UK Health Security Agency

Point prevalence survey on healthcare-associated infections, antimicrobial use and antimicrobial stewardship in England, 2023

National report

Sixth national point prevalence survey on healthcare-associated infections and third national point prevalence survey on healthcare-associated infections, antimicrobial use and antimicrobial stewardship in England

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Abbreviations

Abbreviation	Meaning
AM	antimicrobial
AMU	antimicrobial use
AMR	antimicrobial resistance
AMS	antimicrobial stewardship
BSI	bloodstream infection
COVID-19	coronavirus disease caused by the SARS-CoV-2 virus
CVC	central vascular catheter
HCAI	healthcare-associated infection
ICU	intensive care unit
IPC	infection prevention and control
NHS	National Health Service
NHSN	National Healthcare Safety Network
OPAT	outpatient parenteral antimicrobial therapy
PICU	paediatric intensive care unit
PNLRI	Pneumonia or lower respiratory tract infection
PPS	point-prevalence survey
PVC	peripheral vascular catheter
UTI	urinary tract infection

Executive summary

This report describes the main results of the point prevalence survey (PPS) on healthcare-associated infections (HCAIs), antimicrobial use (AMU) and antimicrobial stewardship (AMS) which was conducted in England in 2023. It was the sixth National PPS on HCAI and third National PPS on HCAI, AMU and AMS in England.

Participation

In 2023, 121 NHS trusts and independent-sector organisations participated in the National PPS on HCAI, AMU and AMS in England. As in previous PPS, all NHS and independent acute care hospitals were invited to participate. For the first time, NHS community and mental health trusts were invited to participate as well.

To avoid selection bias, 8 trusts which did not report all eligible wards were excluded from the national analysis. This report presents data for 44,372 hospital in-patients submitted by 67 NHS acute trusts, 30 NHS community or mental health trusts and 16 independent sector organisations.

Healthcare-associated infections

The overall prevalence of patients with at least one HCAI, including NHS community and mental health trusts, was 7.6% (95% confidence interval (CI): 7.3% to 7.8%) in 2023. This corresponded to 3,359 patients.

Acute NHS trusts reported an HCAI prevalence of 8.0% (95% CI: 7.7% to 8.3%), up from 6.6% (95% CI: 6.4% to 6.8%) in 2016. In acute specialist trusts, the HCAI prevalence was 16.6% (95% CI: 14.6% to 18.7%), compared to 10.2% (95% CI: 8.6% to 11.8%) in 2016. At the specialty level, the HCAI prevalence was highest in intensive care units (ICUs), including neonatal and paediatric ICUs, with 15.9%.

Of the total number of 3,493 HCAIs reported, pneumonia or lower respiratory tract infections (PNLRI) were the most common sites of infection (29.6%), followed by urinary tract infections (UTIs) (17.5%), and sepsis or disseminated infections (10.6%). The ranking of the top 3 most common infection sites for HCAIs did not differ by indices of multiple deprivation (IMD).

For 37.5% of HCAIs, information for at least one confirmed microorganism was available on the day of the PPS. The most commonly isolated organisms were *Escherichia coli* (16.5%), SARS-CoV-2 (10.7%), *Staphylococcus aureus* (10.6%), *Clostridioides difficile* (7.4%), and *Pseudomonas aeruginosa* (7.2%).

Antimicrobial use

The overall prevalence of AMU in all hospital patients surveyed, was 34.1% (95% CI: 33.7% to 34.5%) in 2023. This means, that out of the 44,372 patients included in the national analysis, 15,134 were treated with an antimicrobial on the day of the PPS.

In NHS acute care hospitals, the overall AMU prevalence was similar in 2023 (37.3% [95% CI: 36.8% to 37.8%]) compared to 2016 (36.7% [95% CI: 36.3% to 37.2%]). The reported AMU prevalence was low in the newly surveyed NHS mental health and community trusts (7.2% [95% CI: 6.3% to 8.1%] and 8.6% [95% CI: 7.2% to 10.1%] respectively) in 2023.

The PPS captured 15,134 patients receiving a total of 20,543 antimicrobial courses. More than half (57.5%) of the courses were intended to treat community-acquired infections, 21.1% to treat hospital-associated infections and 1.7% were given to patients to treat infections acquired in long-term care facilities.

Out of the 1,116 patients on surgical prophylaxis, 40% were receiving prophylaxis for more than 1 day.

The reason for initiating AMU had been documented for more than 92% of all antimicrobial courses reported by participating hospitals and for those courses that had been started 72 or more hours before the time of the survey, 80% had been reviewed.

Using the UK's 2024 AWaRe (Access, Watch, Reserve) categories showed that 'Access' and 'Reserve' antibiotics accounted for 31.3% and 6% of total AMU, respectively, in the participating hospitals. AMU prevalence was evenly distributed across all IMD quintiles across England.

A new module on the appropriateness of AMU, based on the Australian National Antimicrobial Prescribing Survey (NAPS) (1) was included in the PPS 2023. The survey responses showed that 68% of AMU was assessed as compliant with guidelines and 86% of AMU was defined as optimal or adequate.

Structure and process indicators of infection prevention and control

There were differences in infection prevention and control (IPC) practices across healthcare organisations in England. Automation of HCAI surveillance remained a challenge, with many hospitals still reliant on manual data processes.

Overall, 55% of participating hospitals reported having an approved IPC and antimicrobial stewardship (AMS) plan, with community hospitals reporting the lowest availability (29%), compared to 78% of acute specialist organisations. Survey questions on built environments for

IPC, such as single rooms and negative pressure isolation rooms, showed the median percentage of beds in single rooms by organisation type ranged from 18% in acute small and medium organisations to 62.5% in acute specialist organisations.

However, the response rate to hospital-level survey questions was low (percentage depending on the specific indicator), limiting the representativeness and interpretation of results in this section.

Discussion

This is the sixth national PPS on HCAI and AMS in England and the third survey including AMU. It provides a comprehensive overview of current practices, trends, and informs where targeted intervention across various healthcare settings are needed most. The PPS 2023 included mental health and community sites for the first time, which is important for understanding the HCAI risks and AMU across different healthcare settings in England.

In the 2023 PPS, the overall prevalence of HCAI was 7.6% (95% CI: 7.3% to 7.8%), an increase from the 6.6% (95% CI: 6.3% to 6.8%) in 2016, mainly driven by the higher HCAI prevalence in acute NHS trusts. To account for the fact that each participating organisation in the PPS 2023 and the PPS 2016 dealt with patients of differing complexity, further analyses, including case-mix adjustment, will be conducted to allow for a meaningful comparison between organisations. When comparing differences between the 2023 PPS and the 2016 PPS in more detail, the increasing population and especially number of elderly people over this period must also be accounted for. Data must be age-standardised to allow interpretation of the similarities or differences. This will be presented at a later date.

In addition, the increase in HCAI prevalence could be associated with increased pressure on the healthcare system following the COVID-19 pandemic and more severely unwell patients due to changes in access to healthcare, for example, longer waiting times for GP appointments and elective procedures (2 to 5).

Lower HCAI prevalence rates compared to acute care NHS trusts were observed in mental health and community trusts. However, the high prevalence of urinary tract infections (UTIs) and skin and soft tissue in these settings raises the importance of basic nursing care, targeted IPC and tackling contributing risk factors such as reduced mobility, device use, dehydration, and incontinence.

The overall AMU prevalence in acute care NHS trusts in 2023 (37.3%) was similar to 2016 (36.7%). Over the last 10 years, through the development of targeted evidence-based interventions and quality-improvement initiatives by the UK Health Security Agency (UKHSA), NHS England (NHSE) and English surveillance programme for antimicrobial utilisation and resistance (ESPAUR) stakeholders, and effective delivery by front-line primary and secondary health workers, total antibiotic use in England decreased by 20% from 2014 to 2021. A range of national stewardship interventions are available for secondary care including Start Smart then Focus, IV to Oral Switch, a tool to assess appropriateness of prescribed antimicrobials, peer-review AMS support (see [Start smart then focus: antimicrobial stewardship toolkit for inpatient care settings]() and [NHS England 2023/24 CQUIN]()). However, almost a quarter of AMU for surgical prophylaxis in independent sector organisations was given for more than one day. Limiting the duration of AMU for prophylaxis is important to avoid unnecessarily altering patients' bacterial flora, which can potentially lead to adverse changes in the microbiome, development of antimicrobial resistance (AMR) or *C. difficile* infection. This suggests that AMS activities remain important in the independent sector to ensure that antimicrobials are prescribed for the appropriate treatment duration.

Almost 90% of all AMU Compared to the previous PPS in England, the additional information on the quality of local prescribing ensured the use of already standardised and validated questions and will allow international comparison going forward. The qualitative measurements of AMU, including compliance with guidance and, importantly, taking into account any documented, clinically justifiable reasons to vary from these guidelines ('appropriateness'), provides useful information at local, regional and national level to identify targets for quality improvement and support the evaluation of AMS initiatives.

Due to low returns of hospital-level data, the findings on structural and process indicators need to be interpreted with caution. Responses showed variation in collection practices for surveillance purposes across trust types. Acute specialist organisations reported higher use of semi-automated systems for monitoring infections, while acute general hospitals reported more reliance on manual data entry methods. The advantage of automated systems for surveillance include removing the burden from front line staff, which allows end to end analytical pipelines to be used. This facilitates timely dissemination of surveillance data and increases the opportunity to take actions guided by the data.

Future actions

The PPS has identified a need to continue support for hospitals and other care providers to reduce HCAIs and review AMU. Its results will help to focus these activities, particularly related to the Government's 2024 to 2029 National Action Plan (NAP) on targets to reduce Gram-negative bloodstream infections, reduce AMU prescribing, and increase the proportion of Access antibiotics used across the healthcare system.

UKHSA will:

- work with the government's advisory group on Antimicrobial Prescribing, Resistance and Healthcare-Associated Infections (APRHAI) to consider interventions based on the PPS findings
- publish the PPS protocol and forms to allow hospitals to repeat local PPS at regular intervals, develop and measure quality improvement actions

- identify methods to improve data capture to reduce time and resource pressures of data collection for future PPS
- present regional and national PPS results at relevant scientific meetings and conferences to encourage ownership of IPC and AMS actions
- engage with international partners to present and discuss findings, fostering mutual feedback and knowledge exchange

1. Background and objectives

Healthcare-associated infections (HCAI) and antimicrobial resistance (AMR) continue to pose significant public health challenges both in England and globally (6). In 2020, the cost of HCAIs to the National Health Service (NHS) was estimated at approximately £2.7 billion annually, accounting for 834,000 infections and 28,500 deaths. Most costs were due to patient management and extended hospital stays (7).

Following fewer reports of serious AMR infections during the COVID-19 pandemic, numbers have since increased by 6.6% from 2020 to 2022. This was the equivalent of 160 severe AMR infections a day in 2022. With over 2,200 AMR-associated deaths reported in 2022, mortality rates from AMR infections were higher than those from road traffic accidents (8, 9).

Despite the UK government's strong commitment to tackle AMR (10), and successful enhancement of national surveillance systems for HCAI, AMR and AMU (see the English surveillance programme for antimicrobial utilisation and resistance (ESPAUR) report), a gap remains in comprehensive national data for common HCAIs and appropriateness of AMU to inform IPC and antimicrobial stewardship activities in England.

National point prevalence surveys (PPS) have been instrumental in collecting valuable data on HCAIs and AMU, assessing longitudinal trends, and allowing for meaningful country comparisons. PPS facilitate the collection of detailed epidemiological data, not included in routine surveillance, for example infection sources and device use. The PPS data collection used here also provides granular data down to the ward and patient-level, thereby enhancing infection data for improved modelling and supporting the development and evaluation of interventions aimed at reducing HCAI and optimising AMU.

Primary objectives

The primary objectives of the 2023 PPS on HCAI, AMU AMS in England were:

- to estimate the total burden (prevalence) of HCAI and AMU in NHS and independent sector acute care hospitals as well as NHS community and mental health trusts.
- to describe, invasive procedures, infections (sites, microorganisms and markers of antimicrobial resistance) and antimicrobials prescribed (agents, routes, indications) by patient demographics, admitting specialties or healthcare facilities
- to describe key structures and processes for the prevention of HCAI and AMR at the hospital and ward level
- to disseminate results to those who need to know at local, regional and national levels:
    - to raise awareness and development of relevant local and national interventions

    - to train and reinforce surveillance structures and skills
- to identify common problems and guide priority setting accordingly
- to facilitate the evaluation of the effect of strategies and shape policies for the future at the local, regional and national level (assessed through future repeated PPS)
- to identify and better understand differences between healthcare practices and outcomes by providing standardised data for hospitals, allowing benchmarking and identification of targets for quality improvement

Secondary objectives

In addition, the 2023 PPS aimed:

- to provide participating NHS trusts and independent sector hospitals with both organisation-level and national PPS results that would offer evidence of the burden of HCAI and how it is changing over time
- to gain a better understanding of the quality of prescribing
- to link HCAIs to antimicrobial exposure and antimicrobials to diagnosis and indication
- to provide separate data for children and young people and adult patients, recognising differences in healthcare use and risk compared to the adult population
- to support benchmarking by participants with peer group hospitals in England to understand the quality of care locally and identify opportunities for improvement
- to guide future case-mix adjustment to establish a post-pandemic baseline
- to align the England PPS protocol with the 2022 to 2023 PPS coordinated by the European Centre for Disease Prevention and Control (ECDC) to allow comparisons of findings and mutual feedback and knowledge exchange with international partners

2. Methodology

Participation

All NHS and independent acute care hospitals, as well as NHS community and mental health trusts across England, were invited to participate in the 2023 PPS. The invitations were emailed to the Directors of Infection Prevention and Control (DIPC) and Chief Pharmacists of these organisations. Regional AMR and AMS Leads from UKHSA and NHS England proactively encouraged participation from trusts in their regions. The PPS survey period aligned with previous PPS surveys in England. Healthcare workers' industrial action during the survey period caused challenges with changes to routine clinical practice and staffing. Therefore, the data collection period was extended by 3 weeks, from 18 September to 27 October 2023, to try and reflect routine clinical, IPC and AMS practices.

Protocol

The protocol for the 2023 PPS on HCAI and AMU in England was based on the protocol of the third PPS in European acute care hospitals (PPS 2022 to 2023) (11). This ensured alignment with data captured during the previous surveys in 2011 and 2016, coordinated by ECDC. In addition, community and mental health trusts were eligible for participation in England and indicators for compliance with AMU guidelines and appropriateness of prescribing (adapted from the Australian National Antimicrobial Prescribing Survey (1)) were added to the protocol in England.

Information governance

UKHSA has approval under section 251 of the National Health Service Act 2006 and its Regulations, to process specific patient identifiable health records without direct patient consent, which would normally be required in the common law duty of confidentiality for processing confidential patient information. This enables the transfer of patient information without breaching confidentiality laws, while still complying with other legal obligations such as the Data Protection Act 2018. There are exceptions to the common law duty of confidence, on which the UK Health Security Agency (UKHSA) relies as the legal basis for data processing in the absence of consent (SI 1438 Control of Healthcare Information Regulations 2002 ('Section 251').

1.2. Regulation 3(1) of the 2002 Regulations allows for the processing of confidential patient information for specified purposes relating to communicable diseases and other risks to public health.
1.3. Regulation 3(3) specifies the persons who may process information under regulation 3(1), namely: persons employed or engaged for the purposes of the health service (regulation

3(3)(b)), and other persons employed or engaged by a Government Department or other public authority in communicable disease surveillance (regulation 3(3)(c)).

To safeguard and monitor the use of regulation 3(1) by UKHSA to process confidential patient information without consent, and to facilitate compliance with regulation 3(5) and regulation 7, UKSHA has implemented a procedure for prior written authorisation from UKSHA's Caldicott Advisory Panel for internal uses of confidential patient information. For each case in which it is proposed to rely on regulation 3(1) of the 2002 Regulations (that is, to process confidential patient information without consent for purposes relating to communicable diseases and other risks to public health), an application must be made to UKHSA's Caldicott Advisory Panel and written confirmation must be received before the information can be processed.

All data processed by UKHSA is stored on secure, encrypted servers, accessible only to trained personnel. Data held by hospitals must adhere to Caldicott principles. The national data opt-out does not apply when Regulation 3 provides a lawful basis for collecting this data, and UKHSA has approval from the Caldicott Guardian to process patient information for the PPS under this regulation.

UKHSA has been given approval by the Caldicott Guardian to process confidential patient information for the PPS under Regulation 3 (reference: CAP-2018-116).

Inclusion criteria

Hospitals

All NHS and independent acute care hospitals, NHS community and mental health trusts in England were eligible for inclusion regardless of size. Acute care hospitals were defined according to national definitions published on the Hospital Estates and Facilities Statistics Centre website (12). Hospitals that exclusively cared for day-case patients were excluded. For administrative hospital groups (for example, NHS trusts) data were collected by hospital site.

Wards

All acute care wards had to be included as well as chronic care, rehabilitation, long-term care wards, acute psychiatric wards, and intensive care units (ICUs). The speciality of each ward had to be recorded to facilitate stratified and standardised results, which were needed for accurate benchmarking across specialities.

For trusts with both community and mental health sites, there was an option to register only community health sites, only mental health sites, or both. If choosing to include only community health sites, all patient and ward data from all community health units in the trust had to be included. Similarly, if choosing to include only mental health sites, all patient and ward data from all mental health units in the trust had to be included. This ensured accurate denominator data and allowed benchmarking with peers.

Patients

Patients to be included were those admitted to the ward before or at 08:00am on the day of the survey and not discharged at the time of survey. This included neonates on maternity and paediatric wards if born before or at 8:00am, patients temporarily off the ward for diagnostic investigations or procedures (provided they returned before the end of the PPS day or information about them was available at 8:00am), and patients on the patient administration system, that is, not discharged, but at home for several hours.

Excluded patients were day case patients, those undergoing same-day treatment or surgery with an expectation of discharge before 9:00pm, patients seen only in outpatient departments, those in the emergency room not admitted to the hospital, routine dialysis patients, patients in virtual wards, and those receiving outpatient parenteral antimicrobial therapy (OPAT). The decision to include or exclude patients was based on information available at 8:00am on the day of the survey.

The study population was categorised as paediatric (under 19 years) and adult patient groups (19 years or over). The age threshold was selected to be inclusive of paediatric services in England, which in some cases routinely care for patients aged 0 to 18, and to align with ages at which patients may continue to transition care from children to adult services, and also aligning with public health commissioning guidance.

Detailed results for paediatric or adult patients are separately available on the PPS webpage.

Data levels and definitions

Data collected included trust, hospital, ward and patient-level information.

Trust and hospital data

The trust and hospital questionnaire captured details on the type and size of the organisation, hospital statistics (such as patient-days and discharges in the preceding year), and structure and process indicators for IPC and antimicrobial stewardship (described below).

NHS trusts were defined according to national definitions (12):

- acute (large, medium or small): trusts with an accident and emergency (A&E) department and core acute specialities, subdivided into 3 categories based on 2021 to 2022 Estates Returns Information Collection (ERIC) data
- acute (teaching): trusts with an attached undergraduate medical school
- acute (specialist): trusts with restricted specialities such as orthopaedic and children's trusts
- mental health: trusts exclusively providing mental health services, including specialist services like secure units

- community: trusts offering alternatives to acute, general hospital care, including minor injuries units, inpatient care for older people, rehabilitation, maternity services, outpatient clinics, day surgery or care, and diagnostics

Independent sector organisations include any providers of NHS services that are not foundation trusts or NHS trusts, for example, charities, social enterprises, private or public limited companies.

