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

## REPORT ON THE SURGICAL PATIENT POPULATION

## AUGUST 2013

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# 1.0 Executive Summary & Introduction

## Executive Summary

- This supplementary report presents data collected during the May 2012 point prevalence survey on patients with a history of surgery during the current admission and all patients with a reported surgical site infection
- Data was collected on 1,591 patients with a history of surgery during the current admission, admitted to 44 acute hospitals in the Republic of Ireland. This patient group accounted for 18% of the total population of 9,030 patients in 50 participating hospitals.
- The prevalence of hospital-acquired infections (HAI) in patients with a history of surgery during the current admission was twice that of the overall patient cohort (10.4% versus 5.2%)
- The distribution of all HAI types was similar between the patients with a history of surgery and the overall patient cohort. However, the prevalence of all HAI types was higher in patients with a history of surgery
- The proportion of bloodstream infections that were related to a vascular device (central vascular catheter; 62% versus 57% and peripheral vascular catheter; 13% versus 7%) was higher for patients with a history of surgery
- Of all active HAI identified in patients with a history of surgery, positive microbiology results were available for 56%, with *Enterobacteriaceae*, enterococci and *S. aureus* the most commonly isolated
- The prevalence of antimicrobial use (AMU) in patients with a history of surgery during the current admission was higher than that of the overall patient cohort (47.8% versus 34.4%)
- Patients with a history of surgery were less likely to have a documented indication for the prescribed antimicrobial (78.5% versus 83%) and more likely to have an antimicrobial prescription that was non-compliant with local prescribing policy than the overall patient population (31% versus 27%)
- The proportion of antimicrobials prescribed as surgical antimicrobial prophylaxis that exceeded 24 hours duration was 45%
- There were 91 reported surgical site infections (SSI) during the PPS, 52 (57%) of which developed in the current hospital, whilst the patient remained an inpatient. The remainder manifested either post-discharge or in another acute hospital, prior to the current hospital admission
- Colon surgery, open reduction of fracture and hip/knee prosthesis were the surgical procedures most commonly associated with a reported SSI in the 2012 PPS
- *S. aureus* was the most frequently isolated microorganism from SSI, with 50% reported as flucloxacillin resistant (i.e., MRSA)

## Introduction

A national point prevalence survey (PPS) was conducted in May 2012 to assess the prevalence of hospital-acquired infections (HAI) and antimicrobial use in Irish hospitals. Fifty acute hospitals participated, with 9,030 eligible patients surveyed. The PPS was coordinated in Ireland by the Health Protection Surveillance Centre (HPSC). The national PPS protocol and report may be accessed at the following link:

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

This supplementary report contains the following information:

- Analysis of risk factors, HAI and antimicrobial use data on eligible patients with a history of surgery (PWHS) since admission to hospital (**Section 3**)
- Analysis of patients with a reported surgical site infection (SSI). This includes patients with SSI and a history of surgery since admission to hospital and patients with SSI related to a previous admission to hospital (**Section 4**)

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 surveillance 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

During the PPS, all eligible patients in each hospital were surveyed by a multi-disciplinary local PPS team for anonymous demographic details, risk factors, antimicrobial use and the presence of active HAI (**Appendix A:** PPS Patient Data Collection Form).

As per the ECDC survey protocol, surgery was defined as a primarily therapeutic procedure, where an incision is made (not just a needle puncture), with breach of mucosa and/or skin – not necessarily in the operating theatre.
The following procedures were **NOT** considered to be surgical procedures in the PPS:

- Endoscopic procedures (OGD, colonoscopy, ERCP, bronchoscopy)
- Percutaneous angioplasty (coronary, cerebral or peripheral vascular)
- Percutaneous drainage of a collection (e.g., in interventional radiology)
- Insertion of a central vascular catheter
- Insertion of an intra-aortic balloon pump
- Insertion of an intercostal tube drain or chest drain
- Insertion of a percutaneous nephrostomy

Where a patient was recorded as having undergone surgery since admission, the PPS data collector was requested to record the surgical procedure performed from a list of surgical categories and procedures provided in the survey protocol (**Appendix B: List of Surgical Procedures**).

## 2.0 Participating Hospitals with Eligible Surgical Patients

Of the 50 participating hospitals, 44 reported patients with a history of surgery (PWHS) since hospital admission (Table 2.1).

**Table 2.1:** Participating hospitals categorised by ownership

| HSE Region | Hospital Name | Hospital Type |
|---|---|---|
| **Dublin-North East (DNE)** | Beaumont Hospital, Dublin | Tertiary |
| | Cappagh National Orthopaedic Hospital, Dublin | Specialist |
| | Cavan General Hospital, Cavan | Primary |
| | Connolly Hospital, Dublin | Secondary |
| | Our Lady of Lourdes Hospital, Drogheda | Secondary |
| | Our Lady's Hospital, Navan | Primary |
| | Rotunda Hospital, Dublin | Specialist |
| **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. Michael's Hospital, Dun Laoghaire | Primary |
| | St. Vincent's University Hospital | Tertiary |
| **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 |
| **West** | Galway University Hospitals | Tertiary |
| | Letterkenny General Hospital | Secondary |
| | Mid-Western Regional Hospital, Dooradoyle | Tertiary |
| | 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 |
| **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 |

# 3.0 Results for Patients with a History of Surgery during the Current Admission

## 3.1 Eligible Patients

### 3.1.1 Patient Location, by Admitting Consultant Specialty

Of the 9,030 eligible patients, 1,591 (18%) were reported to have had a surgical procedure since admission. For the purposes of this report, such patients will hereafter be referred to as patients with a history of surgery (PWHS). At the time of the PPS, the vast majority of those PWHS (n=1,429; 90%) were recorded as being admitted under the care of either a surgical consultant (72.3%) or a consultant obstetrician and gynaecologist (17.5%) as displayed in Table 3.1. Table 3.2 displays a further analysis of 1,429 PWHS by admitting surgical consultant specialties.

**Table 3.1:** PWHS, by admitting consultant specialty

| Consultant Specialty | Number of Patients | Percentage of Patients |
|---|---|---|
| Surgical | 1,150 | 72.3 |
| Obstetrics/gynaecology | 279 | 17.5 |
| Medical | 120 | 7.5 |
| Care of the elderly | 20 | 1.3 |
| Paediatrics | 12 | 0.6 |
| Other specialties | 10 | 0.6 |
| **Total** | **1,591** | **100** |

**Table 3.2:** PWHS who were admitted under care of a surgeon, further analysed by the admitting surgical consultant specialty

| Surgical Consultant Specialty | Number of Patients | Percentage of Patients |
|---|---|---|
| Orthopaedics | 384 | 26.9 |
| General surgery | 297 | 20.8 |
| Obstetrics/maternity | 208 | 14.6 |
| Digestive tract/bowel surgery | 72 | 5.0 |
| Gynaecology | 71 | 5.0 |
| Vascular surgery | 68 | 4.8 |
| Urology | 60 | 4.2 |
| Ear, nose & throat surgery (ENT) | 55 | 3.8 |
| Neurosurgery | 53 | 3.7 |
| Cardiac surgery | 47 | 3.3 |
| Other surgical specialties | 114 | 8.0 |
| **Total** | **1,429** | **100** |

### 3.1.2 Patient Demographics – Gender and Age Groups

Overall, 1,591 (18%) of the 9,030 PPS patients were classified as PWHS. Table 3.3 displays the age and gender distribution of PWHS. There was a female preponderance (55.7%). The majority of PWHS were aged ≥16 years (93.8%) and the overall median age was 61 years (inter-quartile range [IQR] 38-74 years). The median age of male PWHS was higher than that of females [66 years (IQR 49-76) versus 54 (IQR 35-73)]. In addition, 52.1% of male PWHS were aged ≥65 years compared with just 36.9% of females. Of the 98 PWHS aged <16 years, 30.6% (n=30) were under two years-old.

**Table 3.3:** PWHS, by age and gender

| Age Group | Male | | Female | | Total | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| **Paediatrics** | **60** | **8.5** | **38** | **4.3** | **98** | **6.2** |
| <1 month | 1 | 1.7 | 4 | 10.5 | 5 | 5.1 |
| 1-23 months | 17 | 28.3 | 8 | 21.1 | 25 | 25.5 |
| 2-15 years | 42 | 70.0 | 26 | 68.4 | 68 | 69.4 |
| **Adults** | **645** | **91.5** | **848** | **95.7** | **1,493** | **93.8** |
| 16 – 29 years | 36 | 5.6 | 89 | 10.5 | 125 | 8.4 |
| 30 – 49 years | 82 | 12.7 | 263 | 31.0 | 345 | 23.1 |
| 50 – 64 years | 160 | 24.8 | 169 | 19.9 | 329 | 22.0 |
| 65 – 79 years | 271 | 42 | 194 | 22.9 | 465 | 31.1 |
| 80+ years | 96 | 14.9 | 133 | 15.7 | 229 | 15.3 |
| **Total** | **705** | **44.3** | **886** | **55.7** | **1,591** | **100** |

### 3.1.3 Patients by Surgical Category

Table 3.4 displays the category of surgery reported for the 1,591 PWHS since admission. Within those surgical categories, the most commonly reported procedures were hip prosthesis (n=189; 11.9%), caesarean section (n=169; 10.6%) and colon surgery (n=112; 7.0%) (**Appendix B: List of Surgical Procedures**).

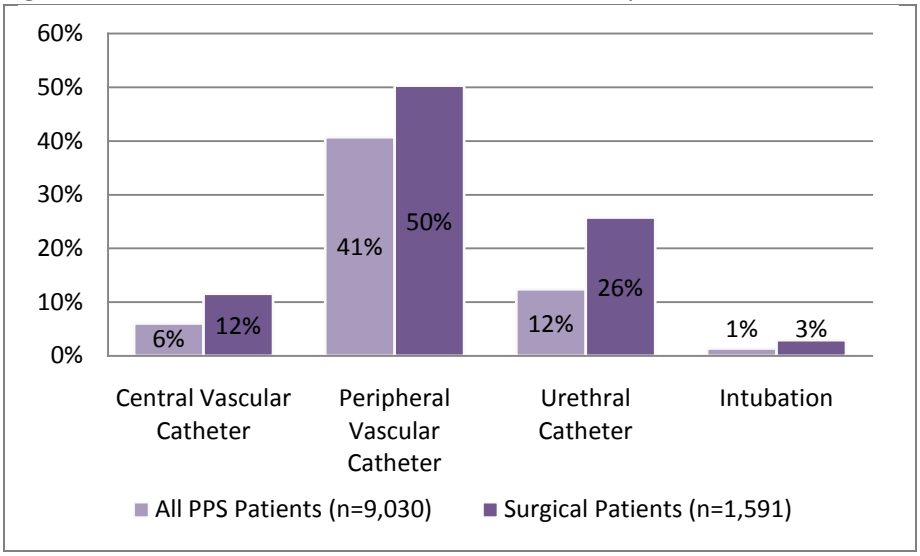
**Table 3.4:** PWHS, by surgical category

| Surgical Category | Number of PWHS | Percentage of PWHS |
|---|---|---|
| General surgical procedure | 464 | 29.2 |
| Orthopaedic surgical procedure | 456 | 28.7 |
| Obstetrics or gynaecological surgical procedure | 276 | 17.3 |
| Vascular surgical procedure | 78 | 4.9 |
| ENT or maxillofacial surgical procedure | 74 | 4.7 |
| Cardiac surgical procedure | 68 | 4.3 |
| Urological surgical procedure | 67 | 4.2 |
| Neurosurgical procedure | 44 | 2.8 |
| Thoracic surgical procedure | 28 | 1.8 |
| Ophthalmological procedure | 13 | 0.8 |
| Other surgical procedure | 23 | 1.3 |
| **Total** | **1,591** | **100** |

### 3.1.4 Patient Risk Factors for HAI

Risk factors for hospital-acquired infections (HAI) in the overall PPS cohort and in PWHS are displayed in Figure 3.1. The prevalence of all HAI risk factors was higher in PWHS compared to the overall PPS population. In particular, the prevalence of central vascular catheter (CVC) use in PWHS was twice that of the overall population (12% versus 6%). Of the 1,591 PWHS, 62.5% (n=995) had at least one invasive device *in situ* at the time of survey compared with 49% of the overall PPS cohort. The prevalence of urethral catheters was also higher in PWHS versus the overall population (26% versus 12%).

**Figure 3.1:** Device utilisation in PWHS versus overall patient cohort.




The McCabe score is a subjective score of underlying illness severity and was used to categorise patients during the PPS.[1] Table 3.5 presents the McCabe score distribution for the overall patient population versus the PWHS. The majority of PWHS (81.3%) were classified as having a 'non-fatal prognosis' (life expectancy greater than five years). A lower proportion of PWHS were deemed to have a 'rapidly fatal or end-of-life prognosis' (life expectancy less than one year) compared to the overall PPS cohort (1.7% versus 3.4%). The proportion reported as having an 'ultimately fatal or life-limiting prognosis' (life expectancy between one and four years) was also lower in PWHS (16.0% versus 21.7%).

**Table 3.5:** Number of patients surveyed in overall PPS and PWHS, by McCabe score

| Risk Factor | All PPS Patients | | PWHS | |
|---|---|---|---|---|
| | N | % | N | % |
| Non-fatal | 6,673 | 73.9 | 1,294 | 81.3 |
| Ultimately fatal | 1,955 | 21.7 | 254 | 16.0 |
| Rapidly fatal | 311 | 3.4 | 27 | 1.7 |
| Not known | 91 | 1.0 | 16 | 1.0 |
| **Total** | **9,030** | **100** | **1,591** | **100** |

### 3.2 Hospital-Acquired Infections

The PPS HAI results should be reviewed and interpreted in conjunction with the HAI definitions used in this survey. There 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/

#### 3.2.1 Prevalence of Hospital-Acquired Infections

The HAI prevalence in PWHS was double that of the overall patient population. Of the 9,030 eligible patients, 467 (5.2%; 95% CI: 4.7-5.6) were classified as having an active HAI. Overall, a total of 501 HAI were identified, which equates to 1.07 HAI per infected patient. Of the 1,591 PWHS, 165 (10.4%; 95% CI: 9.0-12.0) were classified as having an active HAI. Overall, a total of 180 HAI were identified, which equates to 1.09 HAI per infected patient. Table 3.6 displays the HAI distribution for the overall population and PWHS.

**Table 3.6** Number of active HAI per patient: overall PPS population and PWHS

| Number of HAI reported per patient | All PPS Patients | | PWHS | |
|---|---|---|---|---|
| | N | % | N | % |
| 0 | 8,563 | 94.8 | 1,426 | 89.6 |
| 1 | 434 | 4.8 | 151 | 9.5 |
| 2 | 32 | 0.4 | 13 | 0.8 |
| 3 | 1 | 0.0 | 1 | 0.1 |
| **Total** | **9,030** | **100** | **1,591** | **100** |

#### 3.2.2 Overall HAI Prevalence, by Admitting Consultant Specialty

The overall HAI prevalence by admitting consultant specialty is displayed in Table 3.7. The HAI prevalence for PWHS who were admitted under a medical consultant was 15.0% (95% CI: 9.7-22.5), followed by 11.5% (95% CI: 9.8-13.5) for PWHS who were admitted under the care of a surgical consultant.

