NHS National Services Scotland

ARHAI Scotland 2023 Annual Report

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ARHAI Scotland

Antimicrobial Resistance and Healthcare Associated Infection

Contents

Alternative formats

This publication can be made available in large print, Braille (English only), audio tape and different languages. Please contact nss.equalitydiversity@nhs.scot for further information.

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About ARHAI Scotland

ARHAI Scotland overall vision is to:

Enable Scotland to adopt an evidence based and innovative approach to minimising the burden of infection and antimicrobial resistance (AMR).

Our mission is to:

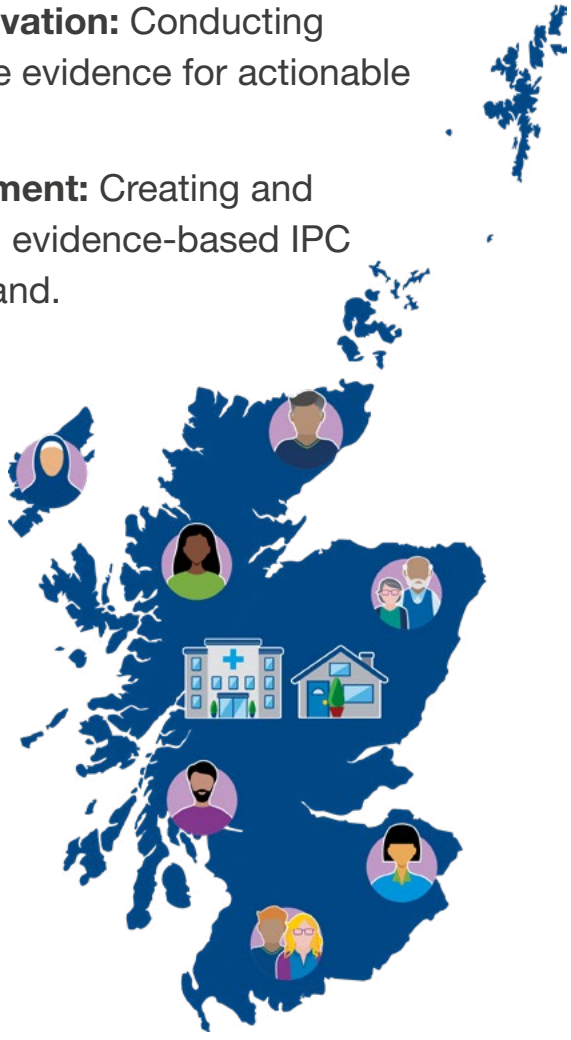
Enhance the health and wellbeing of the population by reducing infection and antimicrobial resistance within Scottish care settings.

We will achieve this by:

- establishing a robust evidence base for best practices
- developing mechanisms for monitoring key priority areas
- connecting with the broader health, social care, and public health systems
- collaborating with key delivery partners, including NHSScotland boards, care providers, and other national bodies as commissioned by the Scottish Government

The work of ARHAI Scotland is grounded in delivering a comprehensive range of functions in collaboration with stakeholders across health, care, and other sectors. ARHAI Scotland's functions include:

- **Surveillance and monitoring:** Assessing the impact of infections and antimicrobial resistance on health.
- **Clinical assurance:** Reducing risk in the healthcare built environment.
- **Programme coordination:** Overseeing national Infection Prevention and Control (IPC) and Antimicrobial Resistance (AMR) programmes.
- **Expert advice and horizon scanning:** Providing specialised IPC/AMR guidance and foresight.
- **Outbreak response:** Preparing for and responding to healthcare-associated infection (HCAI) outbreaks and incidents.
- **Workforce development:** Collaborating with NHS Education for Scotland to cultivate a confident, knowledgeable, and competent IPC workforce.
- **Professional practice:** Promoting high standards of professional conduct.
- **Research and innovation:** Conducting research to generate evidence for actionable interventions.
- **Guidance development:** Creating and maintaining national evidence-based IPC guidelines for Scotland.

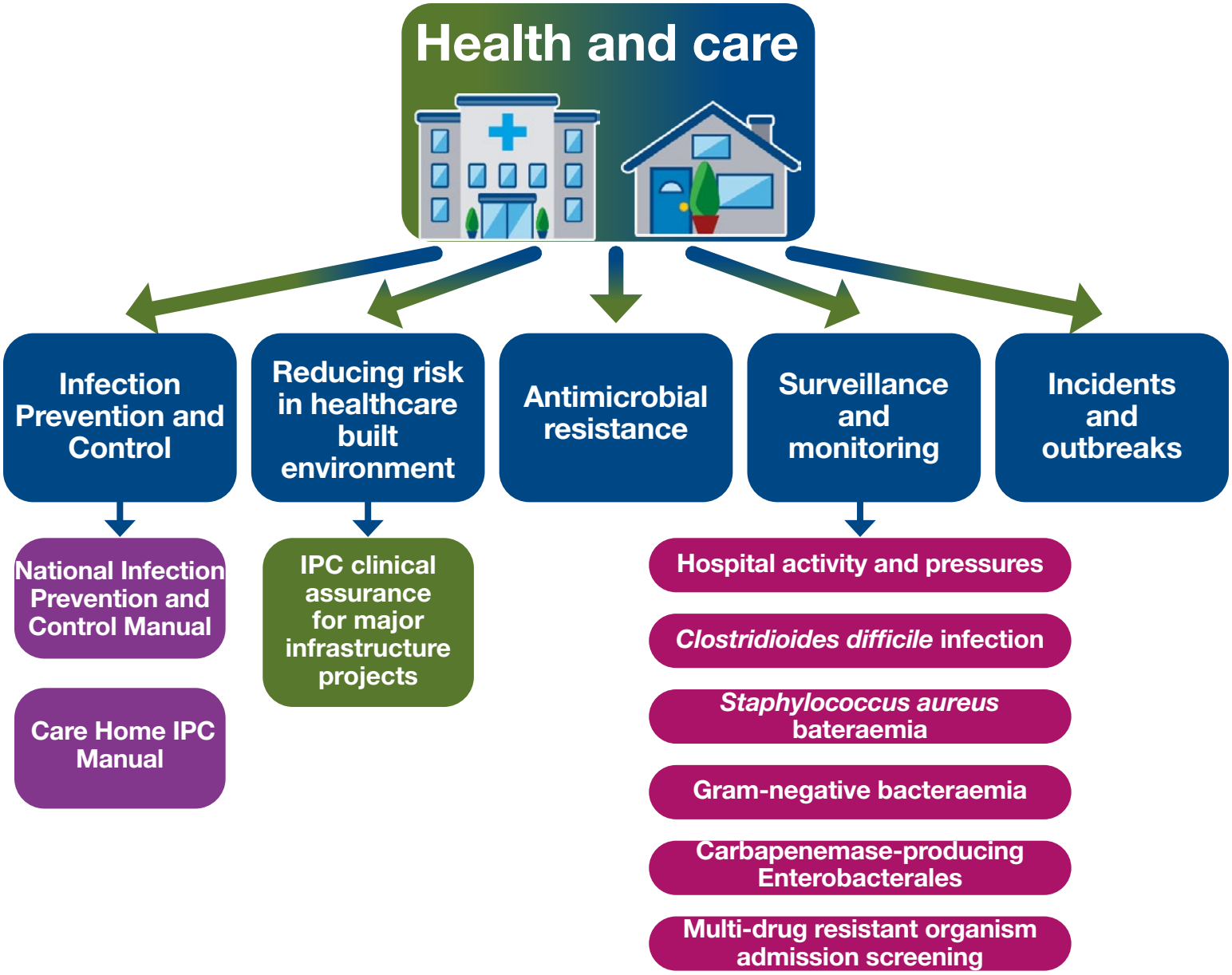


ARHAI Scotland Activities in 2023

Globally, healthcare associated infections (HCAI) and antimicrobial resistance (AMR) continue to pose a significant threat to patient safety in all settings where care is delivered.

This annual report showcases the key initiatives undertaken by ARHAI Scotland in 2023 to support Infection Prevention and Control (IPC), prevent HCAI, and contain AMR. Alongside a planned programme of work, ARHAI Scotland continued to provide responsive IPC expert advice throughout the year.

Click below to read more about ARHAI Scotland's work in 2023.

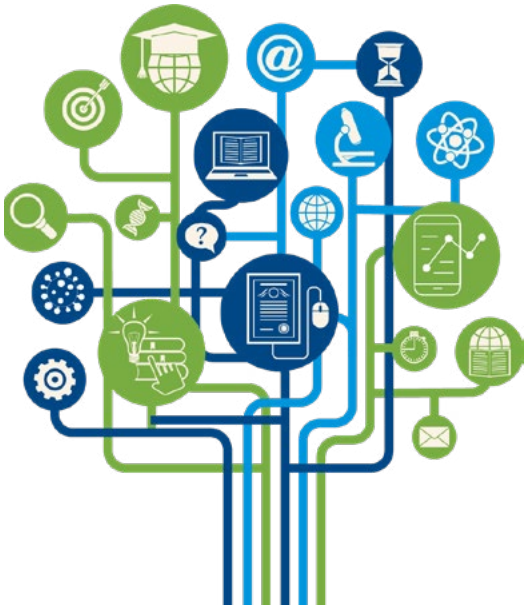


Infection Prevention and Control

National Infection Prevention and Control Manual (NIPCM)

The National Infection Prevention and Control Manual (NIPCM) first published in 2012 provides national evidence-based guidance for Infection Prevention and Control (IPC) which is considered best practice for all health and care settings in Scotland. The NIPCM has continued to expand year on year. The development of new content is informed by horizon scanning, national learning via incidents and outbreaks and stakeholder needs, leading the way as a single national resource for IPC guidance. The NIPCM aims to provide the most up to date evidence-based guidance, enhanced where necessary by expert opinion, to allow healthcare workers to make informed risk assessments in the application of IPC measures.

Following the removal of dedicated COVID-19 pandemic content as part of a phased process in 2022, 2023 has refocused efforts on ensuring the NIPCM is maintained and populated with new guidance which is evidence based, user friendly and meets accessibility standards. A series of annual activities are undertaken to support NIPCM functionality and the delivery of IPC guidance and associated tools. An annual review of the development methodology was also undertaken and 2023 saw the commencement of a new pilot methodology which aimed to increase the robustness and transparency of NIPCM content development where a considered judgement form (CJF) is applied to each pilot literature review. In addition to recommendations and good practice points, the CJF records the reliability of the evidence considered. Expert opinion is used to consider the benefits versus harms as well as any feasibility issues. Doing so supports the practical clinical operationalisation to inform the recommendations and good practice points and consistency of the conclusions within the evidence. The pilot methodology has been published and can be found **here**. The pilot will continue in 2024 when the final development process will be ratified via internal governance groups.



Following completion of three literature reviews in 2023, the NIPCM was strengthened to reflect the following points:

Hand hygiene: skin care. This update provided some additional background information on what skin integrity is and how to maintain it, and the signs and symptoms of contact dermatitis.

Surgical hand antisepsis. The review update clarified that where surgical hand rubbing is the preferred method for surgical hand antisepsis, hand hygiene should be performed using a non-antimicrobial liquid soap and water prior to entering the theatre or care area. The rationale for this is to physically remove contamination (which hand rub products are unable to do).

Indication and techniques for hand hygiene. The need to remove hand and wrist jewellery before performing hand hygiene was expanded to include embedded jewellery (dermal piercings).

It was recognised that after the COVID-19 pandemic, it was necessary to address the use of Personal Protective Equipment (PPE) in the delivery of patient care and make clear the risk assessment required in selecting individual items of PPE. **Appendix 15** underwent a significant change to stipulate the PPE required based on exposure to blood and body fluids and suspected infection. The Appendix 15 tables are intended to be more user friendly than previous versions.

Notable was the commencement of the transmission-based precautions (TBPs) definitions literature review update in 2023 with significant progress made in the analysis of the vast evidence base to inform re-classification of transmission routes. The need for this review was made apparent during the COVID-19 pandemic and ARHAI Scotland are leading the way in this work by challenging the historical droplet/aerosol dichotomy and reviewing the key factors which impact transmission in health and care settings. A dedicated working group will be convened in 2024 to finalise new recommendations and oversee implementable changes to Chapter 2 of the NIPCM. Alongside this work, a review of the literature pertaining to surgical face masks and respiratory protective equipment was commenced to ensure full alignment with published changes to TBPs.

ARHAI Scotland completed a **rapid review of the literature** to consider post cataract surgery endophthalmitis in July 2023 which was used to inform the development of a **cataract IPC pathway** in support of the Centre of Sustainable Delivery (CfSD). This group brought together key IPC and specialist ophthalmology stakeholders from across Scotland to develop a nationally approved evidence-based set of principles aimed at reducing variation and mitigating against any perceived IPC risks associated with increasing the throughput of cataract surgeries, whilst providing a means of monitoring through national data sets. This work was published in the Journal of Hospital Infection and will be included in the NIPCM in 2024.

Care Home IPC Manual

Within the NIPCM website, ARHAI Scotland have a dedicated section for all Care Home IPC guidance, supporting materials and resources. As part of the Care Home IPC section, staff can navigate through the Care Home Infection Prevention and Control Manual (CH IPCM) which is based on evidence and promotes best practice. The content of the CH IPCM is fully aligned to the evidence based NIPCM.

The content of the CH IPCM continues to evolve since publication of Chapter 1: Standard Infection Control Precautions (SICPs) and Chapter 2: Transmission Based Precautions (TBPs) in 2021. Within the CH IPCM, there is a National Cleaning Specification (NCS) section which provides a guide for care home staff to plan their cleaning services and to record local cleaning activities. The NCS supports care home staff to plan, train and monitor standards of cleaning services provided throughout their care home.

In addition to the core chapters, the Care Home section in the NIPCM website also contains multiple appendices and supporting materials which are constantly updated as the evidence base evolves. Throughout 2023, collaboration with Care Home stakeholders ensured that ARHAI Scotland Care Home IPC guidance and materials were relevant and context specific.