Ward data

Ward data described ward size and composition, capturing structure and process indicators (SPIs) at the ward level for IPC and antimicrobial stewardship. Collected data included ward code, main ward speciality, ward survey date, and aggregated denominators for the total ward and each consultant or patient speciality.

Broad speciality categories (surgery, medicine, intensive care, paediatrics, neonatology, gynaecology/obstetrics, geriatrics, psychiatry, rehabilitation, long-term care, mixed specialities, and other specialities) were used to describe ward specialities.

The main ward speciality was defined as the speciality of at least 80% of the patients on the ward, otherwise, it was reported as 'mixed'. Some SPIs were preferentially collected at the ward level, though hospitals could opt to collect these at the hospital level.

Patient data

A core set of patient data was collected for every patient on a ward, independent of HCAI or AMU. Variables included date of birth, gender, ethnicity, postcode, date of hospital admission, consultant or patient speciality, surgery since admission, McCabe severity of underlying illness score, presence of indwelling devices at the time of survey, COVID-19 vaccination status, and current ward code. Additional variables were collected for patients who fulfilled the criteria for having an active HCAI and/or receiving antimicrobials (11).

Healthcare-associated infection data

A full definition of an active HCAI is included in the protocol (11). In short, an active HCAI was defined as an infection present on the survey date with signs and symptoms, or if the patient was receiving treatment for an infection diagnosed before the survey date. Onset criteria included symptoms appearing on day 3 or later of the current hospital admission, readmission within 48 hours after discharge, infections related to surgical procedures, *C. difficile* infections within 28 days of discharge, or infections related to invasive devices placed on day 1 or 2 of current admission. COVID-19 cases were included as HCAI if symptoms or the first positive test occurred on day 3 or later (although noting that a negative test was not required upon admission), or if the patient was readmitted within 48 hours after a stay of more than 7 days in a healthcare facility. Data on AMU were collected if the patient received at least one antimicrobial at the time of the survey or had an active HCAI.

Antimicrobial use data

Data on antimicrobial use were collected if the patient received at least one antimicrobial at the time of the survey. Collected information included the antimicrobial agent, route of administration, indication for use, site of diagnosis, whether the reason for prescribing was documented and whether the antimicrobial or the route of administration changed for this indication, and if so, the reason for change.

The UK-adapted version of the World Health Organization (WHO) AWaRe classification (13) was used to categorise antibiotics since several national- and trust-level AMU targets are based on AWaRe categories in England (8).

For the first time, optional questions on adherence to guidance and appropriateness of AMU – adapted from the Australian National Antimicrobial Prescribing Survey (1) – were included in the PPS in England to assess the quality of antimicrobial prescribing practices.

Structure and process indicators

Structure and process indicators for the prevention of HCAI and antimicrobial resistance were analysed to evaluate the implementation of IPC practices and AMS programmes in hospitals. These indicators align with the core components of IPC programmes as outlined by WHO and are listed in the PPS protocol (11).

Survey materials

In addition to the protocol, materials and tools were developed to assist hospitals in conducting the 2023 PPS:

- data entry forms
- study codebook, including case definitions of HCAI
- standardised training material
- web-based software to enter data (including user guides)
- PPS email inbox with short turnaround time for queries
- drop-in sessions for PPS participants organised by regional NHSE AMS leads

Data collection

Data could be collected and processed in several ways:

- initially, data was collected on handwritten or entered electronically onto forms distributed to registered hospital leads – after verification, these forms were entered into a web-based data tool by hospital staff
- alternatively, data could be entered directly onto the web-based tool by hospital staff during data collection

- data could also be uploaded to the web-based data tool via a spreadsheet

The data on wards, patients, HCAIs, and antimicrobial use was retrieved from patient charts in hospital wards and other available sources, such as hospital information systems and laboratory databases, using standardised data collection forms. Healthcare workers involved in PPS data collection included IPC staff, ward nurses and physicians, infectious disease physicians, medical specialist trainees, microbiologists, pharmacists, and other hospital personnel.

The UKHSA's Data Capture System (DCS) was utilised to capture hospital, ward, and patient data. Users had the option to input data in real-time or retrospectively. Batch upload of data was possible via the Data Upload Wizard function and users were enabled to download their data as a Line listings report. A PPS inbox was set up to respond to queries and support data entry by PPS participants. Data quality reports were generated and reviewed to ensure accuracy and completeness, and validation reports were sent back to the participating organisations to correct any erroneous information in the DCS.

Training

More than 600 participants were trained in preparation for the PPS via a series of webinars and online training sessions. The sessions were recorded and made publicly available on a dedicated PPS website.

Validation survey

Validation surveys have been important in measuring the accuracy and consistency of the data being collected for thee PPS by hospital staff during previous national PPSs. In 2023, data validation teams also visited a subset of participating hospitals and collected PPS data in parallel with hospital staff to estimate the sensitivity and specificity of the primary PPS data.

Data analysis

Data processing

The data for this study was processed and analysed using R version 4.4.0 and RStudio version 2024.04.2. Each participating hospital received an initial data report and slide set within 6 weeks of data receipt by UKHSA, after which they were asked to check their data for consistency and accuracy.

Data validation

The data cleaning process involved several steps. In addition to the automated validation checks when PPS participants inputted into the DCS, there were additional automated checks devised.

There were separate data validation processes for patient, ward and hospital data collections, respectively. The complete criteria of data validation and amendments are presented in the report annexe.

As per the study protocol, hospitals which did not upload the hospital data failed the eligibility criteria for inclusion in the national analysis. Hospitals also had to upload data for all eligible patients from all eligible wards to be included. However, several hospitals failed to comply with this requirement. Consequently, 2 distinct data sets were devised to address this issue:

Standard Protocol Data Set

This data set comprises all hospitals that adhered to the eligibility criteria regarding provision of core hospital data and inclusion of all eligible patients from all eligible wards. This data set was used for all primary national analyses to ensure consistency and reliability.

Unless stated, analyses in this report are based on the standard protocol data set.

Extended Data Set

The extended data set includes all patient data that passed validation checks. This data set was utilised for:

- statistical analysis: the extended data set provided a larger sample size, thereby improving the reliability of the risk adjustment models through the inclusion of a more diverse patient population – this was particularly important for capturing variation in healthcare practices and patient outcomes across different settings
- detailed analysis of paediatric data (available on the PPS webpage)

Additional information provided in the report annexe

The following additional information can be found in the report annexe:

- data validation
- amending data
- data deduplication
- ethnicity linkage
- other data amendments
- calculation of indicators

Statistical analysis

Single-variable analysis was conducted to provide an overall description of the data. Confidence intervals (CI) of 95% were determined as appropriate. Prevalence was compared using estimations to assess overlapping CIs.

Both univariate and multivariate logistic regression models were employed to investigate the relationship between several risk factors and the outcomes of interest for adult patients and children/young people respectively and can be found on the PPS webpage.

3. Results

3.1 Descriptive summary of data

3.1.1 Participation

Data from a total of 121 NHS England trusts or independent sector organisations was submitted to UKHSA. Of these, 113 trusts or organisations (93.4%) with 293 hospital sites and 44,372 patients were included in the Standard Protocol Data Set. In addition, 49 hospitals and 10,892 patients were included in the Extended Data Set (see Figure 3.1.1.1.).

The PPS was conducted between 18 September and 30 November 2023.

Figure 3.1.1.1 Flow diagram of study population and data set inclusion criteria, PPS England 2023

Number of records extracted from DCS (on 8 August 2024)

Patient data set: 57,465	**Hospital data set:** 369	**Ward data set:** 3,493

↓

Number of records remaining after deduplication or withdrawal requests

Patient data set: 55,555	**Hospital data set:** 342	**Ward data set:** 3,080

↓

Number of records remaining after fatal errors were censored (Extended Data Set)

Patient data set: 55,253	**Hospital data set:** 342	**Ward data set:** 3,080

↓

Number of records remaining following application of eligibility criteria for national data set (Standard Protocol Data Set)

Patient data set: 44,372	**Hospital data set:** 293	**Ward data set:** 2,476

3.1.2 Sample representativeness

All NHS and independent sector acute care hospitals, as well as NHS community and mental health trusts in England, were invited to participate in the PPS on HCAI and AMU in England in 2023 (Table 3.1.2.1).

Overall, 97 (49%) of the 198 NHS trusts and 16 (total number not available to PPS team) independent sector organisations in England participated.

Table 3.1.2.1. Representativeness of participating trusts or organisations, PPS England 2023

Type of trust or organisation	Number of participating trusts or organisations	Total number of trusts or organisations in England	Participation compared to national total (%)
Acute - large	10	24	41.7
Acute - medium	14	28	50.0
Acute - small	9	21	42.9
Acute - specialist	9	16	56.3
Acute - teaching	25	48	52.1
Mental health	21	45	46.7
Community	9	16	56.3
Independent sector	16	N/A	N/A

N/A = not available to PPS team.

3.1.3 Hospital characteristics

The analysis of hospital characteristics by organisation type in England for 2023, as outlined in Table 3.1.3.1, provides detailed insights into hospital size, patient numbers, and bed allocation across organisation types.

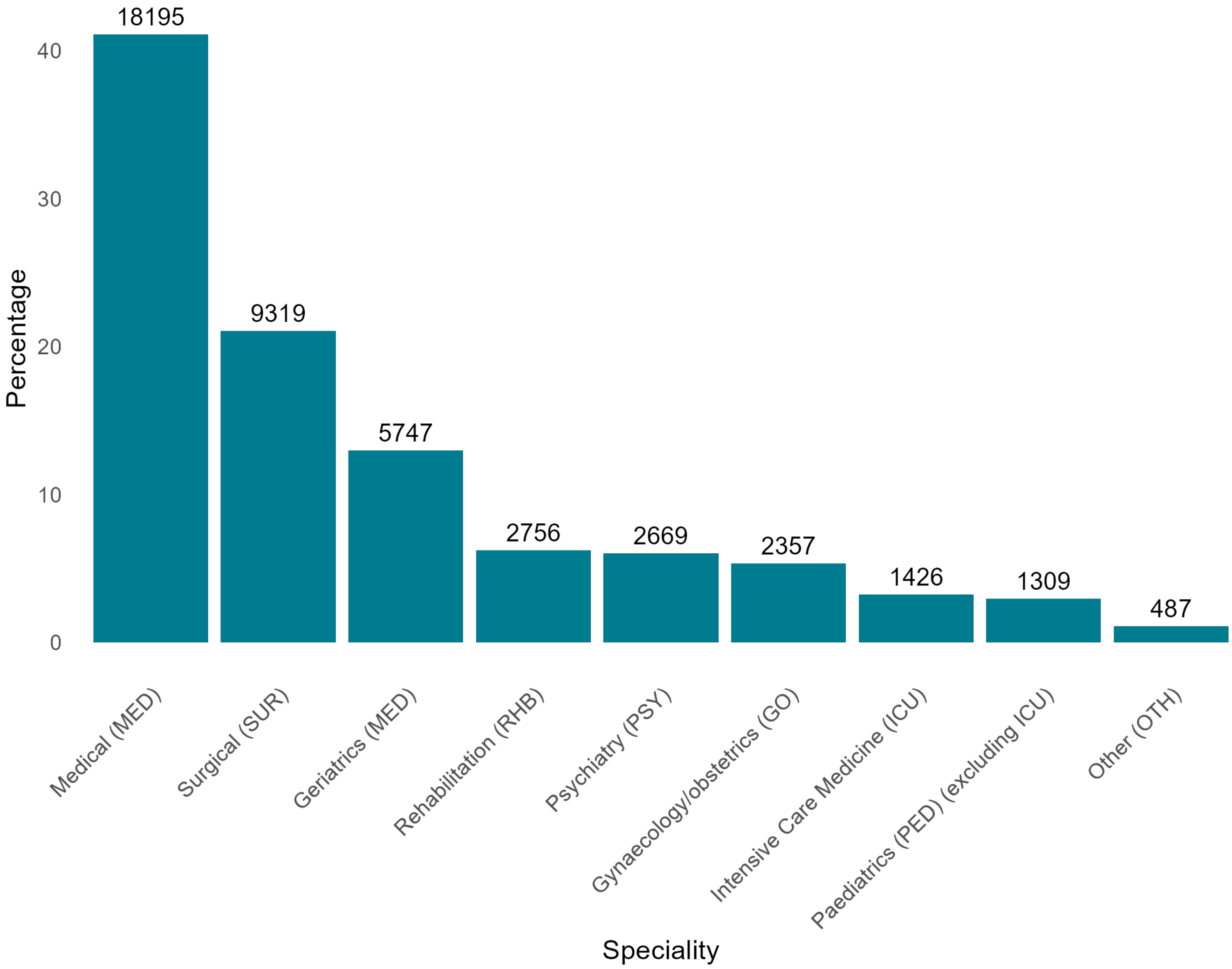
Table 3.1.3.2. Hospital characteristics by organisation type, PPS England 2023

Trust or organisation type	Number of hospitals	Number of patients	% of PPS patients	Total beds			
				Mean	P25	P50	P75
Acute - large	18	7,139	16	1,077	774	971	1,278
Acute - medium	20	7,088	16	687	653	745	800
Acute - small	9	3,705	8	495	452	506	565
Acute - teaching	38	19,053	43	1,119	680	1,076	1,412
Acute - specialist	9	1,251	3	215	141	209	257
Mental health	90	3,540	8	386	300	388	430
Community	48	1,451	3	210	185	185	282
Independent sector	61	1,145	3	41	27	35	43
Total	293	44,372	100	-	-	-	-

Patient or consultant specialty

The distribution of patients across different specialties is represented in Figure 3.1.3.1 below. Medical specialities accounted for 41% of patients, with 18,195 individuals. Surgical specialities represented 21% of the patient population.

Figure 3.1.3.2 Patients included in PPS by speciality, PPS England 2023



3.1.4 Patient demographics and risk factors

Patient demographics are summarised in Table 3.1.4.1. Overall, there were 44,372 patients included in the analysis. Of these, 51.5% were female and more than 60% of patients were aged 65 years and older. The patient population was predominantly White (72.5%), followed by Asian or Asian British (5.3%) and Black, African, Caribbean or Black British (3.6%) ethnic groups. For 64.7% of patients information on the Index of Multiple Deprivation (IMD), a relative measure of deprivation, was available. The IMD showed even distribution across patients captured by the PPS.

Table 3.1.4.3. Distribution of the patient demographics, PPS England 2023

Category	Number of patients	%
Overall	**44,372**	**100**
Sex		
Female	22,852	51.5
Male	21,139	47.6
Unknown	370	0.8
Missing	11	0.0
Age groups		
Under 1 month	1,231	2.8
1 to 11 months	612	1.4
1 to 9 years	732	1.6
10 to 15 years	451	1.0
16 to 18 years	344	0.8
19 to 29 years	2,079	4.7
30 to 49 years	5,175	11.7
50 to 64 years	7,000	15.8
65 to 79 years	12,703	28.6
80 years and over	14,045	31.7
Ethnicity		
White	32,173	72.5
Asian or Asian British	2,351	5.3
Black, African, Caribbean or Black British	1,594	3.6
Mixed or multiple ethnic groups	506	1.1
Other ethnic group	3,171	7.1
Unknown	1,717	3.9
Missing	2,860	6.4
Index of Multiple Deprivation quintile 2019		
1 (Most deprived)	5,676	12.8
2	6,067	13.7
3	5,886	13.3
4	5,719	12.9
5 (Least deprived)	5,382	12.1
Missing	15,642	35.3

An overview of important risk factors for HCAI by adult and paediatric patient groups is shown in Table 3.1.4.2. Among the 44,372 patients, 81.3% did not undergo surgery, 92.2% did not have a central vascular catheter, 41.6% had a peripheral vascular catheter, 19.2% had a urinary catheter, the majority had non-fatal diseases (63.4%), 33.6% of patients had a hospital stay of more than 15 days (33.6%) and 35.0% received 4 or more COVID-19 vaccine doses.

Table 3.1.4.4. Distribution of risk factors, PPS England 2023

Category	Number of patients	%
Overall	**44,372**	**100**
Surgery		
No	36,058	81.3
Yes (NHSN) (14)	6,531	14.7
Yes (Non-NHSN)	1,321	3.0
Unknown or not available	462	1.0
Central vascular catheter		
Yes	3,103	7.0
No	40,898	92.2
Unknown	371	0.8
Peripheral vascular catheter		
Yes	18,476	41.6
No	24,625	55.5
Unknown	1,271	2.9
Urinary catheter		
Yes	8,516	19.2
No	35,498	80.0
Unknown	358	0.8
Endotracheal tube or tracheostomy		
Yes	687	1.5
No	43,367	97.7
Unknown	318	0.7
McCabe score		
Non-fatal disease	28,154	63.4
Ultimately fatal disease	8,573	19.3
Rapidly fatal disease	1,428	3.2
Unknown	6,217	14.0

Category	Number of patients	%
Length of stay		
1 to 3 days	10,409	23.5
4 to 7 days	9,846	22.2
8 to 14 days	8,588	19.4
More than 15 days	14,897	33.6
Unknown	632	1.4
COVID-19 vaccination		
Yes, patient received 1 to 2 doses	4,176	9.4
Yes, patient received 3 doses	5,337	12.0
Yes, patient received 4 or more doses	15,548	35.0
No	4,522	10.2
Unknown	14,787	33.3

3.2 Overview of healthcare-associated infections

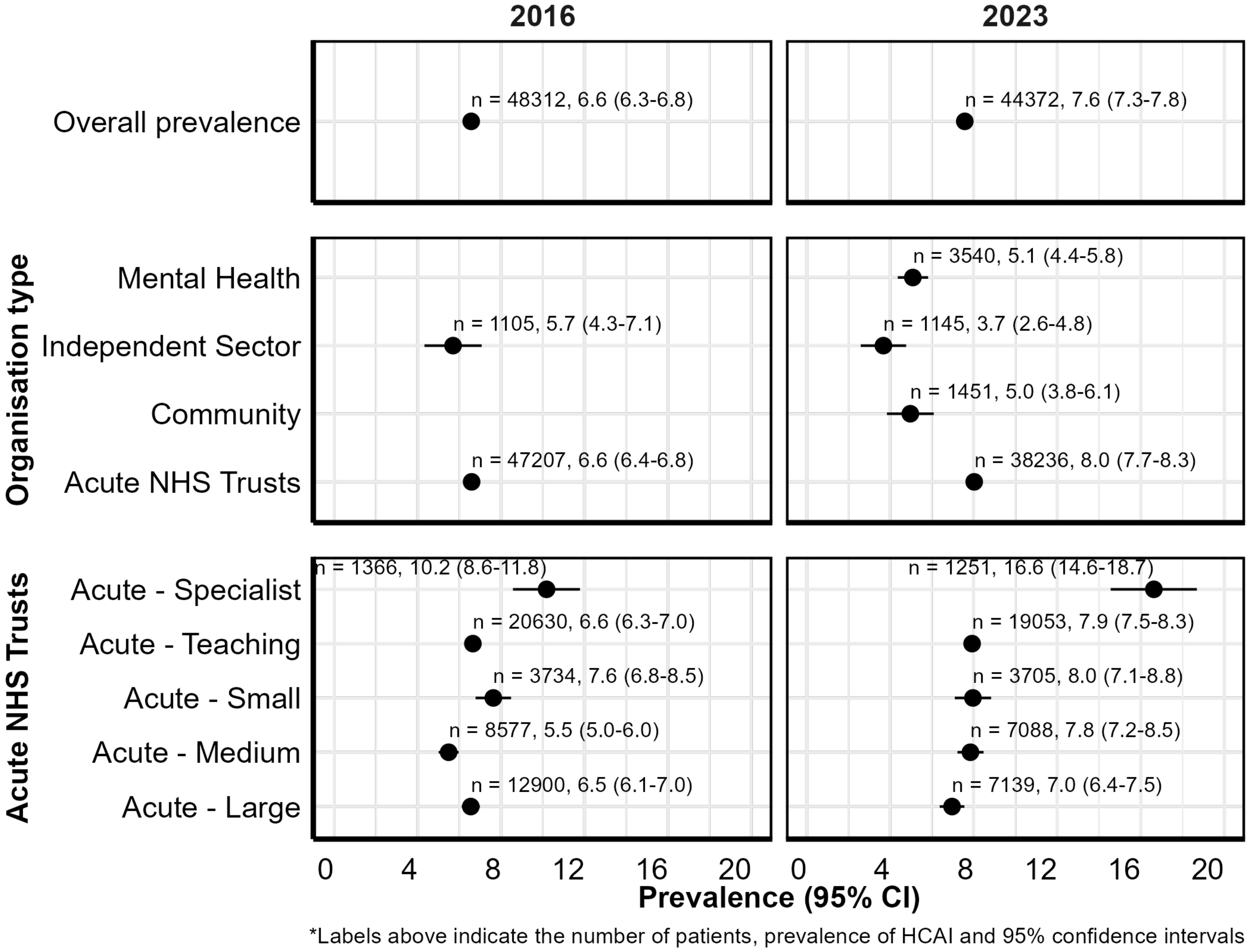
3.2.1 Prevalence of HCAIs

The crude HCAI prevalence was 7.6% (95% CI: 7.3 to 7.8) in the 2023 PPS in England, an increase compared to the 6.6% (95% CI: 6.3 to 6.8) HCAI prevalence reported in the previous PPS 2016 (Figure 3.2.1.1). Testing the statistical significance of these differences in overall HCAI proportion is limited by the inclusion of community and mental health trusts in 2023, which has changed the population under study. Overall, 3,359 patients captured by the PPS were reported to have at least one HCAI.

