

# ARHAI Scotland 2022 Annual Report

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# About ARHAI Scotland

## ARHAI Scotland's overall vision is to

**Enable Scotland to have a world leading approach to reducing the burden of infection and antimicrobial resistance (AMR).**



## Our mission is to

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

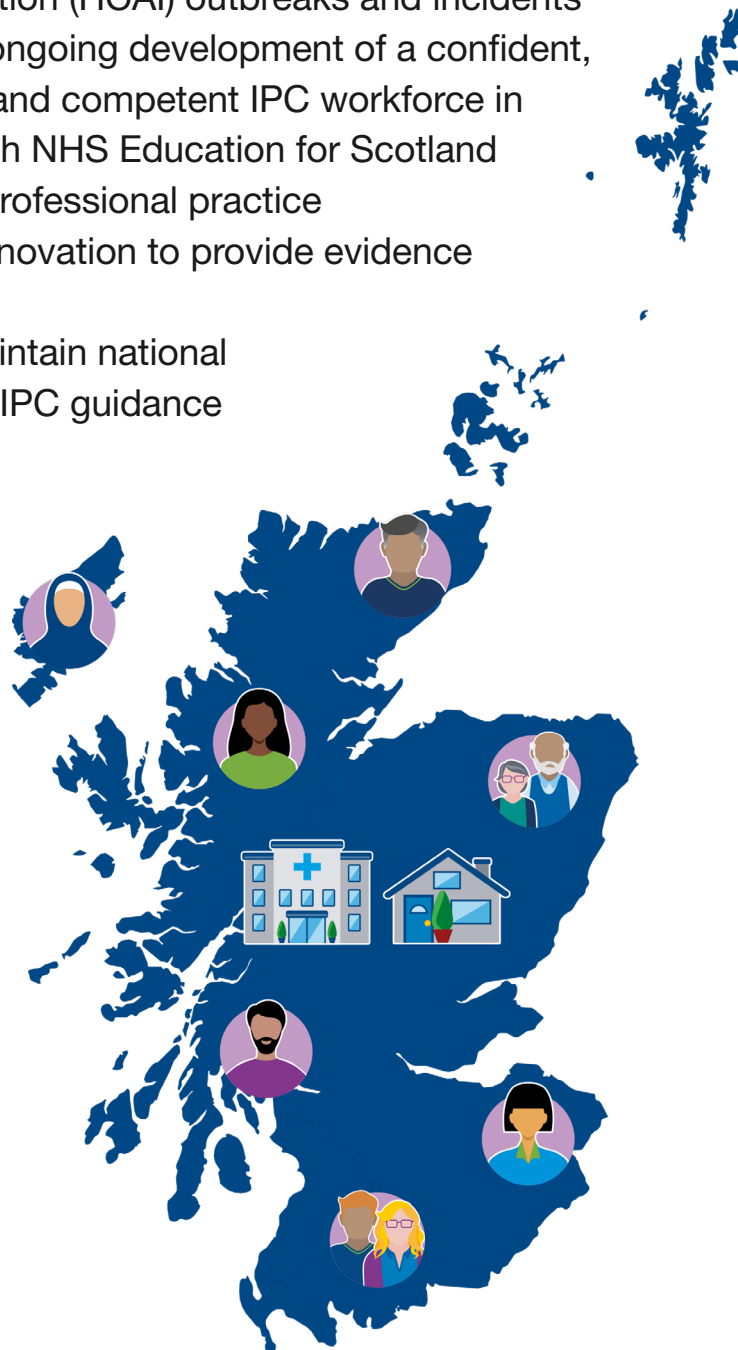


We will do this by establishing a robust evidence base for practice and building mechanisms for monitoring key priority areas, connecting with the wider health and social care and public health system and collaborating with key delivery partners including NHS boards, care providers and other national bodies as commissioned by the Scottish Government.



The work of ARHAI Scotland is underpinned by delivering a wide range of functions, working with stakeholders across health and care, and beyond to fulfil these functions. ARHAI Scotland's functions are:

- Surveillance and monitoring of infections and antimicrobial resistance to assess their impact on health
- Clinical assurance to reduce risk in the built healthcare environment
- Co-ordination of national Infection Prevention and Control (IPC) and Antimicrobial Resistance (AMR) programmes
- Expert IPC/AMR advice and horizon scanning
- Effective preparation and response to healthcare associated infection (HCAI) outbreaks and incidents
- Supporting the ongoing development of a confident, knowledgeable and competent IPC workforce in collaboration with NHS Education for Scotland
- Enabling good professional practice
- Research and innovation to provide evidence for action
- Develop and maintain national evidence based IPC guidance for Scotland

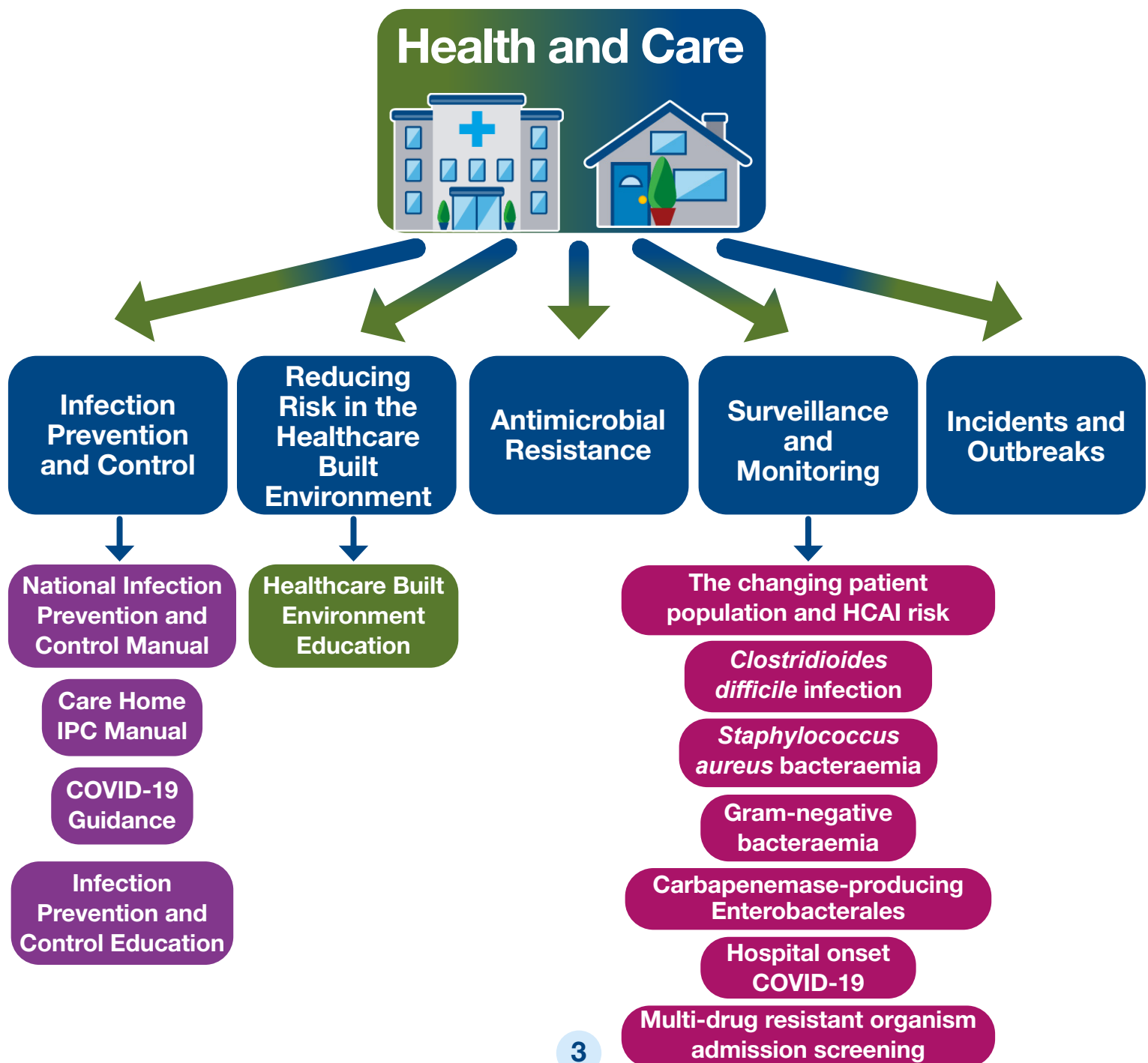


# ARHAI Scotland Activities in 2022

Healthcare associated infections (HCAs) continue to be a threat to patient safety in NHSScotland and to safe care, wherever it is delivered.

This annual report focuses on some of the key work delivered by ARHAI Scotland to support Infection Prevention and Control (IPC), HCAI prevention and tackling Antimicrobial Resistance (AMR) during 2022. The planned work was undertaken alongside reactive provision of IPC expert advice throughout 2022.