ARHAI Scotland continues to support the interim Scottish Health Protection Network Guidance Group from a community IPC perspective and in 2023 developed an IPC Chapter for inclusion in the 'Health protection in children and young people settings, including education' Guidance. Assistance was provided for an IPC review of the National Childsmile Executive Standards for Nursery and School Toothbrushing Programme content and to the Care Inspectorate publication entitled 'Space to Grow'. During 2023, the IPC Respiratory and Gastrointestinal support resources for Care Homes was also updated and refreshed.

Reducing risk in the healthcare built environment

During 2023, ARHAI Scotland continued to focus on reducing risk in the healthcare-built environment by providing access to infection prevention and control (IPC) guidance and supportive tools. ARHAI Scotland also supported NHS Boards through the design, construction and commissioning of new health care facilities.

ARHAI Scotland assesses potential IPC risks at all stages of health care construction and refurbishment as part of NHSScotland Assure's key stage assurance review (KSAR) process, and also supports local NHS boards and IPC teams with subject matter expertise during environmental incidents and outbreaks.

Expert IPC advice continued to be provided through developing guidance and educational materials to assist local IPC Teams in reducing risk in all healthcare buildings.

The water services literature review utilising the new National Infection Prevention and Control Manual (NIPCM) methodology gathered speed and involved extensive consultation with stakeholders. It is anticipated that the water services literature review and associated manual content/ recommendations will continue to progress with publication expected late summer 2024.The dental unit water lines literature review was initiated with publication also expected in 2024. A further notable review was the commencement of the ventilation literature review which will be for inclusion within Chapter 4 of the NIPCM. The question set for this literature review is being developed and is expected to significantly progress throughout 2024.

The focus for the year ahead is the continued development of Chapter 4 of the NIPCM content; tools specifically designed to reduce risk; and evidence to support the safe management of risks from the complex components within the built environment. This will include the review of outbreak and incident assessment to improve reporting of incidents relating to the built environment.

IPC clinical assurance for major infrastructure projects

The multidisciplinary team within the NHSScotland Assure Assurance service continues to review the design, construction and maintenance of major health care infrastructure developments across NHSScotland at key stages during the project lifecycle. ARHAI Scotland provide IPC support as subject matter experts through the KSAR processes, ensuring an overarching focus on IPC and infection risk during all stages of the building lifecycle.

Support has been given to board IPC teams which resulted in completion of a further 11 KSARs in 2023, enabling progression of design and construction of the healthcare built environment estate across NHSScotland.

During 2023, as part of the Assurance Service, ARHAI Scotland supported two NHS boards' project teams through the commissioning of National Treatment Centres which opened this year: NHS Fife (Victoria Hospital, Kirkcaldy) and NHS Highland (Raigmore Hospital, Inverness).

In addition to Assurance reviews, ARHAI Scotland have continued to support IPC project teams across respective boards regarding construction projects out with KSAR review specialist support or general built environment board enquiries.

During 2023, IPC support was formally included within the NHSScotland Design Assessment Process (NDAP). The NDAP process in addition to the review process is included within the Assurance process. IPC support is provided to NHS boards during the design of their facility with the aim of ensuring IPC requirements are met in advance of the Assurance Review being undertaken.

ARHAI Scotland are developing a suite of resources (Notes for Boards) to assist board IPC teams through health care construction projects and the KSAR process for delivery over 2024. The first resource is KSAR: Notes for Board Infection Prevention and Control Teams and advises IPC teams of what the KSAR process is and what can be expected throughout each of the stage reviews. Work has also commenced on Notes for Boards: Summary of guidance for the design of Neonatal units, level 2 and 3 care units, and Bone marrow transplant units and haemato-oncology units. These will be published in 2024. A Notes for Boards: Air sampling in operating theatres has also commenced and is expected to publish in 2024.

Antimicrobial resistance

Antimicrobial resistance (AMR) happens when microbes, such as bacteria, fungi, viruses and parasites change and no longer respond to medicines designed to kill them. This change is an adaption of the microbe's genetics and is driven by the exposure of the microbe to antimicrobials in humans, animals and the environment. The result of this AMR is that certain infections become increasingly difficult or impossible to treat. This is a global concern.

Causes of antimicrobial resistance

Antimicrobial resistance happens when bacteria change and become resistant to the antimicrobials used to treat the infections they cause.

Over-prescribing of antimicrobials

Patients not finishing their treatment

Over-use of antimicrobials in livestock and fish farming

Poor infection control in hospitals and clinics

Lack of hygiene and poor sanitation

Lack of new antimicrobials being developed

As **The King's Fund essay, 'What if antibiotics stopped working?'** highlighted, antimicrobials (including antibiotics) add 20 years on average to life expectancy across the world through their ability to prevent and treat infection. This ability is central to managing infectious disease, making surgery and childbirth safer, protecting people undergoing transplants and cancer treatments, and supporting animal health and food production.

AMR is a natural phenomenon therefore it cannot be fully prevented but human activity is accelerating the emergence and spread. Accordingly, the focus, as set out in the **UK Government 20-year vision for antimicrobial resistance**, is to effectively contain, control and mitigate AMR by 2040. This long-term vision is supported by five-year AMR national action plans (NAP). This ARHAI annual report is published at an important point with the transition from the 2019 to 2024 NAP **'Tackling antimicrobial resistance'** to the 2024–2029 NAP to **'Confronting antimicrobial resistance'**.

In 2023, ARHAI Scotland provided intelligence on the trends in antimicrobial use and resistance. ARHAI Scotland's work on monitoring antimicrobial use and resistance is aligned with the 'One Health' approach to tackling AMR in the UK AMR NAP. This 'One Health' approach works across sectors and recognises that many of the same bacteria infect humans and animals and may be found in the environment as they share the same ecosystem and calls for action across and between sectors.

Data and intelligence on the trends in antimicrobial use and resistance in humans and animals for 2023 will be published in the annual Scottish One Health Antimicrobial Use and Antimicrobial Resistance (SONAAR) report in November 2024. The publication on the **ARHAI Scotland website** will coincide with World Antibiotic Awareness Day and European Antibiotic Awareness Week.

ARHAI Scotland's 2023 achievements

- Undertook near real time monitoring and reporting of use of antibiotics commonly used for respiratory infections to support antimicrobial stewardship activities coordinated by the Scottish Antimicrobial Prescribing Group aimed at optimising antibiotic use in the community.

- Using our AMR early warning system, undertook monitoring for instances of organisms displaying unexpected antimicrobial resistance (see NIPCM Appendix 13 Table 6). This work is intended to enable a timely scientific and public health response to potential emerging AMR issues, informs infection control practices and appropriate therapy, and is critical to contain the development and spread of AMR.

- Supported our stakeholders to access quarterly data on antimicrobial use and resistance through ARHAI Indicators dashboards in Discovery to inform clinical practice across NHSScotland.

AMR is a serious and complex problem but there are actions which, if taken, will make a difference. In 2024, ARHAI Scotland will continue to play our part and will support the delivery of the UK AMR NAP implementation plan and measurement of impact within Scotland, building on our role in monitoring and reporting trends in antimicrobial use and resistance in human and animal health.

Key activities for ARHAI Scotland in support of the UK AMR NAP will include:

Reducing the burden of infections, AMR and exposure to antimicrobials through leadership, expert advice and guidance on infection prevention and control.

Developing and utilising data and intelligence to inform actions – this aims to enable decisions to be based on robust surveillance data and intelligence.

Identifying unwarranted variation and health inequalities – this aims to improve the information available to identify where the burden of antibiotic use and AMR is greatest. This will help to target future interventions where they will have the greatest impact.

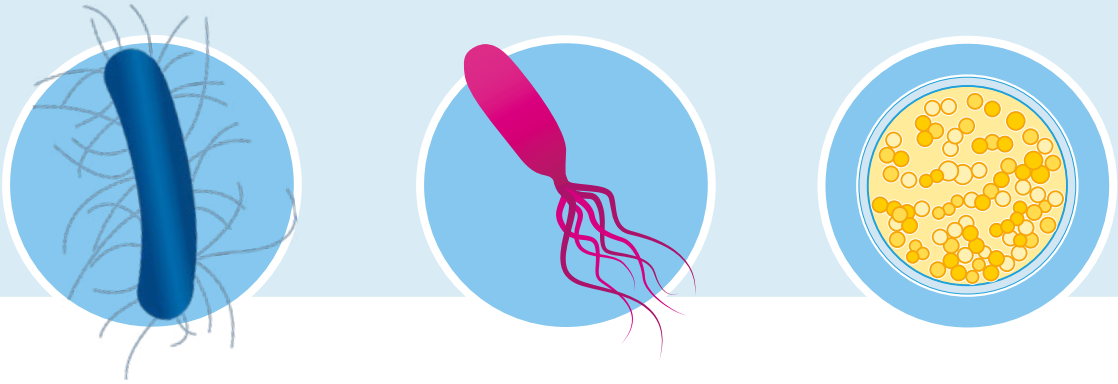
Surveillance and monitoring

Surveillance of healthcare associated infection in Scotland

ARHAI Scotland coordinate the national surveillance programme of healthcare associated infection (HCAI) monitoring the burden of key HCAI, supporting benchmarking and providing intelligence to inform the development of interventions.

In 2023, the surveillance of three key infection types continued:

- ***Clostridioides difficile*** **infection (CDI)**
- ***Escherichia coli*** **bacteraemia (ECB)**
- ***Staphylococcus aureus*** **bacteraemia (SAB)**



National surveillance of surgical site infection (SSI) remained paused during 2023 though some boards continued with local surveillance.

Trends in key HCAI rates **continued to be published quarterly** in 2023 and provided in **Discovery**, supporting local NHS boards with data for benchmarking and to inform quality improvement and reduction strategies.

Surveillance priorities for 2024

- Complete a review of the national HCAI surveillance programme ensuring a focus on reducing risk and harm.
- Complete review of paused SSI surveillance programme including a focus on smarter solutions for surveillance to reduce the burden of data collection.
- Support the implementation of the redeveloped surveillance system for healthcare associated infection in intensive care units (ICU).
- Continue to support the development of a competent and confident infection prevention and control (IPC) workforce by delivery of epidemiology and surveillance training in conjunction with NHS Education Scotland.

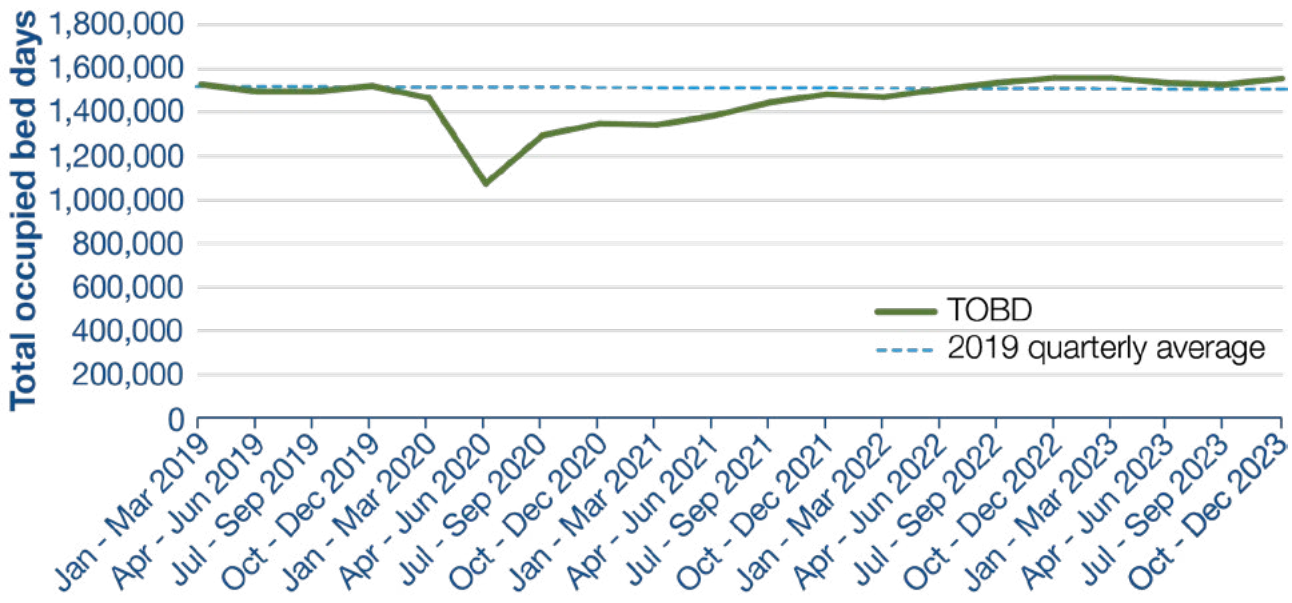
Hospital activity and pressures

Healthcare delivery, activity and the inpatient population is evolving and healthcare systems remain under pressure following the pandemic. Changes within the system can affect the risk of Healthcare Associated Infection (HCAI) in the hospital population and present a challenge to the interpretation of epidemiological data. Interpretation can be supported by consideration of other contextual measures describing healthcare. HCAI outcome data should be interpreted with caution and in the context of the wider healthcare system.

Hospital activity

6,217,510 occupied bed days in **2023**, compared to **6,112,174** in **2022**.