The highest HAI prevalence (18.2%; 95% CI: 5.2 -40.3) was recorded for the category 'other specialty' which included 22 PWHS; 12 of whom were admitted under the care of a paediatric consultant, eight under the care of a consultant in intensive care medicine and two under the care of a rehabilitation consultant on the PPS date. All four HAI recorded in this category occurred in the patients whose admitting consultant was recorded as a consultant in intensive care medicine. In Ireland, the majority of patients admitted to critical 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.

**Table 3.7:** HAI prevalence in PWHS, by admitting consultant specialty

| Consultant Specialty | Total Number of PWHS | Number of PWHS with HAI | HAI Prevalence (%) | 95% Confidence Interval |
|---|---|---|---|---|
| Surgical | 1,150 | 132 | 11.5 | 9.8 – 13.5 |
| Obstetrics/Gynaecology | 279 | 10 | 3.6 | 2.0 – 6.5 |
| Medical | 120 | 18 | 15.0 | 9.7 – 22.5 |
| Care of the elderly | 20 | 1 | 5.0 | 0.1 – 24.9 |
| Other specialty | 22 | 4 | 18.2 | 5.2 – 40.3 |
| **Total** | **1,591** | **165** | **10.4** | **9.0 – 12.0** |

Table 3.8 displays a further analysis of HAI prevalence in the 1,429 PWHS who were recorded as being under the care of a surgeon or obstetrician or gynaecologist at the time of the PPS, by admitting surgical consultant specialties. The HAI prevalence was highest in PWHS who were admitted under the care of a vascular surgeon (19.1%), digestive tract/bowel surgeon (18.1%) and general surgeon (16.5%). The HAI prevalence was lowest in patients admitted under the care of an ENT surgeon (1.8%), gynaecologist (2.8%), and obstetrician (3.8%).

**Table 3.8:** HAI prevalence in those PWHS, who were admitted under care of a surgeon, further analysed by the admitting surgical consultant specialty

| Surgical Consultant Specialty | Total Number of Patients | Number of Patients with HAI | HAI Prevalence (%) | 95% Confidence Interval |
|---|---|---|---|---|
| Orthopaedics | 384 | 33 | 8.6 | 6.2 – 11.8 |
| General surgery | 297 | 49 | 16.5 | 12.7 – 21.1 |
| Obstetrics/maternity | 208 | 8 | 3.8 | 2.0 – 7.4 |
| Digestive tract/bowel surgery | 72 | 13 | 18.1 | 10.9 – 28.5 |
| Gynaecology | 71 | 2 | 2.8 | 0.3 – 9.8 |
| Vascular surgery | 68 | 13 | 19.1 | 11.5 – 30.0 |
| Urology | 60 | 3 | 5.0 | 1.0 – 13.9 |
| Ear, nose & throat (ENT) | 55 | 1 | 1.8 | 0.0 – 9.7 |
| Neurosurgery | 53 | 7 | 13.2 | 6.5 – 24.8 |
| Cardiac surgery | 47 | 6 | 12.8 | 6.0 – 25.2 |
| Other surgical specialty | 114 | 7 | 6.1 | 3.0 – 12.1 |
| **Total** | **1,429** | **142** | **9.9** | **8.5 – 11.6** |

### 3.2.3 HAI Prevalence, by Surgical Category

Table 3.9 describes the overall HAI prevalence in the 1,591 PWHS, by the category of surgery performed. The highest overall HAI prevalence was recorded for patients who had undergone neurosurgical (18.2%), thoracic surgical (17.9%), vascular surgical (16.7%) and general surgical (16.6%) procedures. (**Appendix B: List of Surgical Procedures**)

**Table 3.9:** HAI prevalence in PWHS, by surgical category

| Surgical Category | Number of PWHS | Number of PWHS with HAI | Percentage of PWHS with HAI | HAI Prevalence (%) |
|---|---|---|---|---|
| General surgical procedure | 464 | 77 | 46.7 | 16.6 |
| Orthopaedic surgical procedure | 456 | 40 | 24.2 | 8.8 |
| Obstetrics/gynaecological procedure | 276 | 11 | 6.7 | 4.0 |
| Vascular surgical procedure | 78 | 13 | 7.9 | 16.7 |
| ENT or maxillofacial surgical procedure | 74 | 4 | 2.4 | 5.4 |
| Cardiac surgical procedure | 68 | 5 | 3.0 | 7.4 |
| Urological surgical procedure | 67 | 1 | 0.6 | 1.5 |
| Neurosurgical procedure | 44 | 8 | 4.8 | 18.2 |
| Thoracic surgical procedure | 28 | 5 | 3.0 | 17.9 |
| Ophthalmological surgical procedure | 13 | 0 | 0.0 | 0.0 |
| Other surgical procedure type | 23 | 1 | 0.6 | 4.3 |
| **Total** | **1,591** | **165** | **100** | **10.4** |

Table 3.10 displays the overall HAI prevalence for PWHS, by the surgical procedure performed. The highest HAI prevalence was recorded in patients who had undergone ventricular shunt procedures (30.8%) followed by small bowel surgery (29.2%). Patients who had one of ten surgical procedures with highest HAI prevalence accounted for over 52.7% (n=87) of the 165 patients with a reported HAI.

**Table 3.10:** HAI prevalence, by surgical procedure

| Surgical Procedure | Number of PWHS | Number of PWHS with HAI | Percentage of PWHS with HAI | HAI Prevalence (%) |
|---|---|---|---|---|
| Ventricular shunt | 13 | 4 | 2.4 | 30.8 |
| Small bowel surgery | 48 | 14 | 8.5 | 29.2 |
| Colon surgery | 112 | 31 | 18.8 | 27.7 |
| Gastric surgery | 15 | 4 | 2.4 | 26.7 |
| Incision with surgical wound left open to heal by secondary intervention | 12 | 3 | 1.8 | 25.0 |
| Limb amputation | 32 | 7 | 4.2 | 21.9 |
| Abdominal aortic aneurysm repair | 16 | 3 | 1.8 | 18.8 |
| Thoracic surgery | 28 | 5 | 3.0 | 17.9 |
| Abdominal surgery | 47 | 8 | 4.8 | 17.0 |
| Lower limb surgery | 48 | 8 | 4.8 | 16.7 |
| Other surgical procedures | 1,220 | 78 | 47.3 | 6.4 |
| **Total** | **1,591** | **165** | **100** | **10.4** |

### 3.2.4 Onset and Origin of HAI

There were 180 HAI recorded in 165 PWHS. Figure 3.2 displays the location of PWHS at the onset of HAI signs and symptoms and Figure 3.3 displays the HAI origin (i.e., where the PWHS acquired the infection).

The majority of HAI developed whilst PWHS remained in the hospital (n= 155; 86%) and the vast majority of reported HAI in PWHS were attributable to the current hospital (n=166; 92%).

However, 25 HAI (14%) were already evident at the time the PWHS was admitted to the hospital. Of those, 11 (44%) had origin in the current hospital (i.e., HAI related to a prior admission to the current hospital), 13 (52%) had origin in another acute hospital (i.e., the patient was transferred to or subsequently admitted to the current hospital, with an active HAI which had been acquired in the referring/other acute hospital) and one infection (4%) had origin in a non-acute hospital.

**Figure 3.2:** Percentage of HAI, by HAI onset

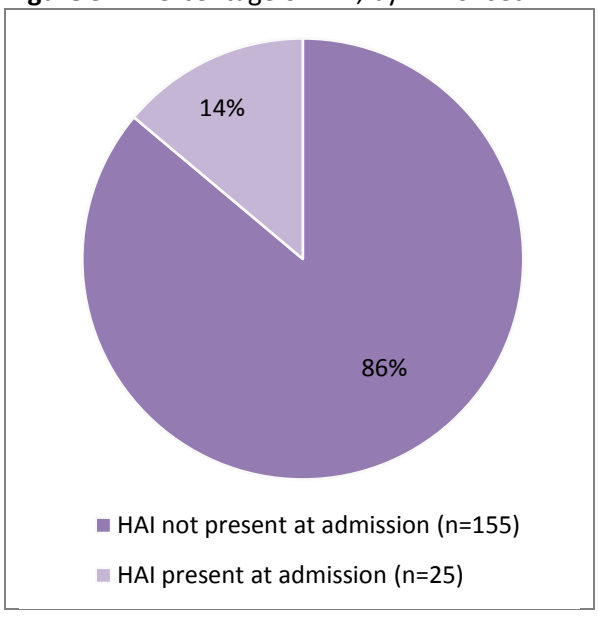
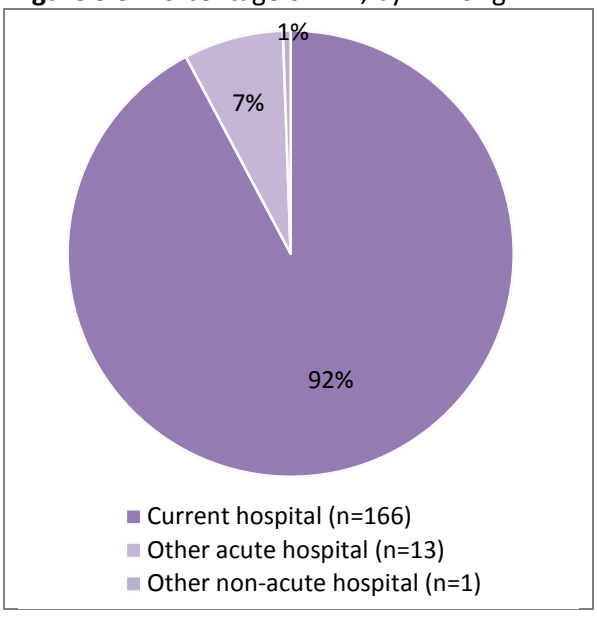



**Figure 3.3:** Percentage of HAI, by HAI origin



### 3.2.5 Distribution of HAI, by Type

Table 3.11 displays the distribution of the 180 HAI in 165 PWHS since admission, with surgical site infections (SSI) the most common infection type reported (n=63; 35% of all HAI) and the most prevalent HAI in PWHS. The prevalence of SSI in PWHS was double that of the second most prevalent HAI; pneumonia (4% versus 1.9%).

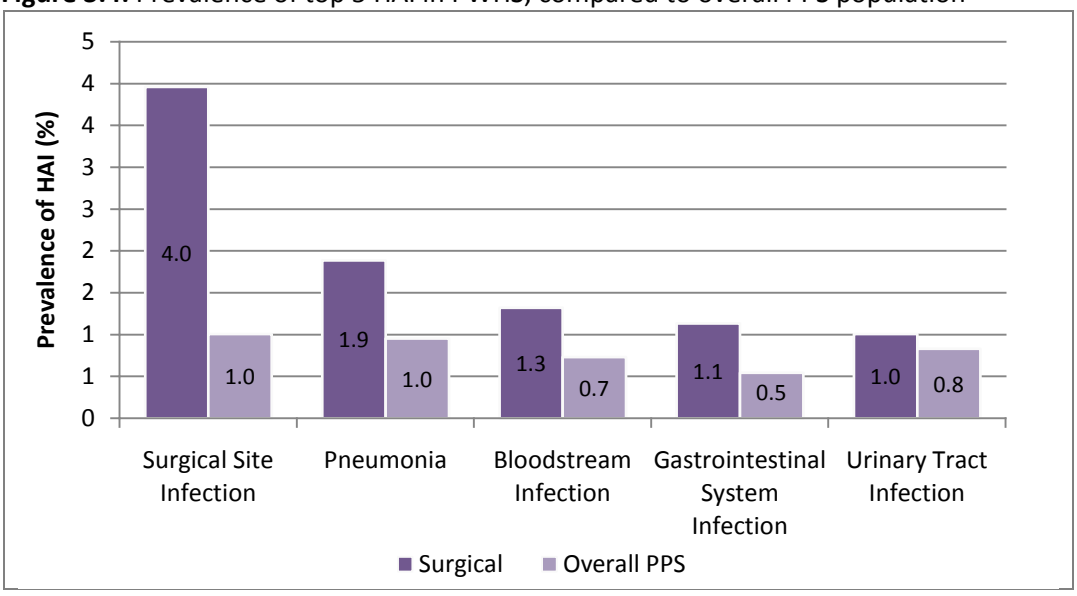
The top five HAI [SSI, pneumonia, bloodstream infections (BSI), gastrointestinal system infections and urinary tract infections (UTI)] combined, accounted for over 80% of all reported HAI. (**Appendix C** – Case Definitions for the Most Prevalent HAI Reported in PWHS).

**Table 3.11:** Number, percentage and HAI prevalence, by HAI type

| Rank Order | HAI Infection Site | N | HAI % | Prevalence (%) |
|---|---|---|---|---|
| 1 | Surgical site infection (SSI) | 63 | 35.0 | 4.0 |
| 2 | Pneumonia | 30 | 16.7 | 1.9 |
| 3 | Bloodstream infections (BSI) | 21 | 11.7 | 1.3 |
| 4 | Gastrointestinal system infections | 18 | 10.0 | 1.1 |
| 5 | Urinary tract infections (UTI) | 16 | 8.9 | 1.0 |
| 6 | Bone and joint infections | 9 | 5.0 | 0.6 |
| 7 | Skin and ssoft tissue infections | 8 | 4.4 | 0.5 |
| 8 | Systemic infections | 6 | 3.3 | 0.4 |
| 9 | Reproductive tract infection | 3 | 1.7 | 0.2 |
| 10 | Eye, ear, nose, throat or mouth infections | 2 | 1.1 | 0.1 |
| 11 | Lower respiratory tract infections | 2 | 1.1 | 0.1 |
| 12 | Central nervous system infections | 1 | 0.6 | 0.1 |
| 13 | Catheter-related infections | 1 | 0.6 | 0.1 |
| | **Total** | **180** | **100** | |

Figure 3.4 displays the higher prevalence of the top five HAI was in PWHS, in comparison with the overall PPS population.