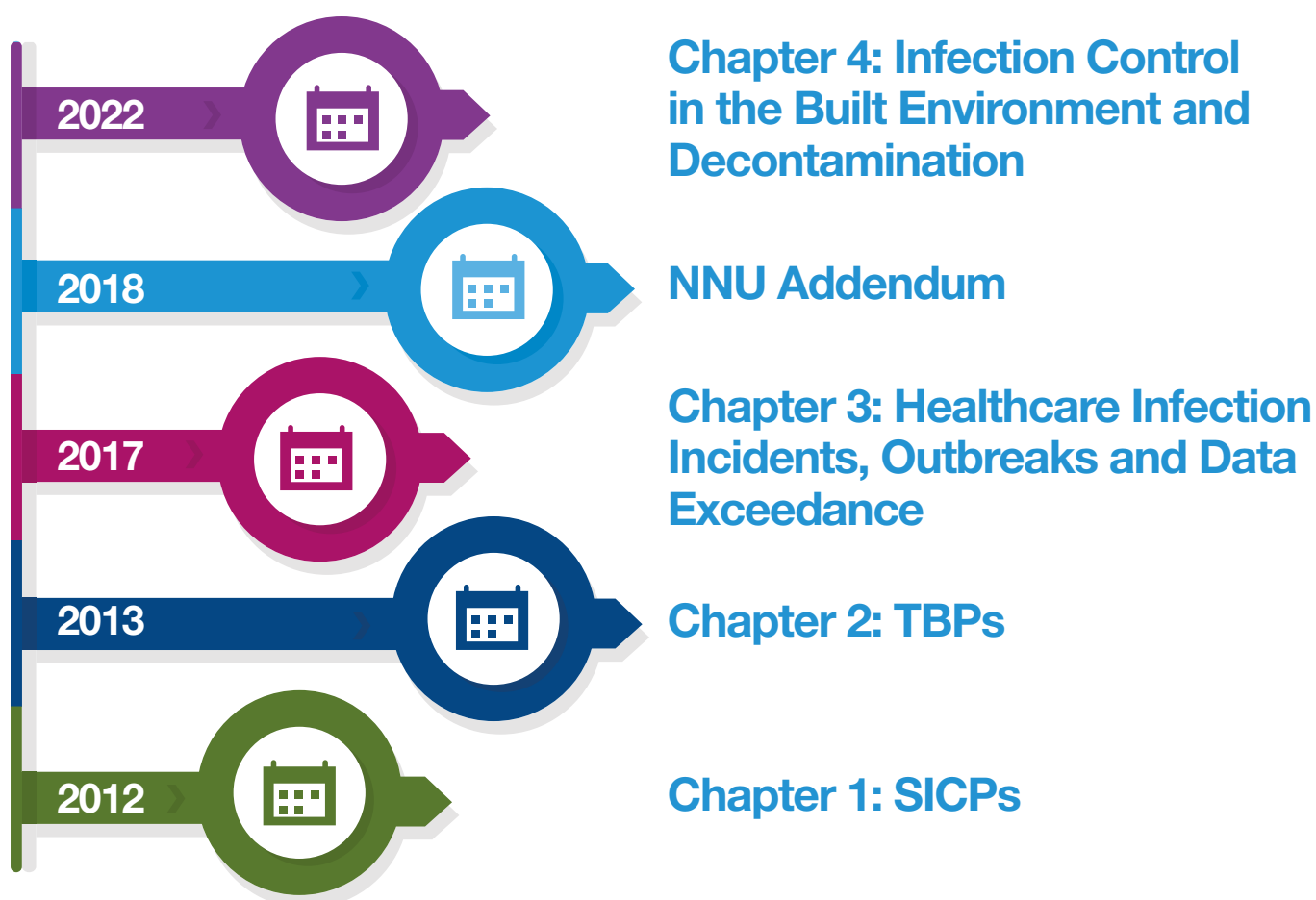
Click below to read more about ARHAI Scotland's work in 2022.



# Infection Prevention and Control

## National Infection Prevention and Control Manual

The **National Infection Prevention and Control Manual (NIPCM)** continues to evolve from its inaugural chapter, Chapter 1: Standard Infection Control Precautions (SICPs) in 2012, followed by Chapter 2: Transmission Based Precautions (TBPs) in 2013/2014; Chapter 3: Healthcare Infection Incidents, Outbreaks and Data Exceedance in 2017 and the Addendum for Infection Prevention and Control within Neonatal Settings (NNU) in 2018.

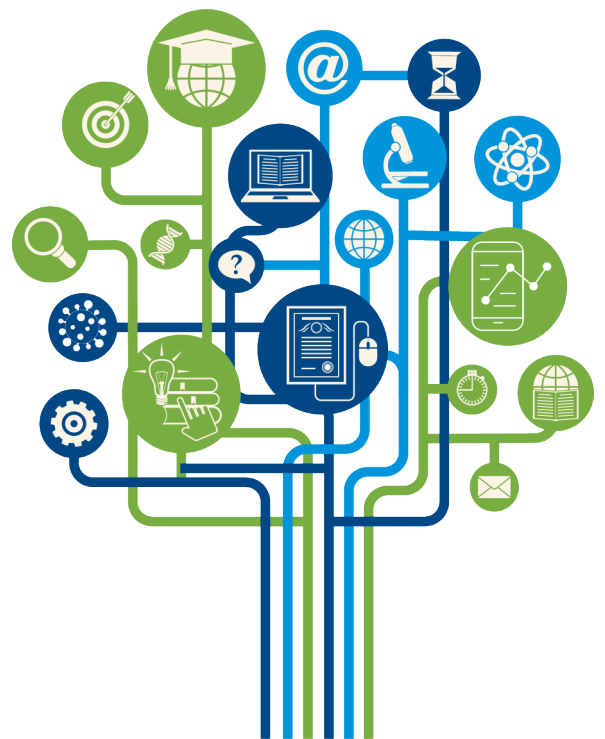


In 2022, Chapter 4 covering infection prevention and control (IPC) in the built environment and decontamination was launched. Chapter 4 exists as a repository for evidence reviews and tools relating to IPC in the built environment. This includes delivery of appropriate decontamination methods within health and care settings and risk mitigation for water-based pathogens. Content will continue to be developed with stakeholder engagement, learning from Scottish outbreaks/incidents and systematic literature reviews.

In addition to the core chapters, the NIPCM also contains multiple appendices and supporting materials which are constantly being updated as the evidence base evolves. The NIPCM is based on real time reviews of the current scientific literature ensuring that content is evidence based and promotes best practice. In 2022, the **evidence and research** section of the NIPCM was given dedicated front facing presence providing a sign post for evidence based IPC guidance. This section details all literature reviews that inform NIPCM content including supporting tools and appendices.

In 2022, the NIPCM **Personal Protective Equipment (PPE): Gloves' literature review** was updated and resulted in a change to the recommendation for when to use gloves, moving to a risk-assessment based approach. Reducing glove overuse will support the NHS sustainability agenda. Further updates to NIPCM literature reviews, using the two person methodology, in 2022 included existing and emerging technologies used for decontamination of the health and care environment: **wipes, ultraviolet light** and **airborne hydrogen peroxide, PPE: aprons/gowns**, incidents and outbreaks: **healthcare incidents and outbreaks in Scotland, management in neonatal units** and **management of occupational exposure to blood borne viruses** and **Standard Infection Control Precautions (SICPs) and Transmission Based Precautions (TBPs) literature review: surgical face masks**. Work also began in 2022 on updating the systematic literature review 'Transmission Based Precautions Definitions' which assesses the available evidence on the transmission modes of infectious agents. The review has a specific focus on transmission of respiratory infections which is a topic of interest both nationally and internationally as a result of the COVID-19 pandemic.

Work began in 2022 on an evaluation of the current methodology used to develop the NIPCM systematic literature reviews with the aim of increasing transparency and engagement when creating evidence based recommendations for health and care settings.





## Care Home IPC Manual

In 2022, following external stakeholder consultation, the **Care Home Infection Prevention and Control Manual (CH IPCM)** was refreshed and republished. The content of the CH IPCM remains aligned to the evidence based NIPCM and is intended to be used by all those involved in care provision in care homes registered with the Care Inspectorate in Scotland as a good practice guide for IPC. 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 alongside identifying any training needs.

In 2023, the CH IPCM will continue to be developed with stakeholder engagement and consultation to ensure content remains context specific. To support adoption and implementation a series of national webinars will be delivered for care home staff and others.

## COVID-19 Guidance

The ARHAI Scotland 2021 Annual Report recognised the expansion of the NIPCM in response to the COVID-19 pandemic. In 2022, there was a phased move away from the winter respiratory guidance back to SICPs and TBPs. This process included an evaluation of the winter respiratory guidance to inform future requirements.

A re-launch of the NIPCM followed the return to SICPs and TBPs, reinforcing the main aims and visions of the manual, acknowledging that the COVID-19 pandemic would shape much within IPC. The design, content, and functionality of the NIPCM was refreshed as part of the re-launch, which was supported by the Chief Nursing Officer for Scotland. This represented a continued commitment to IPC within NHSScotland.

## Infection Prevention and Control Education

NHS Education for Scotland (NES) and ARHAI Scotland continue to work closely, building on existing collaborative working to facilitate the translation of evidence based IPC guidance into robust educational resources. To support the relaunch of the NIPCM in summer 2022, NES and ARHAI Scotland developed an **animation**, outlining the aims of the manual and the content of each chapter. This new format of education delivery was well received by stakeholders.

To aid the smooth transition back to the NIPCM following the archive of the Winter 21/22 Respiratory Infections in Health and Social Care Settings Infection Prevention and Control Addendum, NES created an **infographic** one-page guide, which demonstrated key changes and updates to the existing NIPCM.