Total occupied bed days, by quarter*

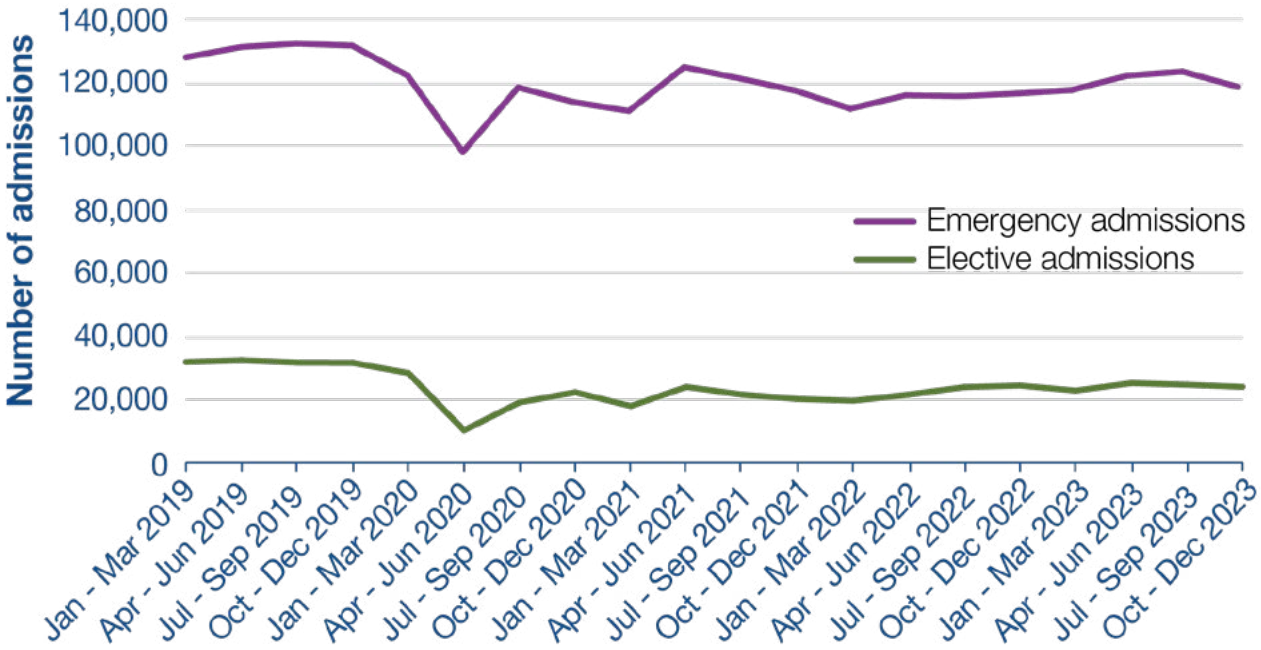


*The dashed line represents the quarterly average for the calendar year 2019 of 1,520,807 Total Occupied Bed Days (TOBD).

98,144 elective inpatient admissions in **2023** compared to **90,995** in **2022**.

482,997 emergency inpatient admissions in **2023** compared to **461,069** in **2022**.

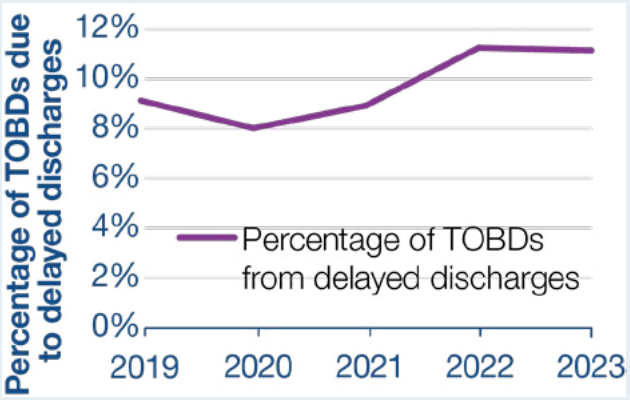
Number of elective and emergency admissions, by quarter



Hospital pressures

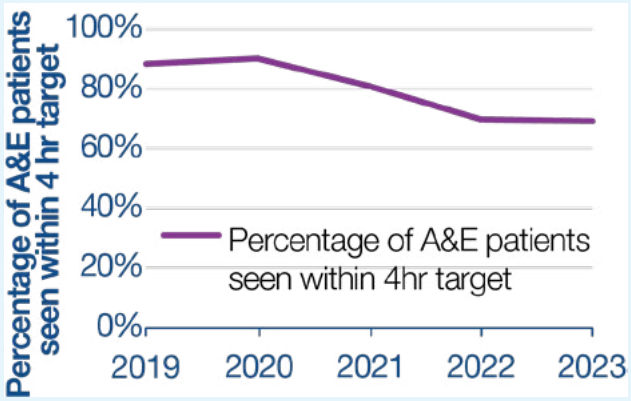
Delayed discharges

The percentage of total occupied bed days due to **delayed discharges** **decreased** by **0.9%** in **2023 (11.1%)** compared to **2022 (11.2%)**.



Accident and Emergency (A&E) attendances

69.6% of **Accident and Emergency (A&E) attendances** were seen within the **4-hour target** in **2023**, a **decrease** from **70.2%** in **2022**.



Clostridioides difficile infection

Epidemiological data

In **2023**, there were **1,209** cases of ***Clostridioides difficile* infection (CDI)** reported in **patients aged 15 years and older** in **Scotland**, **compared** to **1,053** cases in **2022**.

The **annual incidence rate** was **22.2** per 100,000 population.

There has been a **14.8% increase** in the **rate** between **2022** and **2023**.

The **rate in 2023** was **14.5% higher compared to 2019**.

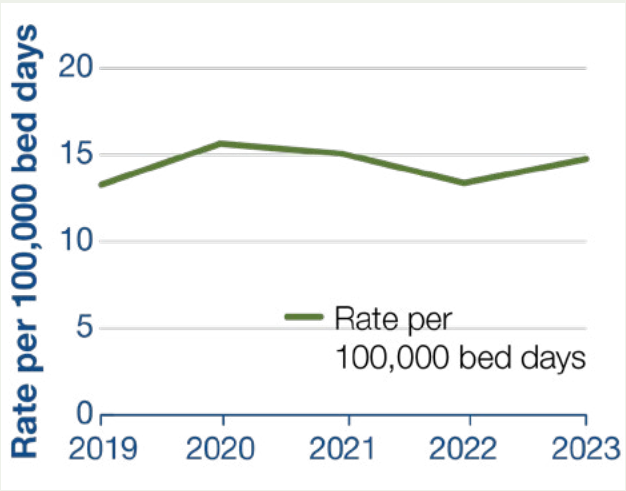
No linear trend over the **past five years** was observed.

Healthcare associated CDI

There were **917 cases** in **patients aged 15 years and older** in **2023**.

The **annual incidence rate** was **14.7** per 100,000 bed days.

There has been a **10.2% increase** in the **rate** between **2022** and **2023**.



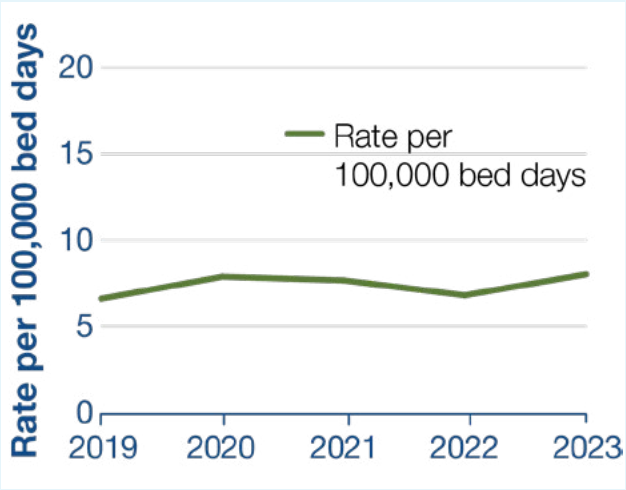
The **five year trend** has remained **stable**.

Hospital acquired CDI

Of the **917** healthcare associated CDI cases, **503** were **hospital acquired infections**.

The **annual incidence rate** was **8.1** per 100,000 bed days.

There has been a **17.5% increase** in the **rate** between **2022** and **2023**.



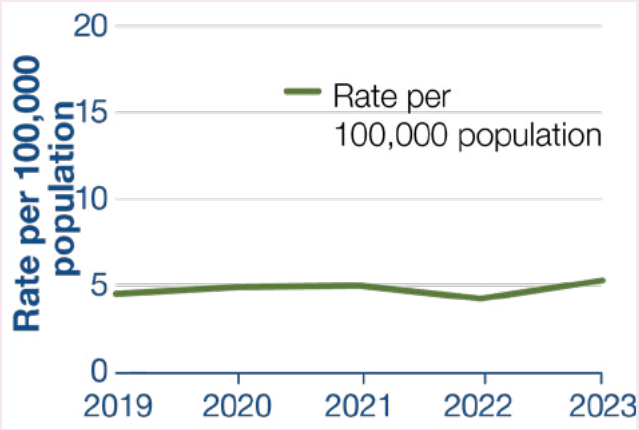
The **five year trend** has remained **stable**.

Community associated CDI

There were **292 cases** in **patients aged 15 years and older** in **2023**.

The **annual incidence rate** was **5.4** per 100,000 population.

There has been a **24.3% increase** in the **rate** between **2022** and **2023**.



The **five year trend** has remained **stable**.

Annual funnel plot analysis

NHS Highland and **NHS Lanarkshire** had **higher annual rates** of **healthcare associated CDI compared** with the **Scottish average rate**.

No NHS boards had **higher annual rates** of **community associated CDI compared** with the **Scottish average rate**.

Note: NHS board rates are **not adjusted** for **differences in the patient population**.

NHS boards are required to submit improvement plans in response to **higher than average quarterly rates** of **healthcare or community associated CDI**, as identified through the **exception reporting process**.

Three improvement plans were developed by **NHS boards** during **2023** in response to **higher than average quarterly rates** of **healthcare associated CDI**.

For further information please see the **quarterly epidemiological reports**.

All cause case fatality

In **2023**, the **30 day all cause case fatality rate** for **CDI** in **patients aged 15 years and older** was **10.8%**.

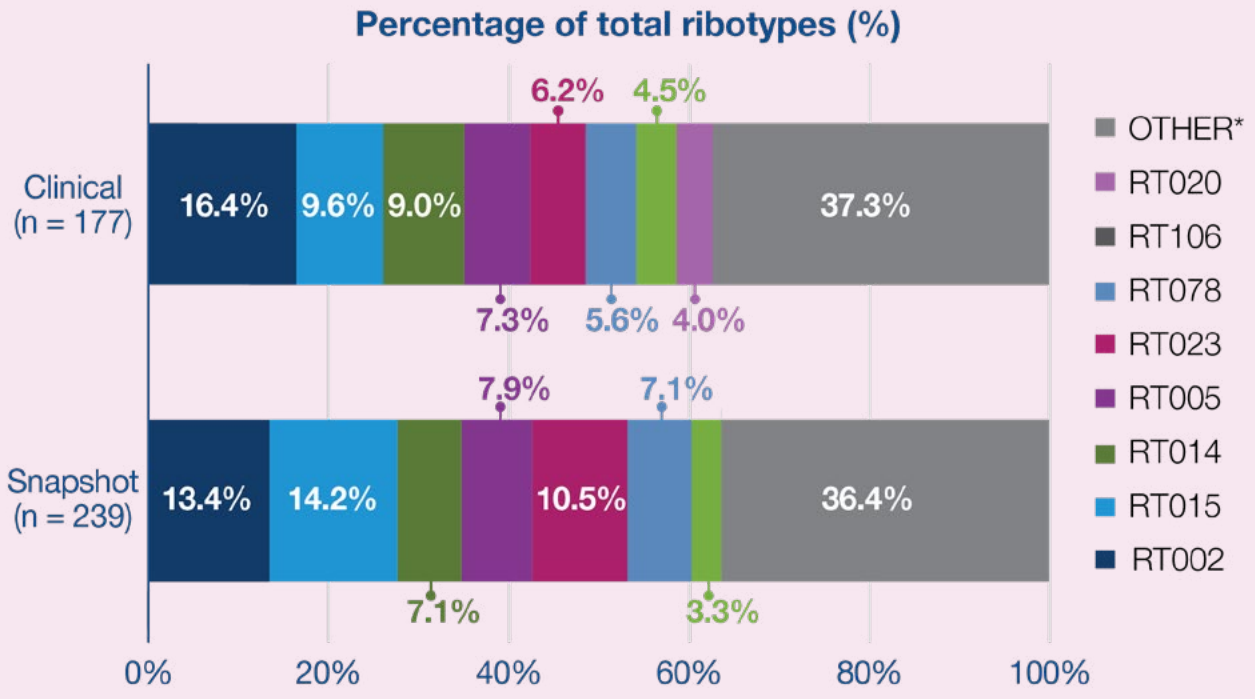
The **CDI case fatality five year trend** has remained **stable**.

Note: rates are **not adjusted** for **differences** in the **patient population over time**.

Molecular epidemiological data

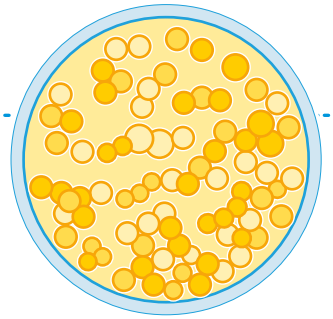
The **three most prevalent ribotypes** reported by **clinical surveillance** in **2023** were **RT002 (16.4%)**, **RT015 (9.6%)** and **RT014 (9.0%)**.

The **three most prevalent ribotypes** (RT) reported by the **snapshot surveillance scheme** in **2023** were **RT015 (14.2%)**, **RT002 (13.4%)** and **RT023 (10.5%)**.



*OTHER contains ribotypes, each with a prevalence of <3%.

Staphylococcus aureus bacteraemia



Epidemiological data

In **2023**, there were **1,712** cases of ***Staphylococcus aureus* bacteraemia (SAB)** reported in **Scotland**, compared to **1,590** cases in **2022**.

The **annual incidence rate** was **31.4** per 100,000 population.

There has been **7.7% increase** in the **rate** between **2022** and **2023**.

The **five year trend** has **increased** with a **3.4% average increase** each year.

96.7% (n = 1,656) of **all SAB cases** were **meticillin-sensitive *Staphylococcus aureus* (MSSA)**.

3.3% (n = 56) of **all SAB cases** were **meticillin-resistant *Staphylococcus aureus* (MRSA)**.

The **rate** of **MSSA bacteraemia** in **2023** was **30.4** per 100,000 population.

There has been a **7.5% increase** in the **rate** between **2022** and **2023**.

The **five year trend** has **increased** with a **3.3% average increase** each year.

The **rate** of **MRSA bacteraemia** in **2023** was **1.0** per 100,000 population.