**Figure 3.4:** Prevalence of top 5 HAI in PWHS, compared to overall PPS population

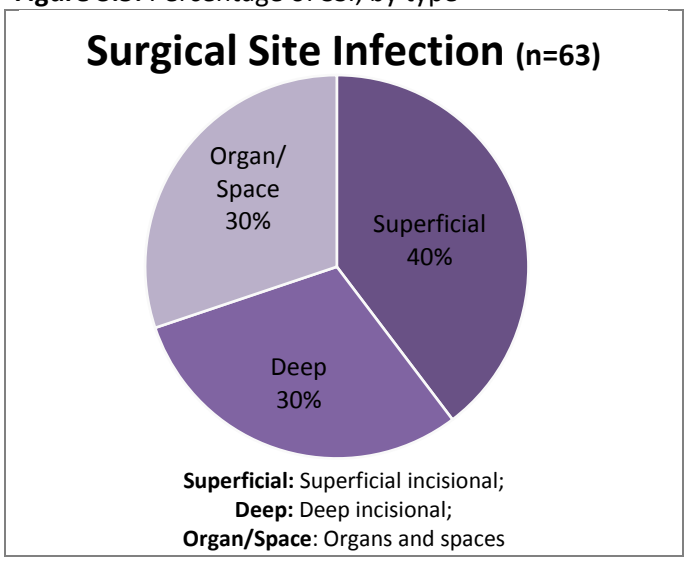


## Surgical Site Infection (SSI)

In the overall PPS patient population, there were a total of 91 reported SSI (1% prevalence), with 63 of those reported in PWHS (4.0% prevalence). The remaining 28 SSI were reported in patients who had not had a surgical procedure during the current hospital admission. A further analysis of all 91 reported SSI is provided in section 4.0.

Of the 63 SSI reported in PWHS, 40% (n=25) were classified as superficial incisional. The remaining SSI (n=38; 60%) were classified as either deep incisional (n=19) or organ/space (n=19) SSI (Figure 3.5).

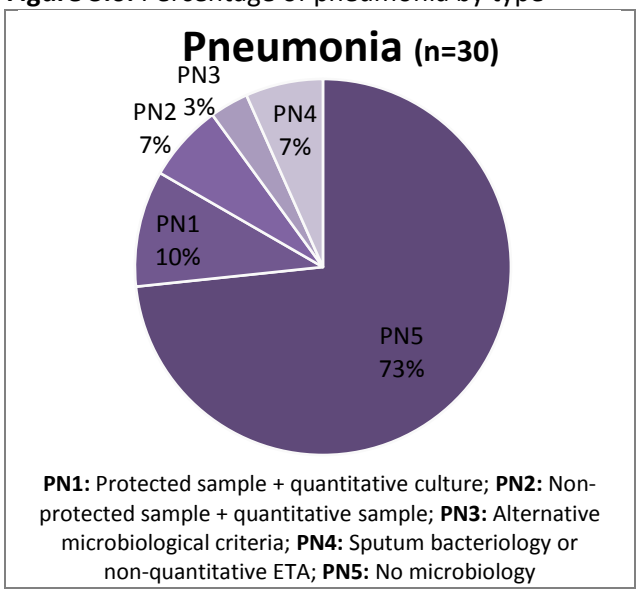
**Figure 3.5:** Percentage of SSI, by type




## Pneumonia (PN)

Pneumonia was the second commonest HAI in PWHS, with 30 cases reported. Of those, 73% (n=23) were not microbiologically-confirmed (Figure 3.6). For 23% (n=7) of the pneumonia cases, respiratory tract intubation was present prior to onset (Table 3.12).

**Figure 3.6:** Percentage of pneumonia by type

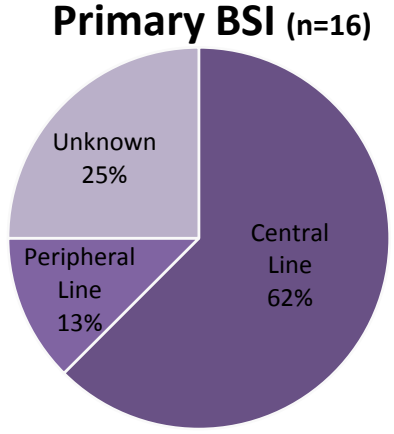


**Bloodstream Infection (BSI)**

BSI was the third commonest HAI in PWHS, with 21 cases reported. Vascular catheterisation was present prior to BSI onset for 76% (n=16) cases (Table 3.12). BSI may be classified as primary BSI (which may be due to an infected vascular catheter 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 21 BSI, 16 (76%) were classified as primary BSI and five (24%) as BSI arising secondary to infection elsewhere in the body (Figures 3.7 & 3.8).

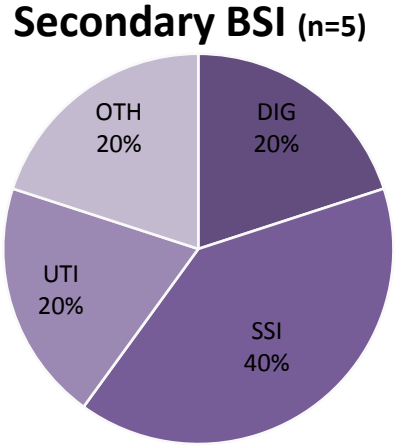
- Of the 16 primary BSI, an indwelling central vascular catheter (CVC) was implicated as the source for 10 (62%) cases and a peripheral vascular catheter (PVC) was implicated for two (13%) cases. For the remaining four (25%) primary BSI no underlying source was identified (Figure 3.7). Although those four patients had documentation of an indwelling vascular catheter prior to BSI onset, there was no clinical or microbiological evidence linking the vascular catheter to the BSI
- Of the five secondary BSI, two resulted from SSI (40%) and one each as a consequence of a digestive tract infection, urinary tract infection and another infection type

**Figure 3.7:** Percentage of primary BSI, by origin




**Central Line:** Central vascular catheter infection;
**Peripheral Line:** Peripheral vascular catheter infection;
**Unknown:** Primary BSI of unknown origin

**Figure 3.8:** Percentage of secondary BSI, by origin

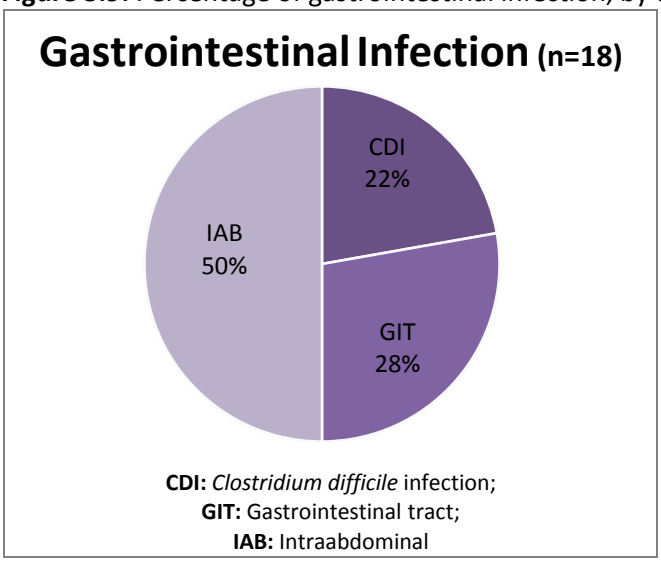



Secondary to:
**DIG:** Digestive tract infection; **SSI:** Surgical site infection;
**UTI:** Urinary tractinfection; **OTH:** Other infection

**Gastrointestinal Infection (GI)**

GI infection was the fourth commonest HAI in PWHS with 18 cases reported. Figure 3.9 displays the breakdown of GI infections; Intra-abdominal infections were the most common infection type (n=9; 50%), followed by gastrointestinal tract infections (n=5; 28%) and *Clostridium difficile* infection (CDI) (n=4; 22%).

**Figure 3.9:** Percentage of gastrointestinal infection, by type




## Urinary Tract Infection (UTI)

UTI was the fifth commonest HAI in PWHS, with 16 cases reported. Figure 3.10 displays the UTIs as categorised by the associated microbiology results. Only 25% were microbiologically-confirmed. A urinary catheter was documented to have been *in situ* prior to UTI onset in 10 (63%) cases (Table 3.12).

**Figure 3.10:** Percentage of urinary tract infection, by type

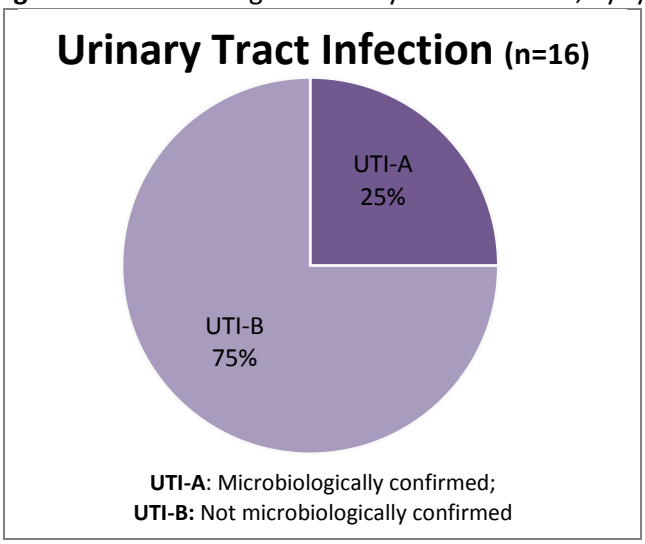


**Table 3.12:** Number and percentage of device-associated HAI

| HAI Type | HAI | |
|---|---|---|
| | N | % |
| **Pneumonia:** | | |
| Respiratory tract intubation present | 7 | 23 |
| Respiratory tract intubation absent | 23 | 77 |
| **Total** | **30** | **100** |
| **Blood stream infection:** | | |
| Vascular catheter present | 16 | 76 |
| Vascular catheter absent | 5 | 24 |
| **Total** | **21** | **100** |
| **Urinary tract infection:** | | |
| Urinary catheterisation present | 10 | 63 |
| Urinary catheterisation absent | 6 | 37 |
| **Total** | **16** | **100** |

### 3.3 Microbiology & Key Antimicrobial Resistance Markers in HAI from PWHS

The PPS microbiology and antimicrobial resistance results should be reviewed and interpreted in conjunction with the definitions used in this survey. There 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/

#### 3.3.1 Microbiology and Antimicrobial Resistance Data

Of the 501 active HAI identified in the overall PPS cohort, positive microbiology results were available for 261 (52%) with a total of 310 microorganisms identified from relevant specimens.

Of the 180 active HAI identified in PWHS since admission, positive microbiology results were available for 100 (56%), with a total of 136 microorganisms identified from relevant specimens. Figure 3.11 displays the distribution of these microorganisms.

*Enterobacteriaceae* (n=49; 36%) were the most frequently detected microorganisms from HAI in PWHS. Of the *Enterobacteriaceae*, *Escherichia coli* was the most commonly isolated (n=24; 49%) followed by *Klebsiella pneumoniae* (n=8; 16%). Just under half of the *Enterobacteriaceae* (46.9%) retained susceptibility to both third-generation cephalosporins (3GC) and carbapenems (Table 3.13). However, 3GC resistance was reported in 20 (40.8%) and carbapenem resistance in two (4.1%) *Enterobacteriaceae* isolates from clinical specimens. There were 16 PWHS with HAI caused by resistant *Enterobacteriaceae,* with one of these patients having two resistant *Enterobacteriaceae* isolated.

*Enterococcus* spp. (n=22; 16%) were the second most frequently detected microorganisms from HAI in PWHS. Of these, four (18.2%) were reported as resistant to glycopeptides (vancomycin resistant enterococci -VRE). Four patients were reported as having a HAI caused by resistant enterococci.

*Staphylococcus aureus* (n=19; 14%) were the third most frequently detected microorganisms from HAI in PWHS. Of these, six (31.6%) were reported as flucloxacillin resistant (MRSA). Six PWHS were reported as having a HAI caused by MRSA.

Of the eight (6%) *Pseudomonas aeruginosa* isolates reported from HAI in PWHS, three (37.5%) were reported as resistant to carbapenems.

**Figure 3.11:** HAI microorganism distribution in PWHS

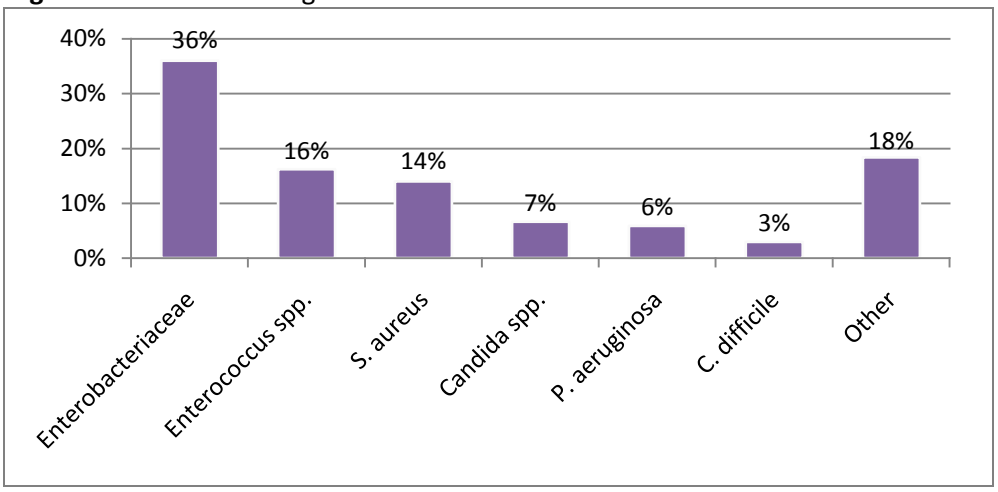



**Table 3.13:** Number of microorganism, by key antimicrobials resistance markers

| Microorganism | Antimicrobials | Microbiology Reports | |
|---|---|---|---|
| | | N | % |
| *Enterobacteriaceae* | 3rd generation cephalosporin sensitive; carbapenem sensitive | 23 | 46.9 |
| | 3rd generation cephalosporin resistant; Carbapenem sensitive | 18 | 36.7 |
| | 3rd generation cephalosporin resistant; Carbapenem resistant | 2 | 4.1 |
| | Unknown | 6 | 12.2 |
| | **Total** | **49** | **100** |
| *Enterococcus* spp. | Vancomycin/teicoplanin (glycopeptide) sensitive (VSE) | 13 | 59.1 |
| | Vancomycin/teicoplanin (glycopeptide) resistant (VRE) | 4 | 18.2 |
| | Unknown | 5 | 22.7 |
| | **Total** | **22** | **100** |
| *Staphylococcus aureus* | Flucloxacillin sensitive (MSSA) | 13 | 68.4 |
| | Flucloxacillin resistant (MRSA) | 6 | 31.6 |
| | **Total** | **19** | **100** |
| *Pseudomonas aeruginosa* | Carbapenem sensitive | 5 | 62.5 |
| | Carbapenem resistant | 3 | 37.5 |
| | **Total** | **8** | **100** |

### 3.3.2 Causative Pathogens of the Most Common HAI Types in PWHS

**Surgical site infections:** Of the 63 SSI, positive microbiology results were reported for 38 (60%) cases. Fifty-seven pathogens were identified with *Enterococcus* spp. (n=11; 19%), *S. aureus* (n=8; 14%) and *E. coli* (n=7; 12%) the most commonly detected.

**Pneumonia:** Of the 30 pneumonia cases, positive microbiology results were reported for 7 (23%) cases. Nine pathogens were isolated with *P. aeruginosa* (n=2; 22%) and *Enterobacteriaceae* (n=2; 22%) the most commonly detected.

