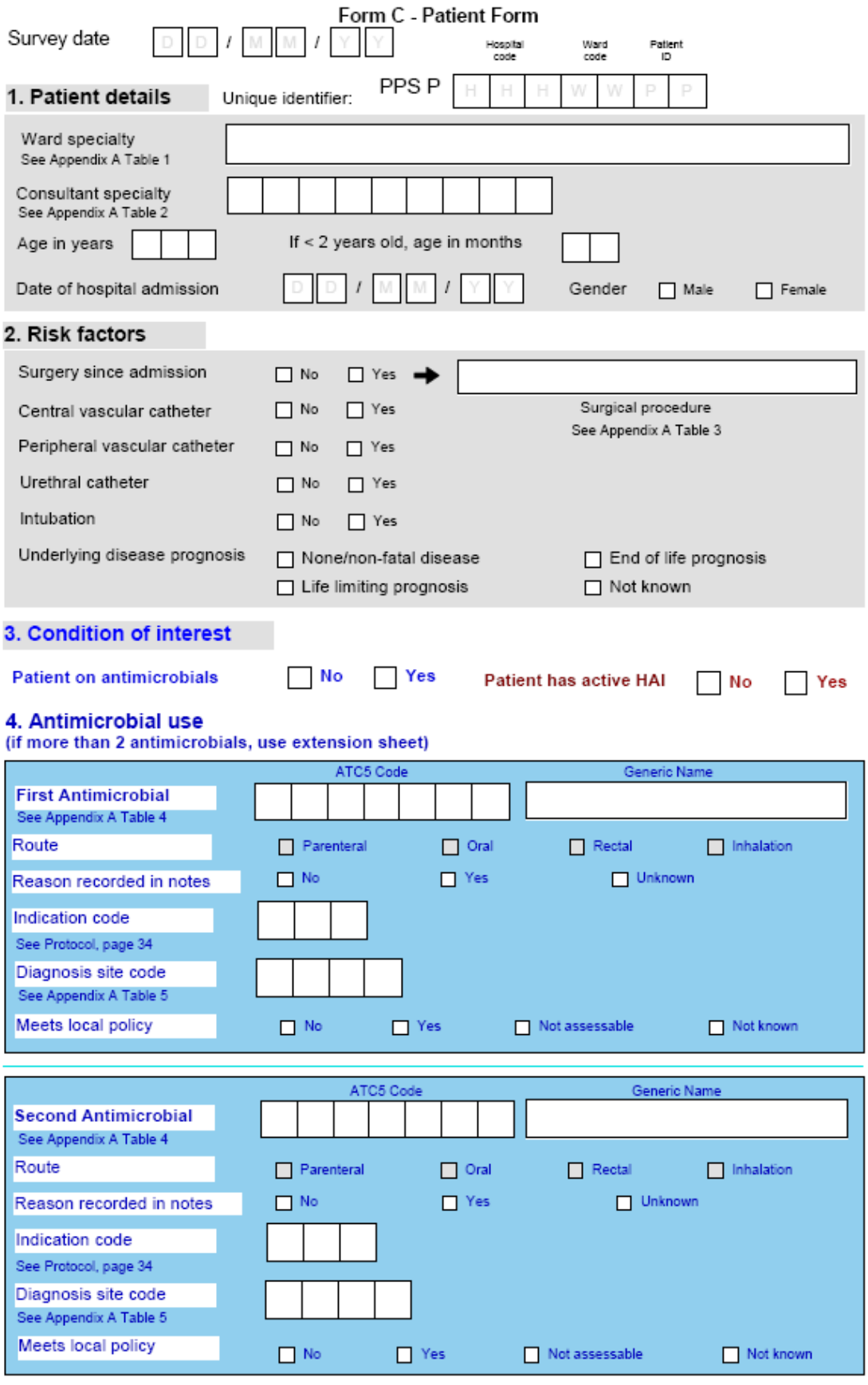
No. patient rooms in hospital — Year

No. single patient rooms in hospital

No. of FTE infection control nurses — Year

No. of FTE infection control doctors

Patient Form (Form C) Page 1 of 3



Form C - Patient Form

Survey date D D / M M / Y Y

Hospital code | Ward code | Patient ID

1. Patient details Unique identifier: PPS P H H H W W P P

Ward specialty
See Appendix A Table 1

Consultant specialty
See Appendix A Table 2

Age in years

If < 2 years old, age in months

Date of hospital admission D D / M M / Y Y

Gender ☐ Male ☐ Female

2. Risk factors

Surgery since admission	☐ No	☐ Yes	→ Surgical procedure See Appendix A Table 3
Central vascular catheter	☐ No	☐ Yes	
Peripheral vascular catheter	☐ No	☐ Yes	
Urethral catheter	☐ No	☐ Yes	
Intubation	☐ No	☐ Yes	

Underlying disease prognosis
☐ None/non-fatal disease ☐ End of life prognosis
☐ Life limiting prognosis ☐ Not known