Acute NHS trusts had an overall HCAI prevalence of 8.0% (95% CI: 7.7 to 8.3) in 2023 compared to 6.6% (95% CI: 6.4 to 6.8) in 2016. Mental health and community trusts, which participated for the first time in the survey and do not provide acute care, had HCAI prevalences of 5.1% (95% CI: 4.4 to 5.8) and of 5.0% (95% CI: 3.8 to 6.1).

COVID-19 was the sole HCAI for 321 patients. An analysis was conducted to determine the prevalence of HCAIs when COVID-19 cases were excluded. When COVID-19 was removed from the data, the national prevalence of HCAI was 7.0% (95% CI: 6.8 to 7.2) (see the report annexe).

Figure 3.2.1.3. Prevalence of healthcare-associated infections by organisation type, PPS England 2016 (15) and 2023



Prevalence by demographics and risk factors is analysed in Table 3.2.1.1. Male patients had a higher HCAI prevalence (8.3%, 95% CI: 7.9 to 8.6) than female patients (6.9%, 95% CI: 6.6 to 7.2). Prevalence was highest in elderly patients, particularly in those aged 80 and over (8.4%, 95% CI: 8.0 to 8.9). HCAI prevalence rises significantly with longer hospital stays. Patients staying more than 14 days had a prevalence of 12.5%, compared to just 1.7% for those staying 1 to 3 days. HCAI prevalence was higher in patients with central vascular catheters (19.8%) and endotracheal tubes or tracheostomies (24.9%). Additionally, HCAI prevalence was high in patients with severe underlying conditions, such as ultimately or rapidly fatal diseases. Prevalence did not show strong differences across IMD quintiles.

Table 3.2.1.5. Demographics and risk factors for patients with at least one HCAI, PPS England 2023

Demographic and risk factors	Number of patients	Number of patients with at least one HCAI	Percent of patients with at least one HCAI	HCAI prevalence (95% CI)
Overall	**44,372**	**3,359**	**100.0**	**7.6 (7.3 to 7.8)**
Patient demographics				
Sex				
Female	22,852	1,579	47.0	6.9 (6.6 to 7.2)
Male	21,139	1,748	52.0	8.3 (7.9 to 8.6)
Unknown	370	32	1.0	8.7 (5.8 to 11.5)
Missing	11	0	0.0	0 (0 to 0)
Age groups				
Under 1 month	1,231	76	2.3	6.2 (4.8 to 7.5)
1 to 11 months	612	70	2.1	11.4 (8.9 to 14)
1 to 9	732	44	1.3	6.0 (4.3 to 7.7)
10 to 15	451	24	0.7	5.3 (3.2 to 7.4)
16 to 18	344	17	0.5	4.9 (2.6 to 7.2)
19 to 29	2,079	91	2.7	4.4 (3.5 to 5.3)
30 to 49	5,175	264	7.9	5.1 (4.5 to 5.7)
50 to 64	7,000	515	15.3	7.4 (6.8 to 8.0)
65 to 79	12,703	1,073	31.9	8.4 (8.0 to 8.9)
80 and over	14,045	1,185	35.3	8.4 (8.0 to 8.9)
Ethnicity				
White	32,173	2,418	72.0	7.5 (7.2 to 7.8)
Asian or Asian British	2,351	153	4.6	6.5 (5.5 to 7.5)
Black, African, Caribbean or Black British	1,594	92	2.7	5.8 (4.6 to 6.9)
Mixed or multiple ethnic groups	506	29	0.9	5.7 (3.7 to 7.8)
Other ethnic group	3,171	261	7.8	8.2 (7.3 to 9.2)
Unknown	1,717	178	5.3	10.4 (8.9 to 11.8)
Missing	2,860	228	6.8	8.0 (7.0 to 9.0)

Demographic and risk factors	Number of patients	Number of patients with at least one HCAI	Percent of patients with at least one HCAI	HCAI prevalence (95% CI)
Index of Multiple Deprivation (2019) quintile				
1 (Most deprived)	5,676	418	12.4	7.4 (6.7 to 8.0)
2	6,067	427	12.7	7.0 (6.4 to 7.7)
3	5,886	448	13.3	7.6 (6.9 to 8.3)
4	5,719	489	14.6	8.6 (7.8 to 9.3)
5 (Least deprived)	5,382	428	12.7	8.0 (7.2 to 8.7)
Missing	15,642	1,149	34.2	7.3 (6.9 to 7.8)
Indwelling devices or procedures				
Central vascular catheter				
Yes	3,103	614	18.3	19.8 (18.4 to 21.2)
No	40,898	2,724	81.1	6.7 (6.4 to 6.9)
Unknown	369	21	0.6	5.7 (3.3 to 8.1)
Missing	2	0	0.0	-
Peripheral vascular catheter				
Yes	18,476	1,828	54.4	9.9 (9.5 to 10.3)
No	24,625	1,466	43.6	6.0 (5.7 to 6.2)
Unknown	1,269	65	1.9	5.1 (3.9 to 6.3)
Missing	2	0	0.0	to
Urinary catheter				
Yes	8,516	1,158	34.5	13.6 (12.9 to 14.3)
No	35,498	2,182	65.0	6.2 (5.9 to 6.4)
Unknown	356	19	0.6	5.3 (3 to 7.7)
Missing	2	0	0	-
Endotracheal tube or tracheostomy				
Yes	687	171	5.1	24.9 (21.7 to 28.1)
No	43,367	3,178	94.6	7.3 (7.1 to 7.6)
Unknown	316	10	0.3	3.2 (1.2 to 5.1)
Missing	2	0	0.0	-

Demographic and risk factors	Number of patients	Number of patients with at least one HCAI	Percent of patients with at least one HCAI	HCAI prevalence (95% CI)
Risk factors				
Length of stay				
1 to 3 days	10,409	174	5.2	1.7 (1.4 to 1.9)
4 to 7 days	9,846	439	13.1	4.5 (4.0 to 4.9)
8 to 14 days	8,588	843	25.1	9.8 (9.2 to 10.4)
More than 14 days	14,897	1,866	55.6	12.5 (12.0 to 13.1)
Missing	632	37	1.1	5.8 (4.0 to 7.7)
Surgery				
Yes (NHSN)	6,531	709	21.1	10.9 (10.1 to 11.6)
Yes (Non to NHSN)	1,321	157	4.7	11.9 (10.1 to 13.6)
No	36,058	2,468	73.5	6.8 (6.6 to 7.1)
Unknown or missing	462	25	0.7	5.4 (3.4 to 7.5)
McCabe score				
Non to fatal disease	28,154	1,817	54.1	6.4 (6.2 to 6.7)
Ultimately fatal disease	8,573	859	25.6	10.0 (9.4 to 10.7)
Rapidly fatal disease	1,428	183	5.4	12.8 (11.1 to 14.6)
Unknown	6,215	500	14.9	8.1 (7.4 to 8.7)
Missing	2	0	0.0	-
COVID-19 vaccination				
No	4,522	280	8.3	6.2 (5.5 to 6.9)
Yes, patient received 1 to 2 doses	4,176	279	8.3	6.7 (5.9 to 7.4)
Yes, patient received 3 doses	5,337	405	12.1	7.6 (6.9 to 8.3)
Yes, patient received 4 or more doses	15,548	1,232	36.7	7.9 (7.5 to 8.3)
Unknown	14,787	1,163	34.6	7.9 (7.4 to 8.3)
Missing	2	0	0.0	-

Among the demographics and risk factors analysed for the 3 most frequent HCAIs (Table 3.2.1.2) the use of central vascular catheters was a high risk factor, particularly for sepsis and disseminated infections.

Table 3.2.1.6. Demographics and risk factors for the 3 most frequent HCAI, PPS England 2023

Demographic and risk factors	Pneumonia or LRI	Urinary tract infections	Sepsis and disseminated infections
Patient demographics			
Sex			
Female	426 (44.3%)	307 (54%)	162 (47.2%)
Male	529 (55%)	254 (44.6%)	181 (52.8%)
Unknown	7 (0.7%)	8 (1.4%)	0 (0.0%)
Age groups			
Under 1	18 (1.9%)	2 (0.4%)	81 (23.6%)
1 to 9	7 (0.7%)	1 (0.2%)	13 (3.8%)
10 to 15	6 (0.6%)	2 (0.4%)	7 (2%)
16 to 18	2 (0.2%)	3 (0.5%)	1 (0.3%)
19 to 29	13 (1.4%)	14 (2.5%)	13 (3.8%)
30 to 49	54 (5.6%)	36 (6.3%)	39 (11.4%)
50 to 64	141 (14.7%)	55 (9.7%)	47 (13.7%)
65 to 79	350 (36.4%)	182 (32%)	73 (21.3%)
80 and over	371 (38.6%)	274 (48.2%)	69 (20.1%)
Ethnicity			
White	714 (74.2%)	437 (76.8%)	219 (63.8%)
Asian or Asian British	34 (3.5%)	31 (5.4%)	26 (7.6%)
Black, African, Caribbean or Black British	22 (2.3%)	11 (1.9%)	26 (7.6%)
Mixed or multiple ethnic groups	7 (0.7%)	3 (0.5%)	9 (2.6%)
Other ethnic group	74 (7.7%)	28 (4.9%)	33 (9.6%)
Unknown	50 (5.2%)	19 (3.3%)	12 (3.5%)
Missing	61 (6.3%)	40 (7%)	18 (5.2%)
Index of Multiple Deprivation (2019) quintile			
1 (Most deprived)	125 (13%)	62 (10.9%)	47 (13.7%)
2	126 (13.1%)	63 (11.1%)	39 (11.4%)

3	120 (12.5%)	81 (14.2%)	52 (15.2%)
4	148 (15.4%)	84 (14.8%)	59 (17.2%)
5 (Least deprived)	124 (12.9%)	70 (12.3%)	41 (12%)
Missing	319 (33.2%)	209 (36.7%)	105 (30.6%)
Indwelling devices or procedures			
Central vascular catheter			
Yes	165 (17.2%)	38 (6.7%)	98 (28.6%)
No	790 (82.1%)	525 (92.3%)	242 (70.6%)
Unknown	7 (0.7%)	6 (1.1%)	3 (0.9%)
Peripheral vascular catheter			
Yes	626 (65.1%)	250 (43.9%)	220 (64.1%)
No	307 (31.9%)	305 (53.6%)	118 (34.4%)
Unknown	29 (3%)	14 (2.5%)	5 (1.5%)
Urinary catheter			
Yes	412 (42.8%)	238 (41.8%)	92 (26.8%)
No	542 (56.3%)	329 (57.8%)	248 (72.3%)
Unknown	8 (0.8%)	2 (0.4%)	3 (0.9%)
Endotracheal tube or tracheostomy			
Yes	81 (8.4%)	3 (0.5%)	29 (8.5%)
No	878 (91.3%)	563 (98.9%)	313 (91.3%)
Unknown	3 (0.3%)	3 (0.5%)	1 (0.3%)
Risk factors			
Length of stay			
1 to 3 days	28 (2.9%)	17 (3%)	49 (14.3%)
4 to 7 days	136 (14.1%)	60 (10.5%)	48 (14%)
8 to 14 days	276 (28.7%)	137 (24.1%)	83 (24.2%)
More than 14 days	515 (53.5%)	345 (60.6%)	161 (46.9%)
Missing	7 (0.7%)	10 (1.8%)	2 (0.6%)
Surgery			
Yes (NHSN)	183 (19%)	81 (14.2%)	64 (18.7%)
Yes (Non-NHSN)	34 (3.5%)	21 (3.7%)	15 (4.4%)
No	737 (76.6%)	465 (81.7%)	261 (76.1%)
Unknown or missing	8 (0.8%)	2 (0.4%)	3 (0.9%)

McCabe score			
Non-fatal disease	470 (48.9%)	312 (54.8%)	202 (58.9%)
Ultimately fatal disease	279 (29%)	145 (25.5%)	78 (22.7%)
Rapidly fatal disease	77 (8%)	24 (4.2%)	17 (5%)
Unknown	8 (0.8%)	2 (0.4%)	3 (0.9%)
COVID-19 vaccination			
No	72 (7.5%)	19 (3.3%)	79 (23%)
Yes, patient received 1 to 2 doses	62 (6.4%)	63 (11.1%)	30 (8.7%)
Yes, patient received 3 doses	117 (12.2%)	53 (9.3%)	33 (9.6%)
Yes, patient received 4 or more doses	362 (37.6%)	243 (42.7%)	97 (28.3%)
Unknown	349 (36.3%)	191 (33.6%)	104 (30.3%)

3.2.2 Site of diagnosis of HCAI

Pneumonia or lower respiratory tract infections (PNLRI) were the most reported HCAI, affecting 960 (29.6%) patients (2.2%, 95% CI: 2.0 to 2.3) across all specialties. The second most common HCAIs were urinary tract infections (UTIs) (17.5%), followed by sepsis and disseminated infections (10.6%). Bloodstream infections (BSIs) represented 7.6% of reported HCAIs (Table 3.2.2.1).

Table 3.2.2.7. Site of diagnosis of HCAI, PPS England 2023

Site of diagnosis	Number of patients with HCAI [note 1]	Prevalence (95% CI)	Number of HCAIs	Percent of total number of HCAIs (%)
Total	**3,359**	**7.6 (7.3 to 7.8)**	**3,493**	**100**
Pneumonia/LRI	960	2.2 (2.0 to 2.3)	962	29.6
Urinary tract infections	568	1.3 (1.2 to 1.4)	569	17.5
Sepsis and disseminated infections	343	0.8 (0.7 to 0.8)	343	10.6
COVID-19 infections	296	0.7 (0.6 to 0.7)	296	9.1
Surgical site infections	286	0.6 (0.6 to 0.7)	288	8.9
Gastro-intestinal tract infections	278	0.6 (0.6 to 0.7)	280	8.6
Bloodstream infections (laboratory or microbiologically confirmed)	242	0.6 (0.5 to 0.6)	247	7.6
Skin and soft tissue infections	180	0.4 (0.3 to 0.5)	180	5.5
Eye, ear, nose or mouth infections	139	0.3 (0.3 to 0.4)	139	4.3
Bone and joint infections	52	0.1 (0.1 to 0.1)	53	1.6

Site of diagnosis	Number of patients with HCAI [note 1]	Prevalence (95% CI)	Number of HCAIs	Percent of total number of HCAIs (%)
Cardiovascular Infections	25	0.1 (0.0 to 0.1)	25	0.8
Central nervous system infections	23	0.0 (0.0 to 0.1)	23	0.7
CVC or PVC-related infection (no positive blood culture)	21	0.0 (0.0 to 0.1)	21	0.6
Reproductive tract infections	19	0.0 (0.0 to 0.1)	19	0.6
Other healthcare-associated infection or unspecified HCAI	48	0.1 (0.1 to 0.1)	48	1.5

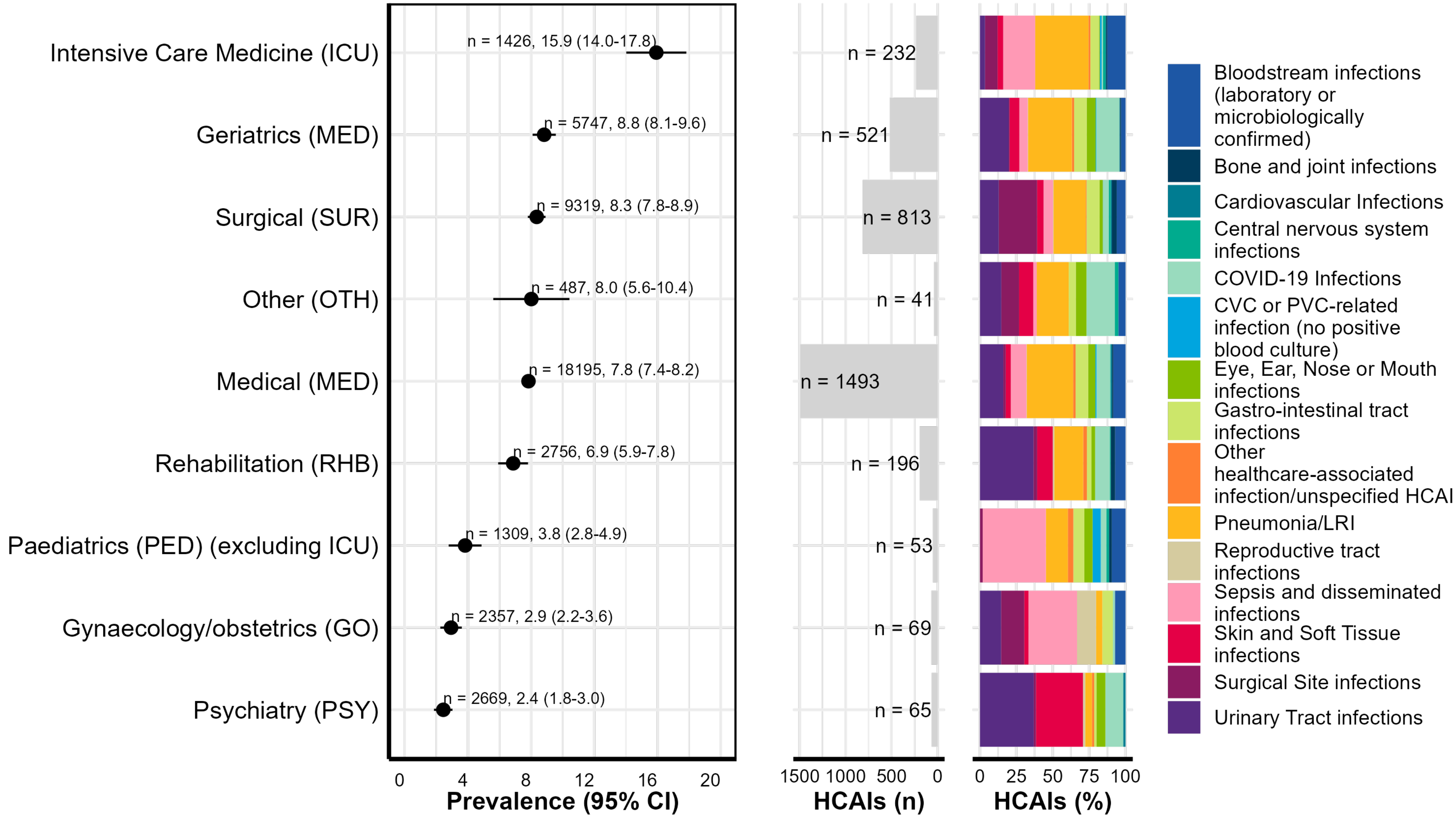
Note 1: Patients may have more than one HCAI.