**Bloodstream infections:** The causative pathogen was reported for all but one of the 21 (95%) reported BSI. Twenty-three pathogens were identified with *S. aureus* (n=4; 17%), *Candida* spp. (n=4; 17%) and *E. coli* (n=3; 13%) the most commonly detected.

**Gastrointestinal system infections:** Of the 18 gastrointestinal system infections, positive microbiology results were reported for 13 (72%) cases. Eighteen pathogens were identified with *E. coli* (n=6; 33%), *C. difficile* (n=4; 22%) and *Enterococcus* spp. (n=3; 17%) the most commonly detected.

### 3.4 Antimicrobial Use

The PPS antimicrobial use results should also be reviewed and interpreted in conjunction with the methodology and definitions used in this survey. There 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/

#### 3.4.1 Prevalence of Antimicrobial Use

The antimicrobial use (AMU) prevalence in PWHS was higher than that of the overall patient population. Of the 9,030 eligible patients in the overall PPS cohort, 3,108 (34.4%; 95% CI: 33.4-35.4) were classified as receiving systemic antimicrobials. A total of 4,532 antimicrobials were prescribed, equating to 1.5 antimicrobials per patient. Of the 1,591 PWHS, 761 (47.8%; 95% CI: 45.4-50.3) were classified as receiving systemic antimicrobials. A total of 1,098 antimicrobials were prescribed, equating to 1.4 antimicrobials per patient. Table 3.14 displays the AMU distribution for the overall population and PWHS.

**Table 3.14:** Number of prescribed antimicrobials per patient: overall PPS population and PWHS

| Number of antimicrobials prescribed per patient | All PPS Patients | | PWHS | |
|---|---|---|---|---|
| | N | % | N | % |
| 0 | 5,922 | 65.6 | 830 | 52.2 |
| 1 | 1,991 | 22.0 | 505 | 31.7 |
| 2 | 984 | 9.9 | 194 | 12.2 |
| 3 | 158 | 1.8 | 45 | 2.8 |
| 4 | 46 | 0.5 | 15 | 0.9 |
| 5 | 19 | 0.2 | 2 | 0.1 |
| **Total** | **9,030** | **100** | **1,591** | **100** |

#### 3.4.2 Antimicrobial Use Prevalence by Admitting Consultant Specialty

The AMU prevalence by admitting consultant specialty is displayed in Table 3.15. Table 3.16 describes AMU prevalence among the 1,429 PWHS who were admitted under the care of surgical and obstetric/gynaecological consultants.

**Table 3.15:** Antimicrobial use prevalence, by admitting consultant specialty

| Consultant Specialty | Total Number of PWHS | Number of PWHS receiving Antimicrobials | Prevalence (%) | 95% Confidence Interval |
|---|---|---|---|---|
| Surgical | 1,150 | 574 | 49.9 | 47.0 – 52.8 |
| Obstetrics/gynaecology | 279 | 118 | 42.3 | 36.6 – 48.2 |
| Medical | 120 | 57 | 47.5 | 38.8 – 56.4 |
| Care of the elderly | 20 | 2 | 10.0 | 1.2 – 31.7 |
| Other specialty | 22 | 10 | 45.5 | 26.9 – 65.3 |
| **Total** | **1,591** | **761** | **47.8** | **45.4 – 50.3** |

**Table 3.16:** Antimicrobial use prevalence in those PWHS, who were admitted under care of a surgeon, further analysed by the admitting surgical consultant specialty

| Surgical Consultant Specialty | Total Number of PWHS | Number of PWHS Receiving Antimicrobials | Prevalence (%) | 95% Confidence Interval |
|---|---|---|---|---|
| Orthopaedics | 384 | 163 | 42.4 | 37.6 – 47.4 |
| General surgery | 297 | 170 | 57.2 | 51.6 – 62.7 |
| Obstetrics/maternity | 208 | 81 | 38.9 | 32.6 – 45.7 |
| Digestive tract/bowel surgery | 72 | 38 | 52.8 | 41.4 – 63.9 |
| Gynaecology | 71 | 37 | 52.1 | 40.7 – 63.3 |
| Vascular surgery | 68 | 38 | 55.9 | 44.1 – 67.1 |
| Urology | 60 | 38 | 63.3 | 50.7 – 74.4 |
| Ear, nose & throat (ENT) surgery | 55 | 27 | 49.1 | 36.4 – 61.9 |
| Neurosurgery | 53 | 16 | 30.2 | 19.5 – 43.5 |
| Cardiac surgery | 47 | 19 | 40.4 | 27.6 – 54.7 |
| Other surgical specialty | 114 | 65 | 57.0 | 47.8 – 65.7 |
| **Total** | **1,429** | **692** | **48.4** | **45.8 – 51.0** |

### 3.4.3 Antimicrobial Use Prevalence by Surgical Category

Table 3.17 displays the AMU prevalence in the 1,591 PWHS, by the category of surgery performed. The highest AMU prevalence was recorded in patients who had undergone urological (59.7%) and general surgical (57.1%) procedures.

**Table 3.17:** Antimicrobial use prevalence, by surgical category

| Surgical Category | Number of PWHS | Number of PWHS Receiving Antimicrobials | Percentage of PWHS Receiving Antimicrobials | Prevalence (%) |
|---|---|---|---|---|
| General surgical procedure | 464 | 265 | 34.8 | 57.1 |
| Orthopaedic surgical procedure | 456 | 191 | 25.1 | 41.9 |
| Obstetrics & gynaecological procedure | 276 | 116 | 15.2 | 42.0 |
| Vascular surgical procedure | 78 | 41 | 5.4 | 52.6 |
| ENT & maxillofacial surgical procedure | 74 | 39 | 5.1 | 52.7 |
| Cardiac surgical procedure | 68 | 25 | 3.3 | 36.8 |
| Urological surgical procedure | 67 | 40 | 5.3 | 59.7 |
| Neurosurgical procedure | 44 | 15 | 2.0 | 34.1 |
| Thoracic surgical procedure | 28 | 14 | 1.8 | 50.0 |
| Ophthalmological surgical procedure | 13 | 5 | 0.7 | 38.5 |
| Other surgical procedure | 23 | 10 | 1.3 | 43.5 |
| **Total** | **1,591** | **761** | **100** | **47.8** |

Table 3.18 displays the AMU prevalence for PWHS, by the surgical procedure performed. The highest AMU prevalence was recorded in patients who had undergone appendix surgery (90.6%), followed by incision and drainage of abscess (85.0%). Ten surgical procedures with the highest associated AMU prevalence accounted for over 32.9% (n=250) of the 761 PWHS who were prescribed antimicrobials at the time of the PPS.

**Table 3.18:** Antimicrobial use prevalence, by surgical procedure

| Surgical Procedure | Number of PWHS | Number of PWHS Receiving Antimicrobials | Percentage of PWHS Receiving Antimicrobials | Prevalence (%) |
|---|---|---|---|---|
| Appendix surgery | 32 | 29 | 3.8 | 90.6 |
| Incision and drainage of abscess | 20 | 17 | 2.2 | 85.0 |
| Tonsillectomy | 13 | 10 | 1.3 | 76.9 |
| Prostate surgery | 30 | 20 | 2.6 | 66.7 |
| Lower limb surgery | 48 | 31 | 4.1 | 64.6 |
| Gall bladder surgery | 25 | 16 | 2.1 | 64.0 |
| Abdominal hysterectomy | 21 | 13 | 1.7 | 61.9 |
| Peripheral vascular bypass | 22 | 13 | 1.7 | 59.1 |
| Colon surgery | 112 | 64 | 8.4 | 57.1 |
| Laparoscopic surgery | 66 | 37 | 4.9 | 56.1 |
| Other surgical procedure type | 1,202 | 511 | 67.1 | 42.5 |
| **Total** | **1,591** | **761** | **100** | **47.8** |

### 3.4.4 Documentation of Indication and Compliance with Local Policy

In the overall PPS patient population, the indication for the antimicrobial prescription was documented in the patient's healthcare record and/or medication chart in 83% of cases. This figure was lower in the PWHS, where the indication was documented in 78.5% (n=862) of cases (Figure 3.12).

In the overall PPS patient population, 27% of the assessable prescriptions were deemed to be non-compliant with the local prescribing policy. This figure was higher in the PWHS, where 31% (n=247) of 796 assessable prescriptions were deemed to be non-compliant (Figure 3.13).

**Figure 3.12:** Documented indication for the prescribed antimicrobial

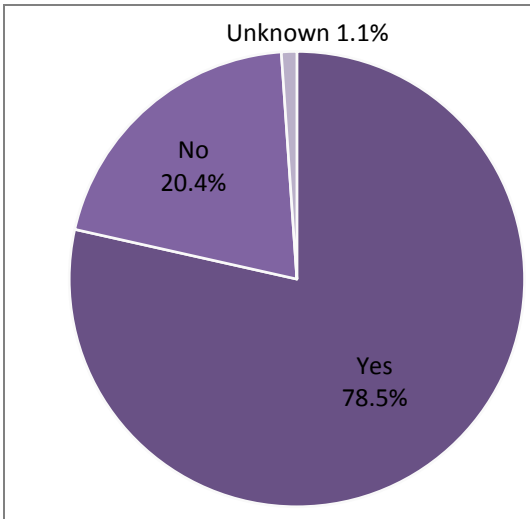
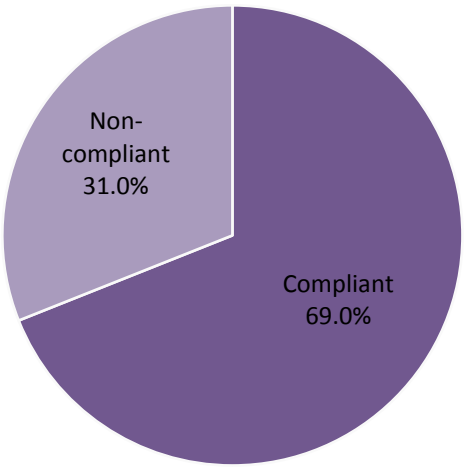



**Figure 3.13:** Percentage of assessable prescriptions, compliant with local prescribing policy (n=796)



### 3.4.5 Description of Prescribed Antibacterials

Table 3.19 displays the breakdown of the 1,068 prescribed antibacterials. The 15 most commonly prescribed agents accounted for over 91.8% (n=980) of all antibacterial prescriptions. The most commonly prescribed antibacterial class was the β lactam/β lactamase inhibitor combination agents (co-amoxiclav and piperacilliin-tazobactam) which together accounted for 350 (33%) antibacterials prescribed to PWHS since admission.

**Table 3.19:** Number, percentage and prevalence of prescribed antibacterials

| Rank Order | Antibacterial Agent | Prescribed Antibacterials | | |
|---|---|---|---|---|
| | | N | % | Prevalence (%) |
| 1 | Co-amoxiclav | 263 | 24.6 | 16.5 |
| 2 | Cefuroxime | 145 | 13.6 | 9.1 |
| 3 | Metronidazole | 134 | 12.5 | 8.4 |
| 4 | Piperacillin-tazobactam | 87 | 8.1 | 5.5 |
| 5 | Ciprofloxacin | 65 | 6.1 | 4.1 |
| 6 | Gentamicin | 56 | 5.2 | 3.5 |
| 7 | Flucloxacillin | 51 | 4.8 | 3.2 |
| 8 | Vancomycin | 45 | 4.2 | 2.8 |
| 9 | Meropenem | 35 | 3.3 | 2.2 |
| 10 | Benzylpenicillin | 21 | 2.0 | 1.3 |
| 11 | Linezolid | 20 | 1.9 | 1.3 |
| 12 | Clindamycin | 16 | 1.5 | 1.0 |
| 13 | Teicoplanin | 15 | 1.4 | 0.9 |
| 14 | Erythromycin | 14 | 1.3 | 0.9 |
| 15 | Trimethoprim | 13 | 1.2 | 0.8 |
| | Other | 88 | 8.2 | |
| | **Total** | **1,068** | **100** | |

### 3.4.6 Description of Prescribed Antifungals

Table 3.20 displays the breakdown of the 30 prescribed antifungals. The most common of which were fluconazole (n=14, 46.7%) and caspofungin (n=10, 33.3%). Overall, only 1.8% (n=29) of the PWHS were prescribed antifungals at the time of the PPS.

**Table 3.20** Number, percentage and prevalence of prescribed antifungals

| Rank Order | Antifungal Agent | Prescribed Antifungals | | |
|---|---|---|---|---|
| | | N | % | Prevalence (%) |
| 1 | Fluconazole | 14 | 46.7 | 0.9 |
| 2 | Caspofungin | 10 | 33.3 | 0.6 |
| 3 | Anidulafungin | 3 | 10.0 | 0.2 |
| 4 | Nystatin | 2 | 6.7 | 0.1 |
| 5 | Amphotericin B | 1 | 3.3 | 0.1 |
| | **Total** | **30** | **100** | |

### 3.4.7 Indication for Antimicrobial Prescribing

Table 3.21 displays the prescriber's indication for the prescribed antimicrobial in the overall PPS population and in PWHS since admission. As expected, the proportion of prescriptions for surgical antimicrobial prophylaxis was considerably higher in PWHS compared to the overall PPS population (41.1% versus 11.2%). There were 57 antimicrobials prescribed for the indication of 'surgical prophylaxis' in patients who did not have a history of surgery during the current admission. It is possible that the PPS data collectors may have recorded antimicrobials as 'surgical prophylaxis' where a patient admitted under the care of a surgeon was prescribed an antimicrobial and the PPS data collector could not find any documented evidence that the antimicrobial was prescribed for treatment of infection. In such cases, the prescriptions would probably have better been categorised under the prescriber's indication of 'unknown indication'.

**Table 3.21** Number and percentage of antimicrobials, by prescriber's indication

| Prescriber's Indication | Antimicrobials Prescribed in Overall PPS Population | | Antimicrobials Prescribed in PWHS | |
|---|---|---|---|---|
| | N | % | N | % |
| Treatment of infection | 3,526 | 77.8 | 563 | 51.3 |
| Surgical prophylaxis | 508 | 11.2 | 451 | 41.1 |
| Medical prophylaxis | 361 | 8.0 | 50 | 4.6 |
| Other | 38 | 0.8 | 11 | 1.0 |
| Unknown | 99 | 2.2 | 23 | 2.1 |
| **Total** | **4,532** | **100** | **1,098** | **100** |

### 3.4.8 Antimicrobials Prescribed for the Treatment of Infection

Of 563 antimicrobials prescribed for treatment of infection, 59% (n=332) were for hospital-associated infections and 41% (n=231) were for community-associated infections (Figure 3.14). The majority of antimicrobials prescribed for treatment of infection were for treatment of intra-abdominal (n=138; 25%) and skin/soft tissue infections (n=130; 23%) (Figure 3.15).