To support staff with winter planning and communications, NES, in conjunction with ARHAI Scotland, developed a series of **key winter messages**, based on content within the NIPCM and CH IPCM. These were provided as social media and marketing assets, to assist stakeholders with their local communications. Key messages included the importance of respiratory precautions and hand hygiene and promoting the uptake of winter vaccinations.

Furthermore, to support adoption and implementation of national guidance and to increase health and care staff knowledge and awareness of IPC, ARHAI Scotland supported the Scottish Government (SG) Chief Nursing Officer (CNO) Directorate and our national partners to deliver a series of support webinars.

As ARHAI Scotland progress with updating the TBP's literature review, it is anticipated that there will be educational outputs created by NES in 2023, to support stakeholders with any upcoming changes to the existing definitions within the NIPCM.

# Reducing Infection Risk in the Healthcare Built Environment

During 2022, ARHAI Scotland continued to focus on reducing risk in the healthcare built environment by providing infection prevention and control (IPC) expertise through the development of guidance, provision of board support and the Assurance service.

Chapter 4 within the NIPCM was launched and contains a range of evidence reviews and tools to support reducing the infection risk related to the built environment. In 2022, a systematic literature review focusing on risk prevention and control of waterborne infection was commenced. This review will inform guidance for the health and care sector by formulating evidence-based recommendations and is due for publication in 2023.

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

Fifteen Key Stage Assurance Reviews (KSARs) were completed in 2022, enabling progression of design and construction of the healthcare built environment estate across NHSScotland. Of these reviews, two included the completion of two new National Treatment Centres which are due to open in 2023: NHS Forth Valley (Larbert) and NHS Highland (Inverness).

During 2022, IPC support was formally included within the NHSScotland Design Assessment Process (NDAP). IPC support is provided to NHS boards during the design of their facility with the aim of ensuring IPC requirements are met.

The focus for the year ahead is the continued development of evidence and tools to support the safe management of risks from the complex components within the built environment alongside continued IPC expertise support to the NHSScotland Assurance and Design Assessment Services.

## Healthcare Built Environment Education

During 2022, NHS Education for Scotland (NES) and ARHAI Scotland worked collaboratively 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. The Learning and Development Strategy key deliverables for Year 2 were delivered and progressed to Year 3. The Knowledge and Skills Framework, user guide and accompanying video, launched on 1 September 2022 and is now available on TURAS Learn.

NES and ARHAI Scotland worked collaboratively to take forward some of the key activities identified, including development of specific tools aimed at increasing staff awareness of potential risks associated with the improper use of clinical hand wash basins. The poster and educational animation will be published in 2023.

The vision to provide skills and capabilities for staff, which help prevent infection and improve safety in the healthcare built environment, is being realised as we work collaboratively to develop innovative educational tools.



# Antimicrobial Resistance

Antimicrobial Resistance (AMR) occurs when micro-organisms, such as bacteria, change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness and death. As a result of AMR, antibiotics and other antimicrobial treatments become ineffective and infections become increasingly difficult or impossible to treat.

AMR is a global concern. Actions to tackle AMR in Scotland, within the United Kingdom and internationally are underway with ARHAI Scotland playing an important role. In January 2019, the UK Government published a vision for AMR in 20 years '**Contained and controlled: The UK's 20-year vision for antimicrobial resistance**' and a five-year national action plan '**Tackling antimicrobial resistance 2019–2024**'.

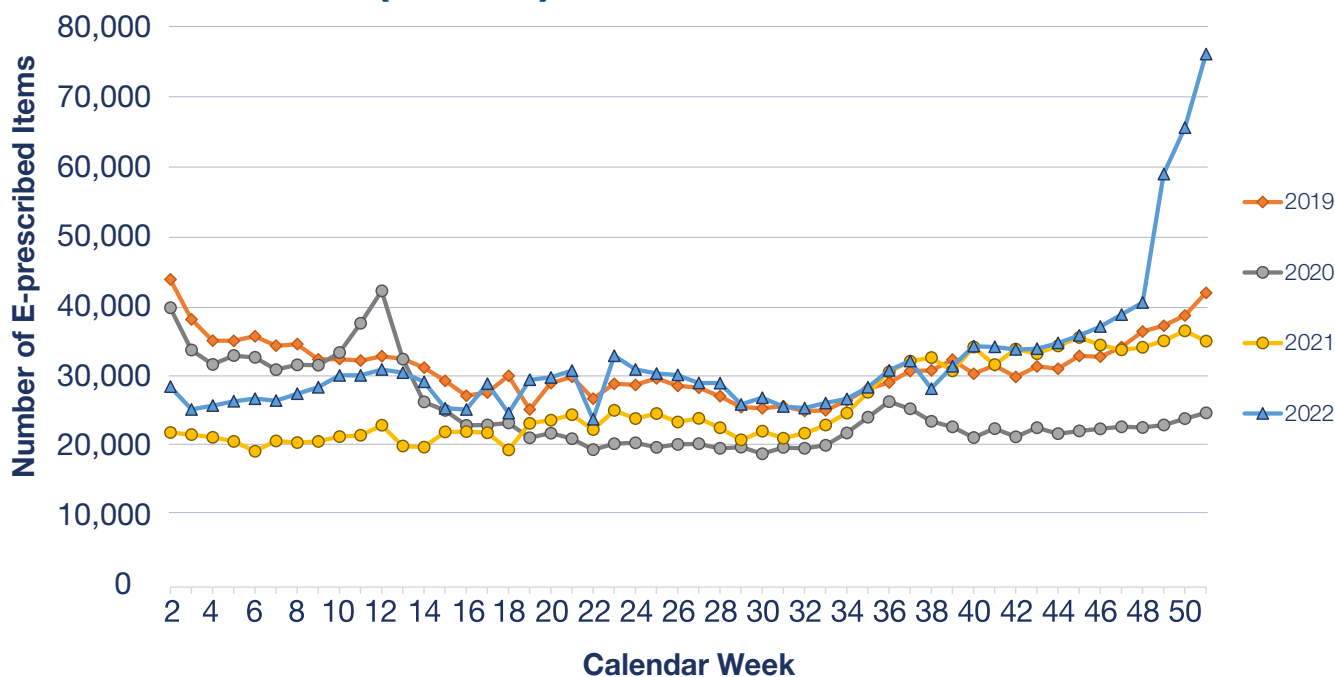
The UK AMR National Action Plan (NAP) acknowledges that intelligence and evidence for action are essential for supporting the vision to optimise antibiotic use and contain and control AMR across all sectors. This is known as a 'One Health' approach to tackling AMR which accepts that the health of humans, animals and the environment are interconnected and that a co-ordinated cross sectoral response to AMR is needed. ARHAI Scotland informs local and national interventions, and initiatives in human and animal health through the provision of epidemiological evidence on trends in antibiotic use and resistance.

Data and intelligence from 2022 will be published in the annual **Scottish One Health Antimicrobial Use and Antimicrobial Resistance (SONAAR) report** providing information on antibiotic use and resistance to antibiotics in humans and animals. The reports are published in November to coincide with World Antibiotic Awareness Day and European Antibiotic Awareness Week and are available on the **Antimicrobial resistance - One Health** website.

In 2022, ARHAI Scotland continued to monitor trends and provide data on antibiotic use and AMR to stakeholders through **Discovery** informing practice to contain and control AMR. This was undertaken alongside continued surveillance of monitoring unusual phenotypes for emergence of new and unusual AMR.

One of the key drivers for AMR is the overuse and inappropriate use of antibiotics. ARHAI Scotland conduct near real time monitoring of antibiotics. In 2022, this system supported an assessment of prescribing associated with a change in epidemiological infections caused by Group A *Streptococcus* informing Scottish Antimicrobial Prescribing Group (SAPG) review of prescribing guidance.

### Data for antibiotics commonly used in Group A Streptococcal infection\* by year (2019 to 2022) and calendar week (2 to 51).



\*amoxicillin, azithromycin, cefalexin, clarithromycin, co-amoxiclav, co-trimoxazole, erythromycin, flucloxacillin, phenoxymethylpenicillin

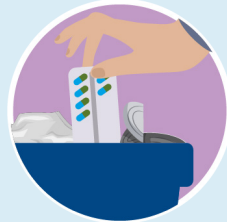
In 2023, ARHAI Scotland will continue to monitor and report trends in antimicrobial use and AMR across human and animal health sectors to support optimisation of antimicrobial use to improve patient outcomes and minimise the risk from AMR. ARHAI Scotland will also support the Scottish Government with development of the UK NAP for 2024 to 2029.

# Causes of Antibiotic Resistance

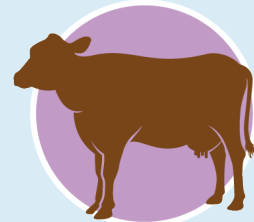
Antibiotic resistance happens when bacteria change and become resistant to the antibiotics used to treat the infections they cause.