Prevalence of healthcare-associated infections by patient specialty

The patient speciality with the highest HCAI prevalence was intensive care unit (ICU) (n=1,426, 15.9% 95% CI: 14.0 to 17.8).

Within ICUs, pneumonia or LRI was reported as the site of diagnosis for 36.4% of HCAIs, sepsis and disseminated infections for 22.0%, and BSIs for 12.5%. UTIs accounted for a significant proportion of HCAIs in medical (16%), surgical (12.9%), and geriatric specialities (19.8%). Surgical site infections (SSIs) accounted for 26.3% of HCAIs in patients under the Surgical speciality.

Figure 3.2.2.4. Prevalence of HCAIs per patient specialty type and site of diagnosis of HCAIs, PPS England 2023



*Labels above indicate the number of patients, prevalence of HCAI and 95% confidence intervals

3.2.3 Origin of healthcare-associated infections

The majority of HCAIs were reported in patients hospitalised for more than 3 weeks. Intubation within 48 hours before pneumonia or LRI onset was associated with a 7.4% incidence. For bloodstream infections, the presence of a vascular catheter within 48 hours before onset correlated with a higher incidence (3.5%) compared to those without (1.1%) (Table 3.2.3.1). Tables with details across the different types of organisations can be found in the annexe.

Table 3.2.3.8 Origin and device-association of HCAIs, PPS England 2023

Characteristics of HCAIs	Number of HCAIs	Percent of HCAIs
Total	**3,493**	**100.0**
Origin of HCAI		
HCAIs present on admission	**366**	**10.5**
Origin of HCAI at admission		
Current hospital	195	5.6
Other acute care hospital	102	2.9
Other community or mental health hospital	10	0.3
Long-term care facility	16	0.5
Other	17	0.5
Unknown	26	0.7
HCAI with onset during current hospitalisation	**2,961**	**84.8**
Days until HCAI onset		
1 to 2	275	7.9
3 to 4	326	9.3
5 to 7	436	12.5
8 to 14	666	19.1
15 to 21	400	11.5
More than 3 weeks	829	23.7
Missing	29	0.8
HCAI presence on admission unknown	**166**	**4.8**
HCAI associated with current ward		
Yes	2,538	72.7
No	790	22.6
Unknown	165	4.7
Device-associated infections		

Characteristics of HCAIs	Number of HCAIs	Percent of HCAIs
Pneumonia or LRI		
Intubation within 48 hours before onset	260	7.4
No intubation	508	14.5
Presence of intubation unknown	37	1.1
Missing	157	4.5
Urinary tract infections		
Urinary catheter within 7 days before onset	249	7.1
No urinary catheter	279	8
Presence of urinary catheter unknown	17	0.5
Missing	24	0.7
Bloodstream infections (laboratory or microbiologically confirmed)		
Vascular catheter within 48 hours before onset	122	3.5
No vascular catheter	39	1.1
Presence of vascular catheter unknown	12	0.3
Missing	74	2.1
BSI origin		
Total BSI	**247**	**100**
Catheter-related		
Central vascular catheter	31	12.6
Peripheral vascular catheter	9	3.6
Missing	63	25.5
Secondary BSI		
Pulmonary infection	5	2
Urinary tract infection	36	14.6
Surgical site infection	4	1.6
Digestive tract infection	15	6.1
Skin or soft tissue infection	9	3.6
Other infection	17	6.9
BSI of unknown origin		
None of the above, BSI of unknown origin (clinically asserted)	31	12.6
Missing	27	10.9

3.2.4 Microorganisms identified from HCAIs and antimicrobial resistance

Of the 3,493 reported HCAIs, 1,309 (37.5%) had at least one positive microorganism result with a total of 1,513 microorganisms identified. The 5 most commonly identified microorganisms were *Escherichia coli (*16.5%), SARS-CoV-2 (10.7%), *Staphylococcus aureus* (10.6%), *Clostridioides difficile* (7.4%) and *Pseudomonas aeruginosa* (7.2%) (Table 3.2.4.1).

Overall, Enterobacterales were the most common order of bacterial microorganisms (33.6%) found and were the dominant microoganisms in PNLRIs (33.7%), UTIs (73.7%), and sepsis (32.6%) (Table 3.2.4.1). Gram-positive cocci, the second most identified bacteria (27.1%), were the dominant microorganisms in SSIs (46.7%) and BSIs (44.1%).

Table 3.2.4.9. Microorganisms isolated from HCAIs per diagnosis site, PPS England 2023

Microorganism	Total N (%)	PNLRI N (%)	UTI N (%)	SSI N (%)	Sepsis N (%)	BSI N (%)	Other N (%)
Number of HCAIs,	**3,493**	**962**	**569**	**288**	**343**	**247**	**1,084**
Number of HCAIs with microorganisms	**1,309 (37.5)**	**155 (16.1)**	**292 (51.3)**	**128 (44.4)**	**35 (10.2)**	**227 (92.9)**	**472 (43.5)**
Number of microoganisms	**1,513 (100.0)**	**199 (100.0)**	**308 (100.0)**	**182 (100.0)**	**43 (100.0)**	**256 (100.0)**	**525 (100.0)**
Enterobacterales	**509 (33.6)**	**67 (33.7)**	**227 (73.7)**	**51 (28.0)**	**14 (32.6)**	**94 (36.7)**	**56 (10.7)**
Citrobacter spp.	21 (1.4)	7 (3.5)	5 (1.6)	4 (2.2)	0 (0.0)	2 (0.8)	3 (0.6)
Enterobacter spp.	55 (3.6)	6 (3)	11 (3.6)	10 (5.5)	2 (4.7)	15 (5.9)	11 (2.1)
Escherichia coli	249 (16.5)	17 (8.5)	145 (47.1)	26 (14.3)	5 (11.6)	38 (14.8)	18 (3.4)
Klebsiella pneumoniae	80 (5.3)	14 (7)	27 (8.8)	2 (1.1)	4 (9.3)	24 (9.4)	9 (1.7)
Other *Klebsiella* spp.	38 (2.5)	11 (5.5)	14 (4.5)	1 (0.5)	0 (0.0)	7 (2.7)	5 (1.0)
Proteus spp.	26 (1.7)	1 (0.5)	17 (5.5)	2 (1.1)	0 (0.0)	3 (1.2)	3 (0.6)
Serratia spp.	21 (1.4)	11 (5.5)	2 (0.6)	2 (1.1)	1 (2.3)	3 (1.2)	2 (0.4)
Other Enterobacterales	19 (1.3)	0 (0.0)	6 (1.9)	4 (2.2)	2 (4.7)	2 (0.8)	5 (1)
Gram-positive cocci	**410 (27.1)**	**40 (20.1)**	**43 (14.0)**	**85 (46.7)**	**10 (23.3)**	**113 (44.1)**	**119 (22.7)**
Staphylococcus aureus	160 (10.6)	28 (14.1)	4 (1.3)	31 (17)	0 (0.0)	42 (16.4)	55 (10.5)
Coagulase-negative staphylococci	77 (5.1)	4 (2)	4 (1.3)	14 (7.7)	3 (7)	30 (11.7)	22 (4.2)
Staphylococcus sp. not specified	10 (0.7)	0 (0.0)	2 (0.6)	3 (1.6)	0 (0.0)	2 (0.8)	3 (0.6)
Enterococcus faecium	60 (4.0)	1 (0.5)	11 (3.6)	14 (7.7)	4 (9.3)	16 (6.2)	14 (2.7)
Enterococcus faecalis	30 (2.0)	0 (0.0)	8 (2.6)	4 (2.2)	1 (2.3)	6 (2.3)	11 (2.1)

Microorganism	**Total N (%)**	**PNLRI N (%)**	**UTI N (%)**	**SSI N (%)**	**Sepsis N (%)**	**BSI N (%)**	**Other N (%)**
Other *Enterococcus* spp.	27 (1.8)	0 (0.0)	13 (4.2)	5 (2.7)	1 (2.3)	5 (2.0)	3 (0.6)
Streptococcus spp.	44 (2.9)	7 (3.5)	1 (0.3)	13 (7.1)	0 (0.0)	12 (4.7)	11 (2.1)
Other Gram-positive cocci	2 (0.1)	0 (0.0)	0 (0.0)	1 (0.5)	1 (2.3)	0 (0.0)	0 (0.0)
Gram-negative bacilli	**172 (11.4)**	**58 (29.1)**	**23 (7.5)**	**22 (12.1)**	**7 (16.3)**	**35 (13.7)**	**27 (5.1)**
Acinetobacter spp.	10 (0.7)	0 (0.0)	1 (0.3)	0 (0.0)	1 (2.3)	8 (3.1)	0 (0.0)
Pseudomonas aeruginosa	109 (7.2)	34 (17.1)	18 (5.8)	16 (8.8)	4 (9.3)	18 (7)	19 (3.6)
Stenotrophomonas maltophilia	13 (0.9)	8 (4)	0 (0.0)	1 (0.5)	0 (0.0)	3 (1.2)	1 (0.2)
Pseudomonadaceae family, other	7 (0.5)	3 (1.5)	1 (0.3)	1 (0.5)	1 (2.3)	0 (0.0)	1 (0.2)
Haemophilus influenzae	11 (0.7)	10 (5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)
Other gram-negative bacilli	22 (1.5)	3 (1.5)	3 (1)	4 (2.2)	1 (2.3)	6 (2.3)	5 (1)
Anaerobic bacilli	**133 (8.8)**	**2 (1.0)**	**0 (0.0)**	**8 (4.4)**	**2 (4.7)**	**4 (1.6)**	**117 (22.3)**
Bacteroides spp.	5 (0.3)	1 (0.5)	0 (0.0)	1 (0.5)	0 (0.0)	3 (1.2)	0 (0.0)
Clostridioides difficile	112 (7.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	112 (21.3)
Other anaerobes	16 (1.1)	1 (0.5)	0 (0.0)	7 (3.8)	2 (4.7)	1 (0.4)	5 (1)
Gram-negative cocci	**6 (0.4)**	**2 (1)**	**1 (0.3)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**3 (0.6)**
Gram-positive bacilli	**7 (0.5)**	**0 (0.0)**	**1 (0.3)**	**5 (2.7)**	**0 (0.0)**	**0 (0.0)**	**1 (0.2)**
Other bacteria	**4 (0.3)**	**0 (0.0)**	**4 (1.3)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**
Fungi	**63 (4.2)**	**9 (4.5)**	**9 (2.9)**	**11 (6.0)**	**3 (7.0)**	**10 (3.9)**	**21 (4.0)**
Yeast and mould sps. [note 1]	57 (3.8)	9 (4.5)	8 (2.6)	11 (6)	3 (7)	9 (3.5)	17 (3.2)

Microorganism	Total N (%)	PNLRI N (%)	UTI N (%)	SSI N (%)	Sepsis N (%)	BSI N (%)	Other N (%)
Aspergillus spp.	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)
Other fungi	5 (0.3)	0 (0.0)	1 (0.3)	0 (0.0)	0 (0.0)	1 (0.4)	3 (0.6)
Viruses	**208 (13.7)**	**20 (10.1)**	**0 (0.0)**	**0 (0.0)**	**7 (16.3)**	**0 (0)**	**181 (34.5)**
SARS-CoV-2	185 (12.2)	9 (4.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	176 (33.5)
Other viruses	23 (1.5)	11 (5.5)	0 (0.0)	0 (0.0)	7 (16.3)	0 (0.0)	5 (1.0)
Other parasites, yeasts, fungi, filaments	**1 (0.1)**	**1 (0.5)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**	**0 (0.0)**
Micro-organism not identified	30 (1.4)	9 (1.1)	13 (4.7)	2 (1.2)	0 (0.0)	1 (4.8)	5 (0.8)
Microbiology test available: no positive microbiology	440 (20.1)	178 (22.1)	63 (22.7)	29 (18.1)	67 (21.8)	2 (9.5)	101 (16.5)
Examination not done	17 (0.8)	9 (1.1)	3 (1.1)	1 (0.6)	0 (0.0)	0 (0.0)	4 (0.7)
Microbiology test not requested	972 (44.5)	409 (50.7)	88 (31.8)	54 (33.8)	82 (26.6)	9 (42.9)	330 (53.9)
Sterile examination	5 (0.2)	1 (0.1)	1 (0.4)	2 (1.2)	0 (0.0)	0 (0.0)	1 (0.2)
Results not available at the time of the survey	721 (33.0)	201 (24.9)	109 (39.4)	72 (45.0)	159 (51.6)	9 (42.9)	171 (27.9)

Note 1: Originally coded as *Candida* spp.

Of the 509 Enterobacterales identified, 48.9% were sensitivity tested for third-generation cephalosporins and 23.7% of the tested organisms were resistant (Table 3.2.4.2). 3.7% of the Enterobacterales tested for carbapenems were resistant. For *E. coli*, 22.7% were resistant to a third-generation cephalosporin. 54.2% of the *E. faecium* tested for a glycopeptide (of 48 isolates) were resistant.

Table 3.2.4.10. Antimicrobial resistance of HCAIs for the most frequently isolated pathogens, PPS England 2023

	Total	Number tested [note 1] (% of total)	Number resistant (% of tested)
Enterobacterales			
Third generation cephalosporins	509	249 (48.9)	59 (23.7)
Carbapenems	509	214 (42.0)	8 (3.7)
E. coli			
Third generation cephalosporins	249	119 (47.8)	27 (22.7)
Carbapenems	249	87 (34.9)	3 (3.4)
S.aureus			
Meticillin/oxacillin	160	92 (57.5)	13 (14.1)
Glycopeptides	160	36 (22.5)	0 (0.0)
P. aeruginosa			
Carbapenems	109	74 (67.9)	9 (12.2)
K. pneumoniae			
Third generation cephalosporins	80	38 (47.5)	10 (26.3)
Carbapenems	80	38 (47.5)	2 (5.3)
Other *Klebsiella* spp.			
Third generation cephalosporins	38	15 (39.5)	3 (20.0)
Carbapenems	38	16 (42.1)	1 (6.2)
E. faecium			
Glycopeptides	60	48 (80.0)	26 (54.2)
E. faecalis			
Glycopeptides	30	16 (53.3)	0 (0.0)

Note 1: Information available at the time of the survey.

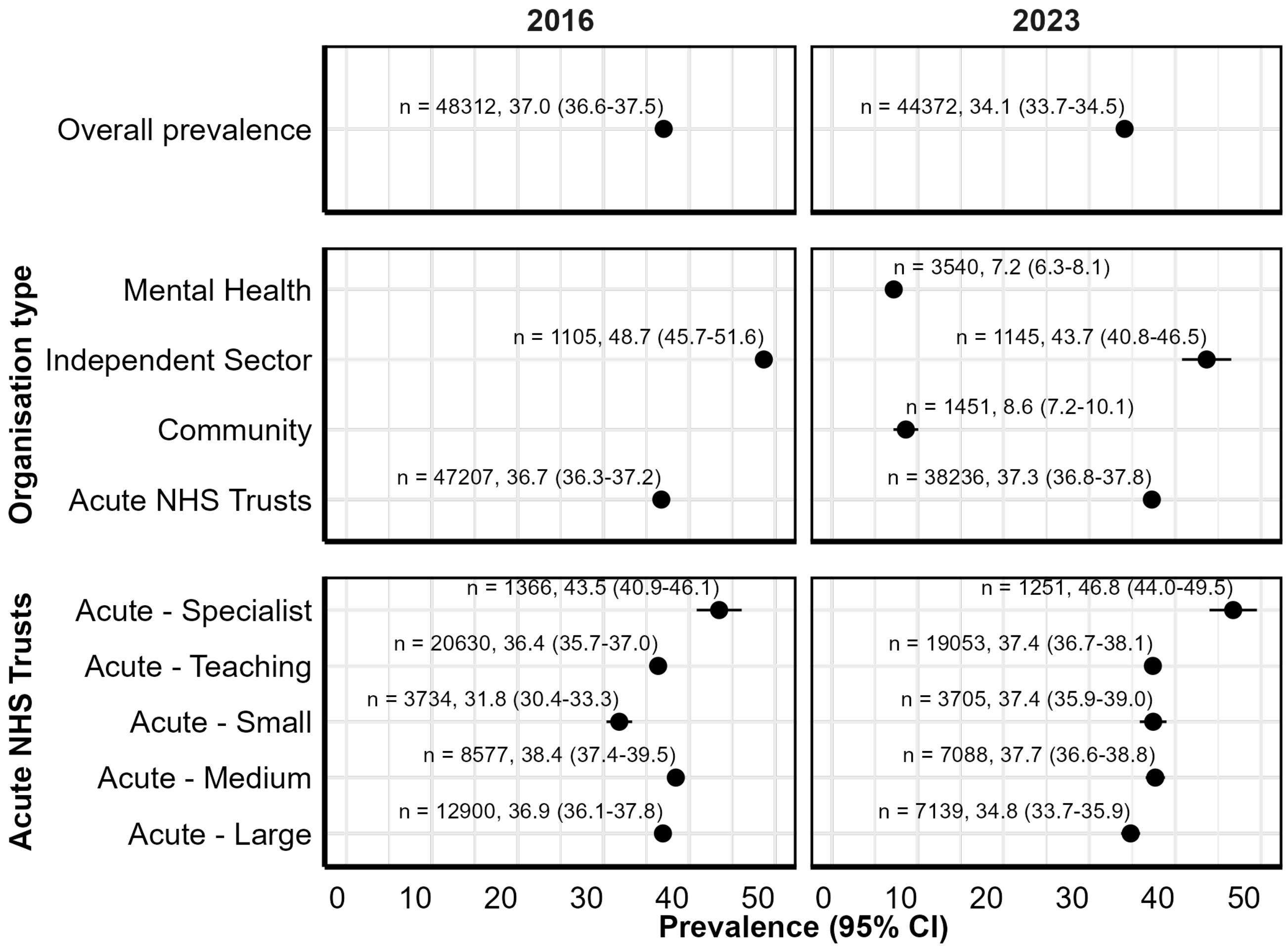
3.3 Overview of antimicrobial use and stewardship

3.3.1 Prevalence of AMU

The PPS captured 15,134 patients on antimicrobials at the time of the survey. This corresponds to an overall AMU point prevalence of 34.1% (95% CI: 33.7 to 34.5) in 2023 compared to a higher prevalence of 37.0% (95% CI: 36.6 to 37.5) in the PPS 2016 (Figure 3.3.1.1). However, the inclusion of community and mental health trusts in 2023 has changed the population under study. The AMU prevalence in acute NHS trusts was similar in both the PPS periods (2016 36.7%, 95% CI: 36.3 to 37.2 versus 2023 37.3%, 95% CI: 36.8 to 37.8).

In 2023, the highest AMU prevalence was reported by NHS acute specialist trusts (46.8%, 95% CI: 44.0 to 49.5) and independent sector organisations (43.7%, 95% CI: 40.8 to 46.5). Mental health and community trusts had the lowest AMU prevalences when compared to other organisation types with 7.2% (95% CI: 6.3 to 8.1) and 8.6% (95% CI: 7.2 to 10.1) respectively.