**Figure 3.14** Percentage of antimicrobials prescribed for treatment of infection, by origin of infection (n=563)

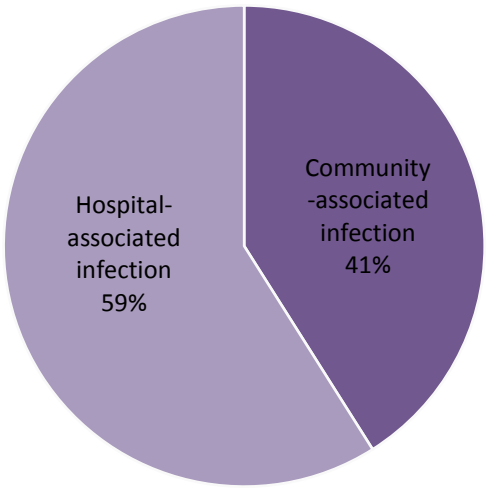
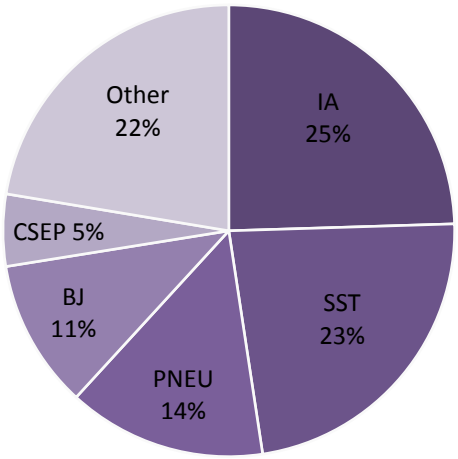



**Figure 3.15:** Percentage of antimicrobials prescribed for treatment of infection, by site of infection (n=563)

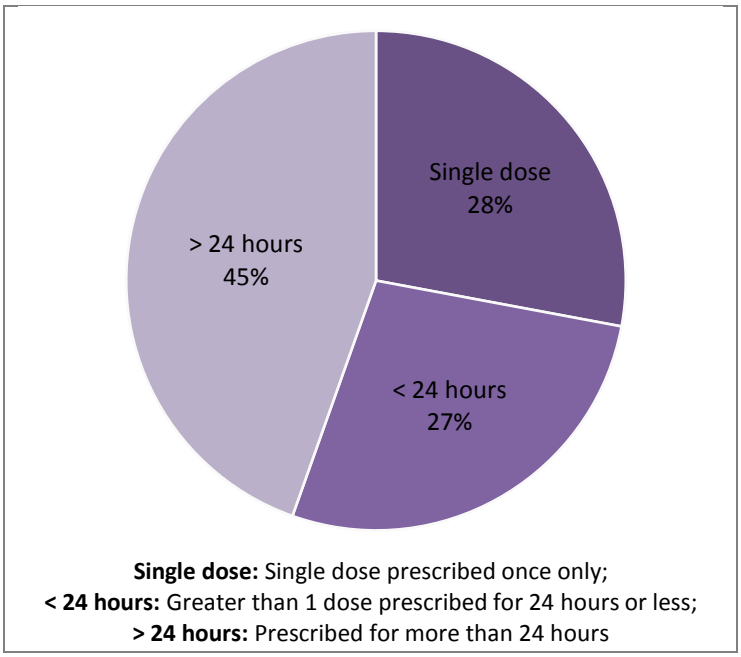



**IA:** Intraabdominal infection;
**SST:** Skin and soft tissue infection; **PNEU:** Pneumonia;
**BJ:** Bone or joint infection; **CSEP:** Clinical Sepsis

### 3.4.9 Surgical Antimicrobial Prophylaxis

Surgical antimicrobial prophylaxis (SAP) accounted for 41.1% (n=451) of prescriptions in PWHS. Just 28% (n=126) were single dose prescriptions (Figure 3.16). Seventy-two percent (n=325) of surgical antimicrobial prescriptions exceeded one dose and 45% (n=201) exceeded 24 hours duration.

**Figure 3.16:** Duration of surgical antimicrobial prophylaxis in PWHS since admission




**Single dose:** Single dose prescribed once only;
**< 24 hours:** Greater than 1 dose prescribed for 24 hours or less;
**> 24 hours:** Prescribed for more than 24 hours

Table 3.22 displays the agents prescribed. There were 370 PWHS (23.3%) who were prescribed 451 antimicrobials for SAP. Co-amoxiclav accounted for 39% (n=176), followed by cefuroxime which accounted for 28.8% (n=130) of SAP prescriptions.

**Table 3.22:** Agents prescribed for surgical antimicrobial prophylaxis

| Rank Order | Antimicrobial Agent | Prescribed Antimicrobials | |
|---|---|---|---|
| | | N | % |
| 1 | Co-amoxiclav | 176 | 39.0 |
| 2 | Cefuroxime | 130 | 28.8 |
| 3 | Metronidazole | 51 | 11.3 |
| 4 | Gentamicin | 24 | 5.3 |
| 5 | Ciprofloxacin | 17 | 3.8 |
| | Other | 53 | 11.8 |
| | **Total** | **451** | **100** |

# 4.0 Results for Patients with Surgical Site Infections

## 4.1 Surgical Site Infection (SSI) Types

The most frequent HAI reported during the PPS was SSI, with 91 (18%) cases. The SSI prevalence in the overall patient population was 1% and for patients with a history of surgery (PWHS) during the current admission, the SSI prevalence was 4%. Of the 91 SSI, 44% were classified as superficial incisional and 56% were classified as either deep incisional or organ/space SSI (Table 4.1). It is likely that the category of superficial incisional SSI was underestimated in the PPS; as such SSI may be diagnosed and managed following patient discharge from hospital, either by the general practitioner or via the outpatient department.

The majority of SSI (n=63; 69%) were diagnosed during the current hospital admission and for the remaining 28 SSI, the diagnosis was made during a subsequent admission.

**Table 4.1:** Number and percentage of all reported SSI, by SSI type

| SSI Type | Number | Percentage |
|---|---|---|
| Superficial incisional | 40 | 44.0 |
| Deep incisional | 25 | 27.5 |
| Organ/space | 26 | 28.6 |
| **Total** | **91** | **100** |

## 4.2 SSI, by Type and Surgical Category

Table 4.2 displays the breakdown of the 91 reported SSI, by the category of surgery performed and by the SSI type. Combined, general surgical and orthopaedic surgical procedures accounted for the majority of reported SSI (n=64; 70%). Of the SSI associated with general surgical procedures, two-thirds of those were either deep or organ/space infections. Of the SSI associated with orthopaedic surgical procedures, over half were either deep or organ/space infections (n=14; 54%). Of the five SSI related to a neurosurgical procedure, four (80%) were classified as organ/space infections.

**Table 4.2:** Number and percentage of SSI, by surgical category and SSI type

| Surgical Category | Total SSI | | Superficial SSI | | Deep SSI | | Organ/Space SSI | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| General surgical procedure | 38 | 41.8 | 13 | 32.5 | 8 | 32.0 | 17 | 65.4 |
| Orthopaedic surgical procedure | 26 | 28.6 | 12 | 30.0 | 12 | 48.0 | 2 | 7.7 |
| Vascular surgical procedure | 9 | 9.9 | 6 | 15.0 | 2 | 8.0 | 1 | 3.8 |
| Cardiac surgical procedure | 5 | 5.5 | 2 | 5.0 | 2 | 8.0 | 1 | 3.8 |
| Neurosurgical procedure | 5 | 5.5 | 1 | 2.5 | 0 | 0.0 | 4 | 15.4 |
| Obstetric/gynaecological procedure | 4 | 4.4 | 3 | 7.5 | 0 | 0.0 | 1 | 3.8 |
| ENT/maxillofacial procedure | 2 | 2.2 | 2 | 5.0 | 0 | 0.0 | 0 | 0.0 |
| Ophthalmological procedure | 1 | 1.1 | 1 | 2.5 | 0 | 0.0 | 0 | 0.0 |
| Thoracic surgical procedure | 1 | 1.1 | 0 | 0.0 | 1 | 4.0 | 0 | 0.0 |
| **Total** | **91** | **100** | **40** | **100** | **25** | **100** | **26** | **100** |

### 4.3 SSI, by Surgical Procedure

Table 4.3 displays the breakdown of the 91 reported SSI, by the surgical procedure performed. Colon surgery was most frequently associated with a subsequent SSI (n=14; 15.4%). Open reduction of fracture was the second most frequently reported procedure associated with a subsequent SSI (n=11; 12.1%). Combined, hip and knee prosthesis surgeries were associated with 10 subsequent SSI (n=10; 11%).

**Table 4.3:** Number and percentage of SSI, by surgical procedure

| Surgical Procedure | Total SSI | |
|---|---|---|
| | N | % |
| Colon surgery | 14 | 15.4 |
| Open reduction of fracture | 11 | 12.1 |
| Hip prosthesis | 7 | 7.7 |
| Ventricular shunt | 5 | 5.5 |
| Small bowel surgery | 5 | 5.5 |
| Lower limb surgery | 5 | 5.5 |
| Limb amputation | 4 | 4.4 |
| Laparoscopic surgery | 3 | 3.3 |
| Peripheral vascular bypass surgery | 3 | 3.3 |
| Knee prosthesis | 3 | 3.3 |
| Pacemaker surgery | 3 | 3.3 |
| Incision and drainage of abscess | 3 | 3.3 |
| Gallbladder surgery | 2 | 2.2 |
| Herniorrhaphy | 2 | 2.2 |
| Caesarean section | 2 | 2.2 |
| Abdominal aortic aneurysm repair | 2 | 2.2 |
| Coronary artery bypass graft with both chest and donor site incisions | 2 | 2.2 |
| Incision with surgical wound left open to heal by secondary intervention | 2 | 2.2 |
| Appendix surgery | 2 | 2.2 |
| Abdominal hysterectomy | 2 | 2.2 |
| Tonsillectomy | 1 | 1.1 |
| Spleen surgery | 1 | 1.1 |
| Bile duct, liver or pancreatic surgery | 1 | 1.1 |
| Breast surgery | 1 | 1.1 |
| Thoracic surgery | 1 | 1.1 |
| Eye surgery | 1 | 1.1 |
| Head and neck surgery | 1 | 1.1 |
| Rectal surgery | 1 | 1.1 |
| Abdominal surgery | 1 | 1.1 |
| **Total** | **91** | **100** |

### 4.4 Onset and Origin of SSI

Of the 91 SSI, 57% (n=52) developed whilst the patient remained in hospital during the post-operative period (Figure 4.1). The majority of all reported SSI (77%) had been acquired in the current hospital. However, just over one-in-five SSI (n=21; 23%) had been acquired in a hospital other than the current hospital (Figure 4.2).

Of the 39 SSI (43%) that were already evident at the patient's current admission to hospital (i.e., post-discharge SSI onset or patient transferred from elsewhere with active SSI), 19 (49%) had origin in the current hospital (i.e., SSI related to a prior admission to the current hospital), 18 (46%) had origin in another acute hospital (i.e., the patient was transferred to or subsequently admitted to the current hospital with an active SSI related to surgery performed in the referring/other acute hospital) and two SSI (5%) had an origin in a non-acute hospital.

**Figure 4.1:** Percentage of SSI, by onset

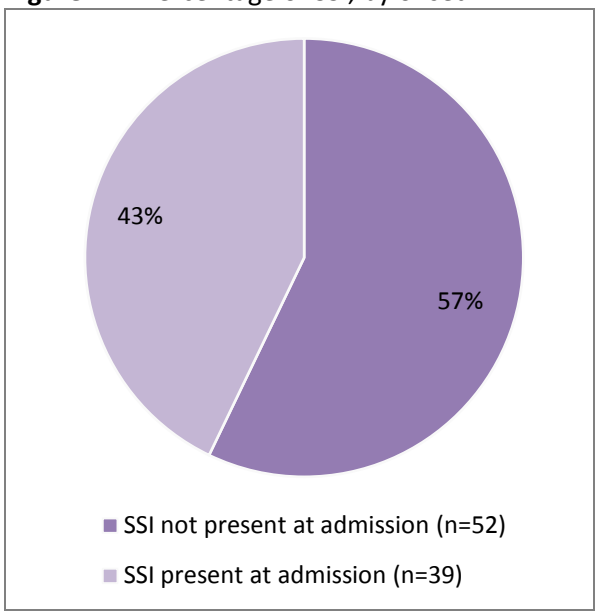
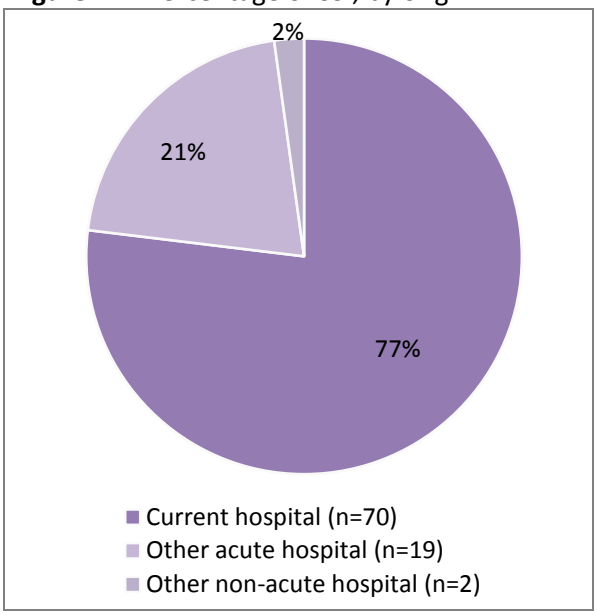



**Figure 4.2:** Percentage of SSI, by origin




### 4.5 Interval between hospital admission and SSI onset

Table 4.4 displays the interval between the date of hospital admission and the date of SSI onset for the 52 SSI that developed whilst the patient remained in hospital during the post-operative period. Because the date of surgery was not recorded in the PPS, this data should be interpreted with the caveat that the date of hospital admission does not equate to the date of surgery. Some patients may have been admitted to hospital ahead of the planned surgical date for pre-operative investigations or optimisation of co-morbidities or a patient admitted to hospital for another reason may subsequently have required an emergency or unforeseen surgical procedure.

The median length-of-stay prior to SSI onset was 12 days (inter-quartile range (IQR): 7-22 days). The highest number of SSI (n=16; 30.8%) were diagnosed between eight and 14 days following admission to hospital. The median length-of-stay prior to SSI onset was shorter for superficial compared to deep and organ/space SSI; 10 (IQR: 7 – 20) and 13 (IQR: 7 -32.5) days respectively.