3. Condition of interest

Patient on antimicrobials ☐ No ☐ Yes

Patient has active HAI ☐ No ☐ Yes

4. Antimicrobial use
(if more than 2 antimicrobials, use extension sheet)

	ATC5 Code	Generic Name
First Antimicrobial See Appendix A Table 4		
Route	☐ Parenteral ☐ Oral ☐ Rectal ☐ Inhalation	
Reason recorded in notes	☐ No ☐ Yes ☐ Unknown	
Indication code See Protocol, page 34		
Diagnosis site code See Appendix A Table 5		
Meets local policy	☐ No ☐ Yes ☐ Not assessable ☐ Not known	

	ATC5 Code	Generic Name
Second Antimicrobial See Appendix A Table 4		
Route	☐ Parenteral ☐ Oral ☐ Rectal ☐ Inhalation	
Reason recorded in notes	☐ No ☐ Yes ☐ Unknown	
Indication code See Protocol, page 34		
Diagnosis site code See Appendix A Table 5		
Meets local policy	☐ No ☐ Yes ☐ Not assessable ☐ Not known	

Patient Form (Form C) Page 2 of 3

5. Hospital-acquired infection data (HAI)

Unique identifier: PPS P | Hospital code: H H H | Ward code: W W | Patient ID: P P