**Over-prescribing of antibiotics**



**Patients not finishing their treatment**



**Over-use of antibiotics in livestock and fish farming**



**Poor infection control in hospitals and clinics**



**Lack of hygiene and poor sanitation**



**Lack of new antibiotics being developed**

# Surveillance and Monitoring

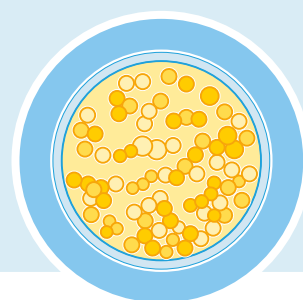
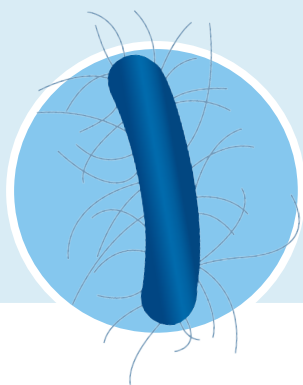
## Surveillance of Healthcare Associated Infection in Scotland

Healthcare associated infections (HCAI) represent a threat to patient safety and can contribute to morbidity and mortality in an already vulnerable population. A significant proportion of HCAI are avoidable and preventing these infections provides an opportunity to improve patient outcomes and reduce unnecessary costs within healthcare systems.

The mandatory national surveillance programme in Scotland has been developed to monitor the burden of key HCAI, providing intelligence to inform the development of interventions and monitor their impact.

**During 2022, three key infection types were included in the national surveillance programme:**

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



As the COVID-19 response continued in 2022, surveillance of surgical site infection (SSI) and HCAI in intensive care units remained paused. Full enhanced surveillance of *E. coli* and *S. aureus* bacteraemia resumed in October 2022.





## Cases of these infections are classified as:

### Healthcare Associated Infection



Healthcare associated infections include patients who have had contact with healthcare within a defined period prior to their positive sample date (as defined in the **bacteraemia** or **CDI** surveillance protocols). Such as:

- a stay in hospital
- a recent discharge from a hospital
- or the use of a medical device.

### Hospital Acquired Infection

Within the healthcare associated cases, any patients who have been inpatients for 48 hours or more prior to the positive sample date are defined as hospital acquired infections.

### Community Associated Infection

Cases with no known contact with healthcare and who do not meet the definition for HCAI are defined as community associated infections.



Trends in key HCAI rates continued to be **published quarterly** in 2022 and provided in **Discovery**, supporting local NHS boards with data to inform quality improvement and reduction strategies.



## Surveillance priorities for 2023

- **Undertake a comprehensive review of national HCAI surveillance.**
- **Continue to develop epidemiological intelligence to support reducing risk in the healthcare built environment.**
- **Development and delivery of epidemiology and surveillance training for the IPC workforce.**
- **Continued focus of smarter solutions for surveillance of HCAI, maximising clinical effectiveness whilst reducing the burden of data collection.**



# The changing patient population and HCAI risk

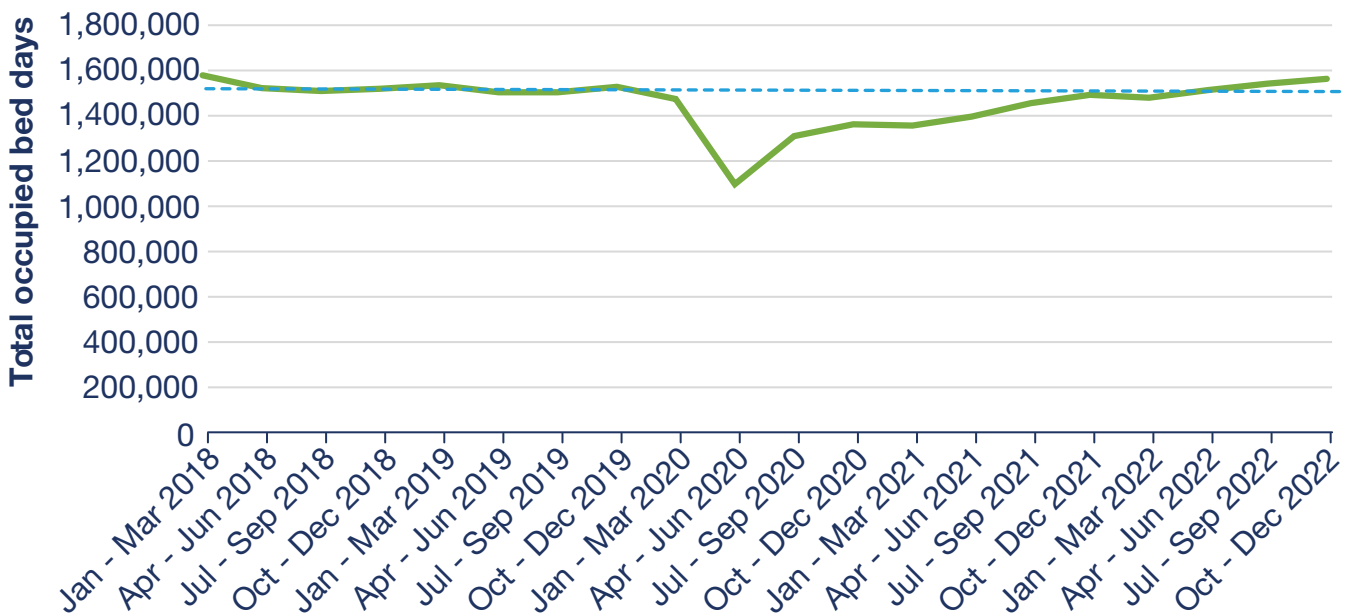
Healthcare delivery, activity and the inpatient population have evolved over the past three years as a result of the pandemic. This evolving picture in the Scottish healthcare system changes the risk of HCAI including risk associated with later presentation for treatment and longer stays in hospital e.g. as a result of delayed discharge. Interpretation of HCAI data can be supported by considering contextual data such as the measures described below.

## Hospital activity



**6,112,174 occupied bed days in 2022**, compared to **5,696,926 in 2021**.

### Total occupied bed days, by quarter\*



\*The dashed line represents the quarterly average for the calendar years 2018 and 2019 of 1,528,455 Total Occupied Bed Days (TOBD).



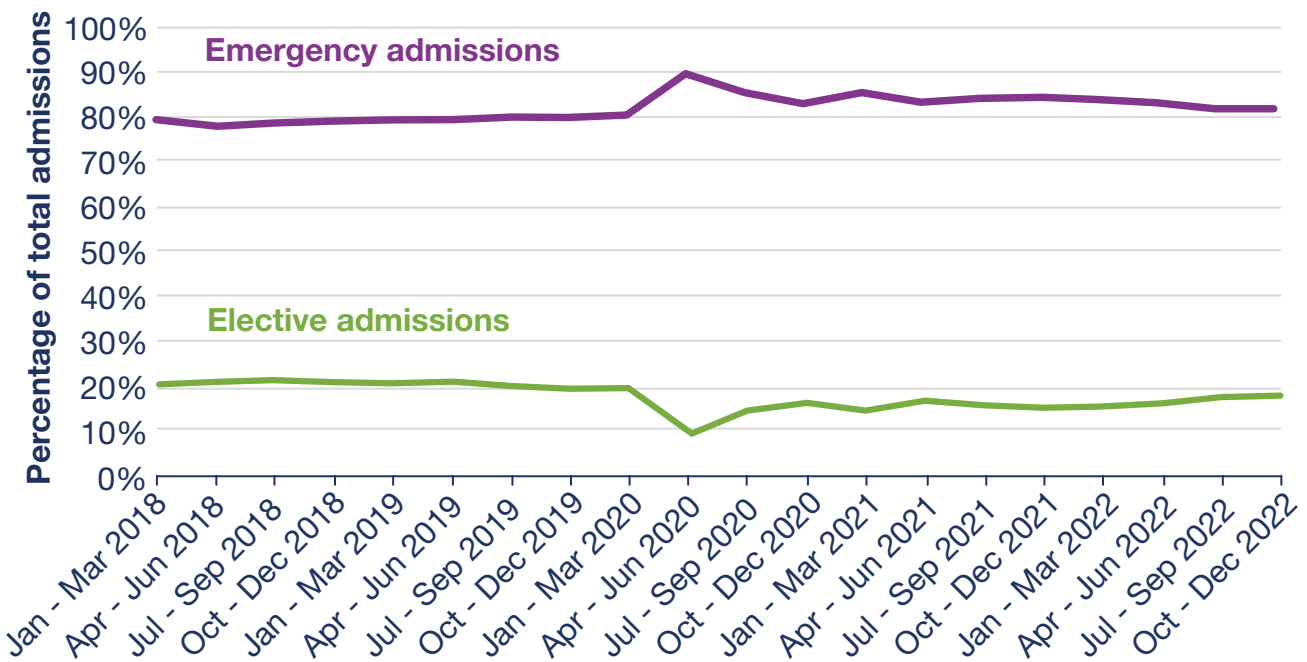
Elective inpatient admissions **increased** by **6.3%** in **2022 (90,043)** compared to **2021 (84,674)**.



Emergency inpatient admissions **decreased** by **3.2%** in **2022 (456,082)** compared to **2021 (471,047)**.



### Percentage of elective and emergency admissions, by quarter\*



Percentage admitted as an **emergency decreased** from **84.1%** in **2021** to **82.6%** in **2022**.



## Hospital pressures

Hospitals continued experiencing pressure on their services as they worked towards remobilisation in 2022.

The rate of **delayed discharges** per 1,000 TOBDs **increased** by **25.2%** in **2022 (111.6)** compared to **2021 (89.2)**.