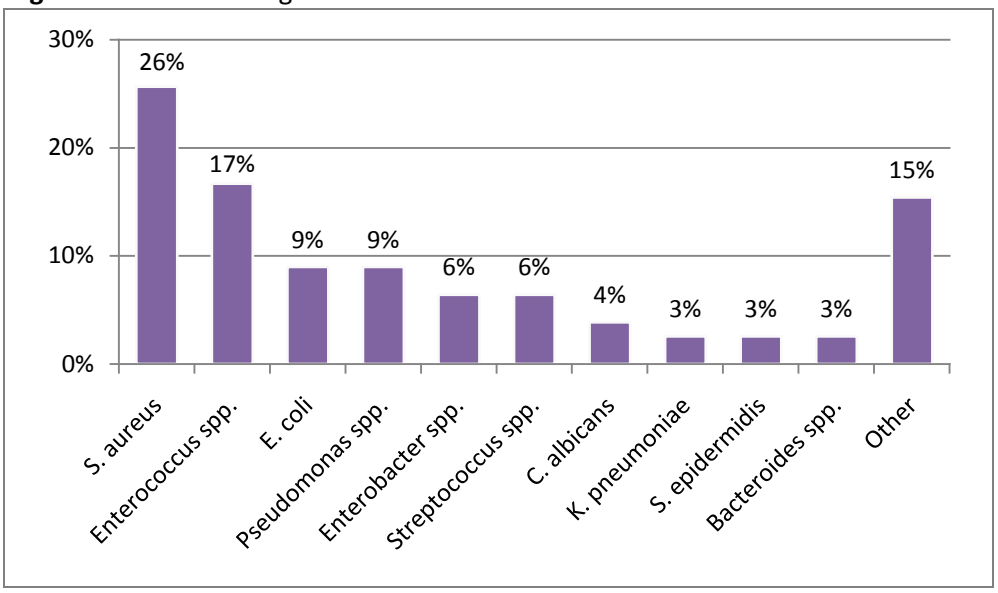
**Table 4.4:** Interval between date of hospital admission and date of SSI onset

| Length of Stay Prior to SSI Onset | Number of SSI | Percentage of SSI |
|---|---|---|
| 1 – 2 days | 0 | 0.0 |
| 3 – 4 days | 7 | 13.5 |
| 5 – 7 days | 11 | 21.2 |
| 8 – 14 days | 16 | 30.8 |
| 15 – 21 days | 4 | 7.7 |
| 21+ days | 14 | 26.9 |
| **Total** | **52** | **100** |

### 4.6 SSI Microbiology and Antimicrobial Resistance Data

Of the 91 SSI identified during the PPS, positive microbiology results were available for 55 (60%), with a total of 78 microorganisms identified from relevant specimens. Figure 4.3 displays the distribution of these microorganisms and Table 4.5 displays microorganism breakdown, by key antimicrobial resistance markers.

**Figure 4.3:** SSI microorganism distribution




- *Staphylococcus aureus* was the most frequently detected microorganism from SSI (n=20; 26%) and 50% (n=10) were reported as resistant to flucloxacillin (MRSA).
- *Enterococcus* spp. were the second most frequently detected microorganism from SSI (n=13; 17%) and three (23.1%) were reported as resistant to glycopeptides (vancomycin resistant enterococci - VRE).
- *Escherichia coli* was the third most frequently detected microorganism from SSI (n=7; 9%) and three (42.9%) were reported as resistant to third-generation cephalosporins (3GC).
- In total, 20 *Enterobacteriaceae* isolates were detected from SSI. 3GC resistance was reported in eight (40.0%) and carbapenem resistance in one (5.0%). Just under half of the *Enterobacteriaceae* (45.0%) retained susceptibility to both 3GC and carbapenems.
- *Pseudomonas aeruginosa* was detected from seven SSI (9%) and three (75.0%) were reported as resistant to carbapenems.

**Table 4.5:** Number of microorganisms, by key antimicrobials resistance markers

| Microorganism | Antimicrobials | Microbiology Reports | |
|---|---|---|---|
| | | N | % |
| *Staphylococcus aureus* | Flucloxacillin sensitive (MSSA) | 10 | 50.0 |
| | Flucloxacillin resistant (MRSA) | 10 | 50.0 |
| | **Total** | **20** | **100** |
| *Enterobacteriaceae* | 3rd generation cephalosporin sensitive; carbapenem sensitive | 9 | 45.0 |
| | 3rd generation cephalosporin resistant; carbapenem sensitive | 7 | 35.0 |
| | 3rd generation cephalosporin resistant; carbapenem resistant | 1 | 5.0 |
| | Unknown | 3 | 15.0 |
| | **Total** | **20** | **100** |
| *Enterococcus* spp. | Vancomycin/teicoplanin (glycopeptide) sensitive (VSE) | 6 | 46.2 |
| | Vancomycin/teicoplanin (glycopeptide) resistant (VRE) | 3 | 23.1 |
| | Unknown | 4 | 30.8 |
| | **Total** | **13** | **100** |
| *Pseudomonas aeruginosa* | Carbapenem sensitive | 3 | 75.0 |
| | Carbapenem resistant | 1 | 25.0 |
| | **Total** | **4** | **100** |

## 5.0 Discussion

There was excellent participation in the 2012 point prevalence survey (PPS), with 44 of 50 (88%) participating acute hospitals (37 public and seven private) submitting anonymous data on hospital-acquired infections (HAI) and antimicrobial use from 1,591 patients with a history of surgery (PWHS) since admission. PWHS accounted for 18% of the total population. Although 90% of PWHS were admitted under the care of a surgeon or obstetrician/gynaecologist at the time of the PPS, the remainder were admitted under the care of another clinician. Those patients may have previously been under the care of a surgeon, at the time the surgical procedure was performed and subsequently transferred to the care of another clinician at some point during the post-operative period. Three surgical consultant specialties accounted for 62% of PWHS (orthopaedics, general surgery and obstetrics/gynaecology) with the remaining PWHS distributed among a variety of different surgical specialties.

There was a greater female preponderance in PWHS versus the overall patient cohort (55.7% versus 53.7% female) and the median age of PWHS (61 years) was slightly less than the overall patient cohort (63 years).[2] PWHS had the inherent HAI risk factor of having undergone a surgical procedure and also had a higher prevalence of indwelling medical device use (peripheral and central vascular catheters, urethral catheters and respiratory tract intubation). However, PWHS were more likely to have a less severe underlying illness in comparison with the overall patient cohort, as measured by the McCabe score, as fewer PWHS had an ultimately or rapidly fatal underlying disease severity. This would not be unexpected, as a decision to perform a surgical procedure typically involves assessment of the patient's underlying disease prognosis and fitness for anaesthesia.

The overall prevalence of HAI in PWHS was 10.4%, which was twice that of the overall patient cohort (5.2%). Additionally, the prevalence of PWHS with two active HAI at the time of survey was 0.8%, versus 0.4% for the overall patient cohort. The HAI prevalence varied by the category of surgery performed, with the highest HAI prevalence reported in patients who had undergone neurosurgical, thoracic surgical, vascular surgical and general surgical procedures.

Overall, a higher proportion of HAI developed whilst PWHS remained inpatients (86%) than for the overall patient cohort (76%) and more HAI in PWHS were attributable to the current hospital (92%) than for the overall patient cohort (86%).

The rank order of the different HAI types reported in the PPS was similar between the overall patient cohort and PWHS. However, the prevalence of each of the HAI types was higher in PWHS when compared with the overall patient cohort; SSI (4% versus 1%), pneumonia (1.9% versus 1.0%), BSI (1.3% versus 0.7%), GI infections (1.1% versus 0.5%) and UTI (1.0% versus 0.8%).

For PWHS who developed a primary BSI, the proportion that were due to an infected central vascular catheter (62%) was higher than the overall patient cohort (57%) and the proportion that were due to an infected peripheral vascular catheter (13%) was also higher than the overall patient cohort (7%).

A slightly higher proportion of HAI in PWHS were associated with a positive microbiology result than for the overall patient cohort (56% versus 52%). The rank order of the different microorganisms detected from all HAI types was similar between the two groups, with *Enterobacteriaceae* the most frequently detected. However, the proportion of *Enterobacteriaceae* that displayed resistance to third-generation cephalosporins was higher in PWHS (36.7%) than the overall patient cohort (25%) and both of the carbapenem resistant *Enterobacteriaceae* (CRE) reported in the 2012 PPS were detected in PWHS.

*S. aureus* was the most common microorganism isolated from the group of all 91 reported SSI (26%); this includes PWHS and patients with an SSI diagnosed during a subsequent hospital admission. Half of the *S. aureus* isolates were reported as flucloxacillin resistant (i.e., MRSA) and this proportion was higher than for the overall patient cohort (37%). Ireland participates in the European Antimicrobial Resistance Surveillance Network (EARS-Net) and although the proportion of *S. aureus* bloodstream infections that are MRSA has declined in recent years (to 22.8% in 2012), the finding in the May 2012 PPS that almost half of SSI caused by *S. aureus* are MRSA illustrates that this remains an important cause of HAI in Irish hospitals.

The proportion of enterococci detected from HAI that were resistant to glycopeptides (i.e., VRE) was lower in PWHS (18.2%) than the overall patient cohort (26%).

The prevalence of antimicrobial use (AMU) in PWHS was 47.8%, which was higher than that of the overall patient cohort (34.4%). The proportion of PWHS who were simultaneously prescribed two, three and four antimicrobials was higher than the overall patient cohort. The β lactam-β lactamase inhibitor combination antimicrobials (co-amoxiclav & piperacillin-tazobactam) were the most commonly prescribed antimicrobial class for both PWHS and the overall patient population.

By the surgical category performed, the AMU prevalence was highest in patients who had a history of a urological procedure (59.7%) and lowest for patients who had a history of a neurosurgical procedure (34.1%) during the current admission.

PWHS were less likely to have a documented indication for the prescribed antimicrobial than the overall patient cohort (78.5% versus 83%) and were more likely to be prescribed an antimicrobial which was non-compliant with local prescribing policy (31% versus 27%).

In the PPS, the proportion of surgical antimicrobial prophylaxis (SAP) that exceeded a single dose administration was 72% and almost half (45%) exceeded 24 hours duration. SSI prevention is multi-factorial and encompasses pre-, intra- and postoperative-interventions, description of which is beyond the scope of this report. Administration of SAP is one evidence-based measure to prevent SSI and is applicable to certain categories of surgery. [3, 4] It is recommended that SAP is administered within one hour prior to skin incision. There is an increasing body of evidence and international guidance to support this practice. The principle of single-dose SAP administered within one hour prior to skin incision is a key practice recommendation of the joint Royal College of Surgeons in Ireland (RCSI) and Royal College of Physicians of Ireland (RCPI) working group on prevention of SSI, which published guidance in 2012.[5] 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.[3]

Extended duration of SAP 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 PPS 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.[3] This classification should be included in future surveys to ensure that antimicrobials administered for 'dirty' surgical procedures are more accurately categorised as treatment of infection and not as surgical antimicrobial prophylaxis.

Overall, SSI was the commonest HAI type reported in the 2012 PPS (n=91; 18%) and the majority of cases (69%) were diagnosed during the same hospital admission as the surgical procedure had been performed. Twenty-eight reported SSI cases had not had surgery during the current admission and although information on the indication for a patient's admission to hospital was not collected, it is possible that SSI treatment may have been the indication for readmission in some of those 28 cases. Over half of the reported SSI in hospitalised patients (56%) were classified as either deep incisional or organ/space infections. However, 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-post-operative 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.

The surgical procedures most commonly associated with subsequent SSI in the Irish PPS were colon surgery, open reduction of fracture and hip/knee prosthesis. The ECDC PPS protocol did not request inclusion of information on the surgical procedure type with which the SSI was associated. This question was added to the PPS protocol for Ireland, which was adapted from the ECDC PPS protocol. It is recommended that specific information on the surgical procedure types associated with SSI is sought in future surveys as this will facilitate comparison between EU Member States.

The findings of this survey demonstrate that a significant proportion of SSI are diagnosed after the patient has been discharged from hospital as 43% of SSI were evident at the time of the current admission to hospital. Over three-quarters (77%) of reported SSI were attributed to the participating hospital. When compared with all reported HAI types combined in PWHS, only 14% were evident at the time the patient was admitted to hospital, although 92% of all HAI types combined were attributable to the current hospital. This data suggests that patients may be readmitted to a hospital other than that in which the original surgery was performed and the reason for readmission may be for SSI management. For example, a patient may present to a local general hospital with a SSI that may be related to a procedure performed in a tertiary hospital farther away or alternatively, a patient may develop a complicated SSI following a procedure in a general hospital and subsequently require transfer for tertiary care of complications related to that infection. These findings demonstrate the importance of including post-discharge active surveillance for SSI in the design of any prospective robust SSI surveillance programme.[6] Such surveillance might involve telephoning the patient at an interval following discharge from hospital or issuing a questionnaire upon the patient's return to the clinic. The aim of post-discharge surveillance is to detect SSI which otherwise would not be counted.

The median length-of-stay prior to SSI onset was 12 days and 52% of SSI was diagnosed in the period between five and 14 days post admission. In future prevalence surveys, where a patient is recorded as having a SSI, the date of surgery should also be recorded to more accurately evaluate the time to SSI diagnosis post-operatively.

In July 2013, the ECDC published the European PPS report.[7] Data on 231,459 patients from 947 hospitals in 33 EU countries was analysed. SSI accounted for 19.6% of 15,000 reported HAI (n=2,933 patients with a SSI prevalence of 1.3%) and were the second most commonly encountered HAI across EU Member States. In the European PPS report, the ECDC have estimated that over half a million patients acquire SSI in European acute hospitals per year and that SSI are one infection type for which the adoption of evidence-based prevention strategies is most likely to impact positively on reducing SSI rates.

## 6.0 Conclusion

Analysis of data captured from the surgical population in Ireland during the 2012 PPS illustrates that patients who undergo surgery have a higher prevalence of HAI across all infection types than the overall population, and also are more likely to have additional HAI risk factors, such as use of indwelling devices. Surgical patients also have a higher prevalence of antimicrobial use than the overall population. Almost half of surgical antimicrobial prophylaxis prescriptions were for durations in excess of 24 hours and other indicators of quality antimicrobial prescribing, such as documentation of the indication for prescription and compliance with local prescribing policy were lower in the surgical population. Where microbiological results were available for HAI, there was evidence that HAI caused by resistant pathogens (e.g., MRSA and resistant *Enterobacteriaceae*) were more common in surgical patients than the overall patient cohort.

The implementation priorities (immediate, short-term and medium-to-longer term) recommended in the PPS national report are especially relevant to this at-risk patient group. In addition to local implementation and actions, some of the identified priorities should be considered for coordination at a regional and national level (e.g., surveillance of surgical site infections and infection-related morbidity and mortality).

It is hoped that the national PPS will be repeated every five years to monitor the impact of implementation of quality improvement initiatives. It is recommended that future European prevalence surveys capture additional information including; the date of surgery for patients with SSI, the surgical procedure type with which each SSI is associated and a more robust classification of surgical antimicrobial prophylaxis based on additional categorisation of the surgery performed (clean, clean-implant, clean-contaminated or dirty procedures).

## 7.0 Implementation Priorities

**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.[8] Hand hygiene compliance should be audited regularly, with feedback of results to staff.