Figure 3.3.1.5 Prevalence of antimicrobial use by organisation type, PPS England 2016 and 2023



*Labels above indicate the number of patients, prevalence of AMU and 95% confidence intervals

The table below (Table 3.3.1.1) provides demographic and risk factor breakdown for patients receiving at least one antimicrobial in the PPS 2023. Higher AMU in males was reported compared to females (36.4% versus. 32.4%). Paediatric patients aged 1 to 9 years had the highest AMU prevalence (52.3%), while AMU in those under one month was low, likely due to the inclusion of healthy babies in the data set. Indwelling devices, such as central vascular catheters and tracheostomies, were associated with significantly higher AMU, as were those patients with prolonged hospital stays (Table 3.3.1.1).

Table 3.3.1.11. Demographics and risk factors for patients receiving at least one antimicrobial, PPS England 2023

Demographic and risk factors	Number of patients	Number of patients receiving at least one antimicrobial	Percentage of patients receiving at least one antimicrobial	AMU prevalence (95% CI)
Overall	**44,372**	**15,134**	**100.0**	**34.1 (33.7 to 34.5)**
Patient demographics				
Sex				
Female	22,852	7,403	48.9	32.4 (31.8 to 33.0)
Male	21,139	7,689	50.8	36.4 (35.7 to 37.0)
Unknown	370	42	0.3	11.3 (8.1 to 14.6)
Missing	11	0	0.0	-
Age groups				
Under 1 month	1,231	235	1.6	19.1 (16.9 to 21.3)
1 to 11 months	612	193	1.3	31.5 (27.9 to 35.2)
1 to 9	732	383	2.5	52.3 (48.7 to 55.9)
10 to 15	451	187	1.2	41.5 (36.9 to 46.0)
16 to 18	344	98	0.6	28.5 (23.7 to 33.3)
19 to 29	2,079	623	4.1	30.0 (28.0 to 31.9)
30 to 49	5,175	1,679	11.1	32.4 (31.2 to 33.7)
50 to 64	7,000	2,637	17.4	37.7 (36.5 to 38.8)
65 to 79	12,703	4,663	30.8	36.7 (35.9 to 37.5)
80 and over	14,045	4,436	29.3	31.6 (30.8 to 32.4)
Ethnicity				
White	32,173	11,128	73.5	34.6 (34.1 to 35.1)
Asian or Asian British	2,351	820	5.4	34.9 (33.0 to 36.8)
Black, African, Caribbean or Black British	1,594	545	3.6	34.2 (31.9 to 36.5)
Mixed or multiple ethnic groups	506	136	0.9	26.9 (23.0 to 30.7)
Other ethnic group	3,171	1,124	7.4	35.5 (33.8 to 37.1)
Unknown	1,717	647	4.3	37.7 (35.4 to 40.0)

Demographic and risk factors	Number of patients	Number of patients receiving at least one antimicrobial	Percentage of patients receiving at least one antimicrobial	AMU prevalence (95% CI)
Missing	2,860	734	4.9	25.7 (24.1 to 27.3)
Index of Multiple Deprivation (2019) quintile				
1 (most deprived)	5,676	1,995	13.2	35.1 (33.9 to 36.4)
2	6,067	2,090	13.8	34.5 (33.2 to 35.6)
3	5,886	2,046	13.5	34.8 (33.5 to 36.0)
4	5,719	2,027	13.4	35.4 (34.2 to 36.7)
5 (least deprived)	5,382	1,847	12.2	34.3 (33.0 to 35.6)
Missing	15,642	5,129	33.9	32.8 (32.0 to 33.5)
Indwelling devices or procedures				
Central vascular catheter				
Yes	3,103	1,869	12.3	60.2 (58.5 to 62.0)
No	40,898	13,139	86.8	32.1 (31.7 to 32.6)
Unknown	369	126	0.8	34.1 (29.3 to 39.0)
Missing	2	0	0.0	-
Peripheral vascular catheter				
Yes	18,476	9,690	64.0	52.5 (51.7 to 53.2)
No	24,625	5,004	33.1	20.3 (19.8 to 20.8)
Unknown	1,269	440	2.9	34.7 (32.0 to 37.3)
Missing	2	0	0.0	-
Urinary catheter				
Yes	8,516	3,802	25.1	44.6 (43.6 to 45.7)
No	35,498	11,216	74.1	31.6 (31.1 to 32.1)
Unknown	356	116	0.8	32.6 (27.7 to 37.5)
Missing	2	0	0	-
Endotracheal tube or tracheostomy				
Yes	687	445	2.9	64.8 (61.2 to 68.3)
No	43,367	14,594	96.4	33.6 (33.2 to 34.1)
Unknown	316	95	0.6	30.1 (25.0 to 35.1)
Missing	2	0	0	-

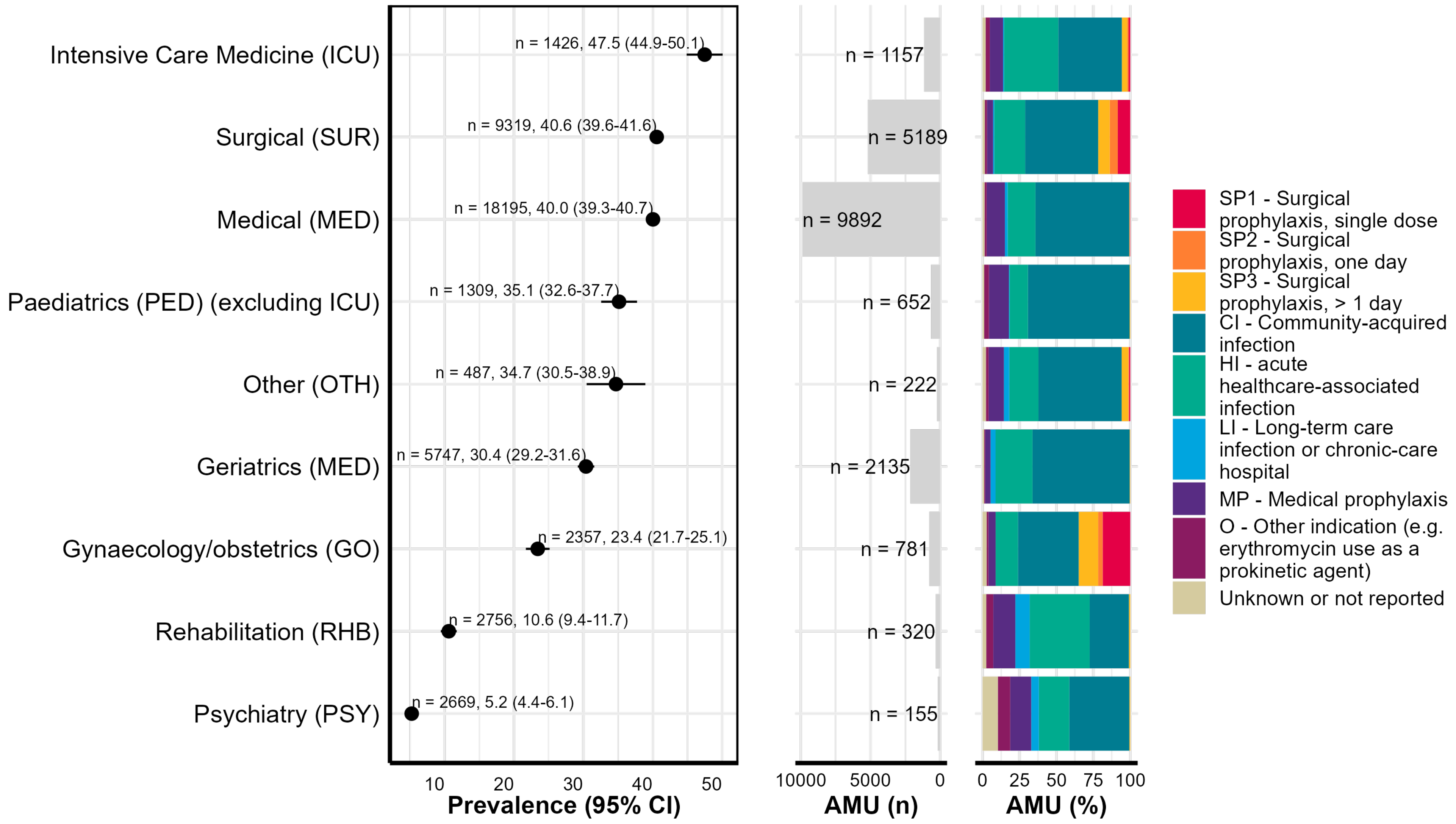
Demographic and risk factors	Number of patients	Number of patients receiving at least one antimicrobial	Percentage of patients receiving at least one antimicrobial	AMU prevalence (95% CI)
Risk factors				
Length of stay				
1 to 3 days	10,409	3,993	26.4	38.4 (37.4 to 39.3)
4 to 7 days	9,846	4,340	28.7	44.1 (43.1 to 45.1)
8 to 14 days	8,588	3,008	19.9	35.0 (34.0 to 36.0)
More than 14 days	14,897	3,701	24.5	24.8 (24.1 to 25.5)
Missing	632	92	0.6	14.6 (11.8 to 17.3)
Surgery				
Yes (NHSN)	6,531	2,603	17.2	39.9 (38.7 to 41.0)
Yes (Non to NHSN)	1,321	634	4.2	48.0 (45.3 to 50.7)
No	36,058	11,754	77.7	32.6 (32.1 to 33.1)
Unknown or missing	462	143	0.9	31.0 (26.7 to 35.2)
McCabe score				
Non to fatal disease	28,154	9,339	61.7	33.2 (32.6 to 33.7)
Ultimately fatal disease	8,573	3,213	21.2	37.5 (36.5 to 38.5)
Rapidly fatal disease	1,428	547	3.6	38.3 (35.8 to 40.8)
Unknown	6,215	2,035	13.4	32.7 (31.6 to 33.9)
Missing	2	0	0	-

Prevalence of antimicrobial use by patient specialty

The patient specialty with the highest AMU prevalence was ICU (47.5%, 95% CI: 44.9 to 50.1) followed by surgical (40.6%, 95% CI: 39.6 to 41.6) and medical (40.0%, 95% CI: 39.3 to 40.7) specialties (Figure 3.3.1.2).

In ICU, 43.0% of the antimicrobials were used to treat community-acquired infections and 36.7% were used to treat HCAI. AMU for HCAI was also high in rehabilitation specialties (40.6%). Almost half (49.4%) of the patients on antimicrobials under a surgical specialty were treated for community-acquired infections and 21.0% for HCAI. Surgical prophylaxis was the indication for 22% and 35% of AMU in patients under surgical and gynaecology or obstetrics care, respectively. A more comprehensive breakdown is reported in the report annexe.

Figure 3.3.1.6. Prevalence of antimicrobial use per patient speciality and indication for antimicrobial use, PPS England 2023



*Labels above indicate the number of patients, prevalence of AMU and 95% confidence intervals

3.3.2 Indication for antimicrobial use

The PPS captured 15,134 patients receiving a total of 20,543 antimicrobial courses. More than half (57.5%) of the courses were intended to treat community-acquired infections, 21.1% to treat hospital-associated infections and 1.7% were given to patients to treat infections acquired in long-term care facilities (Table 3.3.2.1).

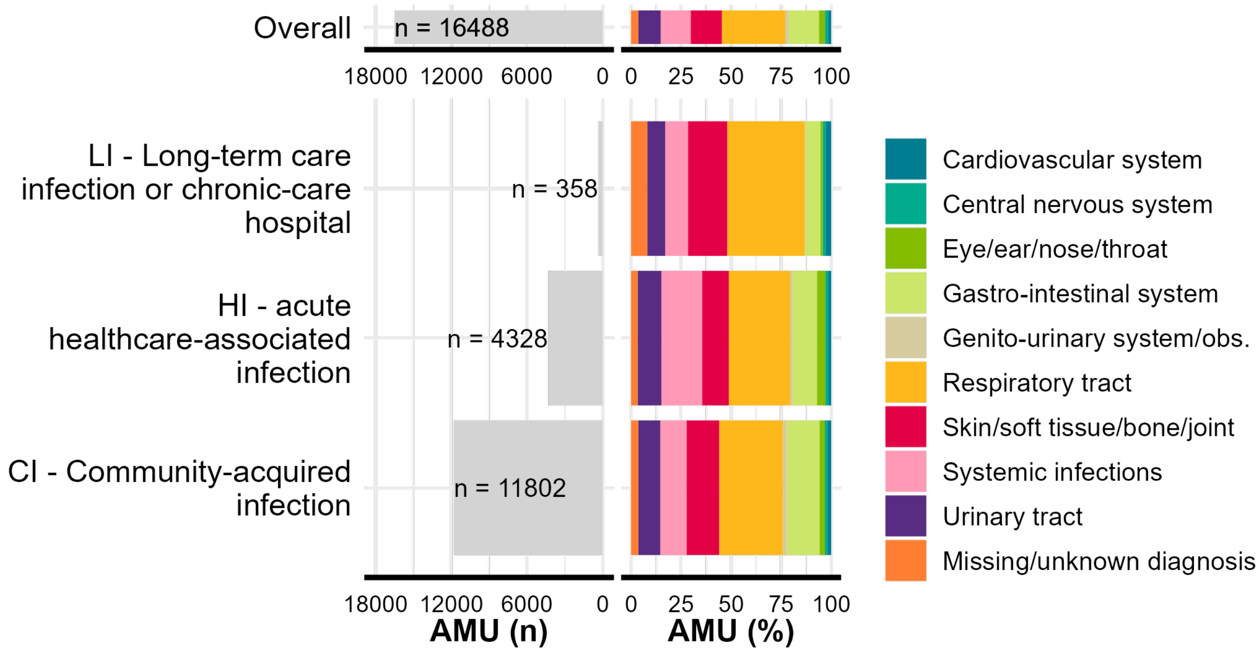
Out of the 1,116 patients on surgical prophylaxis, almost 40% were receiving prophylaxis for more than one day.

Table 3.3.2.12. Indication for antimicrobial use, PPS England 2023

Indication	Number of patients with AMU	Prevalence (95% CI)	Number of AM courses	Percent of total number of AM courses (%)
Total	**15,134**	**34.1 (33.7 to 34.5)**	**20,543**	**100.0**
Surgical prophylaxis	**1,166**	**2.6 (2.5 to 2.8)**	**1,576**	**7.7**
Single dose	460	1.0 (0.9 to 1.1)	631	3.1
One day	312	0.7 (0.6 to 0.8)	333	1.6
More than 1 day	466	1.0 (1.0 to 1.1)	612	3.0
Treatment of infections	**12,660**	**28.5 (28.1 to 29.0)**	**16,488**	**80.3**
Community-acquired infection	9,121	20.6 (20.2 to 20.9)	11,802	57.5
Acute hospital-acquired infection	3,377	7.6 (7.4 to 7.9)	4,328	21.1
Long-term care infection or chronic-care hospital	291	0.7 (0.6 to 0.7)	358	1.7
Medical prophylaxis	**1,373**	**3.1 (2.9 to 3.3)**	**1,842**	**9.0**
Other indication	267	0.6 (0.5 to 0.7)	323	1.6
Missing	262	0.6 (0.5 to 0.7)	314	1.5

Respiratory tract infections accounted for roughly a third of AMU across all settings (31.8% in community-acquired infections, 30.8% in acute HCAI and 38.8% in long-term care infections) (Figure 3.3.2.1).

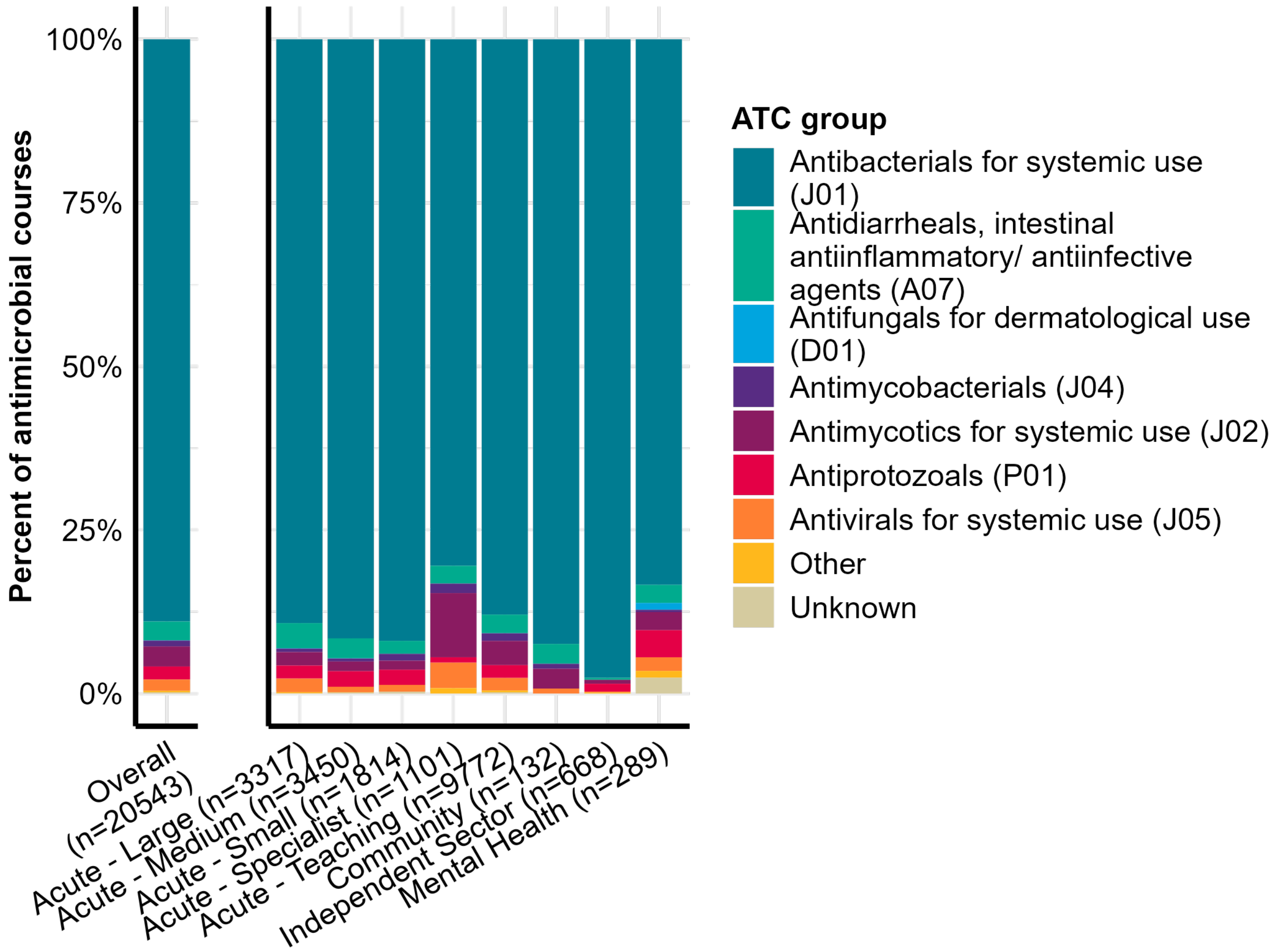
Figure 3.3.2.7 . Site of diagnosis for antimicrobial treatment of infections (AM courses) PPS England 2023



3.3.3 Antimicrobials used

Based on the WHO's ATC classification, 89% of AMU in the PPS 2023 were antibacterials for systemic use, followed by antimycotics for systemic use (Figure 3.3.3.8).