The **rate** has **remained stable** between **2022** and **2023**.

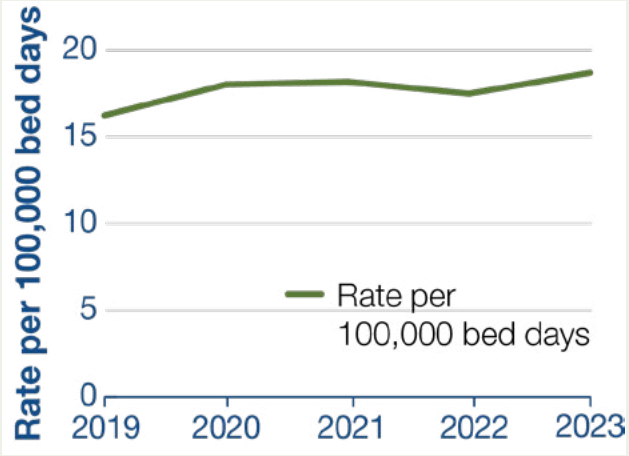
The **five year trend** has remained **stable**.

Healthcare associated SAB

There were **1,162** cases in **2023**.

The **annual incidence rate** was **18.7** per 100,000 bed days.

The **rate** has **remained stable** between **2022** and **2023**.



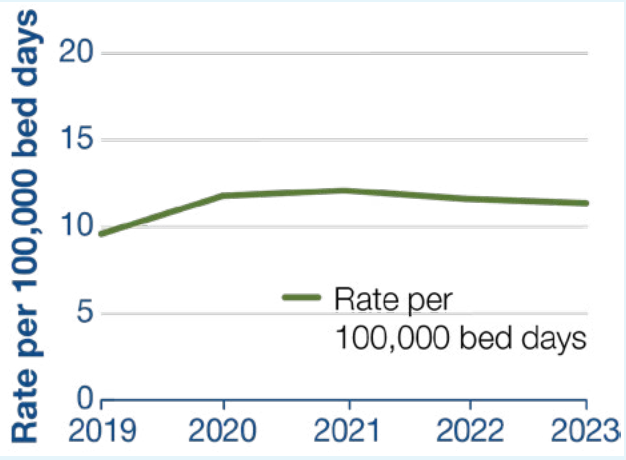
The **five year trend** has **increased** with a **2.6% average increase** each year.

Hospital acquired SAB

Of the **1,162** healthcare associated SAB cases in **2023**, **706** were **hospital acquired infections**.

The **annual incidence rate** was **11.4** per 100,000 bed days.

The **rate** has **remained stable** between **2022** and **2023**.



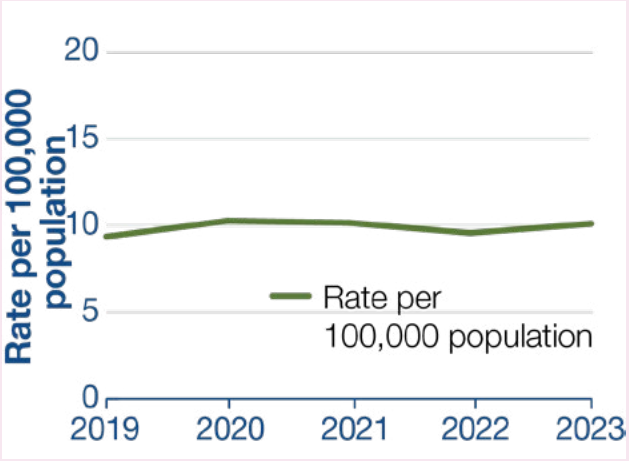
The **rate in 2023** was **18.5% higher compared to 2019**. **No linear trend** over the **past five years** was observed.

Community associated SAB

There were **550** cases in **2023**.

The **annual incidence rate** was **10.1** per 100,000 population.

The **rate** has **remained stable** between **2022** and **2023**.



The **five year trend** has remained **stable**.

Annual funnel plot analysis

NHS Tayside had a **higher annual rate** of **healthcare associated SAB**, compared with the **Scottish average rate**.

NHS Ayrshire & Arran and **NHS Shetland** had a **higher annual rate** of **community associated SAB compared** with the **Scottish average rate**.

Note: NHS board rates are **not adjusted** for **differences in the patient population**.

NHS boards are required to submit improvement plans in response to **higher than average quarterly rates** of **healthcare or community associated SAB**, as identified through the **exception reporting process**.

Two improvement plans were developed by **NHS boards** during **2023** in response to **higher than average quarterly rates** of **healthcare associated SAB**.

One improvement plan was developed by an **NHS board** during **2023** in response to **higher than average quarterly rates** of **community associated SAB**.

For further information please see the **quarterly epidemiological reports**.

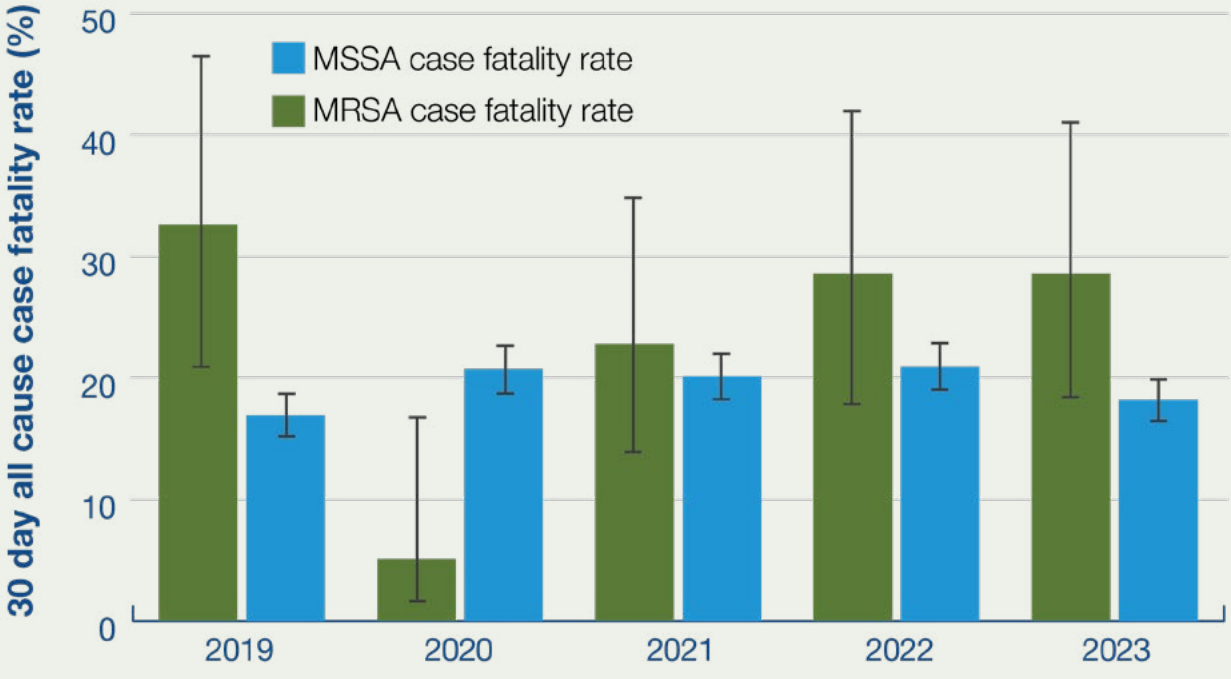
All cause case fatality

In **2023**, the **30 day all cause case fatality rates** for **SAB** were

28.6% for MRSA | **18.2% for MSSA**

The **MRSA** and **MSSA** **case fatality five year trends** have remained **stable**.

Note: rates are **not adjusted** for **differences** in the **patient population over time**.



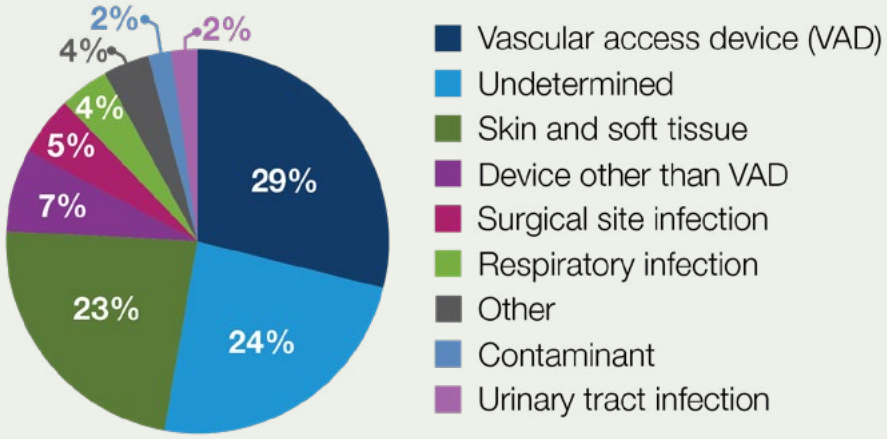
In **2023**, **entry points** of **healthcare associated SAB** were known for **75.7%** of cases.

The most common entry points (as determined by the clinical team) include:

29.4% Vascular access device (VAD)

22.9% Skin and soft tissue

Healthcare associated SAB entry points



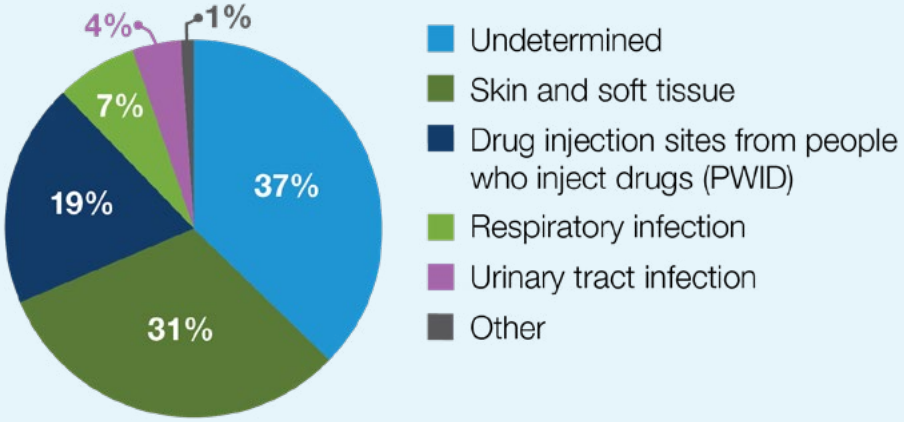
In **2023**, **entry points** of **community associated SAB** were known for **62.9%** of cases.

The most common entry points (as determined by the clinical team) include:

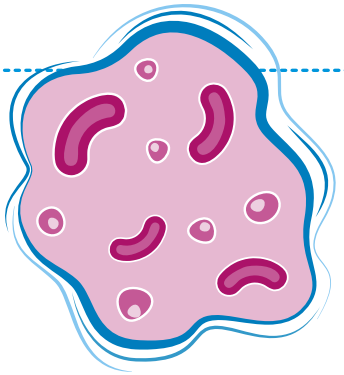
31.5% Skin and soft tissue

19.5% Drug injection sites from people who inject drugs (PWID)

Community associated SAB entry points

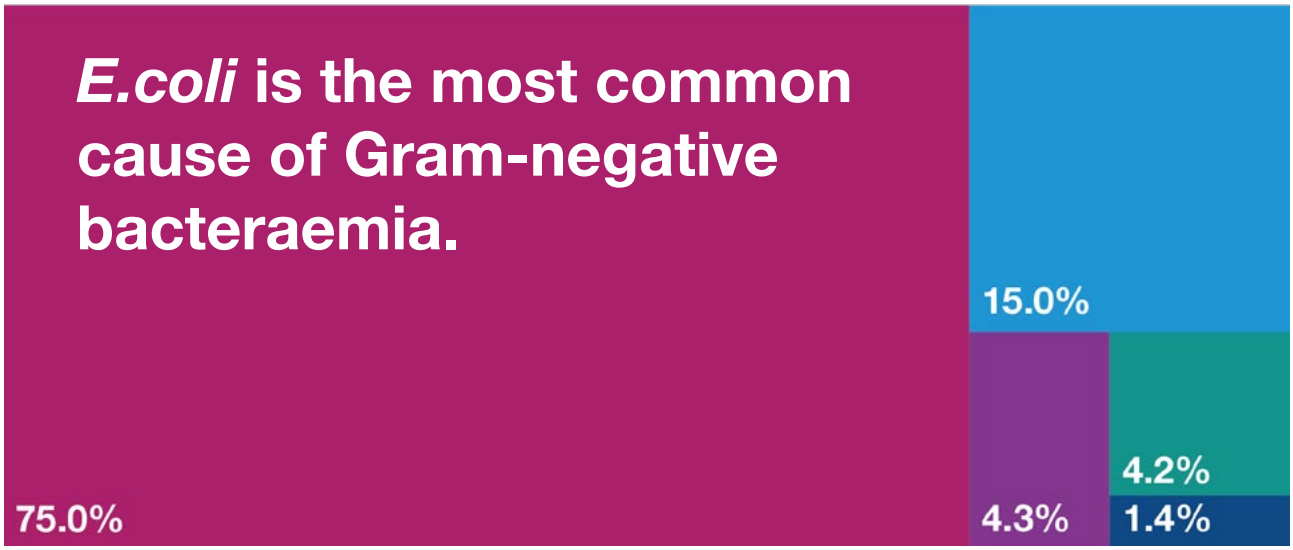


Gram-negative bacteraemia



Epidemiological data

In **2023**, there were **5,744 Gram-negative bacteraemia** in **Scotland** caused by **5 key Gram-negative pathogens**.



- *Escherichia coli* (n=4,309)
- *Pseudomonas aeruginosa* (n=248)
- *Acinetobacter* species (n=82)
- *Klebsiella pneumoniae* (n=863)
- *Klebsiella oxytoca* (n=242)

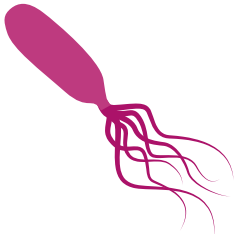
In **2023**, there were **4,309** cases of ***Escherichia coli* bacteraemia (ECB)** reported in **Scotland**, compared to **4,218** cases in **2022**.