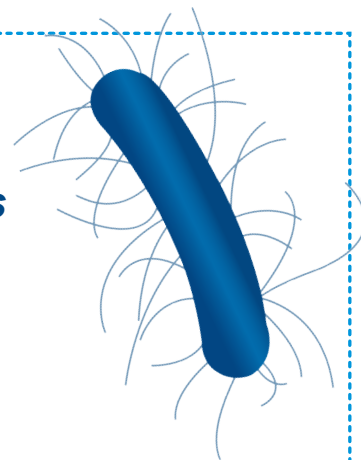
**70.2%** of **Accident and Emergency (A&E)** attendances were seen within the **4-hour target**, a **decrease** from **81.5%** in **2021**.



## *Clostridioides difficile* infection

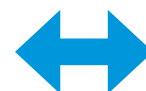
### Epidemiological data

In **2022**, there were **1,053** cases of *Clostridioides difficile* infection (CDI) reported in **patients aged 15 years and older** in **Scotland**, compared to **1,135** cases in **2021**.



The **annual incidence rate** was **19.2** per 100,000 population.

The **rate** has **remained stable** between **2021** and **2022**.



There has been a **4.0%** **year-on-year decrease** over the **last five years**.





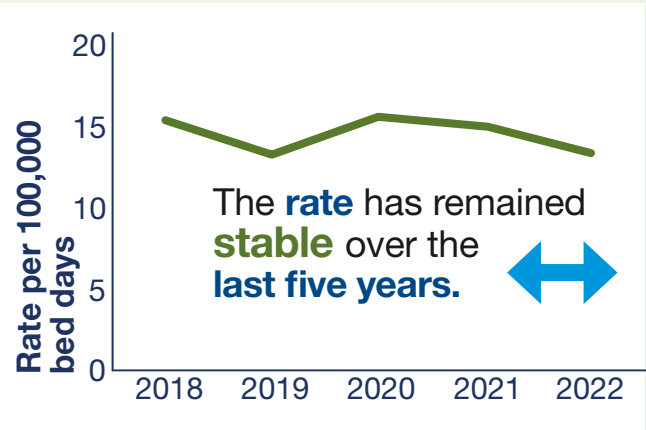
In **2022**, the **cases and rates of CDI** in patients aged 15 years and older were:

### Healthcare associated CDI

**818 cases**

Annual incidence rate of **13.4** per 100,000 bed days.

There has been an **11.2% decrease** in the **rate** between **2021** and **2022**.

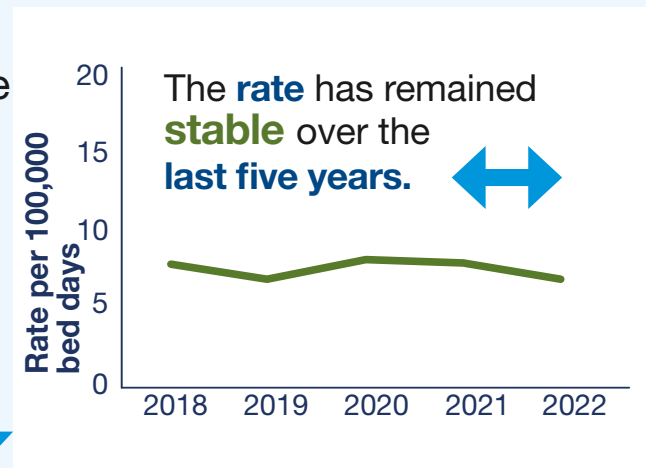


### Hospital acquired CDI

Of the **818** healthcare associated CDI cases, **410** were **hospital acquired infections**.

Annual incidence rate of **6.7** per 100,000 bed days.

There has been a **13.4% decrease** in the **rate** between **2021** and **2022**.

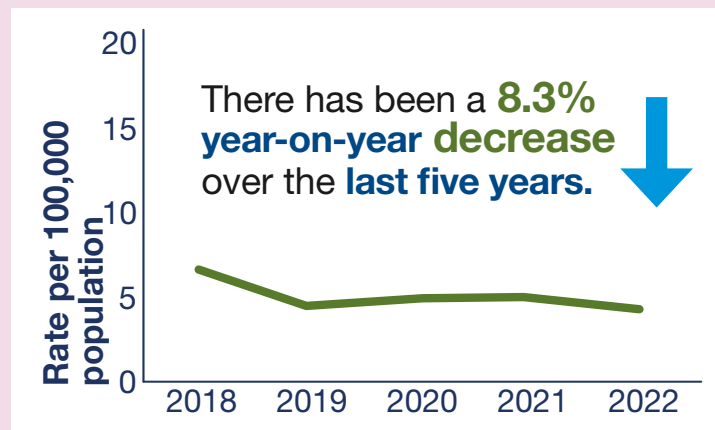


### Community associated CDI

**235 cases**

Annual incidence rate of **4.3** per 100,000 population.

The **rate** has remained **stable** between **2021** and **2022**.



## 2022 funnel plot analysis

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

NHS Highland had a **higher annual rate** of **community associated CDI** compared with the **Scottish average rate**.

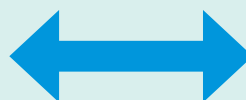
**Note:** NHS board rates are **not adjusted** for **differences in the patient population**.

Three **improvement plans** were developed by **NHS boards** during **2022** in response to **higher than average quarterly rates** of **healthcare associated CDI**.

## All cause case fatality

In **2022**, the **30 day all cause case fatality rate** for **CDI** in **patients aged 15 years and older** was **12.3%**.

The **rate** has **remained stable** over the **last five years**.



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



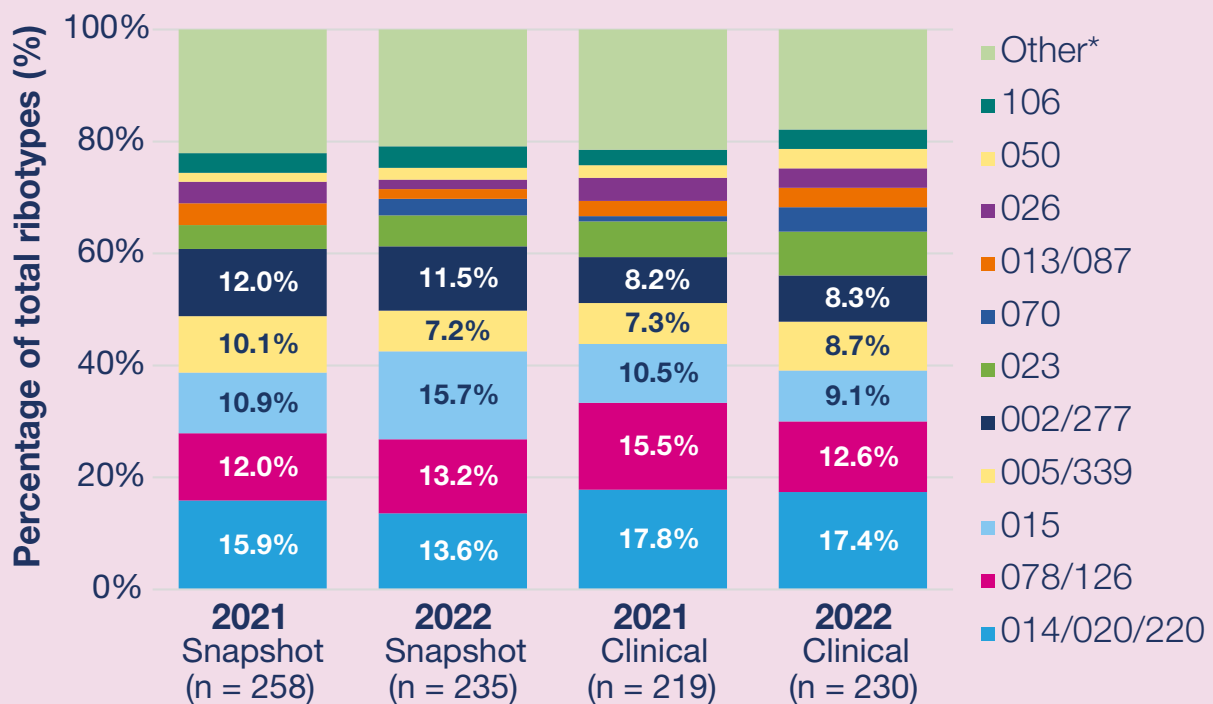
## Molecular epidemiological data

As part of the epidemiological surveillance of CDI, the Enteric Bacterial Infections Service (EBIS) carry out polymerase chain reaction (PCR) ribotyping of *C. difficile* isolates under a representative sampling (snapshot), and severe cases and/or outbreaks (clinical) typing schemes.

Due to a temporary change to EBIS typing methods during 2022, PCR ribotypes (RTs) have been grouped for analysis based on shared corresponding multi-locus sequence types (MLST), derived from whole genome sequencing (WGS).



The **most prevalent ribotypes** in Scotland, in both **snapshot and clinical surveillance** in **2021** and **2022**, were **RTs 014/020/220, 078/126, 015, 005/339** and **002/277**



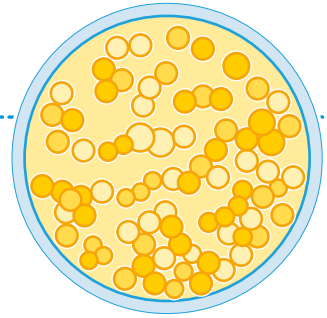
\* 'Other' contains ribotypes contributing <3%.