Figure 3.3.3.9 ATC groups by organisation type, PPS England 2023



Among the antibacterials for systemic use, penicillins were the most commonly used (45.5%). Beta-lactamase inhibitor combinations accounted for 29.7% of penicillin use. Figure 3.3.3.2 shows antibacterial courses by organisation type. Carbapenem use in specialist hospitals was particularly high (9.6% of antibacterial use) compared to the overall use across all types of organisations (4.6%). Independent sector organisations reported a high percentage (26.7%) of first- and second-generation cephalosporin use and nitrofurantoin accounted for 17.0% of antibacterial use in mental health trusts.

Table 3.3.3.1 shows that 'Watch' category antibacterials comprised 31.4% of all antibiotic courses, with amoxicillin/clavulanic acid and piperacillin/tazobactam being the most frequently used. The 'Reserve' antibiotic meropenem accounted for 3.8% of courses. Additionally, the majority of these last-resort antibacterials were administered parenterally, emphasising the importance of antimicrobial stewardship.

Figure 3.3.3.10 Antibacterials by organisation type, PPS England 2023

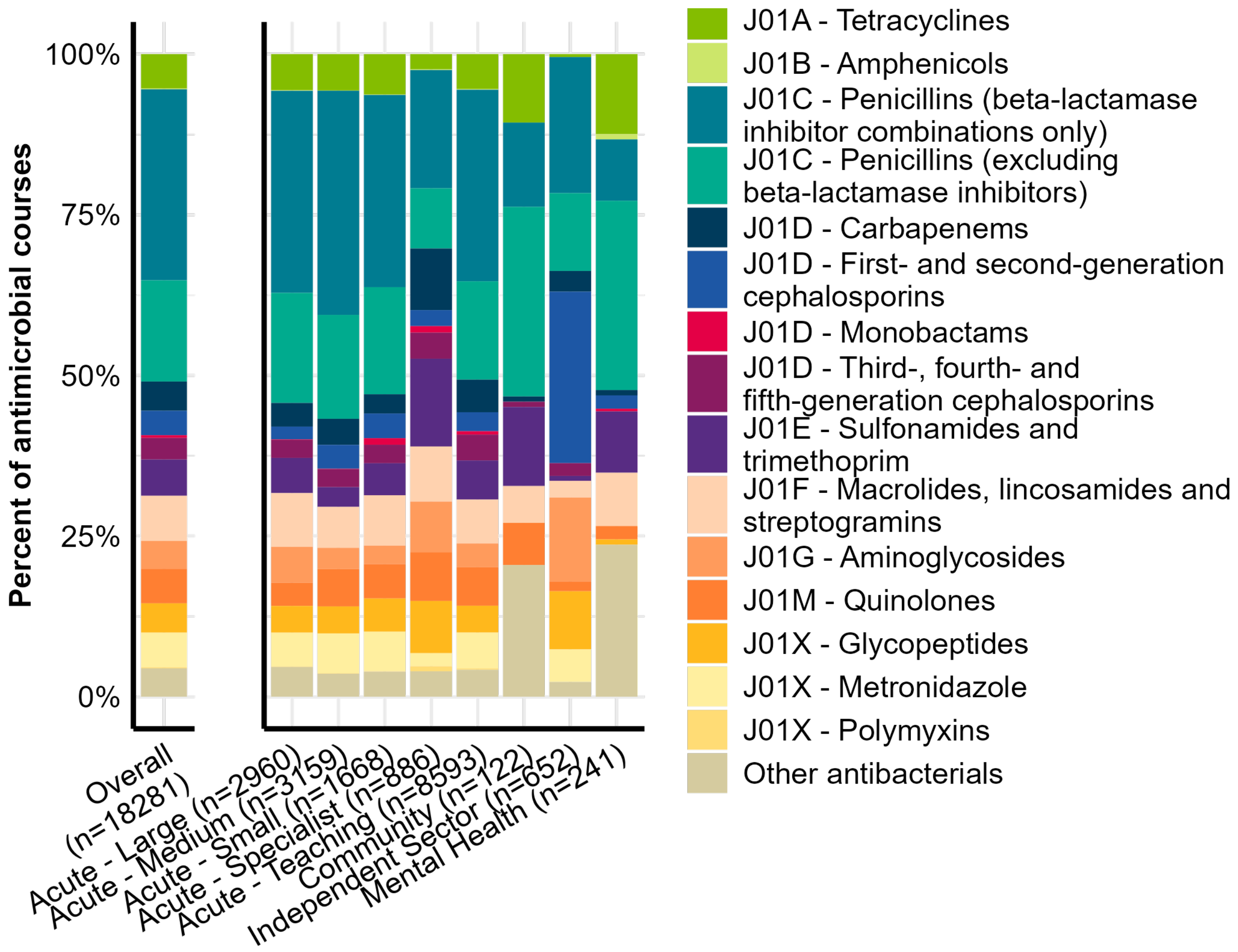


Table 3.3.3.13. Top 10 antimicrobials used, PPS England 2023

Antimicrobial	AWaRe	Count	Percentage of antimicrobial courses (%)	Percentage of patients on antimicrobials (%)	Percentage of total number of patients (%)	Route of administration n (% of AM courses)		
						Parenteral	Oral	Other
Total number of patients	-	44,372	-	-	-	-	-	-
Total number of patients on antimicrobials	-	15,134	-	-	-	-	-	-
Total number of antimicrobial courses	-	20,543	-	-	-	11,887 (57.9)	8,548 (41.6)	108 (0.5)
Amoxicillin and enzyme inhibitor	Watch	3,380	16.5	22.3	7.6	1,972 (58.3)	1,407 (41.6)	5 (0.1)
Piperacillin and enzyme inhibitor	Watch	1,814	8.8	12.0	4.1	1,799 (99.2)	11 (0.6)	4 (0.2)
Amoxicillin	Access	1,070	5.2	7.1	2.4	517 (48.3)	551 (51.5)	2 (0.2)
Flucloxacillin	Access	1,061	5.2	7.0	2.4	706 (66.5)	356 (33.6)	1 (0.1)
Metronidazole (parenteral)	Access	986	4.8	6.5	2.2	967 (98.1)	16 (1.6)	3 (0.3)
Doxycycline	Access	882	4.3	5.8	2.0	26 (2.9)	855 (96.9)	1 (0.1)
Meropenem	Reserve	782	3.8	5.2	1.8	778 (99.5)	3 (0.4)	2 (0.3)
Clarithromycin	Watch	664	3.2	4.4	1.5	137 (20.6)	528 (79.5)	0 (0.0)
Gentamicin	Access	659	3.2	4.4	1.5	653 (99.1)	3 (0.5)	4 (0.6)
Ciprofloxacin	Watch	648	3.2	4.3	1.5	186 (28.7)	462 (71.3)	0 (0.0)

3.3.4 Antimicrobial stewardship

A new module on the appropriateness of AMU, based on the Australian National Antimicrobial Prescribing Survey (NAPS) (1) was included in the PPS 2023.

The reason for initiating antimicrobial treatment had been documented for more than 92% of all antimicrobial courses reported by participating hospitals.

More than a third of courses had been started less than 72 hours before the time of survey so did not qualify for a review. For those courses that had been started 72 hours or more before the time of the survey, 80% had been reviewed.

When using the UK's adapted AWaRe categories (13) to classify antibiotic use, 31.3% of all antibiotics used were from the 'Access' category, 49.0% from the 'Watch' category, and 6.0% from the 'Reserve' category.

Questions on the quality of local antimicrobial prescribing showed that 68% of AMU was compliant with national or local guidelines and 86% fulfilled the criteria for optimal or adequate prescribing.

Figure 3.3.4.11 Assessment of quality of prescribing, PPS England 2023

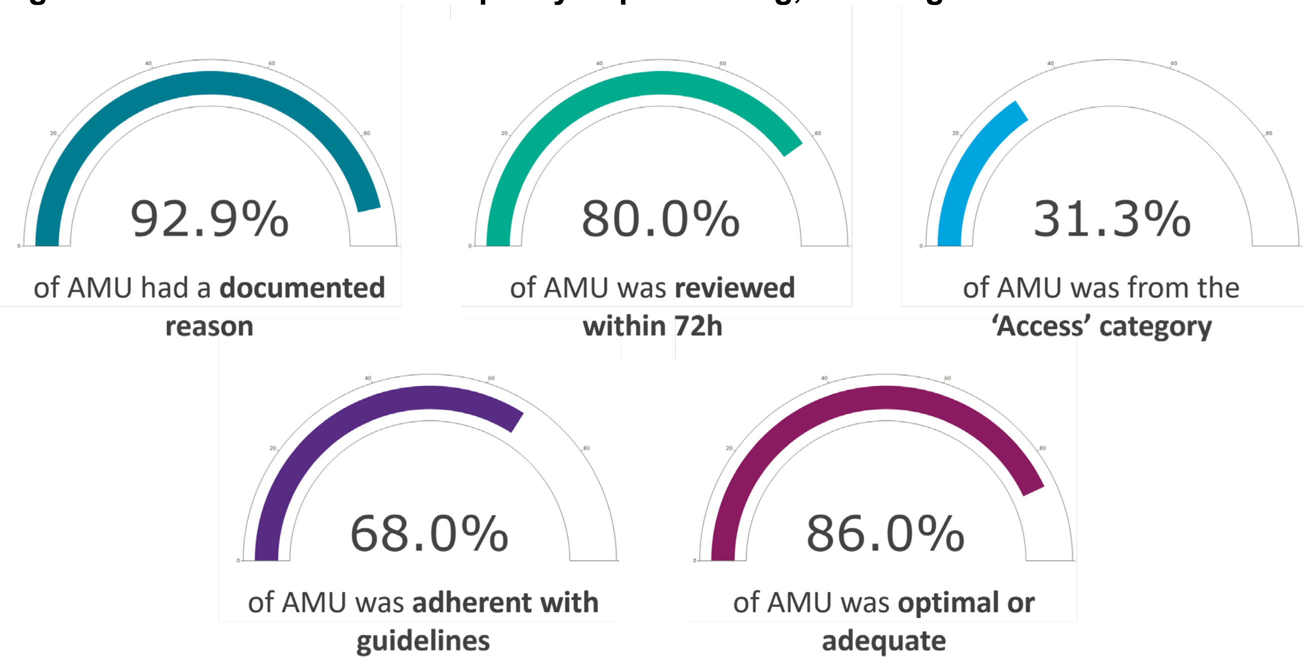


Figure 3.3.4.2b provides an overview of prescription review practices in the different organisations. In large acute trusts, when excluding the 'not applicable' cases, the review rate rises to approximately 80%.

Figure 3.3.4.12 Documentation of the reason for antimicrobial use in patients notes (A) and review of antimicrobial use within 72 hours (B) by organisation type, PPS England 2023

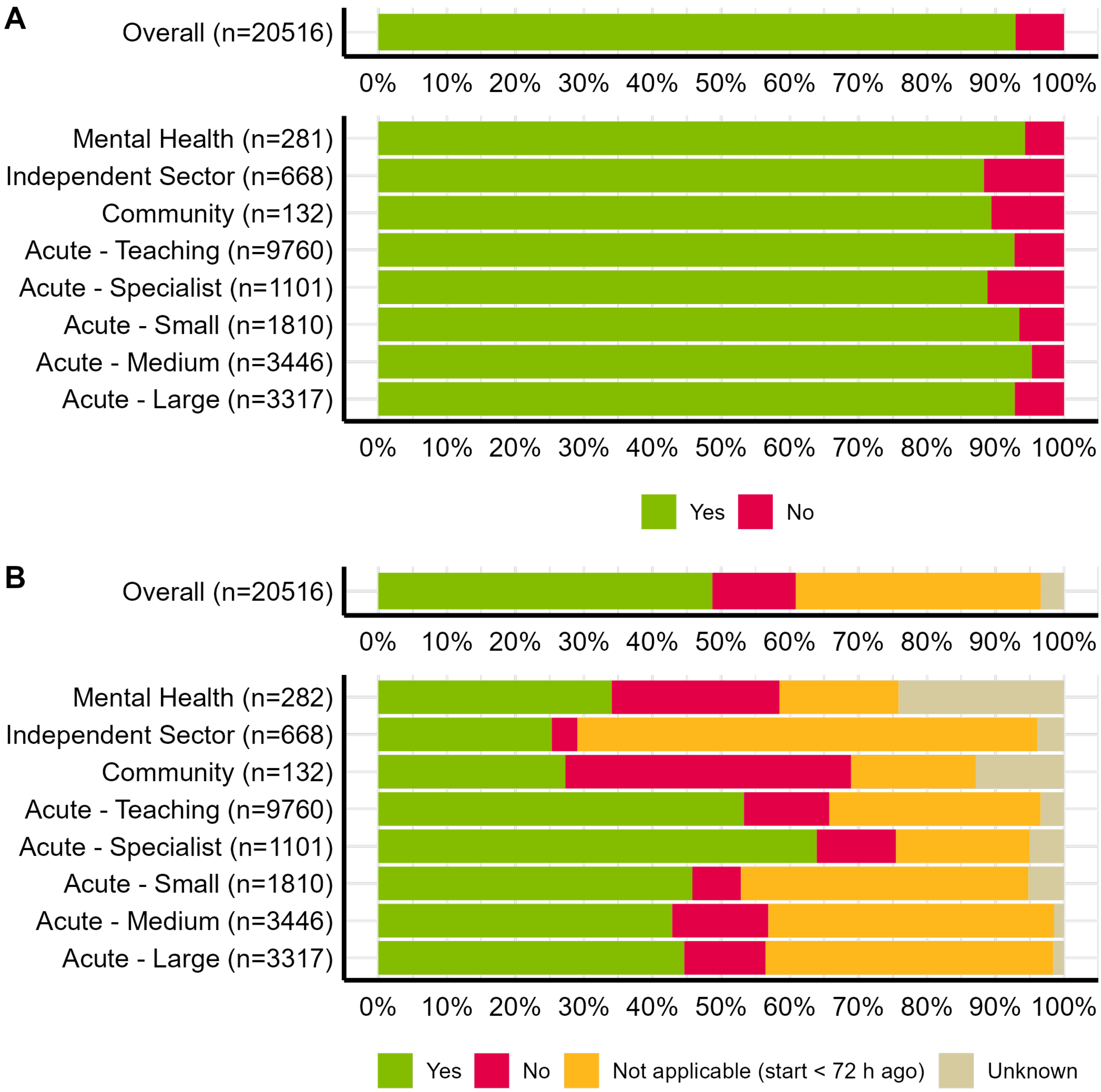


Figure 3.3.4.3 illustrates the distribution of AWaRe categories across different resource categories, with 'Reserve' resources accounting for 4.4%. Figure 3.3.4.4a highlights that 15.7% of prescriptions were non-compliant with guidelines. Figure 3.3.4.4b shows that while 66.4% of prescriptions were optimal, 7.3% were classified as 'inadequate'.

Figure 3.3.4.13 AWaRe category of antimicrobial use by organisation type, PPS England 2023

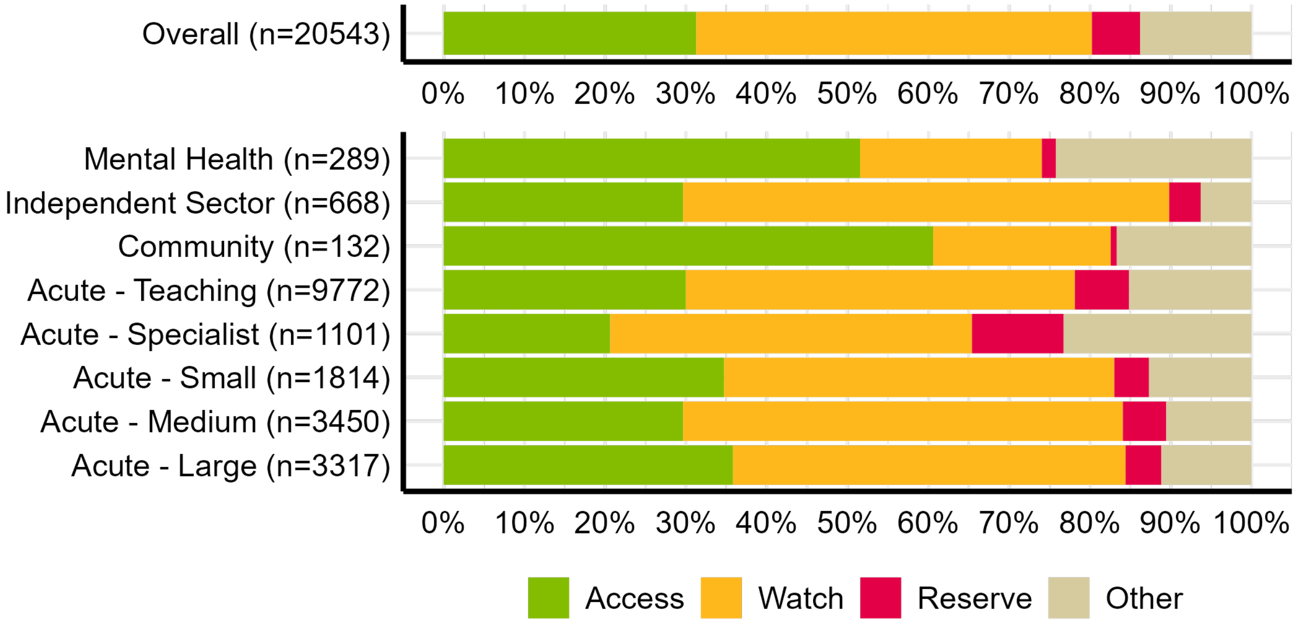
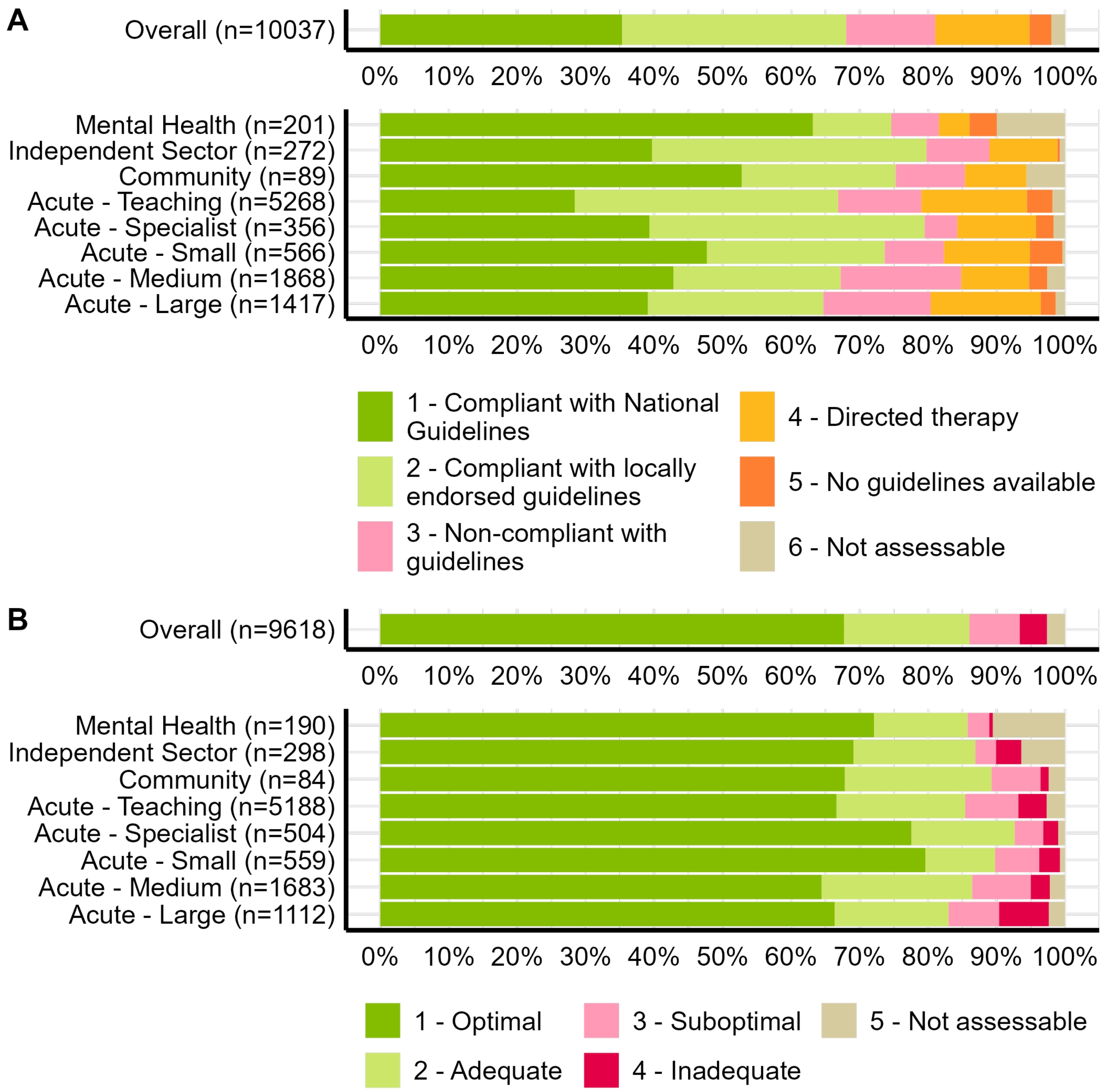


Figure 3.3.4.14 Compliance with guidance (A) and appropriateness (B) of antimicrobial use, PPS England 2023



3.4 Sensitivity, specificity and estimated prevalence of HCAI and AMU

3.4.1 Description of the validation data

In the validation data set, there were 348 records, collected in 17 wards from 10 hospital sites. Upon deduplication, 24 records were excluded. Of the remaining 324 records, 295 (97.8%) were linked to the extended data set of PPS 2023 using NHS number and survey date, 19 (5.9%) were linked using hospital number and survey date, 3 (0.9%) were linked using NHS number only and 7 (2.2%) were not linked to the main data set.