The **annual incidence rate** was **79.1** per 100,000 population.

The **rate** has **remained stable** between **2022** and **2023**.

The **rate in 2023** was **9.3% lower compared to 2019**.

No linear trend over the **past five years** was observed.

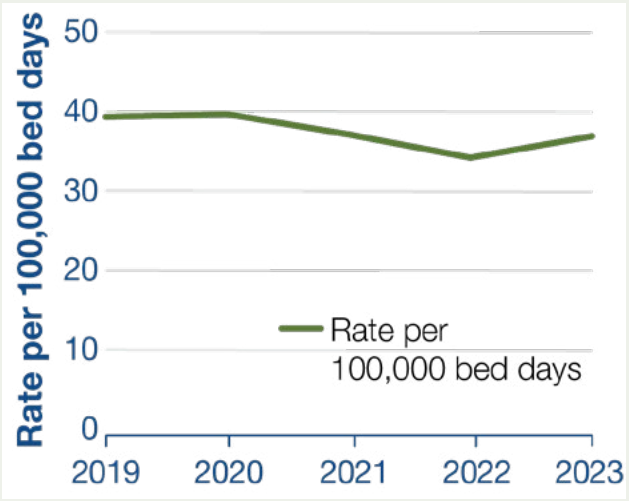


Healthcare associated ECB

There were **2,293** cases in **2023**.

The **annual incidence rate** was **36.9** per 100,000 bed days.

There has been a **7.9% increase** in the **rate** between **2022** and **2023**.



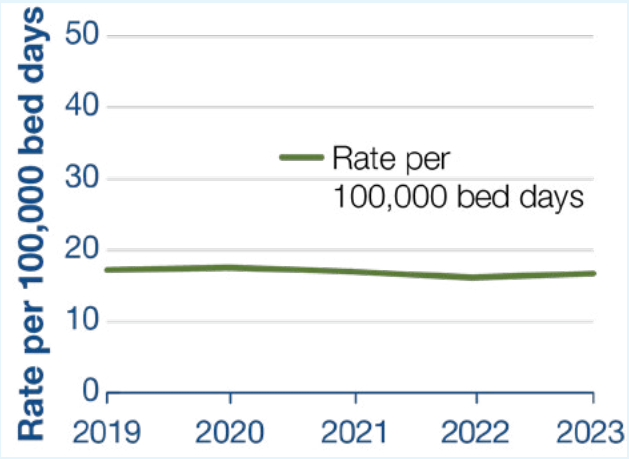
The **rate in 2023** was **6.2% lower compared to 2019**.
No linear trend over the **past five years** was observed.

Hospital acquired ECB

Of the **2,293 healthcare associated ECB cases**, **1,041** were **hospital acquired infections**.

The **annual incidence rate** was **16.7** per 100,000 bed days.

The **rate** has **remained stable** between **2022** and **2023**.



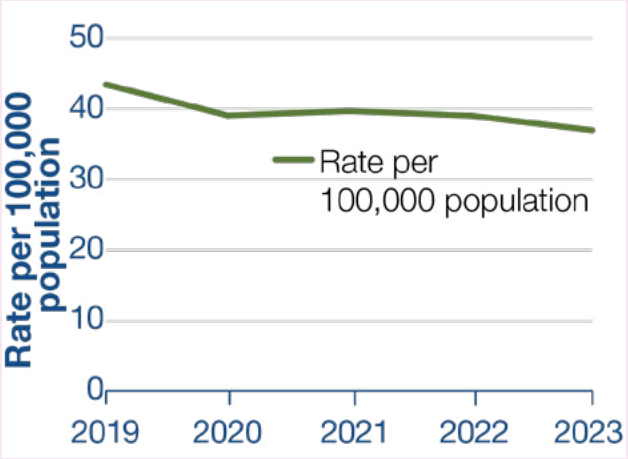
The **five year trend** has remained **stable**.

Community associated ECB

There were **2,016** cases in **2023**.

The **annual incidence rate** was **37.0** per 100,000 population.

The **rate** has **remained stable** between **2022** and **2023**.



The **five year trend** has **decreased** with a **3.2% average decrease** each year.

Annual funnel plot analysis

NHS Forth Valley and **NHS Tayside** had **higher annual rates** of **healthcare associated ECB compared** with the **Scottish average rate**.

NHS Ayrshire & Arran, **NHS Dumfries & Galloway** and **NHS Lanarkshire** all had **higher annual rates** of **community associated ECB compared** with the **Scottish average rate**.

Note: NHS board rates are **not adjusted** for **differences in the patient population**.

NHS boards are required to submit improvement plans in response to **higher than average quarterly rates** of **healthcare or community associated ECB**, as identified through the **exception reporting process**.

Three improvement plans were developed by **NHS boards** during **2023** in response to **higher than average quarterly rates** of **healthcare associated ECB**.

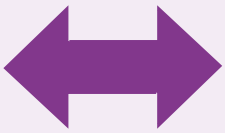
Six improvement plans were developed by **NHS boards** during **2023** in response to **higher than average quarterly rates** of **community associated ECB**.

For further information please see the **quarterly epidemiological reports**.

All cause case fatality

In **2023**, the **30 day all cause case fatality rate** for **ECB** was **12.8%**.

The **ECB case fatality five year trend** has remained **stable**.



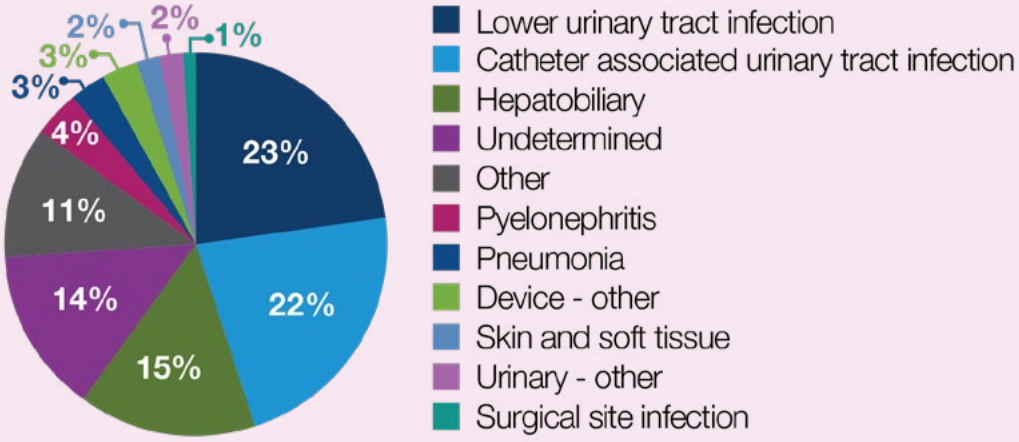
Note: rates are **not adjusted** for **differences** in the **patient population over time**.

In **2023**, the **primary infections** for **healthcare associated ECB** were known for **86.0%** of cases.

The most common primary infections (as determined by the clinical team) include:

23.2% Lower urinary tract infection
22.0% Catheter associated urinary tract infection
14.7% Hepatobiliary infection

Primary infections of healthcare associated ECB in 2023

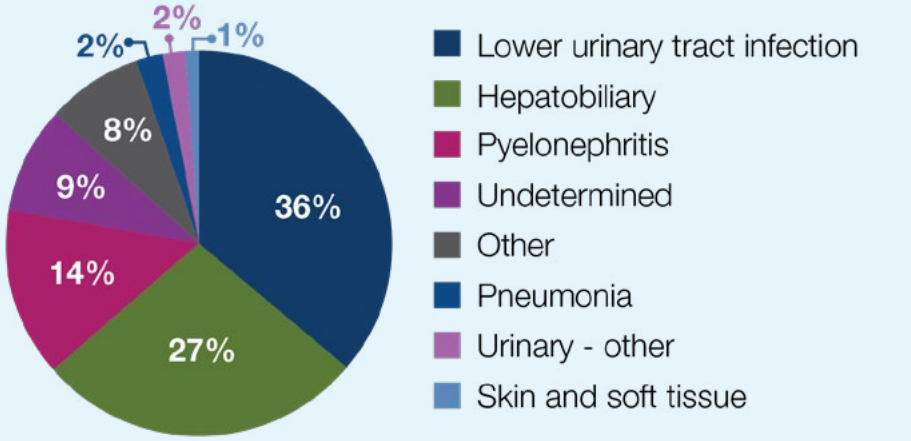


In **2023**, the **primary infections** for **community associated ECB** were known for **90.7%** of cases.

The most common primary infections (as determined by the clinical team) include:

35.7% Lower urinary tract infection
26.7% Hepatobiliary infection
14.5% Pyelonephritis

Primary infections of community associated ECB in 2023



Carbapenemase-producing Enterobacterales

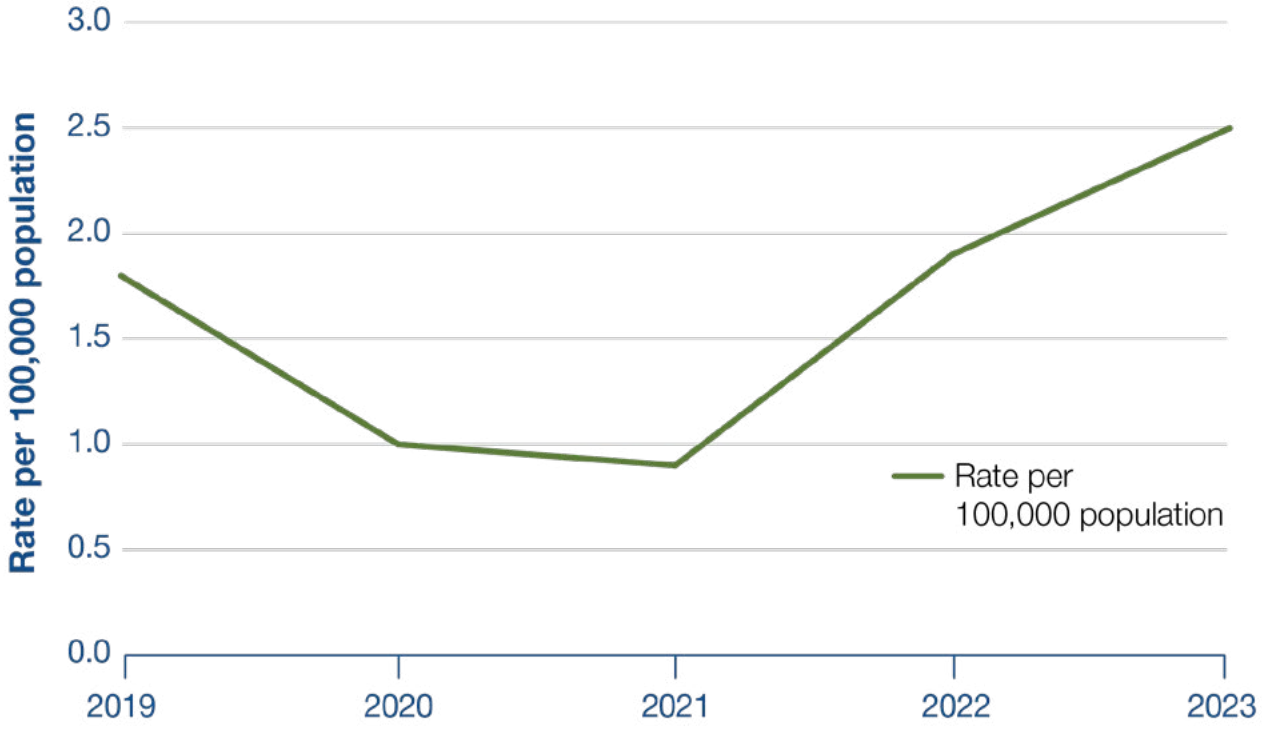
In **2023**, there were **135 cases** of **carbapenemase-producing Enterobacterales (CPE) reported** in **Scotland**, **compared** to **102** in **2022**.

The **annual incidence rate** of **CPE** was **2.5** per 100,000 population.

There has been a **32.4% increase** in the **rate** between **2022** and **2023**.

The **rate in 2023** was **39.6% higher compared to 2019.**

Rate of CPE per 100,000 population in Scotland, 2019 to 2023



Further detail on antimicrobial use and antimicrobial resistance, including Carbapenemase-producing organisms and CPE enzymes, will be published in the annual SONAAR report.

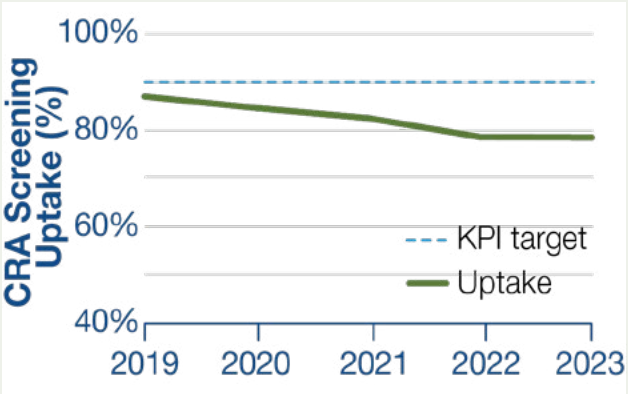
Multi-drug resistant organism admission screening

MRSA CRA screening

In **2023**, **78.5%** of patients audited underwent a **clinical risk assessment (CRA)** for **meticillin-resistant *Staphylococcus aureus* (MRSA)**.

This **remains below** the **90%** Key Performance Indicator and uptake has **remained stable** between **2022** and **2023**.

The **five year trend** in reported uptake has **decreased** with a **2.8% average decrease** each year.