**Scottish Antimicrobial Prescribing Group (SAPG)** co-ordinates a **national framework** for **antimicrobial stewardship** to **improve antibiotic use** supporting **reduced risk from CDI**.

**Updated advice on antimicrobial management of CDI** was issued by the **Scottish Antimicrobial Prescribing Group** in **2022**.



# Staphylococcus aureus bacteraemia



## Epidemiological data

In **2022**, there were **1,590** cases of **Staphylococcus aureus bacteraemia (SAB)** reported in **Scotland**, compared to **1,591** cases in **2021**.

The **annual incidence rate** was **29.0** per 100,000 population.

The **rate** has **remained stable** between **2021** and **2022**.



The **rate** has **remained stable** over the **last five years**.



**96.9%** (n = 1,541) of all **SAB cases** were

**Meticillin-sensitive Staphylococcus aureus (MSSA).**



The **rate** has **remained stable** between **2021** and **2022**.



The **rate** has **remained stable** over the **last five years**.



**3.1%** (n = 49) of all **SAB cases** were

**Meticillin-resistant Staphylococcus aureus (MRSA).**



The **rate** has **remained stable** between **2021** and **2022**.



The **rate** has **remained stable** over the **last five years**.



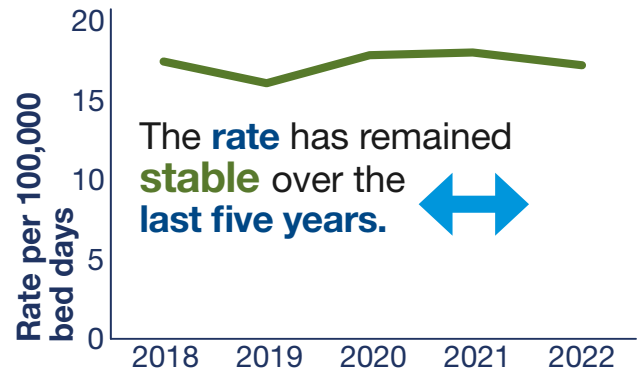


In **2022**, the **cases and rates** of **SAB** were:

### Healthcare associated SAB

**1,069 cases**  
Annual incidence rate of **17.5** per 100,000 bed days.

The **rate** has remained **stable** between **2021** and **2022**.

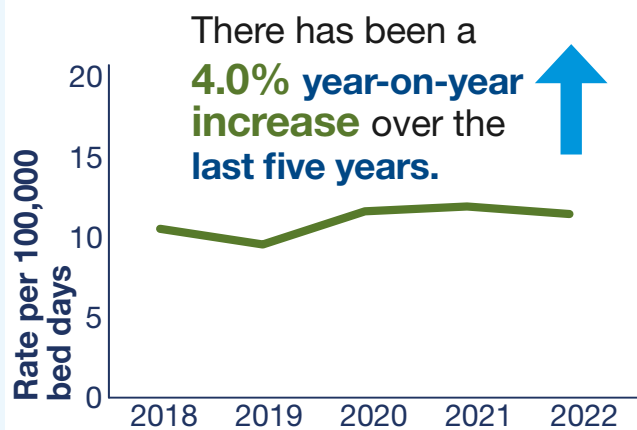


### Hospital acquired SAB

Of the **1,069** healthcare associated SAB cases, **709** were **hospital acquired infections**.

Annual incidence rate of **11.6** per 100,000 bed days.

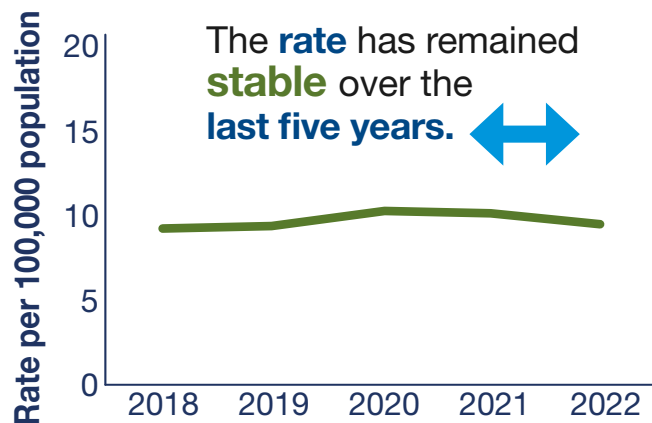
The **rate** has remained **stable** between **2021** and **2022**.



### Community associated SAB

**521 cases**  
Annual incidence rate of **9.5** per 100,000 population.

The **rate** has remained **stable** between **2021** and **2022**.



## 2022 funnel plot analysis

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

NHS Dumfries & Galloway had a **higher annual rate** of community associated SAB compared with the **Scottish average rate**.

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

No NHS boards were required to develop improvement plans due to **higher than average** quarterly rates of healthcare associated SAB.

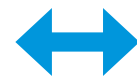
### All cause case fatality

In 2022, the 30 day all cause case fatality rates for SAB were

**28.6% for MRSA**

**21.0% for MSSA**

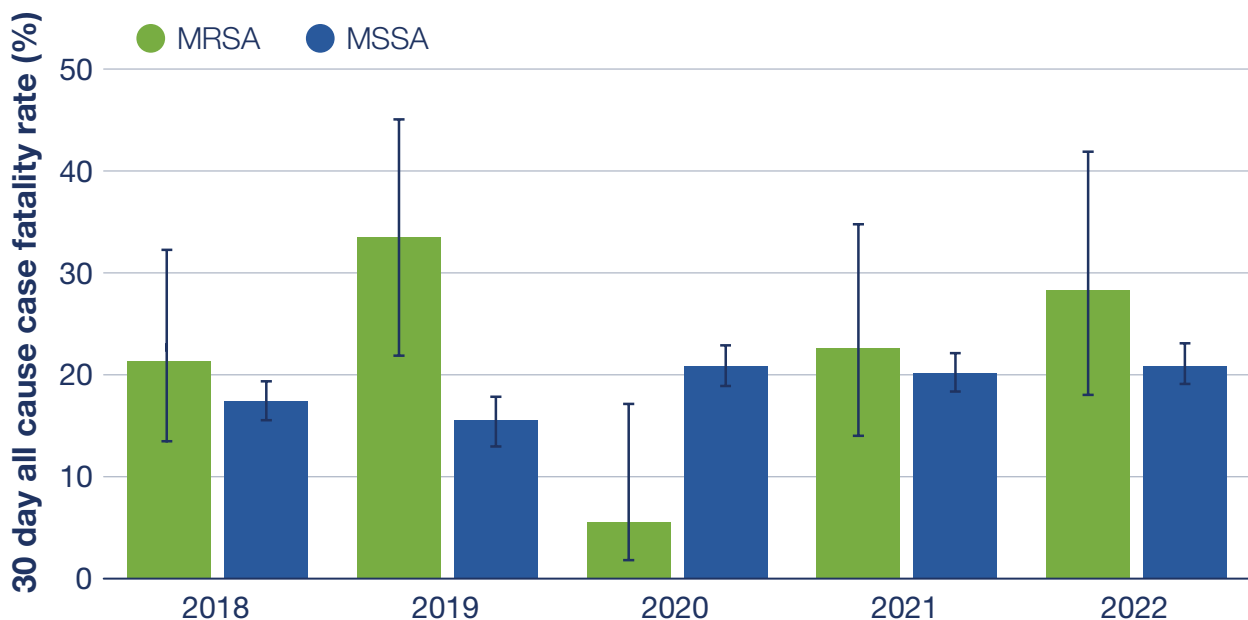
The **MRSA case fatality rate** has remained stable over the **last five years**.



There has been a **5.4% year-on-year increase** in the **MSSA case fatality rate** over the **last five years**.



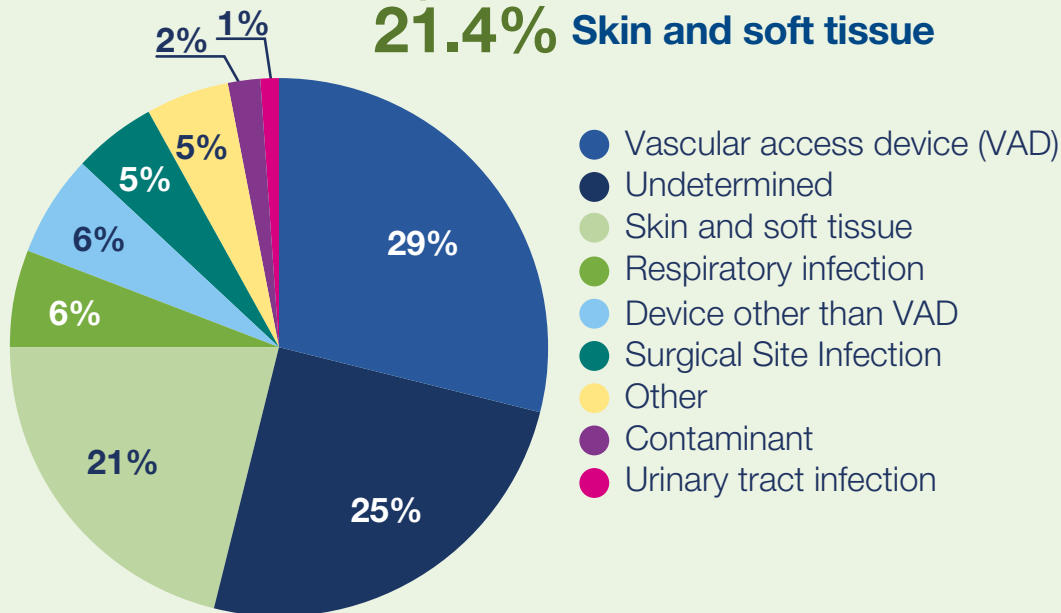
**Note:** the rates are not adjusted for differences in the patient population over time.