Of the 317 linked records, 303 (95.6%) had the same response for the presence of HCAI and 310 (97.8%) had the same response for the presence of AMU (Table 3.4.1.1).

Table 3.4.1.14. Confusion matrices for HCAI and AMU, PPS England 2023, validation and extended data

Healthcare-associated infections					
		Validation results			
		HCAI+	HCAI-	Missing	Total
PPS 2023 results	HCAI+	18	3	0	21
	HCAI-	4	285	4	293
	Missing	2	1	0	3
	Total	24	289	4	317
Antimicrobial use					
		Validation results			
		AMU+	AMU-	Missing	Total
PPS 2023 results	AMU+	97	1	0	98
	AMU-	4	213	0	217
	Missing	2	0	0	2
	Total	103	214	0	317

3.4.2 Sensitivity, specificity and estimated prevalence

The sensitivity and specificity of HCAI recording were 81.8 (95% CI: 59.7 to 94.8) and 99.0 (95% CI: 97.0 to 99.8) respectively and for AMU recording, were 96.0 (95% CI: 90.2 to 98.9) and 99.5 (95% CI: 97.4 to 100.0) respectively (Table 3.4.2.1).

While the observed HCAI prevalence was 7.6 (95% CI: 7.3 to 7.8), when adjusting for sensitivity and specificity, the estimated prevalence of HCAI in England is 8.1 (95% CI: 7.8 to

8.4). The observed prevalence for AMU was 34.1 (95% CI: 33.7 to 34.5) while the estimated prevalence is 35.2 (95% CI: 34.7 to35.7).

Table 3.4.2.15. Sensitivity, specificity and estimated prevalence of HCAI and AMU, PPS England 2023, validation and extended data

	HCAI	AMU
Sensitivity (95% CI)	81.8 (59.7 to 94.8)	96.0 (90.2 to 98.9)
Specificity (95% CI)	99.0 (97.0 to 99.8)	99.5 (97.4 to 100.0)
Observed prevalence (95% CI)	7.6 (7.3 to 7.8)	34.1 (33.7 to 34.5)
Estimated prevalence (95% CI)	8.1 (7.8 to 8.4)	35.2 (34.7 to 35.7)

3.5 Structure and process indicators

3.5.1 Monitoring and audit of IPC practices and feedback

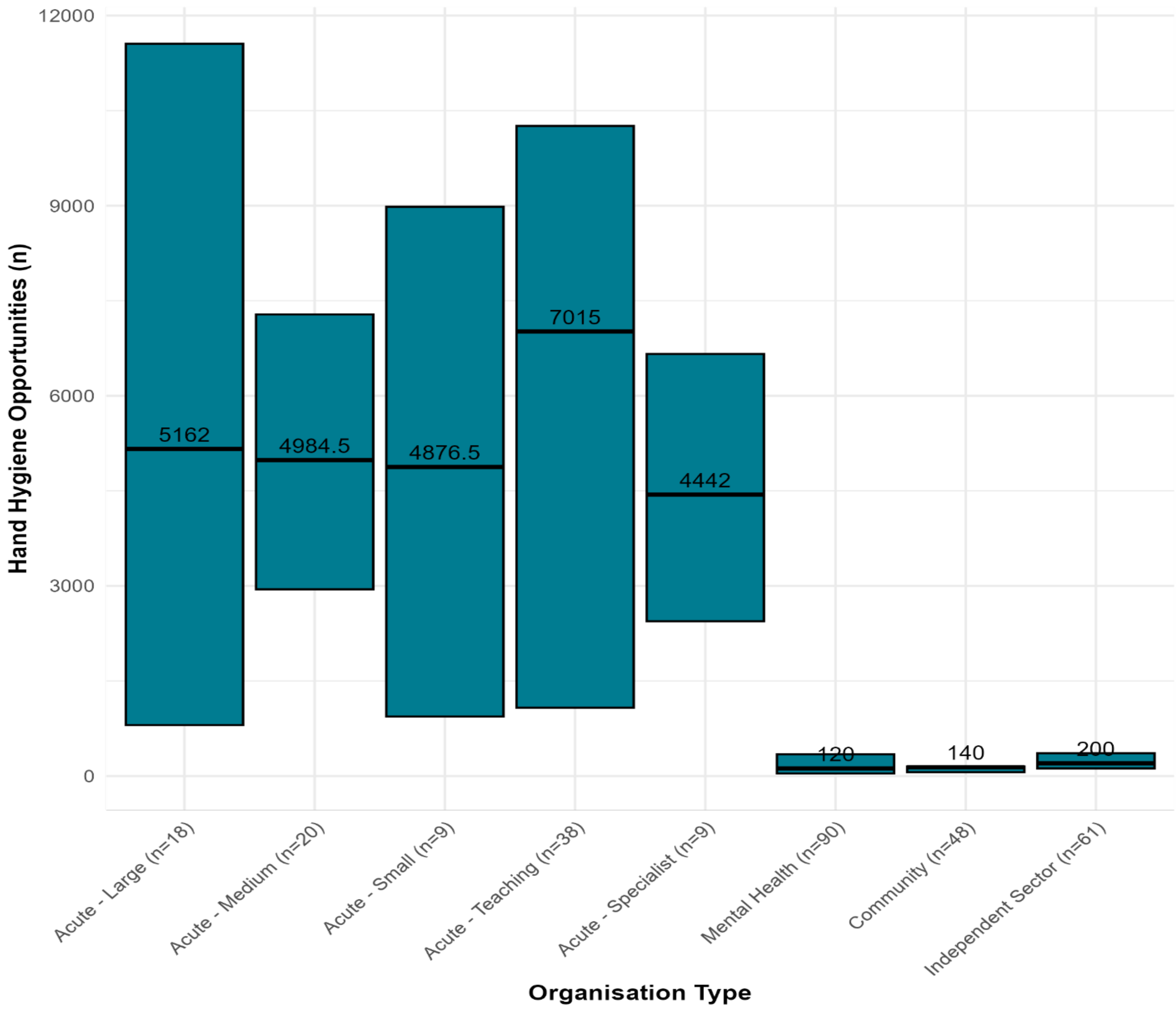
Table 3.5.1.1 shows the hospital alcohol-based hand rub (AHR) consumption (litres per 1,000 patient-days) by organisation type. Acute teaching hospitals had the highest median AHR consumption at 34.5 litres within acute trusts, with the 25th and 75th percentiles at 30.3 and 47.9 litres, respectively. Mental health hospitals showed a significantly higher median of 60.0 litres, with wide variability indicated by a 75th percentile of 249.5 litres. Other hospital types showed lower median values with varying levels of consumption. However, the data quality may be uncertain, potentially affecting the reliability of these findings and warranting further validation. Further work is needed to understand the consumption of AHR in mental health hospitals, as well as differences observed with the Independent Sector.

Table 3.5.1.16 Hospital alcohol-based handrub consumption (litres per 1,000 patient-days), by organisation type, PPS England 2023

Trust type	% of hospitals replying	Median	P25	P75
Acute - large	50.0	19.0	16.9	27.2
Acute - medium	85.0	15.0	5.5	19.4
Acute - small	55.6	10.7	10.6	18.0
Acute - specialist	63.2	19.7	4.8	38.7
Acute - teaching	77.8	34.5	30.3	47.9
Community	24.4	3.9	1.2	51.3
Independent sector	35.4	7.4	6.3	9.0
Mental health	41.0	60.0	36.8	249.5

Figure 3.5.1.1 shows the number of hand hygiene opportunities observed in the previous year by organisation type. Acute teaching hospitals observed the highest median number of hand hygiene opportunities (7,015), with the 25th and 75th percentiles at 1,078 and 10,258, respectively. Mental health and community hospitals observed the lowest median numbers, with 120 and 140 opportunities, respectively.

Figure 3.5.1.15 Observed hand hygiene opportunities by organisation type, PPS England 2023



3.5.2 Microbiology laboratory support

Table 3.5.2.1 indicates the availability of microbiology laboratory support across different types of organisations. Microbiology laboratory support is generally well maintained across most organisation types on weekends. Acute specialist trusts reported markedly lower availability (66.7% for both clinical and screening tests). However, this is most likely due to incomplete data being provided and should be interpreted with caution.

Mental health and independent sector organisations also reported reduced laboratory support being available on weekends, ranging from 75.0% to 90.6% depending on the test type.

Table 3.5.2.17 Availability of microbiology laboratory support per organisation type, PPS England 2023

Trust type	Hospitals replying % %	Clinical tests available (%)		Screening test available (%)	
		Saturday	Sunday	Saturday	Sunday
Acute - large	61	90.9	90.9	90.9	90.9
Acute - medium	60	100.0	100.0	100.0	100.0
Acute - small	67	100.0	83.3	100.0	66.7
Acute - teaching	39	100.0	100.0	100.0	92.9
Acute - specialist	67	66.7	66.7	66.7	66.7
Mental health	49	77.3	77.3	77.3	75.0
Community	29	92.9	92.9	92.9	92.9
Independent sector	50	90.6	80.0	86.7	75.9

3.5.3 Surveillance of HCAIs

Table 3.5.3.1 shows the degree of automation in the surveillance of HCAIs across organisation types. Acute general trusts reported a high percentage of manual processes for surgical site infections (69%) and hospital-onset bloodstream infections (45.2%). In contrast, acute specialist trusts had higher levels of semi-automated processes for these infections.

Table 3.5.3.18 Current degree of automation of surveillance of HCAIs¸ PPS England 2023

	% of hospitals replying	0 = Fully manual	1 = Automated denominator	2 = Semi-automated	3 = Fully automated	4 = Other	9 = Not performed	Unknown
Acute: General								
Surgical site infection	49%	69	4.8	14.3	0	2.4	0	9.5
Hospital-onset BSI	49%	45.2	9.5	26.2	4.8	4.8	0	9.5
Central line-associated BSI	49%	47.6	9.5	16.7	0	2.4	11.9	11.9
Catheter-associated UTI	49%	47.6	0	11.9	0	0	21.4	19
Hospital-acquired pneumonia	49%	38.1	7.1	11.9	0	0	23.8	19
Ventilator-associated pneumonia	49%	45.2	9.5	11.9	0	2.4	19	11.9
Clostridioides difficile infection	49%	47.6	9.5	21.4	7.1	4.8	0	9.5
Acute: Specialist								
Surgical site infection	67%	33.3	16.7	50	0	0	N/A	N/A
Hospital-onset BSI	67%	33.3	16.7	33.3	16.7	0	N/A	N/A
Central line-associated BSI	67%	33.3	16.7	50	0	0	N/A	N/A
Catheter-associated UTI	67%	50	0	50	0	0	N/A	N/A
Hospital-acquired pneumonia	67%	33.3	0	50	0	16.7	N/A	N/A
Ventilator-associated pneumonia	67%	33.3	0	33.3	0	33.3	N/A	N/A
Clostridioides difficile infection	67%	33.3	0	33.3	33.3	0	N/A	N/A
Mental health								
Surgical site infection	50%	24.4	0	0	11.1	62.2	2.2	N/A
Hospital-onset BSI	50%	33.3	20	24.4	15.6	4.4	2.2	N/A
Central line-associated BSI	50%	0	0	4.4	11.1	80	4.4	N/A
Catheter-associated UTI	50%	42.2	0	24.4	13.3	17.8	2.2	N/A
Hospital-acquired pneumonia	50%	33.3	0	24.4	11.1	28.9	2.2	N/A
Ventilator-associated pneumonia	50%	0	0	0	0	95.6	4.4	N/A
Clostridioides difficile infection	50%	33.3	20	24.4	13.3	6.7	2.2	N/A
Community								

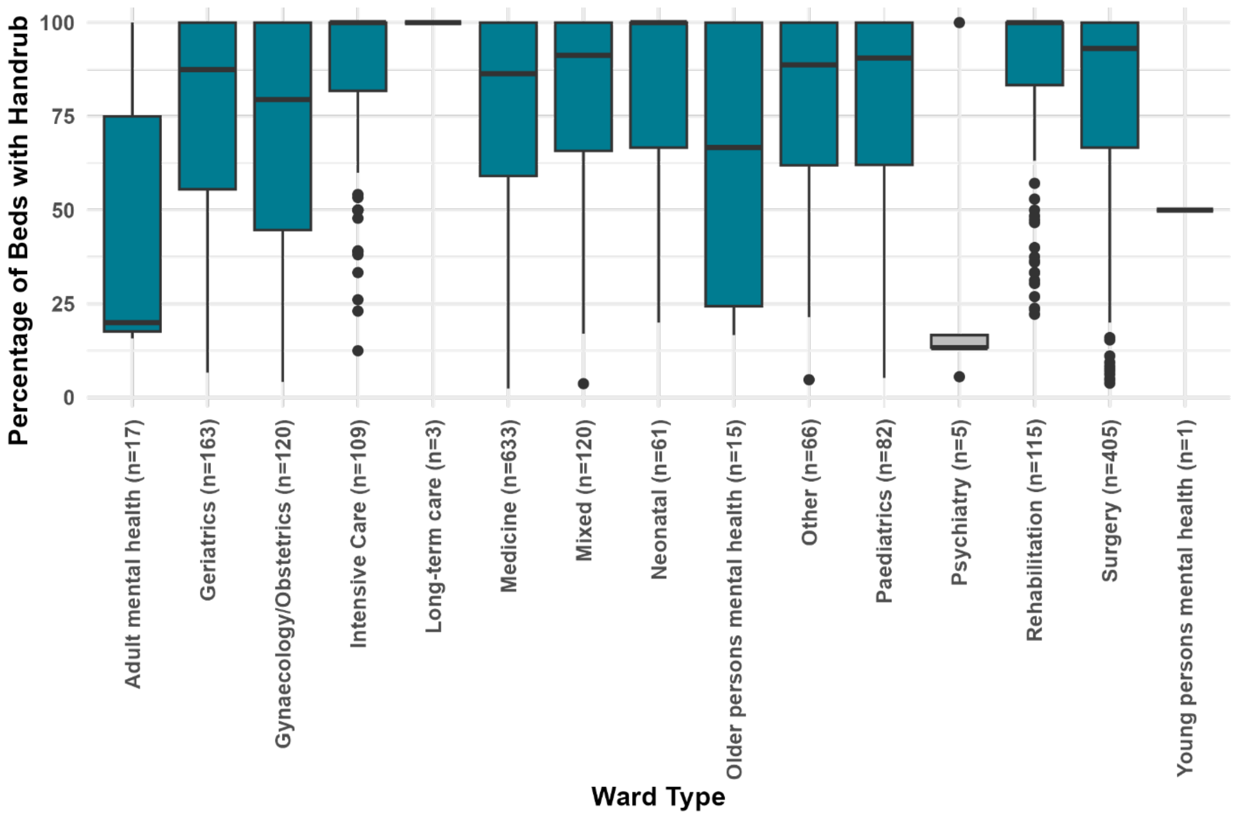
Surgical site infection	29%	7.1	0	0	0	92.9	N/A	N/A
Hospital-onset BSI	29%	14.3	0	0	7.1	78.6	N/A	N/A
Central line-associated BSI	29%	7.1	0	0	7.1	85.7	N/A	N/A
Catheter-associated UTI	29%	7.1	0	7.1	0	85.7	N/A	N/A
Hospital-acquired pneumonia	29%	7.1	7.1	0	0	85.7	N/A	N/A
Ventilator-associated pneumonia	27%	0	0	0	0	100	N/A	N/A
Clostridioides difficile infection	29%	21.4	0	0	7.1	71.4	N/A	N/A
Independent sector								
Surgical site infection	56%	85.3	2.9	5.9	0	5.9	N/A	N/A
Hospital-onset BSI	56%	79.4	2.9	11.8	0	5.9	N/A	N/A
Central line-associated BSI	56%	70.6	2.9	5.9	11.8	8.8	N/A	N/A
Catheter-associated UTI	56%	85.3	2.9	5.9	0	5.9	N/A	N/A
Hospital-acquired pneumonia	56%	82.4	2.9	5.9	0	8.8	N/A	N/A
Ventilator-associated pneumonia	56%	52.9	2.9	5.9	26.5	11.8	N/A	N/A
Clostridioides difficile infection	56%	79.4	2.9	11.8	0	5.9	N/A	N/Av

3.5.4 Built environment, materials and equipment for IPC at the facility level

Alcohol-based handrub dispensers at point-of-care

Figure 3.5.4.1 illustrates the distribution of the percentage of beds with an alcohol-based handrub dispensers (AHR) dispenser at the point-of-care by ward type. After excluding ward types with fewer than 10 observations, the results still show high variability in the range of scores with adult and older persons mental health care wards reporting the lowest median percentages of beds with an AHR

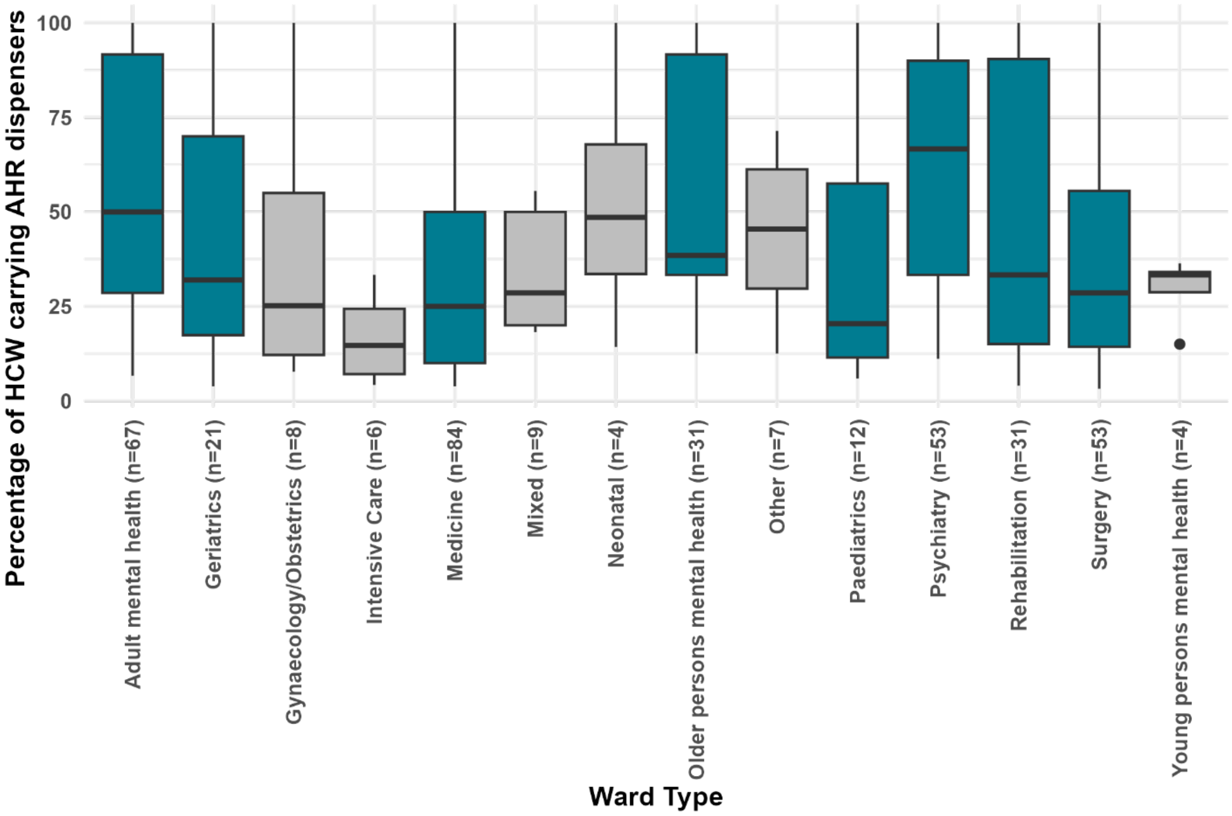
Figure 3.5.4.16 Distribution of the percentage of beds with an AHR dispenser at the point-of-care by type of ward, PPS England 2023 (results reporting less than 10 wards are presented in grey)



Healthcare workers with a personal AHR bottle

Figure 3.5.4.2 shows the distribution of the percentage of healthcare workers (HCWs) with a personal AHR bottle by ward type. The results indicate variability in AHR bottle usage among different ward types. After excluding wards with fewer than 10 instances, the results show significant variability in scores across the remaining ward types with adult mental health and psychiatry wards reporting the highest median scores for their HCWs.