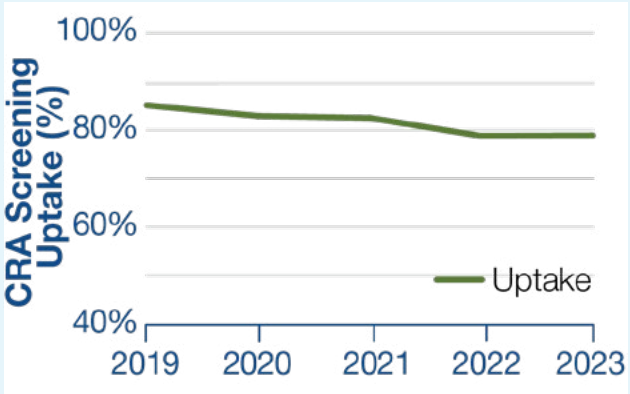


CPE CRA screening

In **2023**, **78.3%** of patients audited underwent a **clinical risk assessment (CRA)** for **carbapenemase-producing Enterobacterales (CPE)**.

Uptake has **remained stable** between **2022** and **2023**.

The **five year trend** in reported uptake has **decreased** with a **2.0% average decrease** each year.



These MRSA and CPE CRA uptake data continue to be monitored by ARHAI Scotland and feedback is provided to NHS boards on a quarterly basis.

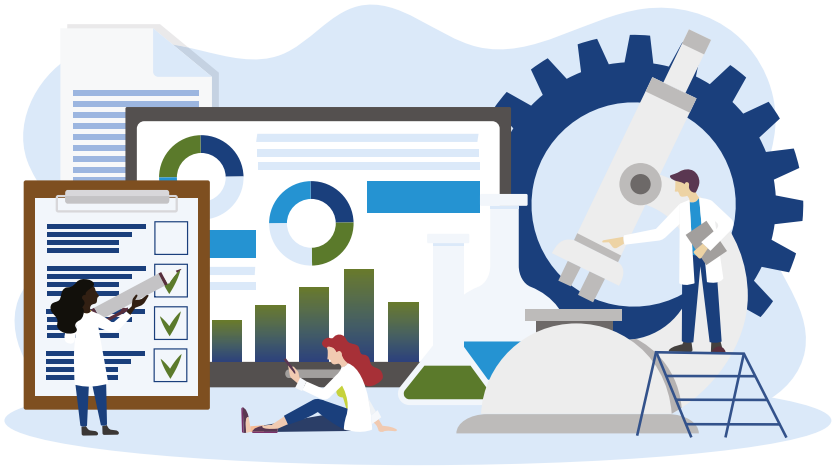
Education and training materials are available on TURAS to support NHS staff in carrying out the two-step admission screening process.

Incidents and outbreaks

ARHAI Scotland supports local Infection Prevention and Control Teams (IPCTs) and Health Protection Teams (HPTs) throughout Scotland to prevent, prepare for, and manage incidents and outbreaks, allowing the sharing of lessons learned throughout the region.

IPCTs and HPTs identify incidents, outbreaks and data exceedances, including decontamination incidents and near misses, in line with **Chapter 3 of the National Infection Prevention and Control Manual (NIPCM)**, which are assessed using the Healthcare Infection Incident Assessment Tool (HIIAT). In collaboration with key stakeholders, work is ongoing to revise the format of the HIIAT, with the aim to address potential variation that may occur with the assessment criteria, to provide a more structured approach in determining the risks associated with an incident or outbreak, and for consistency in the subsequent reporting across Scotland.

HIIAT assessed incidents, outbreaks and data exceedances are reported to ARHAI Scotland through the Outbreak Reporting Tool (ORT), which aims to facilitate the collation of epidemiological data and lessons learned which contribute to the development of national guidance and help inform local incident and outbreak management. The ORT continued to evolve in 2023 with the creation and introduction of the respiratory short form. Any incident/outbreak from key respiratory viruses (COVID-19, influenza and respiratory syncytial virus (RSV) only), where IPC measures align with the checklist and NIPCM and ARHAI support is not requested can be reported through the respiratory short form using a minimum dataset to ease the reporting burden for NHS boards.



In **2023**, there were **181** **healthcare infection incidents** and **outbreaks reported** to ARHAI Scotland (excluding incidents and outbreaks where COVID-19 or Norovirus is the sole pathogen), with HIIATs categorised as **Red**, **Amber** or **Green**.

Of these 181 reports, there were:

32 Red	21 Amber	128 Green

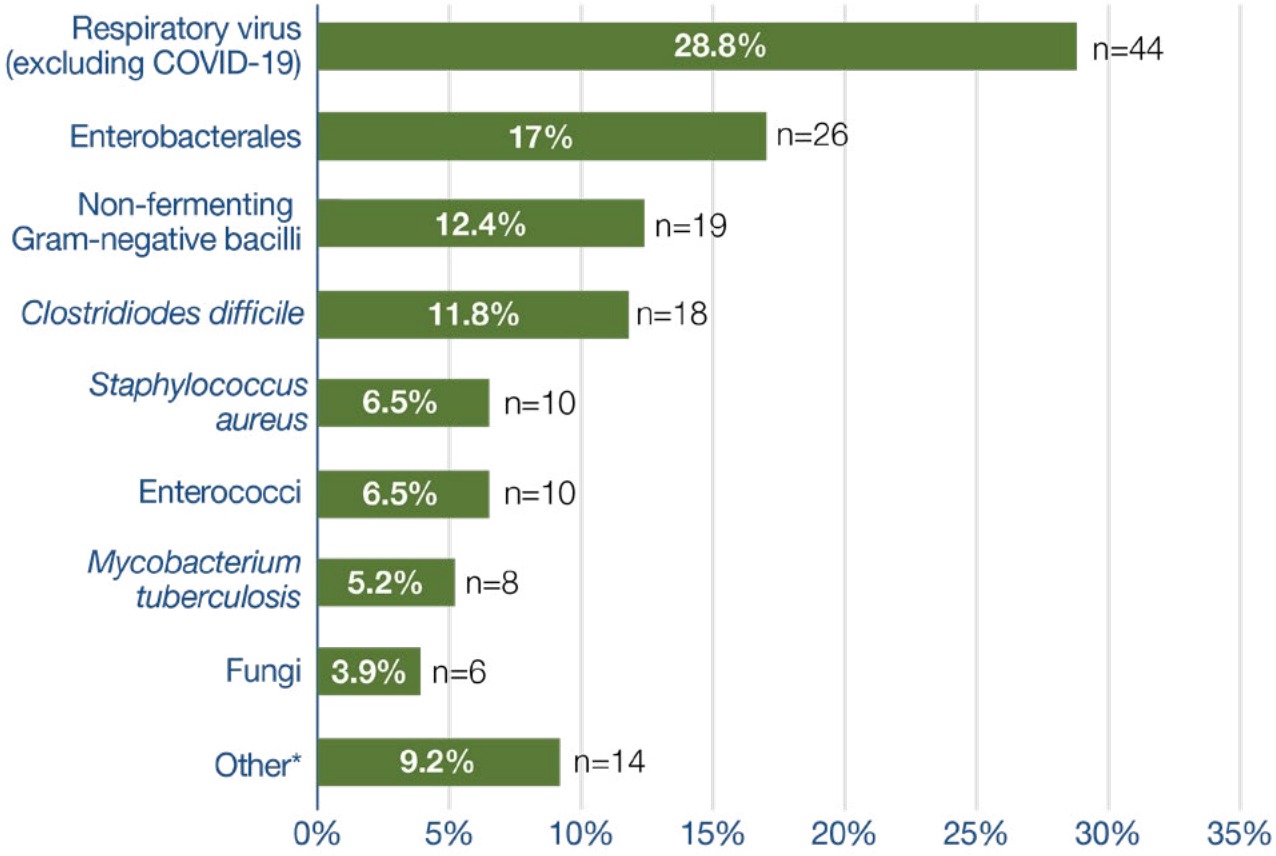
Of the **181** **incidents and outbreaks**, **153** were **reported with one or more patient cases**.

39 incidents involved a single patient case.

4 incidents stated two or more pathogens were involved.

3 incidents were from an unknown causative pathogen.

Percentage of key organism types as reported from incidents and outbreaks with one or more patient cases

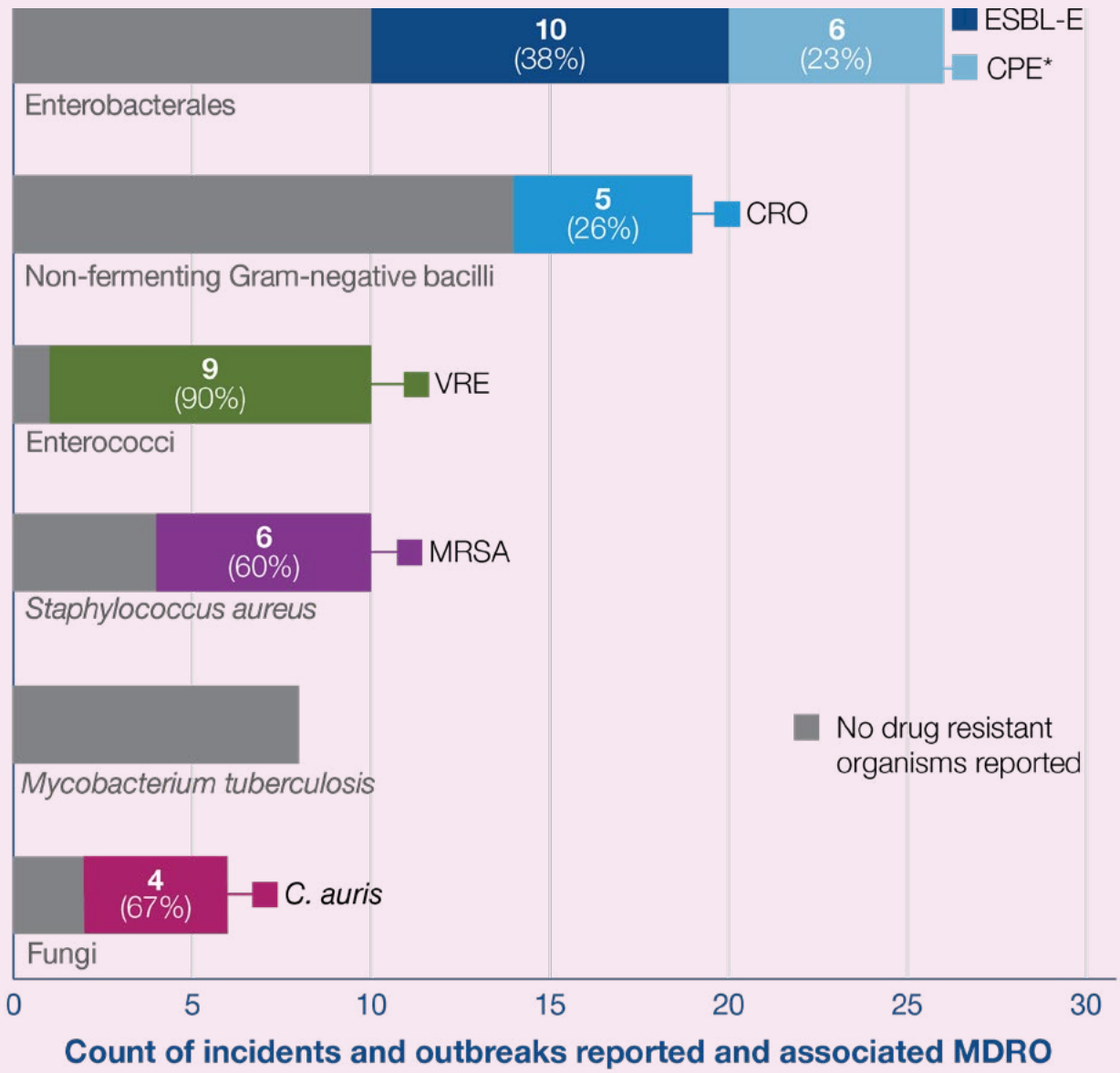


*Other includes: Gastroenteritis viruses (excluding norovirus), other Gram-negatives, other Gram-positives and scabies.

Note: some incidents included multiple organisms so total percentages may not add up to 100%.

Incidents and outbreaks with multi-drug resistant organisms

NHS boards also notify ARHAI Scotland if causative pathogens are multi-drug resistant organisms (MDRO).



*Organisms reported as CPE are not counted as ESBL-E separately.

- ESBL-E – Extended beta-lactamase producing Enterobacterales
- CPE – Carbapenemase-producing Enterobacterales
- CRO - Carbapenem-resistant organism
- VRE – Vancomycin-resistant Enterococcus
- MRSA – Meticillin-resistant *Staphylococcus aureus*
- *C. auris* – *Candida auris* (any susceptibility pattern)

Infection Prevention and Control workforce development

During 2023, NHS Education for Scotland (NES) and ARHAI continued to work collaboratively to embed education across key priority areas, to support improving people's health through a competent and skilled Infection Prevention and Control (IPC) workforce.

Winter preparedness

The winter preparedness campaign for 2023/24 launched 9 infographics containing key IPC messages. The report on our campaign that ended in February 2024 showed better engagement compared to the winter of 2022/23, with more people visiting our website and downloading our content. Our Winter Preparedness 2023/24 video on Vimeo was a hit, with 1,349 views, making it the most-watched video out of over 500 videos posted on our NES Vimeo account in the last 5 months.

Care home webinars

To support adoption and implementation of the Care Home Infection Prevention and Control Manual (CH IPCM), ARHAI Scotland delivered a series of themed national webinars entitled 'Clean Care Homes' to a target audience of care home staff across Scotland. The webinars were planned and jointly delivered with our partners in the Care Inspectorate and the Scottish Social Services Council and feedback was very positive.

Healthcare built environment

Project work was prioritised to develop and deliver learning and development opportunities for the specialist healthcare-built environment workforce. This included identifying priority areas for executive and non-executive NHSScotland board members and the delivery of two senior leadership development sessions.

IPC educational animations

An educational animation aimed at increasing staff awareness of potential risks associated with the improper use of clinical hand wash basins was produced and is hosted on **TURAS**. To support this work, **a safe use of clinical wash hand basin poster** was produced to be placed at all hand hygiene sinks.