4. Implement the RCSI Surgical Quality Improvement Tool, which was launched in 2012.[5]

5. 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'.[9]

    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.[10]

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.[11]

6. 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'.[9]

7. Implement the RCPI & RCSI 'Start Smart & then Focus Antibiotic Care Bundle' which was launched in November 2012 and the core, high impact interventions to promote prudent antimicrobial prescribing recommended in the national guidelines for antimicrobial stewardship.[12, 13]

    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.

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

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

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

**Short-term Priorities – Implement within the Next Year**

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

2. 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.

**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.[9, 13]

**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.[14]

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.*[15, 16, 17]

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

**Table 7.1:** 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)<br>% staff receiving education |
| | | Central line insertion checklists | % central lines inserted with completed checklist<br>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<br>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 (published late 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 (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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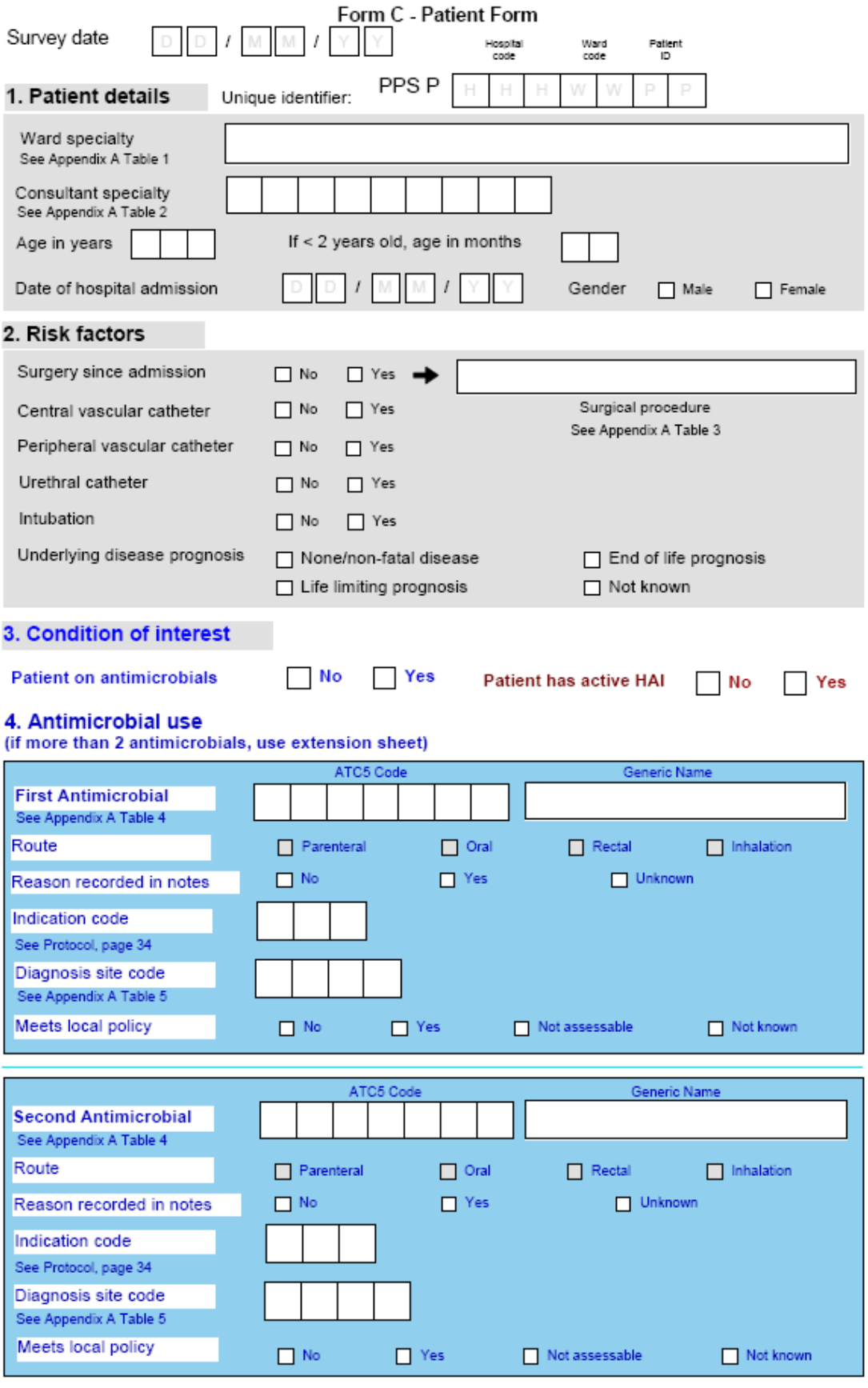
17. RCPI Clinical Advisory Group for Healthcare-Associated Infections and Antimicrobial Resistance. Guidelines on the Control & Prevention of MRSA (Revised version for NCEC: April 2013) http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Guidelines/

# Appendix A: PPS Patient Data Collection Form



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)

| | | | | |
|---|---|---|---|---|
| First 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 |

| | | | | |
|---|---|---|---|---|
| Second 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 |

## 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

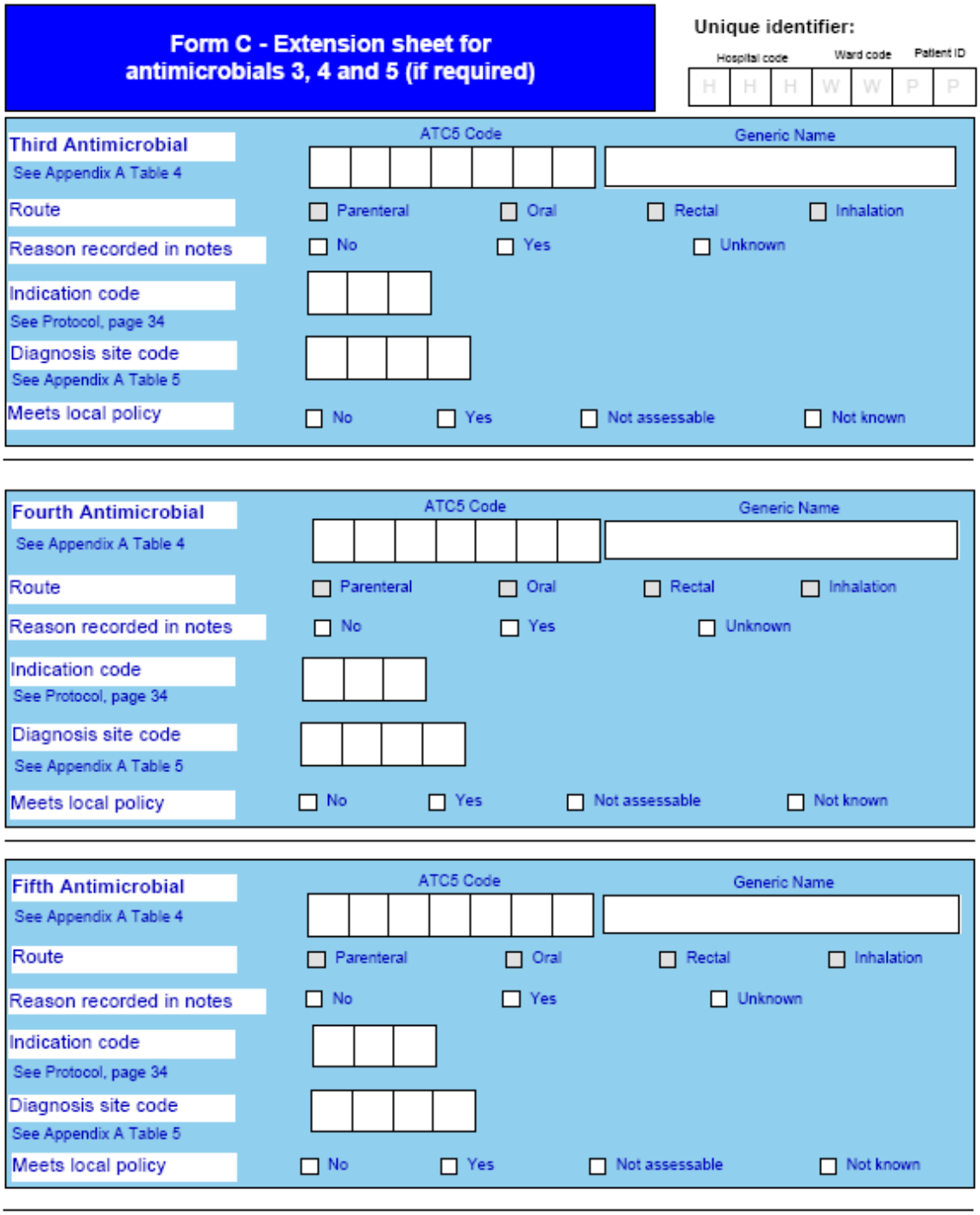
Resistance Code 1
See Appendix A Table 9

Microorganism 2

Resistance Code 2

Microorganism 3

Resistance Code 3


Form C - Extension sheet for antimicrobials 3, 4 and 5 (if required)
Unique identifier:
Hospital code
Ward code
Patient ID
H H H W W 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 B: List of Surgical Procedures

| Surgical Category | Surgical Procedure | Description |
|---|---|---|
| **Cardiac** | **Cardiac surgery** | Procedures on the valves or septum of the heart<br><br>**excludes coronary artery bypass graft, surgery on vessels, heart transplantation or pacemaker transplantation. |
| | **Coronary artery bypass graft with both chest and donor site incisions.** | Chest procedure to perform direct revascularization of the heart; includes obtaining suitable vein from donor site for grafting. |
| | **Coronary artery bypass graft with chest incision only** | Chest procedure to perform direct revascularization of the heart using, for example the internal mammary (thoracic) artery. |
| | **Heart transplant** | Transplantation of heart |
| | **Pacemaker surgery** | Insertion, manipulation or replacement of permanent pacemaker.<br><br>**includes insertion/replacement of leads<br>**Excludes insertion of temporary transvenous pacemaker system. |
| **ENT & Maxillofacial** | **Head & Neck Surgery** | Major excision or incision of the larynx and radial neck dissection<br><br>Maxillofacial surgery<br><br>**Excludes thyroid and parathyroid operations - see thyroid or parathyroid surgery |
| | **Tonsillectomy** | Surgical removal of tonsils |
| | **Ear Surgery** | Operations on the ear |
| **Ophthalmology** | **Eye Surgery** | Operations on the eye |
| **General** | **Abdominal Surgery** | Abdominal operations not involving the gastrointestinal tract or biliary system |
| | **Appendix Surgery** | All operations of the appendix (not incidental to another procedure)<br><br>**includes laparoscopic appendectomy |
| | **Bile duct, liver or pancreatic surgery** | Excision of bile ducts or operative procedures on the biliary tract, liver or pancreas<br><br>**Excludes operations only on gallbladder (See Gallbladder Surgery) |
| | **Breast Surgery** | Excision of lesion or tissue of breast including radical, modified, or quadrant resection, lumpectomy, incisional biopsy or mammoplasty. |
| | **Colon surgery** | Incision, resection or anastomosis of the large intestine |

| | | |
|---|---|---|
| **General** | | **Includes large-to-small and small-to-large bowel anastomosis<br>**Excludes rectal operations |
| | **Gallbladder Surgery** | Cholecystectomy and cholecystotomy |
| | **Gastric Surgery** | Incision or excision of stomach;<br>includes subtotal or total gastrectomy<br><br>**Excludes vagotomy and fundoplication which should be recorded as minimally invasive (unless open) |
| | **Herniorrhaphy** | Repair of inguinal, femoral, umbilical, or anterior abdominal wall hernia;<br><br>**Excludes repair of diaphragmatic or hiatal hernia or hernias at other body sites (See Thoracic Surgery) |
| | **Liver Transplant** | Transplantation of liver |
| | **Rectal Surgery** | Operations on the rectum |
| | **Small bowel surgery** | Incision or resection of the small intestine<br><br>**Excludes small-to-large bowel anastomosis (See colon surgery) |
| | **Spleen Surgery** | Resection or manipulation of spleen |
| | **Thyroid and/or parathyroid surgery** | Resection or manipulation of thyroid and/or parathyroid |
| | **Laparoscopic surgery** | Any surgery involving use of laparoscope |
| | **Incision & drainage of abscess** | Incision and drainage of an abscess at a superficial site |
| | **Incision with surgical wound left open to heal by secondary intention** | Surgical incision without primary closure |
| **Neurosurgery** | **Ventricular shunt** | Ventricular shunt operations, including revision and removal of shunt |
| | **Craniotomy** | Incision through the skull to excise, repair or explore the brain; does not include taps or punctures. |
| **Obstetrics and Gynaecology** | **Abdominal hysterectomy** | Removal or uterus through an abdominal incision<br><br>**Excludes Vaginal Hysterectomy |
| | **Caesarean Section** | Obstetrical delivery by Caesarean section |
| | **Ovarian Surgery** | Operations on ovary and related structures |
| | **Vaginal hysterectomy** | Removal of the uterus through vaginal or perineal incision |
| | **Transvaginal gynaecological or obstetric procedures** | Hysteroscopy + procedure<br>Evacuation of retained products of conception |
| | **Episiotomy** | Transvaginal delivery with episiotomy |
| **Orthopaedics** | **Upper limb surgery** | Operations on the upper limb (hand, arm, shoulder) |
| | **Hip prosthesis** | Arthroplasty of hip |

| | | |
|---|---|---|
| **Orthopaedics** | **Knee prosthesis** | Arthroplasty of knee |
| | **Laminectomy** | Exploration or decompression of spinal cord through excision or incision into vertebral structures |
| | **Open reduction of fracture** | Open reduction of fracture or dislocation of long bones that requires internal or external fixation<br>**Excludes placement of joint prosthesis (see Hip and Knee Prosthesis)<br>**Excludes closed application of external fixator which should be recorded as minimally invasive |
| | **Refusion of spine** | Refusion of spine |
| | **Spinal Fusion** | Immobilization of spinal column<br><br>**Excludes refusion of spine |
| | **Arthroscopy** | Exploration of joint using arthroscopy |
| | **Application of Ilizarov frame** | External fracture fixation device application |
| **Thoracic** | **Thoracic Surgery** | Noncardiac, nonvascular thoracic surgery<br><br>**includes pneumonectomy and diaphragmatic or hiatal hernia repair. |
| **Urology** | **Kidney Surgery** | Resection or manipulation of the kidney with or without removal of related structures<br><br>**excludes kidney transplant |
| | **Kidney Transplant** | Transplantation of kidney |
| | **Prostate Surgery** | Suprapubic, retropubic, radical or perineal excision of the prostate<br><br>Transurethral resection of the prostate (TURP) |
| | **Bladder Surgery** | Operations on the bladder |
| **Vascular** | **Abdominal aortic aneurysm repair** | Resection of abdominal aorta with anastomosis or replacement |
| | **Carotid endarterectomy** | Endarterectomy on vessels of head and neck (includes carotid artery and jugular vein) |
| | **Limb amputation** | Total or partial amputation or disarticulation of the upper or lower limbs, including digits<br><br>**Excludes amputation with healing by secondary intention which should be recorded as minimally invasive |
| | **Peripheral vascular bypass surgery** | Bypass operations on peripheral arteries |
| | **Shunt for dialysis** | Arteriovenostomy for renal dialysis |

## Appendix C: Case Definitions for the Most Prevalent HAI Reported in PWHS

### SSI: SURGICAL SITE INFECTION

**Superficial incisional (SSI-S)**
Infection occurs within 30 days after the operation **and** infection involves only skin and subcutaneous tissue of the incision **and** at least ONE of the following is present:

1. Purulent drainage with or without laboratory confirmation, from the superficial incision.
2. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.
3. At least ONE of the following signs or symptoms of infection: pain or tenderness, localised swelling, redness, or heat **and** superficial incision is deliberately opened by surgeon, **unless** incision is culture-negative.
4. Clinical diagnosis of superficial incisional SSI made by consultant clinician.