In 2022, the **3 most common entry points\*** for healthcare associated SAB were

**29.1%** Vascular access devices (VAD)  
**24.8%** Unable to be determined by the clinical team  
**21.4%** Skin and soft tissue

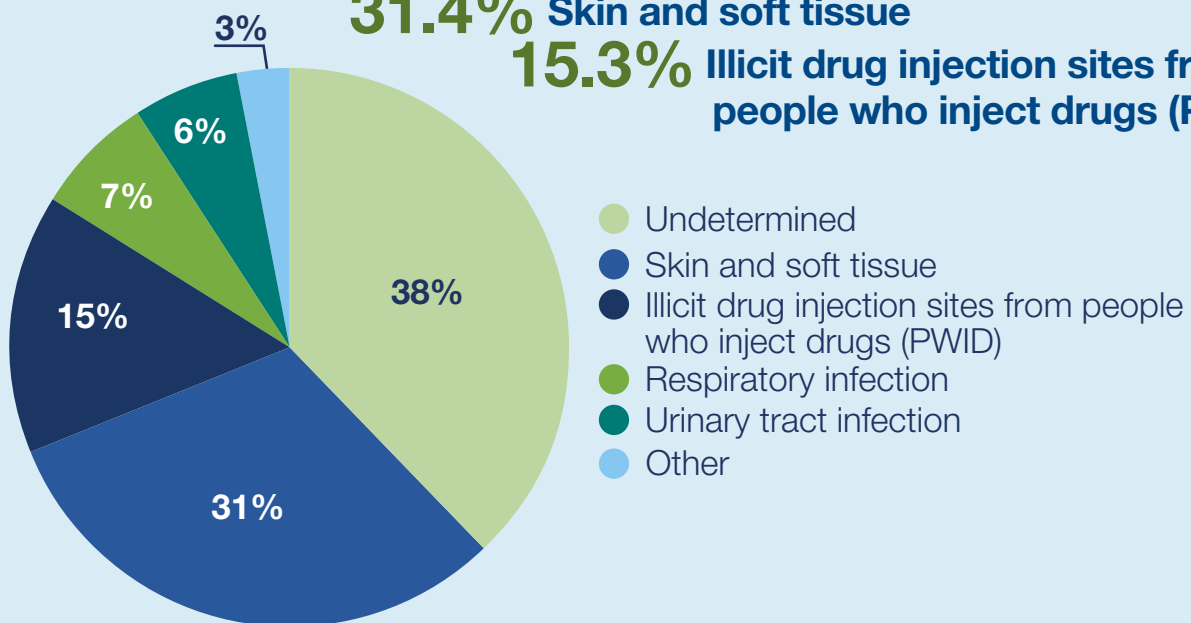


\*voluntary data due to the COVID-19 pandemic, up to October 2022, completed for 89.4% of healthcare associated SAB cases



In 2022, the **3 most common entry points\*** for community associated SAB were

**38.4%** Unable to be determined by clinical team  
**31.4%** Skin and soft tissue  
**15.3%** Illicit drug injection sites from people who inject drugs (PWID)

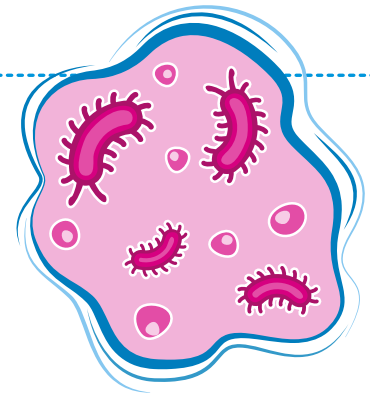


\*voluntary data due to the COVID-19 pandemic, up to October 2022, completed for 90.4% of community associated SAB cases

## Gram-negative bacteraemia

### Epidemiological data

In **2022**, there were **5,506** Gram-negative bacteraemia in **Scotland** caused by **5** key Gram-negative pathogens.



*E. coli* is the most common cause of Gram-negative bacteraemia



**76.6%**

14.0%

3.5%

4.8%

1.2%

● *Escherichia coli*

● *Klebsiella pneumoniae*

● *Pseudomonas aeruginosa*

● *Klebsiella oxytoca*

● *Acinetobacter* species

In **2022**, there were **4,218** cases of *Escherichia coli* bacteraemia (ECB) reported in **Scotland**, compared to **4,291** cases in **2021**.

The **annual incidence rate** was **77.0** per 100,000 population.

The **rate** has **remained stable** between **2021** and **2022**.

There has been a **3.5%** year-on-year decrease over the **last five years**.



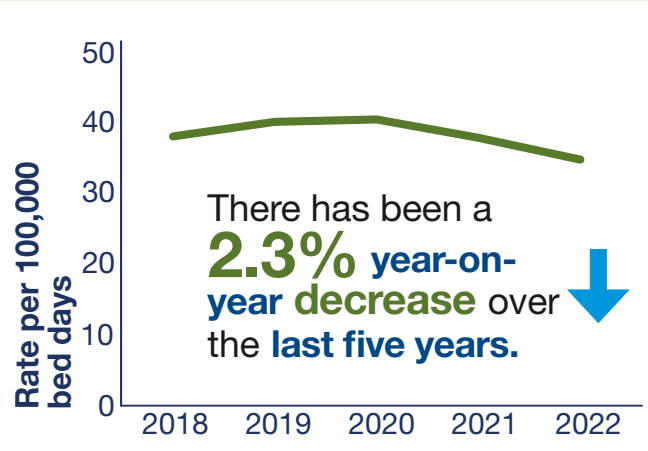


In **2022**, the **cases and rates** of **ECB** were:

### Healthcare associated ECB

**2,081** cases  
Annual incidence rate of  
**34.0** per 100,000 bed days.

There has been an **8.2% decrease** in the **rate** between **2021** and **2022**. ↓

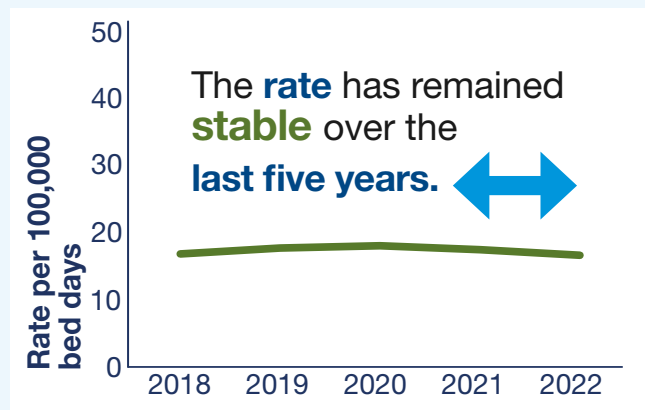


### Hospital acquired ECB

Of the **2,081** healthcare associated ECB cases, **988** were **hospital acquired infections**.

Annual incidence rate of  
**16.2** per 100,000 bed days.

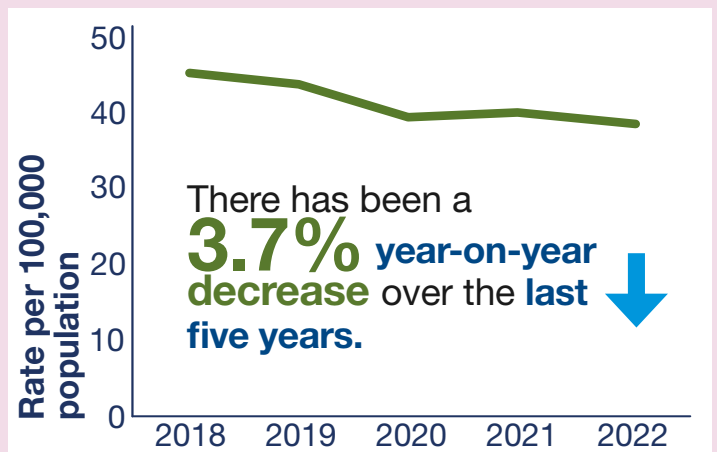
The **rate** has remained **stable** between **2020** and **2021**. ↔



### Community associated ECB

**2,137** cases  
Annual incidence rate of  
**39.0** per 100,000 population.

The **rate** has remained **stable** between **2021** and **2022**. ↔



## 2022 funnel plot analysis

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

NHS Ayrshire & Arran, NHS Dumfries & Galloway, NHS Fife 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.

Eight improvement plans were developed by NHS boards during 2022 in response to **higher than average quarterly rates** of healthcare associated ECB.

Four improvement plans were developed by NHS boards during 2022 in response to **higher than average quarterly rates** of community associated ECB.

## All cause case fatality

In 2022, the 30 day all cause case fatality rate for ECB was **14.4%**.

There has been a **3.3%** year-on-year increase in the **ECB case fatality rate** over the last five years.