A further suite of four educational animations which will identify IPC risks associated with the design, construction, commissioning and handover of healthcare water and above ground drainage systems also commenced. The preparatory work for the animations has begun and two of the four are complete with the remaining two to be undertaken in 2024. The development of the first animation is underway and will conclude in 2024 and sequentially all four will be available by the end of 2024.

Antimicrobial resistance

To continue to embed the importance of reducing the development and transmission of antimicrobial resistance (AMR), ARHAI Scotland provided sessions on post-graduation education to local universities. During Scottish Antimicrobial Prescribing Group network events, topics were presented and discussion groups led. Working in collaboration with NES, subgroups were facilitated on antimicrobial stewardship and AMR.

Surveillance and epidemiology

ARHAI Scotland and NES developed and delivered courses on **Epidemiology and Surveillance for IPC** and **Outbreak Simulation Training**. The learning outcomes for the epidemiology and surveillance course included foundational epidemiology for HCAI with a focus on epidemiological methods for outbreak investigations. The outbreak simulation training allowed participants to apply and enhance their knowledge, skills and confidence in outbreak management in a realistically simulated Incident Management Team environment. These courses will continue to be delivered during 2024.

ARHAI Scotland launched a Sharepoint site with training materials designed to support IPC staff with ongoing mandatory national surveillance programmes. In addition to links to key protocols and resources, ARHAI Scotland compiled additional video guides for users on the mandatory national surveillance programmes. These materials have been developed to support infection prevention and control teams to collect, submit and validate data according to surveillance definitions.

Education and training goals for 2024

- **Focus on educational content beyond social media campaigns to better reach our target audience.**
- **Introduce new educational tools and resources to support the launch of recommendations from the Transmission Based Precautions (TBPs) literature review.**
- **To continue support for adoption and implementation of national IPC guidance, a further series of Care Home themed webinars will be delivered**
- **Further development and creation of a suite of educational animations**
- **Continued education sessions feeding into the post-graduation programme**
- **Continue to deliver epidemiology and surveillance training to the IPC workforce.**
- **Expand the suite of training materials to support the provision of national surveillance data and outbreak reporting.**

List of abbreviations and acronyms

A&E	Accident and Emergency
AMR	Antimicrobial Resistance
ARHAI	Antimicrobial Resistance and Healthcare Associated Infections
C. *auris*	*Candida auris*
C. *difficile*	*Clostridioides difficile*
CDI	*Clostridioides difficile* Infection
CfSD	Centre of Sustainable Delivery
CHI	Community Health Index
CH IPCM	Care Home Infection Prevention and Control Manual
CJF	Considered Judgement Form
COVID-19	Coronavirus disease 2019 COVID-19
CPE	Carbapenemase-producing Enterobacterales
CRA	Clinical Risk Assessment
CRO	Carbapenem-resistant Organism
EBIS SMiRL	Enteric Bacterial Infections Service Scottish Microbiology Reference Laboratories
E. coli	*Escherichia coli*
ECB	*Escherichia coli* Bacteraemia
ECOSS	Electronic Communication of Surveillance in Scotland
ESBL-E	Extended beta-lactamase producing Enterobacterales
HAI	Hospital Acquired Infection
HCAI	Healthcare Associated Infection
HIIAT	Healthcare Infection Incident Assessment Tool
HIIORT	Healthcare Infection, Incident and Outbreak Reporting Template
HPT	Health Protection Team
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
IPCT	Infection Prevention and Control Team
ISD	Information Services Division
KPI	Key Performance Indicator
KSAR	Key Stage Assurance Review
MDRO	Multi-Drug Resistant Organism

MLST	Multi-locus Sequence Typing
MRSA	Meticillin-resistant *Staphylococcus aureus*
MSSA	Meticillin-sensitive *Staphylococcus aureus*
NAP	National Action Plan
NCS	National Cleaning Specification
NDAP	NHSScotland Design Assessment Process
NES	NHS Education for Scotland
NHS	National Health Service
NIPCM	National Infection Prevention and Control Manual
NRS	National Records of Scotland
NSS	National Services Scotland
ORT	Outbreak Reporting Tool
PCR	Polymerase Chain Reaction
PHS	Public Health Scotland
PPE	Personal Protective Equipment
PWID	People Who Inject Drugs
RSV	Respiratory syncytial virus
RT	Ribotype
S. aureus	*Staphylococcus aureus*
SAB	*Staphylococcus aureus* Bacteraemia
SAMRS **SMiRL**	Scottish Antimicrobial Resistance Service Scottish Microbiology Reference Laboratories
SICPs	Standard Infection Control Precautions
SMR	Scottish Morbidity Record
SONAAR	Scottish One Health Antimicrobial Use and Antimicrobial Resistance
SSI	Surgical Site Infection
TBPs	Transmission Based Precautions
TOBD	Total Occupied Bed Days
UK	United Kingdom
VAD	Vascular Access Device
VRE	Vancomycin-resistant Enterococcus
WGS	Whole Genome Sequencing

Appendix 1 – Publication metadata

Publication title

ARHAI Scotland 2023 Annual Report

Description

This release provides information on activity within Antimicrobial Resistance and Healthcare Associated Infection (ARHAI) Scotland for the period January to December 2023.

Theme

Healthcare associated infections in Scotland

Topic

Healthcare associated infections

Infection prevention and control

Format

Online resource (PDF)

Data source(s)

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: N/A

Hospital Activity and Pressures:

Total occupied bed days: **Public Health Scotland, ISD(S)1**.

Elective admissions data: **Public Health Scotland, Acute hospital activity and NHS beds information**.

Emergency admissions data: **Public Health Scotland, Acute hospital activity and NHS beds information**.

Delayed discharges data: **Scottish Health and Social Care Open Data platform, Delayed discharges in NHSScotland**.

Accident & Emergency (A&E) waiting times data: **Scottish Health and Social Care Open Data platform, Monthly A&E Activity and Waiting TimesScottish Health and Social Care Open Data platform, Monthly A&E Waiting Times**.

***Clostridioides difficile* infection**:

Case data: Electronic Communication of Surveillance in Scotland (ECOSS).

Data linkage source: general / acute inpatient and day case Scottish Morbidity Records (SMR01): Public Health Scotland.

Healthcare associated denominator: Public Health Scotland ISD(S)1 total occupied bed days.

Community associated denominator: National Records of Scotland (NRS) mid-year population estimates.

Case fatality data: NRS.

Molecular typing data: ECOSS, Enteric Bacterial Infections Service (EBIS SMiRL, Glasgow).

***Staphylococcus aureus* bacteraemia:**

Case data: ECOSS Enhanced Surveillance Web Tool.

Healthcare associated denominator: Public Health Scotland ISD(S)1 total occupied bed days.

Community associated denominator: NRS mid-year population estimates.

Case fatality data: NRS.

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia):

Case data: ECOSS.

Gram-negative bacteraemia (*Escherichia coli* bacteraemia):

Case data: ECOSS and ECOSS Enhanced Surveillance Web Tool.

Healthcare associated denominator: Public Health Scotland ISD(S)1 total occupied bed days.

Community associated denominator: NRS mid-year population estimates

Case fatality data: NRS.

Multi-drug resistant organism admission screening: National Multi-drug resistant organism (MDRO) Admission Screening Uptake Monitoring Tool.

Carbapenemase-producing Enterobacterales: ECOSS, Scottish Antimicrobial Resistance Service (SAMRS SMiRL, Glasgow).

Population denominator: NRS mid-year population estimates.

Incidents and Outbreaks: Healthcare infection incidents and outbreaks reported to National Services Scotland (NSS) through the Healthcare Infection, Incident and Outbreak Reporting Template (HIIORT) reporting process and the ARHAI Scotland Outbreak Reporting Tool (ORT).

Infection Prevention and Control Workforce Development: N/A

Date that data are acquired

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: N/A

Hospital Activity and Pressures: 28 May 2024

***Clostridioides difficile* infection:** 19 March 2024

***Staphylococcus aureus* bacteraemia:** 19 March 2024

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia):
8 April 2024

Gram-negative bacteraemia (*Escherichia coli* bacteraemia):
19 March 2024

Multi-drug resistant organism admission screening: 27 March 2024

Carbapenemase-producing Enterobacterales: 9 April 2024

Incidents and Outbreaks: 11 June 2024

Infection Prevention and Control Workforce Development: N/A

Release date

15 October 2024

Frequency

Annual

Timeframe of data and timeliness

The latest iteration of data are to 31 December 2023, therefore ten months in arrears.

Continuity of data

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: N/A

Hospital Activity and Pressures: Please see each **data source** for any relevant information.

***Clostridioides difficile* infection:** Changes in the hospital population and activity during the pandemic period may have affected the epidemiology of *Clostridioides difficile* infection and comparison of results should be interpreted with caution.

In 2023, a small number of *C. difficile* isolates were typed using whole genome sequencing (WGS) derived from multi locus sequence type (MLST) due to an ongoing shortage of DNA polymerase, and ribotypes were inferred from the sequence type. Polymerase chain reaction (PCR) ribotyping was resumed in early 2023.Caution is advised in interpretation of the annual ribotype distributions due to the differences in typing methods.

***Staphylococcus aureus* bacteraemia:** Changes in the hospital population and activity during the pandemic period may have affected the epidemiology of *Staphylococcus aureus* infection and comparison of results should be interpreted with caution.

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia):

Changes in the hospital population and activity during the pandemic period may have affected the epidemiology of Gram-negative bacteraemia and comparison of results should be interpreted with caution.

Gram-negative bacteraemia (*Escherichia coli* bacteraemia): Changes in the hospital population and activity during the pandemic period may have affected the epidemiology of Gram-negative bacteraemia and comparison of results should be interpreted with caution.

Multi-drug resistant organism admission screening: Changes in the hospital population and activity during the pandemic period may have affected screening uptake; results of the clinical risk assessment (CRA) screening audits for meticillin-resistant *Staphyloccocus aureus* (MRSA) and carbapenemase-producing Enterobacterales (CPE) should be interpreted with caution.

Carbapenemase-producing Enterobacterales: Changes in the hospital population and activity during the pandemic period, including international travel restrictions, may have affected the epidemiology of CPE and comparison of results should be interpreted with caution.

Incidents and Outbreaks: Changes in the hospital population and activity during the pandemic period may have affected the epidemiology of healthcare incidents and outbreaks and comparison of results should be interpreted with caution.

Infection Prevention and Control Workforce Development: N/A

Revisions statement

These data are not subject to planned major revisions. However, our aim is to continually improve the interpretation of the data and therefore analysis methods are regularly reviewed and may be updated in the future.

Revisions relevant to this publication

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: N/A

Hospital Activity and Pressures: Please see each **data source** for any relevant information.

***Clostridioides difficile* infection:** Details provided in **quarterly publication**.

***Staphylococcus aureus* bacteraemia:** Details provided in **quarterly publication**.

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia): N/A

Gram-negative bacteraemia (*Escherichia coli* bacteraemia): Details provided in **quarterly publication**.

Multi-drug resistant organism admission screening: N/A

Carbapenemase-producing Enterobacterales: Due to data quality updates the number of CPE cases in 2023 is reported as 102 cases, whereby this was previously reported as 103 cases in the ARHAI Scotland 2022 Annual Report.

Incidents and Outbreaks: N/A

Infection Prevention and Control Workforce Development: N/A

Concepts and definitions

Statistical significance:

Please note an increase or decrease stated in this report refers to a statistically significant change ($p < 0.05$), and where a trend is referred to as stable, or there has been no change, this means that there has been no significant increase or decrease.

Origin of infection:

Clostridioides difficile infection, *Staphylococcus aureus* bacteraemia and *Escherichia coli* bacteraemia: Cases are presented by origin of infection, where definitions are applied as per each surveillance protocol to classify cases as hospital acquired, healthcare associated, community associated or unknown. Please see the **quarterly publications**, corresponding **methods & caveats** document and individual surveillance protocols for **CDI** and **SAB/ECB** for full details.

Case fatality:

Clostridioides difficile infection, *Staphylococcus aureus* bacteraemia and *Escherichia coli* bacteraemia: The definition of 30 day all cause case fatality is any death occurring within 30 days of the first positive specimen date within each infection episode. Therefore, the data includes deaths where

Clostridioides difficile infection, *Staphylococcus aureus* bacteraemia or *Escherichia coli* bacteraemia may not have been either the underlying or contributory cause of death. All cause case fatality depends solely on the number of deaths identified and is not subject to bias that may be introduced as a result of inaccuracies in completion of the death certificate or coding of the cause of death. If more than one episode occurs in the 30 days prior to death, only the latest episode will be counted as resulting in a death. Some cases may not be able to be linked to NRS death data due to missing or invalid Community Health Index (CHI) numbers.

Year-to-year comparisons:

The current calendar year 2023 is compared to the previous calendar year 2022 using two sided z-tests for proportions and rate ratio tests (using Poisson counts) for incidence rates. A resulting p-value of less than 0.05 was deemed statistically significant to determine an increase or decrease relative to the previous year.

Five-year trends:

Incidence rates and incidence proportions over the past five years are modelled using Poisson regression and negative binomial regression respectively. This is performed to determine the presence of a significant upwards or downwards linear trend in the changing incidence rate/ proportion, and the corresponding rate of change of the best-fit gradient over the past five years from 2019 to 2023.

Where a year-on-year increase or decrease has been reported, this represents a significant linear trend over the past five years.

Where no five year increases or decreases have been detected, these are reported as stable.

Where a change over the past five years has been detected, but the trend is not linear, a direct year-to-year comparison between the incidence rate in 2023 and the incidence rate in 2019 has been made.

Funnel plots:

Funnel plot analyses are used to determine if any NHS board's rate is significantly higher than the NHSScotland average rate. The incidence rates for each NHS board are plotted against NHS board size/hospital activity,

with 95% confidence intervals calculated from the NHSScotland average. Any NHS board above the 95% confidence interval are deemed to be exceptions. Funnel plots are generated on a quarterly basis in the **quarterly epidemiological reports**; in this report the funnel plots incorporate the full year's data for 2023, and therefore as a result, some NHS boards may be above the 95% confidence interval upper limit in the annual funnel plot who may not have exceeded the quarterly funnel plots limits.