**Deep incisional (SSI-D)**
Infection occurs within 30 days after the operation if no implant is left in place or within one year if implant is in place **and** the infection appears to be related to the operation **and** infection involves deep soft tissue (e.g., fascia, muscle) of the incision **and** at least ONE of the following:

1. Purulent drainage from the deep incision but not from the organ/space component of the surgical site.
2. A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38º C), localised pain or tenderness, unless incision is culture-negative.
3. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
4. Diagnosis of deep incisional SSI made by consultant clinician.

**Organ/Space (SSI-O)**
Infection occurs within 30 days after the operation if no implant is left in place or within one year if implant is in place **and** the infection appears to be related to the operation **and** infection involves any part of the anatomy (e.g., organs and spaces) other than the incision which was opened or manipulated during an operation **and** at least ONE of the following:

1. Purulent drainage from a drain that is placed through a stab wound into the organ/space .
2. Organisms isolated from an aseptically-obtained microbiological culture of fluid or tissue in the organ/space.
3. An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
4. Diagnosis of organ/space SSI made by consultant clinician.

**Reporting instruction:** Report vaginal cuff infections as SSI-O if diagnosed within 30 days of hysterectomy. See section on REPR: Reproductive tract infection

## PN: PNEUMONIA

**Rx**

Two or more serial chest X-rays or CT-scans of lungs with suggestive image of pneumonia for patients with underlying cardiac or pulmonary disease. In patients without underlying cardiac or pulmonary disease, one definitive chest X-ray or CT-scan is sufficient.

**and** at least ONE of the following

**Symptoms**

- Fever > 38 °C with no other cause
- Leukopenia (<4000 WBC/$mm^3$) or leucocytosis (≥ 12 000 WBC/$mm^3$)

**and** at least ONE of the following
(or at least TWO if clinical pneumonia only = PN 4 and PN 5)

- New onset of purulent sputum, or change in character of sputum (colour, odour, quantity, consistency)
- Cough or dyspnoea or tachypnoea
- Suggestive auscultation (rales or bronchial breath sounds), rhonchi, wheezing
- Worsening gas exchange (e.g., $O_2$ desaturation or increased oxygen requirements or increased ventilation demand)

**and** according to the used diagnostic method

**Microbiology**

**a – Bacteriologic diagnostic performed by**:

*Positive quantitative culture from minimally contaminated lower respiratory tract (LRT) specimen* **(PN 1)**

- Bronchoalveolar lavage (BAL) with a threshold of ≥ $10^4$ colony-forming units (CFU)/ml or ≥ 5 % of BAL obtained cells contain intracellular bacteria on direct microscopic exam (classified on the diagnostic category BAL).
- Protected brush (PB Wimberley) with a threshold of ≥$10^3$ CFU/ml
- Distal protected aspirate (DPA) with a threshold of ≥ $10^3$ CFU/ml

*Positive quantitative culture from possibly contaminated LRT specimen* **(PN 2)**

- Quantitative culture of LRT specimen (e.g. endotracheal aspirate) with a threshold of $10^6$ CFU/ml

**b – Alternative microbiology methods** **(PN 3)**

- Positive blood culture not related to another source of infection
- Positive growth in culture of pleural fluid
- Pleural or pulmonary abscess with positive needle aspiration
- Histologic pulmonary exam shows evidence of pneumonia
- Positive exams for pneumonia with virus or particular microorganism detected: *Legionella spp.*, *Aspergillus spp.*, mycobacteria, *Mycoplasma spp.*, *Pneumocystis spp.*)
    - Positive detection of viral antigen or antibody from respiratory secretions (e.g., EIA, FAMA, shell vial assay, PCR)
    - Positive direct exam or positive culture from bronchial secretions or tissue
    - Seroconversion
    - Detection of antigens in urine (*Legionella pneumophila, Streptococcus pneumoniae)*

**c – Others**

- Positive **sputum** culture **or non-quantitative LRT specimen** culture **(PN 4)**
- **No positive microbiology** **(PN 5)**

Reporting instruction: For pneumonia, only fill one subcategory (where more than one PN definition is met by the patient, prioritise recorded pneumonia definition as: PN1>PN2>PN3>PN4>PN5).

## BSI: BLOODSTREAM INFECTION

**BSI: Laboratory-confirmed bloodstream infection**

- ONE positive blood culture for a recognised pathogen (e.g., *Staphylococcus aureus, Escherichia coli, Candida albicans* etc.) [If any doubt regarding what constitutes a recognised pathogen, please discuss with microbiology]

or

- Patient has at least ONE of the following signs or symptoms: fever (>38°C), chills or hypotension
  **and**
  TWO positive blood cultures for a common skin contaminant** (the same organism must have been isolated from two separate blood culture samples, usually taken within a 48 hour period).

**Skin contaminants = coagulase-negative staphylococci*, Micrococcus sp., Propionibacterium acnes, Bacillus spp., Corynebacterium spp.*

**Primary BSI**:
**Catheter-related BSI**: Primary BSI due to infection of either a peripheral vascular catheter (PVC) or central vascular catheter (CVC).
When the same microorganism was cultured from both the blood and the vascular catheter, this is microbiologically confirmed catheter-related BSI (CRI3): CRI3-PVC or CRI3-CVC. See CRI definitions below for further information (See **Appendix D** for algorithm for diagnosis of catheter related-infection).
When the patient has positive blood cultures (one or more sets with a significant pathogen or at least two sets with organism regarded as a skin contaminant) without microbiological confirmation of the same organism from the vascular catheter and the patient's symptoms improve within 48 hours after removal of the catheter, this is clinically-diagnosed catheter-related BSI without microbiological confirmation linking the blood culture to the vascular catheter (C-PVC or C-CVC).
**Unknown origin (UO)**: Primary BSI of unknown origin. Not related to vascular catheter infection and not meeting definition of secondary BSI below. Decision to classify as BSI-UO has been verified during the point prevalence survey as no identifiable source was found for that BSI).

**Secondary BSI:**
BSI arising secondary to an infection elsewhere in the body.
When the same micro-organism was cultured from both the blood and another infection site or strong clinical evidence exists that the patient's BSI developed secondary to another infection site, invasive diagnostic procedure or foreign body.
Pulmonary infection resulting in BSI **(S-PUL)**
Urinary tract infection resulting in BSI **(S-UTI)**
Digestive tract infection resulting in BSI **(S-DIG)**
Surgical site infection resulting in BSI **(S-SSI)**
Skin and soft tissue infection resulting in BSI **(S-SST)**
Other infection not covered by those categories above resulting in BSI **(S-OTH)**
**Note: Secondary BSI is reported as a separate HAI, in addition to the primary infection, if the primary infection matches the relevant HAI case definition.**

**BSI Source Unknown (UNK):** No information available about the BSI source or information missing.

## GI: GASTROINTESTINAL SYSTEM INFECTION

### GI-CDI: *Clostridium difficile* infection

*Clostridium difficile* infection must meet at least ONE of the following criteria:

1. Diarrhoeal stools or toxic megacolon, and a positive laboratory assay for *C. difficile* toxin A and/or toxin B in stools.
2. Pseudomembranous colitis revealed by lower gastro-intestinal endoscopy
3. Colonic histopathology characteristic of *C. difficile* infection (with or without diarrhoea) on a specimen obtained during endoscopy, colectomy or autopsy

**NOTE:** If clinical signs of *Clostridium difficile* infection appear within 28 days after hospital discharge period, GI-CDI must be defined as hospital-acquired infection (HAI).

Reporting instructions

- If you report CDI as a HAI – Don't forget to also report *C. difficile* as the causative microorganism using MO-code CLODIF. The only circumstance where CLODIF would not be reported would be if the patient's CDI was diagnosed only on the basis of findings of pseudomembranous colitis at endoscopy or colectomy without a positive microbiological result for *C. difficile* toxin.

### GI-GE: Gastroenteritis (excluding CDI)

Gastroenteritis must meet at least ONE of the following criteria:

1. Patient has an acute onset of diarrhoea (liquid stools for more than 12 hours) with or without vomiting or fever (>38$^0$C) and no likely non-infectious cause (possible non-infectious causes include: bowel preparation for diagnostic tests, therapeutic regimen other than antimicrobial agents (e.g., laxatives, post-GI surgery), acute exacerbation of a chronic condition or psychological stress).
2. Patient has at least TWO of the following signs or symptoms with no other recognised cause: nausea, vomiting, abdominal pain, fever (>38$^0$C) or headache **and** at least ONE of the following:
    a. An enteric pathogen (e.g., *Salmonella spp*, *Shigella spp*, *Campylobacter spp*. *E. coli* O157) is cultured from stool or rectal swab.
    b. An enteric pathogen is detected by routine or electron microscopy (e.g., norovirus, small round structured virus, *Cryptosporidium spp.*)
    c. An enteric pathogen is detected by antigen or antibody assay on blood or faeces (e.g., rotavirus, adenovirus)
    d. Evidence of an enteric pathogen is detected by cytopathic changes in tissue culture (toxin assay)
    e. Diagnostic single antibody titre elevated level of IgM) or 4-fold increase in paired sera (elevation of IgG between acute and convalescent serum samples) for pathogen.

### GI-GIT: Gastrointestinal tract including oesophagus, stomach, small and large bowel and rectum) excluding gastroenteritis and appendicitis

Gastrointestinal tract infections, excluding gastroenteritis and appendicitis, must meet at least ONE of the following criteria:

1. Patient has an abscess or other evidence of infection seen during a surgical operation or histopathologic examination.
2. Patient has at least TWO of the following signs or symptoms with no other recognised cause and compatible with infection of the organ or tissue involved: fever (>38 C), nausea, vomiting, abdominal pain or tenderness **and** at least ONE of the following:
    a. Organisms cultured from drainage or tissue obtained during a surgical operation or endoscopy or from a surgically-placed drain

b. Organisms seen on Gram's or potassium hydroxide (KOH) fungal stain or multinucleated giant cells seen on microscopic examination of drainage or tissue obtained during a surgical operation or endoscopy or from a surgically-placed drain
c. Organisms cultured from blood
d. Evidence of pathologic findings on radiographic examination
e. Evidence of pathologic findings on endoscopic examination (e.g., Candida oesophagitis or proctitis).

**GI-HEP: Hepatitis**

Hepatitis must meet the following criteria:

1. Patient has at least TWO of the following signs or symptoms with no other recognised cause: fever (>38$^0$C), anorexia, nausea, vomiting, abdominal pain, jaundice or history of blood product transfusion within the previous three months **and** at least ONE of the following:
   a. Positive antigen or antibody test for hepatitis A virus, hepatitis B virus, hepatitis C virus or delta hepatitis
   b. Abnormal liver function tests (e.g., elevated ALT/ AST, bili rubin)
   c. Cytomegalovirus (CMV) detected in urine or oropharyngeal secretions

Reporting instructions

- Do not report hepatitis or jaundice of non-infectious origin (alpha-1 antitrypsin deficiency).
- Do not report hepatitis or jaundice resulting from exposure to hepatotoxins (alcoholic or acetaminophen-induced hepatitis).
- Do not report hepatitis or jaundice resulting from biliary obstruction (cholecystitis).

**GI-IAB: Intraabdominal, not specified elsewhere; including gallbladder, bile ducts, liver (excluding viral hepatitis), spleen, pancreas, peritoneum, subphrenic or subdiaphragmatic space or other intraabdominal tissue or area not specified elsewhere**

Intraabdominal infections must meet at least ONE of the following criteria:

1. Patient has organisms cultured from purulent material from intraabdominal space obtained during a surgical operation or needle aspiration.
2. Patient has abscess or other evidence of intraabdominal infection seen during a surgical operation or histopathologic examination.
3. Patient has at least TWO of the following signs or symptoms with no other recognised cause: fever (>38$^0$C), nausea, vomiting, abdominal pain, or jaundice **and** at least ONE of the following:
   a. Organisms cultured from drainage from surgically-placed drain (e.g., closed suction drainage system, open drain or T-tube drain).
   b. Organisms seen on Gram's stain of drainage or tissue obtained during surgical operation or needle aspiration
   c. Organisms cultured from blood and radiographic evidence of infection (e.g., abnormal findings on ultrasound, CT scan, MRI, or radiolabelled scans [gallium, technetium] or on abdominal x-ray).

**Reporting instruction:** Do not report pancreatitis (an inflammatory syndrome characterized by abdominal pain, nausea, and vomiting associated with high serum levels of pancreatic enzymes) unless it is determined to be infectious in origin.

## UTI: URINARY TRACT INFECTION

### UTI-A: microbiologically confirmed symptomatic UTI

Patient has at least ONE of the following signs of symptoms with no other recognised cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness **and** patient has a positive urine microbiology culture report. That is, ≥ $10^5$ microorganisms per ml of urine with no more than two species of microorganisms detected in the same urine sample.

### UTI-B: not microbiologically confirmed symptomatic UTI

Patient has at least TWO of the following with no other recognised cause: fever (>38°C), urgency, frequency, dysuria, or suprapubic tenderness **and** at least ONE of the following:

a. Positive dipstick for leukocyte esterase and/or nitrite
b. Pyuria – White blood cells (WBC) or pus cells seen on urine specimen microscopy with ≥10 WBC/ml or ≥ 3 WBC/high-power field of unspun urine
c. Organisms seen on Gram stain of unspun urine
d. At least two urine cultures with repeated isolation of the same uropathogen (Gram-negative bacteria or *Staphylococcus saprophyticus*) with ≥ $10^2$ colonies/ml urine in non-voided specimens
e. ≤$10^5$ colonies/ml of a single uropathogen (Gram-negative bacteria or *S. saprophyticus*) in a patient being treated with effective antimicrobial agent for a urinary infection
f. Clinician clinical diagnosis of a urinary tract infection
g. Clinician institutes appropriate therapy for a urinary infection

Reporting instruction: For urinary tract infection, only fill in one subcategory (where more than one UTI definition is met by the patient, prioritise urinary tract infection as UTI-A>UTI-B).

**Case definitions for other HAI types may be accessed in the 2012 PPS Protocol which is available on the HPSC website:**
http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Surveillance/PointPrevalenceSurvey/2012/Protocol/