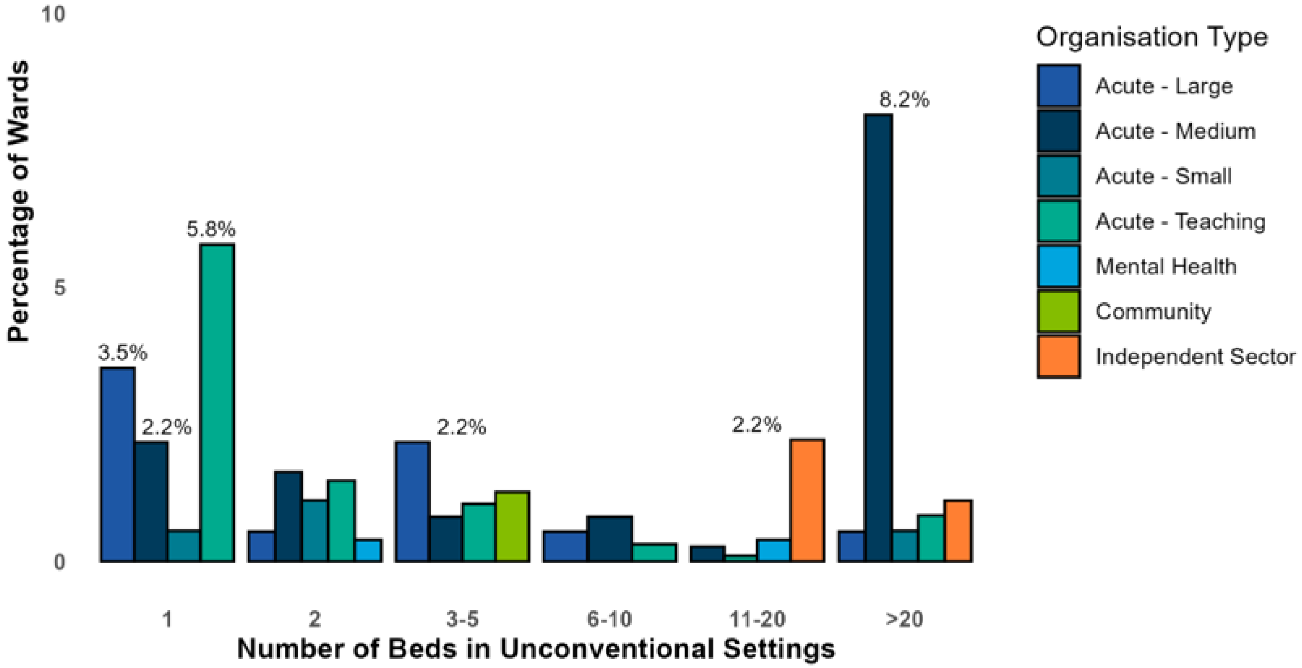
Figure 3.5.4.17 Distribution of the percentage of HCWs with a personal AHR bottle by type of ward, PPS England 2023 (results reporting less than 10 wards are presented in grey)



Beds in unconventional settings

Figure 3.5.4.3 presents the distribution of wards reporting beds in unconventional settings ('corridor beds') by organisation type. This question was added to the data forms and protocol at the request of PPS participants as an indicator of overcrowding and work pressures. Wards from all organisation types reported use of beds in unconventional settings at the time of the survey.

Figure 3.5.4.18 Percentage of wards reporting beds in unconventional settings ('corridor beds') by number of beds and organisation type, PPS England 2023



Discussion

The 2023 PPS is the sixth national survey on HCAI and the third to include AMU. It provides a comprehensive overview of current practices, trends, and areas to focus IPC and AMU interventions in England's NHS and independent-sector healthcare organisations.

HCAI prevalence

In the 2023 PPS, the overall prevalence of HCAI was 7.6% (95% CI: 7.3 to 7.8), an increase from the 6.6% (95% CI: 6.3 to 6.8) in 2016. Acute NHS trusts reported an HCAI prevalence of 8.0% (95% CI: 7.7 to 8.3), up from 6.6% (95% CI: 6.4 to 6.8) in 2016. In acute specialist trusts, the HCAI prevalence was 16.6% (95% CI: 14.6 to 18.7), compared to 10.2% (95% CI: 8.6 to 11.8) in 2016. To account for the fact that each participating organisation in the PPS 2023 and the PPS 2016 dealt with patients of differing complexity, further analyses, including case-mix adjustment, will be conducted to allow for a meaningful comparison between organisations. When comparing differences between the 2023 PPS and the 2016 PPS in more detail, the increasing population and especially number of elderly people over this period must also be accounted for. Data must be age-standardised to allow interpretation of the similarities or differences. This will be presented at a later date.

In addition, the increase in HCAI prevalence could be associated with increased pressure on the healthcare system following the COVID-19 pandemic and more severely unwell patients due to changes in access to healthcare, for example, longer waiting times for GP appointments and elective procedures (2 to 5).

This is the first PPS to include non-acute healthcare institutions. Mental health and community trusts reported lower HCAI prevalence rates than acute trusts: 5.1% (95% CI: 4.4 to 5.8) and 5.0% (95% CI: 3.8 to 6.1), respectively. This is expected as less acutely unwell patients require fewer invasive medical interventions. However, including these trust types in the PPS is an important step in understanding HCAI risks across the healthcare spectrum and will provide data to help target interventions in these settings.

Participating organisations reported 296 HCAI-COVID-19 infections. This is an important finding following the WHO declaration of the end of the public health emergency in 2023, underlining the continued importance of IPC measures and hospital build regarding respiratory infection transmission. A limitation of this analysis is the lack of PPS data for other respiratory viruses, which may influence the interpretation of the findings by underrepresenting the broader context of respiratory infection transmission in healthcare settings.

The PPS highlighted that ICUs remain high-risk environments for HCAIs, with a prevalence of 15.9% (95% CI: 14.0 to 17.8). Within ICUs, pneumonia and lower respiratory tract infections were the most common infection accounting for 36.4% of all HCAIs, followed by sepsis and disseminated infections (22.0%) and bloodstream infections (12.5%). This can be accounted for the most acutely unwell patient group often requiring multiple invasive devices, with prolonged lengths of stay, which are established risk factors for HCAI, and high use of invasive devices and mechanical ventilation.

Pneumonia/LRI and UTIs were the most prevalent HCAIs sites of diagnosis across all healthcare settings-similarly to 2016 – with COVID-19 infections also notable in acute general and independent sector hospitals in the post-pandemic era. A high proportion of HCAIs in mental health trusts were reported as UTIs or skin and soft tissue infections. This raises the importance of targeted IPC measures and tackling contributing factors such as dehydration and reduced mobility or potentially in the management of self-injury (16 to 18). Mental health and community trusts and other allied healthcare providers should be included in system-wide discussions about HCAI and IPC. These discussions should provide shared learning opportunities, such as UTI-reduction strategies in similar settings such as care homes.

Nearly half of healthcare-associated UTIs were linked to catheter use within the preceding 7 days, highlighting the critical need for reducing unnecessary catheterisation and improving catheter care practices.

Among isolated pathogens, 3.7% of Enterobacterales tested were carbapenem-resistant. For *Escherichia coli*, 22.7% demonstrated resistance to third-generation cephalosporins. Additionally, 54.2% of *Enterococcus faecium* isolates tested for glycopeptide resistance were resistant. However, the limited number of isolates and resistance tests reported or present on the day of the survey means these findings need to be interpreted with caution. The respective data entry fields were not mandatory to complete so it is unclear if the lack of data reflects a genuine absence of information or failure to report. Further work will enrich the PPS data with linked data from national laboratory surveillance.

The prevalence of HCAIs did not show strong differences across deprivation quintiles, suggesting that the risk of healthcare-associated infections does not significantly vary based on levels of deprivation.

Prevalence of antimicrobial use and stewardship

The PPS revealed substantial variability in AMU across different trust types. Acute specialist trusts reported the highest AMU prevalence at 46.8% (95% CI: 44.0 to 49.5), a figure that remains comparable to the 43.5% (95% CI: 40.9 to 46.1) recorded in 2016. The very high prevalence – with 1 of every 2 patients on antimicrobials – likely reflects the complexity and severity of conditions treated within these settings, where AMU is often required to treat infections in patients with significant comorbidities or those undergoing complex surgical procedures. Given the current pressure on healthcare delivery and demographic trends with an ageing population, a similar AMU prevalence in 2023 compared to 2016 is encouraging and may reflect the impact of AMS interventions and policy actions that have been implemented as part of national strategies such as Start smart then focus (19).

In comparison with other organisation types, mental health and community trusts reported lower AMU prevalence rates of 7.2% (95% CI: 6.3 to 8.1) and 8.6% (95% CI: 7.2 to 10.1), respectively. These figures align with fewer invasive medical procedures and no surgeries provided in these settings and transfer of patients developing serious infections to acute care settings but potentially also reflect different management practices for the treatment of infections, for example prescription of empirical treatments for longer course durations often with less frequent reviews. The results from the PPS's AMS section seem to mirror this with both trust types having higher proportions of AMU not being reviewed after 72 hours of treatment compared to acute care trusts. This raises the importance of strengthening AMS activities in these healthcare settings.

The higher AMU prevalence reported by independent sector hospitals (43.7%, 95% CI: 40.8 to 46.5), compared to the other organisations, can be explained by with greater proportion of occupied bed days associated with surgical activity in these organisations. However, almost a quarter of AMU for surgical prophylaxis was given for more than one day. Limiting the duration of AMU for prophylaxis is important to avoid unnecessarily altering patients' bacterial flora, which can potentially lead to adverse changes in the microbiome, development of AMR, or *C. difficile infection*. This suggests that AMS activities remain important in the independent sector to ensure that antimicrobials are prescribed for the appropriate treatment duration.

Regarding the indication for AMU of across all trust types, the majority (80.3%) were prescribed with the intention to treat an infection (versus surgical or medical prophylaxis) – 57.5% for community-acquired infections and 21.1% for hospital-associated infections. This is comparable to the results from the PPS 2016 where out of the 81.6% of AMU for the treatment of infections, 58.1% of AMU were for community- and 22.3% for hospital-associated infections.

A total of 7% of all captured antimicrobials were prescribed for surgical prophylaxis. Additionally, medical prophylaxis accounted for 9.0% of antimicrobial use. Almost 58% of antimicrobial courses were administered parenterally.

Of the 20,543 antimicrobial courses captured by the PPS 2023, 99.9% had complete documentation regarding the reason for AMU. This is a considerable achievement and highlights the success of established AMS activities. Notably, 92.9% of these courses had a clearly documented reason for use, reflecting good AMS practice (19). Out of the treatment courses eligible for review, that is, those initiated more than 72 hours prior to the time of the survey, 80% were reviewed within 72 hours. This suggests an area for future educational and targeted AMS work outside of acute NHS trusts.

Only 70% of AMU for which the newly added NAPS questions were completed, adhered to national or locally endorsed guidelines but almost 90% of reported AMU fulfilled the definition of optimal or adequate AMU. This reflects room for improvement, for example, through increased use of apps but also highlights the usefulness of considering any documented, clinically justifiable reasons to vary from these guidelines (‘appropriateness’).

Compared to the previous PPS in England, the additional information on the quality of local prescribing captured based on the Australian NAPS ensured the use of already standardised and validated questions and will allow international comparison going forward. The qualitative measurement of AMU provides useful information at local, regional and national level to identify targets for quality improvement and support the evaluation of AMS initiatives.

The categorisation of AMU using the UK-AWaRe framework showed that 31.3% of antimicrobials used in adults were from the 'Access' category, 68% from the 'Watch' category, and 4.4% were in the ‘Reserve’ category. In contrast, national data on antibiotic use in secondary care settings report that, in 2023, the most commonly prescribed antibiotics in the secondary care belonged to the ‘Access’ category (64%), ‘Watch’ antibiotics were the second most commonly prescribed (32.6%), and ‘Reserve’ antibiotics represented 0.7% (20). In the PPS data, in acute specialist trusts, 11.3% of antimicrobials fell under the 'Reserve' category and 20.6% under 'Access,' reflecting the use of broader-spectrum agents in settings with complex patient case mixes.

The increase in the use of ‘Reserve’ antibiotics observed in this PPS compared to the ESPAUR findings is concerning, particularly as ESPAUR data have consistently highlighted the importance of prioritising ‘Access’ antibiotics to limit resistance risks. Ongoing efforts, in line with the UK 2024 to 2029 AMR National Action Plan (NAP) (10) and WHO recommendations, are critical to reducing reliance on ‘Watch’ and ‘Reserve’ antibiotics to combat antimicrobial resistance and further analyses of the PPS data for AMU and AMS will be conducted.

The analysis of antimicrobial usage by ethnicity and Index of Multiple Deprivation quintiles does not reveal substantial differences across these demographic and socioeconomic groups, suggesting that AMU patterns in the participating organisations are relatively consistent regardless of ethnicity or deprivation level.

Recommendations for antimicrobial stewardship

1. Create and disseminate specialised antimicrobial stewardship resources for mental health trusts, community trusts, and independent sector organisations. These resources should focus on areas such as UTI prevention and provide reminders about appropriate antimicrobial course lengths, mirroring best practices established in primary care.

2. Actively involve mental health trusts, community trusts, and independent sector organisations in antimicrobial stewardship discussions at national, regional, and local levels.
3. Formulate national interventions or guidelines to promote the use of short-course antimicrobials for surgical prophylaxis. Special attention should be given to specialties like plastics and reconstructive surgery, which currently have high AMU and lack specific national guidance.
4. Ensure that independent hospitals are key stakeholders in the development of surgical prophylaxis guidelines.
5. Improve communication channels between hospital and community healthcare settings to facilitate penicillin allergy de-labelling.

Structure and process indicators

Data on the indicators on structure and process indicators were limited by the low response rate of participating organisations. The median alcohol-based hand rub consumption ranged from 3.9 to 60 litres per 1,000 patient days. In the case of community, mental health, and independent sector organisations, less than 50% of the eligible organisations responded to this question, as participation was not mandatory. The number of hand hygiene opportunities recorded in the previous year varied across different organisations, with acute teaching hospitals reporting the highest median number of such opportunities.

The analysis of data collection practices across various hospital types reveals that acute specialist organisations demonstrate the most advanced practices. A substantial proportion (50%) of these organisations utilise semi-automated systems for monitoring infections, such as surgical site infections (SSIs), with a lower reliance on fully manual methods (33.3%). In contrast, acute general trusts are more dependent on manual processes, particularly in the case of SSIs, where 69% of these organisations still rely on fully manual methods, and only 14.3% have transitioned to semi-automated systems. The lack of detailed data for mental health and independent sector hospitals makes it difficult to assess the level of standardised or automated data collection practices in these settings. When examining data collection practices for *C. difficile* infections, acute specialist organisations reported that 50% utilise semi-automated systems, 7.1% employ fully automated processes, and 33.3% remain dependent on manual methods. Conversely, acute general organisations rely more on manual data collection, with 47.6% still using these methods and a small percentage adopting semi-automation (21.4%) or full automation (7.1%).

Addressing the feasibility of automating the surveillance of healthcare-associated infections, acute large hospitals demonstrate a high level of digital data availability, particularly for admission and discharge dates, with all hospitals (100%) having this data digitally available and 81.8% having it structured and well-defined. However, digital data availability and structuring are less consistent in some areas. For instance, while 90.9% of hospitals have digital data for antimicrobial prescriptions, only 63.6% have this data structured and well-defined. Moreover, significant gaps exist in digital data integration for central lines, with only 9.1% of hospitals having digital data available, and none of this data is structured or well-defined. Additionally, while microbiology culture results are digitally available in all hospitals (100%), only 54.5% of this data is structured and well-defined.

The comparison between alcohol-based hand rub dispensers at the point of care and healthcare workers carrying personal AHR bottles indicates that gynaecology/obstetrics and surgery wards score highly in both areas. Medicine, geriatrics and intensive care wards, responded good dispenser availability but showed more variability in personal bottle use. Psychiatry wards, however, show higher personal bottle use despite lower dispenser availability, adhering to the principle that alcohol should not be available at the patient's bedside.

Due to incomplete data capture from the hospitals, data on IPC staffing levels had to be excluded from the analysis.

The PPS data highlighted that wards from all participating organisation types reported the use of ‘unconventional bed settings’ (‘corridor beds’) at the time of the survey, which is likely to indicate pressures to manage patient numbers and/or resource constraints.

Acknowledgements

We extend our heartfelt thanks to all the site leads, data collectors from all participating NHS and independent sector organisations, as well as regional NHS England AMS and IPC national or regional teams, and UKHSA colleagues for their participation in and support of the national point-prevalence survey (PPS) on healthcare-associated infections (HCAI), antimicrobial use (AMU), and antimicrobial stewardship (AMS) in England 2023.

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