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: N/A

Hospital Activity and Pressures: Total occupied bed days: Total number of occupied bed days for years 2019 - 2023, as per **Public Health Scotland ISD(S)1**.

Elective admissions data: Details are provided within **Public Health Scotland Acute hospital activity and NHS beds information quarterly publication**.

Emergency admissions data: Details are provided within **Public Health Scotland Acute hospital activity and NHS beds information quarterly publication**.

Delayed discharges data: Details are provided on the **Scottish Health and Social Care Open Data platform**. These data include the number of hospital bed days occupied by people aged 18 and over who were clinically ready for discharge (excluding NHS Golden Jubilee). Data are presented as a percentage of TOBDs, whereby a comparable number of total hospital occupied bed days are used which excludes TOBDs from NHS Golden Jubilee, paediatric specialties and TOBDs from children's hospitals.

A&E waiting times data: Details are provided within **Scottish Health and Social Care Open Data platform, Monthly A&E Waiting Times.Scottish Health and Social Care Open Data platform**

***Clostridioides difficile* infection:** Details provided in **surveillance protocol and quarterly publication**.

***Staphylococcus aureus* bacteraemia:** Details provided in **surveillance protocol and quarterly publication**.

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia):
Gram-negative organisms including Enterobacterales and non-fermenters, cause serious infections including bacteraemia, pneumonia, meningitis, and surgical site infections (SSIs). Gram-negative bacteraemia is a public health and clinical concern because of:

1. The severity of infection, commonly occurring among vulnerable patients often at the extremes of life and/or with comorbidities.
2. The large number of cases of Gram-negative bacteraemias each year, and high prevalence of Gram-negative infections.
3. The association with receiving healthcare in community and healthcare settings.
4. Their ability to become resistant to multiple classes of antibiotics, limiting treatment options.

Further details provided in the **SONAAR Annual Report**.

Gram-negative bacteraemia (*Escherichia coli* bacteraemia): Details provided in **surveillance protocol and quarterly publication**.

Multi-drug resistant organism admission screening: Screening for MDRO on admission to hospital is a key intervention for early identification and management of patients who are colonised or infected, reducing the risk of introduction of MDRO into healthcare settings.

MRSA and CPE CRA screening policies are in place for all acute hospitals in Scotland. The two-stage screening process includes a CRA to identify patients at high risk of colonisation or infection with either MRSA or CPE, followed by microbiological testing as indicated by the CRA.

Uptake of the MRSA CRA has been a **level 3 HCAI Key Performance Indicator (KPI) since 2013**. The MRSA screening uptake monitoring tool was extended in 2018 to include assessment of CPE CRA uptake for the same patients included in the MRSA KPI audits.

Carbapenemase-producing Enterobacterales: CPE are bacteria that produce enzymes that inactivate carbapenems and other classes of antibiotics. Infections caused by CPE are difficult to treat and are associated with increased mortality.

A case of CPE is defined as one isolate per patient per enzyme and organism combination per year as confirmed by the Scottish Microbiology Reference Laboratory. Further details provided in the **SONAAR Annual Report**.

Incidents and Outbreaks: Healthcare infection incidents and outbreaks reported to NSS. Healthcare associated infection incidents and outbreaks are defined within **Chapter 3 of the National Infection Prevention and Control Manual**.

Individual NHS boards report the MDRO status of organisms. These are typically ascertained by local phenotypic susceptibility testing, reference laboratory phenotypic or genotypic testing or a combination. For more information see the **Reference laboratory referral guide**.

Further details provided in the **SONAAR Annual Report**.

Infection Prevention and Control Workforce Development: N/A

Relevance and key uses of the statistics

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: Details provided in the **SONAAR Annual Report**.

Hospital Activity and Pressures: Figures provided are used for management information for resource planning, surveillance and research in NHSScotland.

***Clostridioides difficile* infection:** Details provided in **quarterly publication**.

***Staphylococcus aureus* bacteraemia:** Details provided in **quarterly publication**.

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia): The outputs of the surveillance programme are intended to support the NHS boards in controlling and reducing the burden of Gram-negative bacteraemia.

Gram-negative bacteraemia (*Escherichia coli* bacteraemia): Details provided in **quarterly publication**.

Multi-drug resistant organism admission screening: These audit data measure uptake of the two-stage admission screening process of CRA followed by microbiological testing of those considered to be at risk of carrying MRSA or CPE based on CRA response, in NHSScotland as per policies. These audit data are collected to support the assurance element of quality improvement processes and gather intelligence to inform and target local interventions where CRA screening uptake is suboptimal. ARHAI Scotland provide enhanced feedback to NHS boards on a quarterly basis.

Carbapenemase-producing Enterobacterales: Details provided in the **SONAAR Annual Report**.

Incidents and Outbreaks: To identify risks or trends in the organisms, types of infection, procedures, patients, or clinical specialities associated with healthcare infection incidents and outbreaks. This informs the production of guidance, tools or policy and assists in preparing for, preventing, detecting, and managing healthcare infection incidents and outbreaks.

Infection Prevention and Control Workforce Development: N/A

Accuracy

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: N/A

Hospital Activity and Pressures: Details available as per each **data source**.

***Clostridioides difficile* infection:** Details provided in **quarterly publication**.

The **snapshot programme** aims to obtain a representative sample of isolates from CDI cases across all NHS boards in Scotland, however not all NHS boards have submitted the required number of isolates as specified by the Snapshot protocol therefore the data should be interpreted with caution.

***Staphylococcus aureus* bacteraemia:** Details provided in **quarterly publication**.

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia): Gram-negative bacteraemia data are the product of the ECOSS. Participating laboratories routinely report all identifications of organisms, infection or microbiological intoxication and where possible the antimicrobial resistance data unless they are known to be of no clinical or public health importance. The collected data are used for the identification of single cases of severe disease, outbreaks, antimicrobial resistance patterns and longer-term trends in the incidence of laboratory reported infections, enhanced surveillance, health protection, analytical and statistical use.

Gram-negative bacteraemia (*Escherichia coli* bacteraemia): Details provided in **quarterly publication**.

Multi-drug resistant organism admission screening: While audit data does not present the same robust scientific data as surveillance, it provides a nationally representative measure of CRA screening uptake and is valuable for identification of areas for targeted implementation of quality improvement measures. A minimum of 3,500 patients are audited annually for NHSScotland in order to measure uptake with sufficient precision, with each NHS board auditing a representative number of patients.

For each eligible patient admitted during the audit period, data are collected for the most recent opportunity for the CRA to have been undertaken. It is acknowledged that all patients are eligible for CPE CRA admission screening though not all areas are included in the screening audit. These areas will not be represented in these data. Patients are selected for audit based on the **Protocol for CRA MRSA Screening National Rollout in Scotland**, with the exception of NHS Golden Jubilee from which only CPE CRA screening uptake audits are submitted (as all patients are screened for MRSA). In order to maximise the representativeness of the national KPI measure whilst ensuring flexibility at a local level, NHS boards are asked that data collection throughout the year should be spread as much as possible across; hospital, wards, high/low impact specialties, medical/surgical specialties, elective and emergency admissions.

Carbapenemase-producing Enterobacterales: Details provided in the **SONAAR Annual Report**.

Incidents and Outbreaks: NSS are aware that the healthcare infection incident assessment tool (HIIAT) is subjective and there is variation in how NHSScotland boards assess and therefore report healthcare infection incidents. The extent of variation in assessment and unreported incidents has not been fully quantified.

Infection Prevention and Control Workforce Development: N/A

Completeness

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: N/A

Hospital Activity and Pressures: Details available as per each **data source**.

***Clostridioides difficile* infection:** Details provided in **quarterly publication**.

The **snapshot programme** aims to obtain a representative sample of isolates from CDI cases across all NHS boards in Scotland, however not all NHS boards have submitted the required number of isolates as specified by the Snapshot protocol therefore the data should be interpreted with caution.

***Staphylococcus aureus* bacteraemia:** Details provided in **quarterly publication**.

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia): All data for the reporting period have been included in the analysis.

Gram-negative bacteraemia (*Escherichia coli* bacteraemia): Details provided in **quarterly publication**.

Multi-drug resistant organism admission screening: A minimum of 3,500 patients are audited annually for NHSScotland in order to measure uptake with sufficient precision, with each NHS board auditing a representative number of patients. All NHS boards submitted at least their required minimum number of patients audited and all completed audits submitted data for the reporting period have been included in the analysis.

Carbapenemase-producing Enterobacterales: Details provided in the **SONAAR Annual Report**.

Incidents and Outbreaks: NSS are aware that the HIIAT is subjective and there may be some variation in how NHS boards assess and therefore report healthcare infection incidents. The extent of variation in assessment and unreported incidents has not been fully quantified.

Infection Prevention and Control Workforce Development: N/A

Comparability

Changes in the hospital population and activity during the pandemic period may have affected the comparison of results and therefore should be interpreted with caution.

Infection Prevention and Control Guidance: N/A

Reducing Risk in the Healthcare Built Environment: N/A

Antimicrobial Resistance: N/A

Hospital Activity and Pressures: Details available as per each **data source**.

***Clostridioides difficile* infection:** Details provided in **quarterly publication**.

***Staphylococcus aureus* bacteraemia:** Details provided in **quarterly publication**.

Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter species* bacteraemia): Details provided in **SONAAR Annual Report**.

Gram-negative bacteraemia (*Escherichia coli* bacteraemia): Details provided in **quarterly publication**.

Multi-drug resistant organism admission screening: There are no comparable data on CRA screening uptake.

Carbapenemase-producing Enterobacterales: Details provided in the **SONAAR Annual Report**

Incidents and Outbreaks: Reporting of all HCAI outbreaks is not mandatory elsewhere in the UK and comparable data are not published.

Infection Prevention and Control Workforce Development: N/A

Accessibility

It is the policy of NSS to make its website and products accessible according to published guidelines.

Coherence and clarity

Development of guidance: all National Infection Prevention and Control Manual (NIPCM) reviews and resources are produced using a **defined process** which ensures clarity and coherence.

Value type and unit of measurement

Total occupied bed days per year and quarter.

Count of emergency admissions per year and quarter. Count of elective admissions per year and quarter.

Percentage of total occupied bed days due to delayed discharges (%) = Number of bed days occupied by people aged 18 and over who were clinically ready for discharge (excluding NHS Golden Jubilee) / Total number of occupied bed days (excluding bed days from NHS Golden Jubilee and all paediatric specialties/children's hospitals) * 100.

Percentage of A&E attendances seen within 4-hour target (%) = Total number of patients seen within 4 hours in A&E / Total number of patients who attended A&E * 100.

Healthcare associated and hospital acquired cases and incidence rates (per 100,000 total occupied bed days) for *Clostridioides difficile* infection, *Escherichia coli* bacteraemia and *Staphylococcus aureus* bacteraemia.

Community associated cases and incidence rates (per 100,000 population) for Clostridioides difficile infection, *Escherichia coli* bacteraemia and *Staphylococcus aureus* bacteraemia.

30 day all cause case fatality rate for *Clostridioides difficile* infection, *Staphylococcus aureus* bacteraemia and *Escherichia coli* bacteraemia = count of cases with death occurring within 30 days of positive specimen date / total number of cases.

Percentage of *C. difficile* ribotypes (%) = count of each ribotype or ribotype group / total number of isolates submitted for typing.

Percentage of each SAB entry point (%) = count of healthcare associated or community associated SAB with a specific entry point / total number of healthcare associated or community associated *Staphylococcus aureus* bacteraemia.

Percentage of each ECB primary infection (%) = count of healthcare associated or community associated ECB with a specific source / total number of healthcare associated or community associated *Escherichia coli* bacteraemia.

Due to rounding percentages may not add up to 100%.

MRSA Clinical Risk Assessment (CRA) Uptake (%) = number of patients where CRA undertaken / all patients in audit sample *100.

Carbapenemase-producing Enterobacterales (CPE) CRA Uptake (%) = number of patients where CRA undertaken / all patients in audit sample *100.

Count of carbapenemase-producing Enterobacterales per year. Incidence rate of carbapenemase-producing Enterobacterales per 100,000 population per year.

Total number of reported incidents and outbreaks.

Number of reported incidents and outbreaks by HIIAT category.

Number of incident and outbreak reports where one or more patient cases where reported.

Number of incident and outbreak reports where two or more pathogens were reported.

Number of incident and outbreak reports where the causative pathogen was unknown.

Number and percentage of incident and outbreak reports from key organism types (%) = Number of incident and outbreak reports from a key organism type / Total number of incident and outbreak reports * 100. Note: some incidents included multiple organisms so total percentages may not add up to 100%.

Number and percentage of incident and outbreak reports from a key organism type where ARHAI has been notified of a multi-drug resistant organism (%) = Number of incident and outbreak reports from a key organism type where ARHAI has been notified of a multi-drug resistant organism / Number of incident and outbreak reports from corresponding key organism type * 100.

Disclosure

The PHS protocol on **Statistical Disclosure Protocol** is followed.

Official statistics accreditation

Not Assessed

UK Statistics Authority Assessment

Not Assessed

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Date form completed

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Appendix 2 – Early Access Details

Pre-release access

Under terms of the 'Pre-Release Access to Official Statistics (Scotland) Order 2008', NSS is obliged to publish information on those receiving Pre-Release Access ('Pre-Release Access' refers to statistics in their final form prior to publication). The standard maximum Pre-Release Access is five working days. Shown below are details of those receiving standard Pre-Release Access.

Standard pre-release access

Scottish Government Health Department, NHS board Chief Executives, NHS board Communication leads

Appendix 3 – NSS and Official Statistics

Our statistics comply with the **Code of Practice for Statistics** in terms of trustworthiness, high quality and public value. This also means that we keep data secure at all stages, through collection, processing, analysis and output production, and adhere to the **'five safes'**.

NHS National Services Scotland

Alternative formats

This publication can be made available in large print, Braille (English only), audio tape and different languages. Please contact nss.equalitydiversity@nhs.scot for further information.

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ARHAI Scotland

Antimicrobial Resistance and Healthcare Associated Infection

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