HAI 1

HAI Code
See Appendix A Table 6

If SSI, record the procedure
See Appendix A Table 3

If, BSI: source
See Appendix A Table 7

Relevant device in situ before onset ☐ Yes ☐ No

Active HAI at admission ☐ Yes ☐ No

Origin of infection ☐ Current hospital ☐ Other acute hospital ☐ Other origin

Date of HAI onset D D / M M / Y Y

Microorganism 1
See Appendix A Table 8

Resistance Code 1
See Appendix A Table 9

Microorganism 2

Resistance Code 2

Microorganism 3

Resistance Code 3

HAI 2

HAI Code
See Appendix A Table 6

If SSI, record the procedure
See Appendix A Table 3

If, BSI: source
See Appendix A Table 7

Relevant device in situ before onset ☐ Yes ☐ No

Active HAI at admission ☐ Yes ☐ No

Origin of infection ☐ Current hospital ☐ Other acute hospital ☐ Other origin

Date of HAI onset D D / M M / Y Y

Microorganism 1
See Appendix A Table 8

Resistance Code 1
See Appendix A Table 9

Microorganism 2

Resistance Code 2

Microorganism 3

Resistance Code 3

HAI 3

HAI Code
See Appendix A Table 6

If SSI, record the procedure
See Appendix A Table 3

If, BSI: source
See Appendix A Table 7

Relevant device in situ before onset ☐ Yes ☐ No

Active HAI at admission ☐ Yes ☐ No

Origin of infection ☐ Current hospital ☐ Other acute hospital ☐ Other origin

Date of HAI onset D D / M M / Y Y

Microorganism 1
See Appendix A Table 8

Resistance Code 1
See Appendix A Table 9

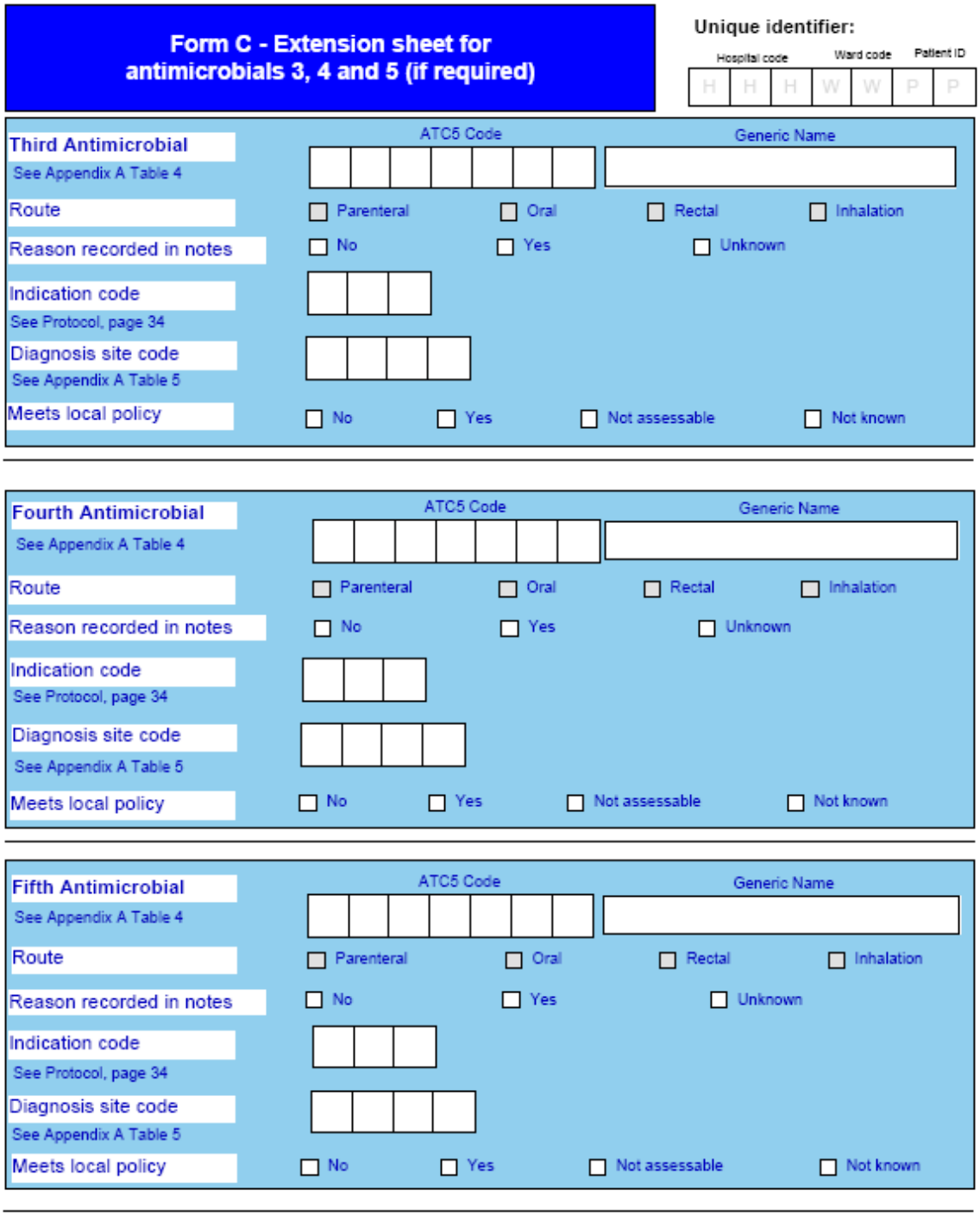
Microorganism 2

Resistance Code 2

Microorganism 3

Resistance Code 3

Patient Form (Form C) Page 3 of 3



Form C - Extension sheet for antimicrobials 3, 4 and 5 (if required)

Unique identifier:

Hospital code: H H H | Ward code: W W | Patient ID: P P

Third Antimicrobial (See Appendix A Table 4) — ATC5 Code | Generic Name

Route: ☐ Parenteral ☐ Oral ☐ Rectal ☐ Inhalation

Reason recorded in notes: ☐ No ☐ Yes ☐ Unknown

Indication code (See Protocol, page 34)

Diagnosis site code (See Appendix A Table 5)

Meets local policy: ☐ No ☐ Yes ☐ Not assessable ☐ Not known

Fourth Antimicrobial (See Appendix A Table 4) — ATC5 Code | Generic Name

Route: ☐ Parenteral ☐ Oral ☐ Rectal ☐ Inhalation

Reason recorded in notes: ☐ No ☐ Yes ☐ Unknown

Indication code (See Protocol, page 34)

Diagnosis site code (See Appendix A Table 5)

Meets local policy: ☐ No ☐ Yes ☐ Not assessable ☐ Not known

Fifth Antimicrobial (See Appendix A Table 4) — ATC5 Code | Generic Name

Route: ☐ Parenteral ☐ Oral ☐ Rectal ☐ Inhalation

Reason recorded in notes: ☐ No ☐ Yes ☐ Unknown

Indication code (See Protocol, page 34)

Diagnosis site code (See Appendix A Table 5)

Meets local policy: ☐ No ☐ Yes ☐ Not assessable ☐ Not known

Appendix F: Latest Available HCAI Surveillance Data for Ireland (Source: HPSC)

Hand Hygiene Compliance & Alcohol Hand Rub Consumption:

http://www.hpsc.ie/hpsc/A-Z/Gastroenteric/Handwashing/HandHygieneAudit/HandHygieneAuditResults/

http://www.hpsc.ie/hpsc/A-Z/Gastroenteric/Handwashing/AlcoholHandRubConsumptionSurveillance/QuarterlyReports/

Hospital Antimicrobial Consumption:

http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/EuropeanSurveillanceofAntimicrobialConsumptionESAC/SurveillanceReports/

***Clostridium difficile* Infection Enhanced Surveillance:**

http://www.hpsc.ie/hpsc/A-Z/Gastroenteric/Clostridiumdifficile/CdifficileSurveillance/CdifficileEnhancedSurveillance/Reports/

***Staphylococcus aureus* Bacteraemia/Bloodstream Infection Surveillance:**

http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/EuropeanAntimicrobialResistanceSurveillanceSystemEARSS/ReferenceandEducationalResourceMaterial/SaureusMRSA/LatestSaureusMRSAdata/

Surveillance of Key Antimicrobial Resistance Data by Pathogen and Year:

http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/EuropeanAntimicrobialResistanceSurveillanceSystemEARSS/EARSSSurveillanceReports/

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