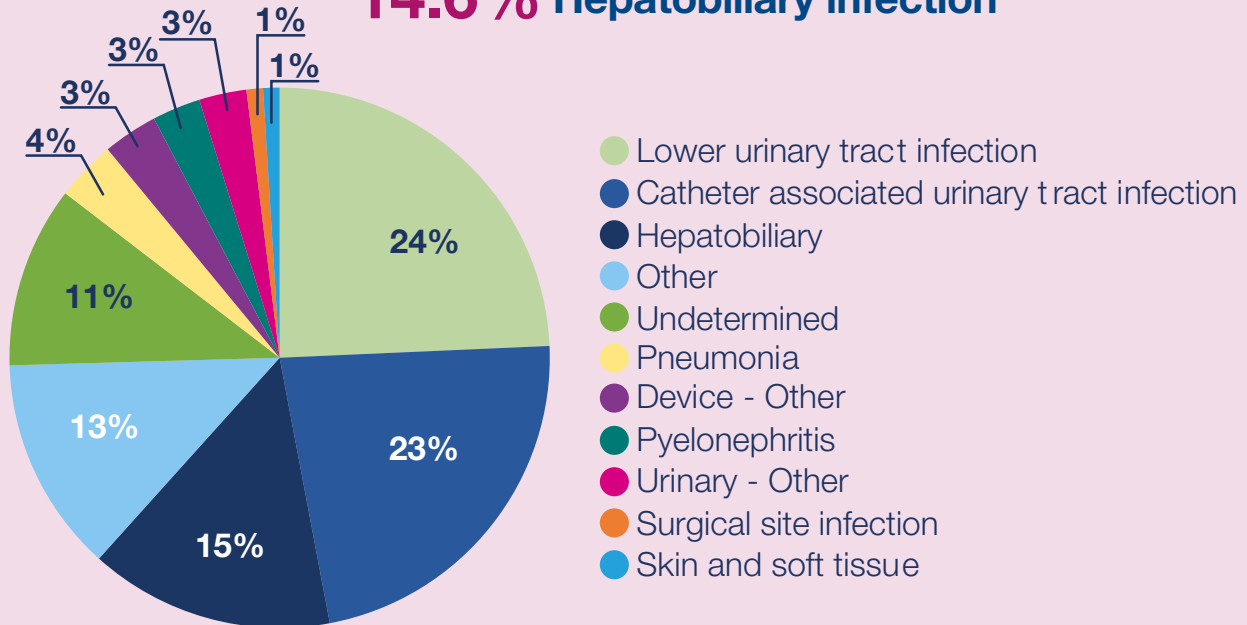


The rates are **not adjusted** for differences in the patient population over time.



In 2022, the **3 most common primary infections\*** for healthcare associated ECB were

**24.3%** Lower urinary tract infection  
**22.7%** Catheter associated urinary tract infection  
**14.6%** Hepatobiliary infection

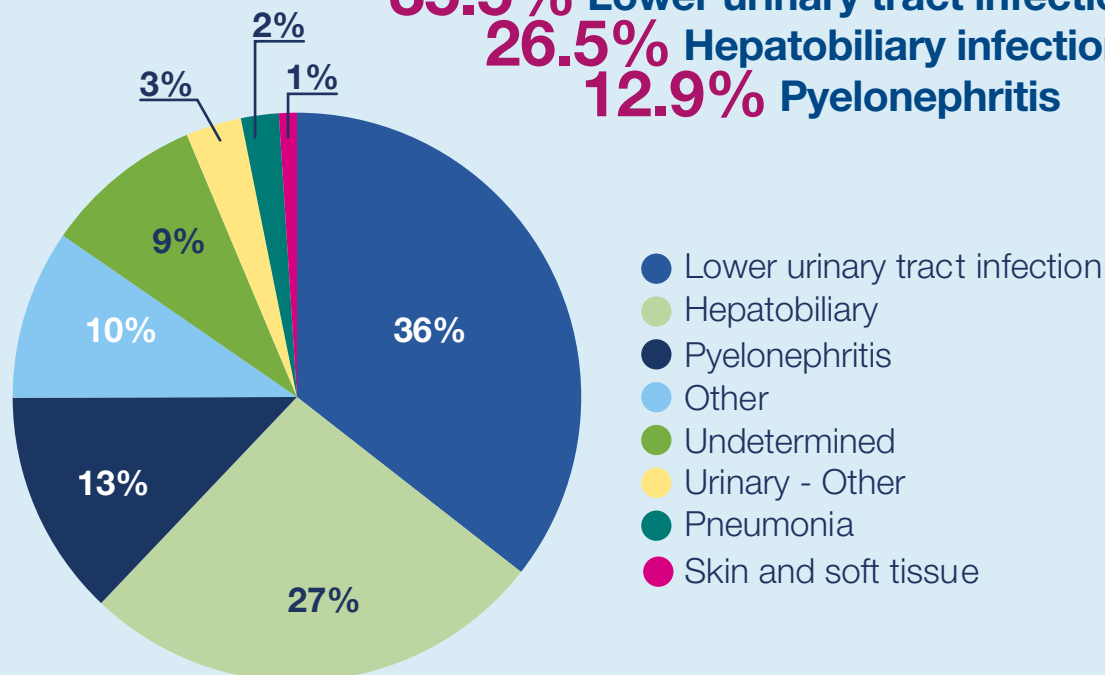


\*voluntary data due to the COVID-19 pandemic, up to October 2022, completed for 88.0% of healthcare associated ECB cases



In 2022, the **3 most common primary infections\*** for community associated ECB were

**35.5%** Lower urinary tract infection  
**26.5%** Hepatobiliary infection  
**12.9%** Pyelonephritis



\*voluntary data due to the COVID-19 pandemic, up to October 2022, completed for 87.3% of community associated ECB cases



## Carbapenemase-producing Enterobacterales

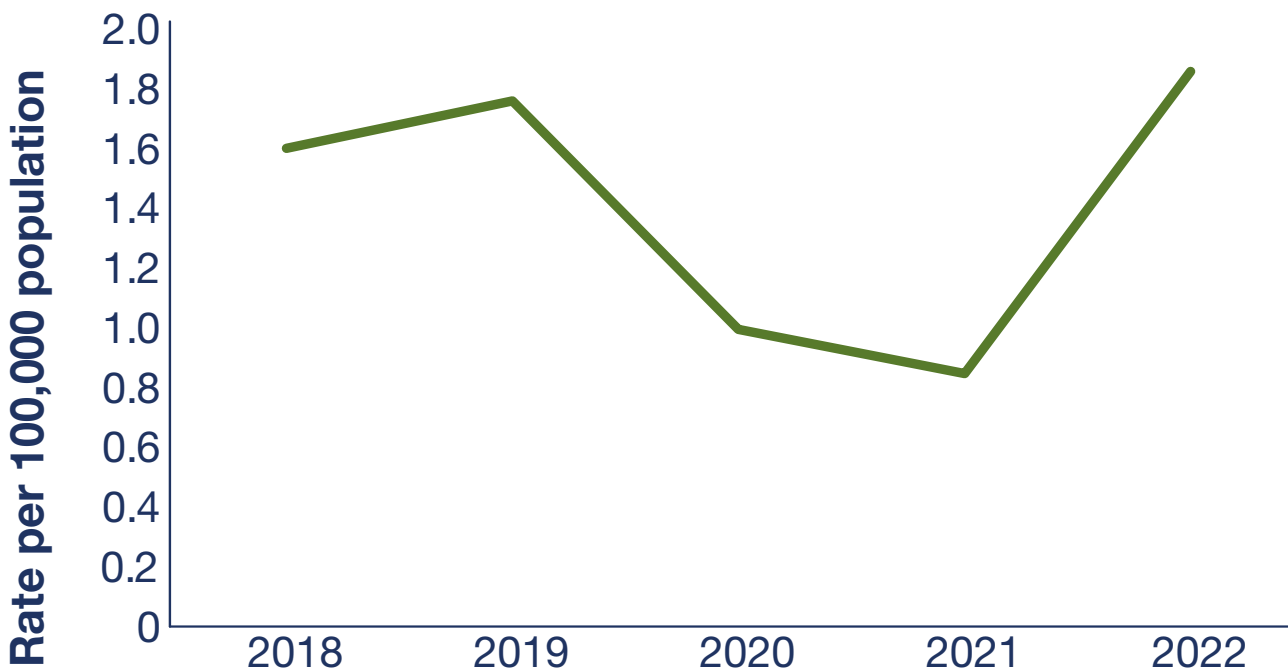
Carbapenemase-producing Enterobacterales (CPE) are bacteria that produce enzymes that inactivate carbapenems and other classes of antibiotics. Infections caused by CPE are difficult to treat and are associated with increased mortality. Cases of CPE are identified from screening and clinical samples. Uptake of CPE screening is described later in this report.

**In 2022, there were 103 cases of CPE reported in Scotland, compared to 47 in 2021.**

**The annual incidence rate of CPE was 1.9 per 100,000 population.**

The incidence of CPE reduced during the COVID-19 pandemic in line with fewer hospital admissions and the restrictions on international travel. CPE incidence has returned to pre-pandemic levels in 2022.

### Rate of CPE per 100,000 population in Scotland, 2018 to 2022.



## Hospital onset COVID-19

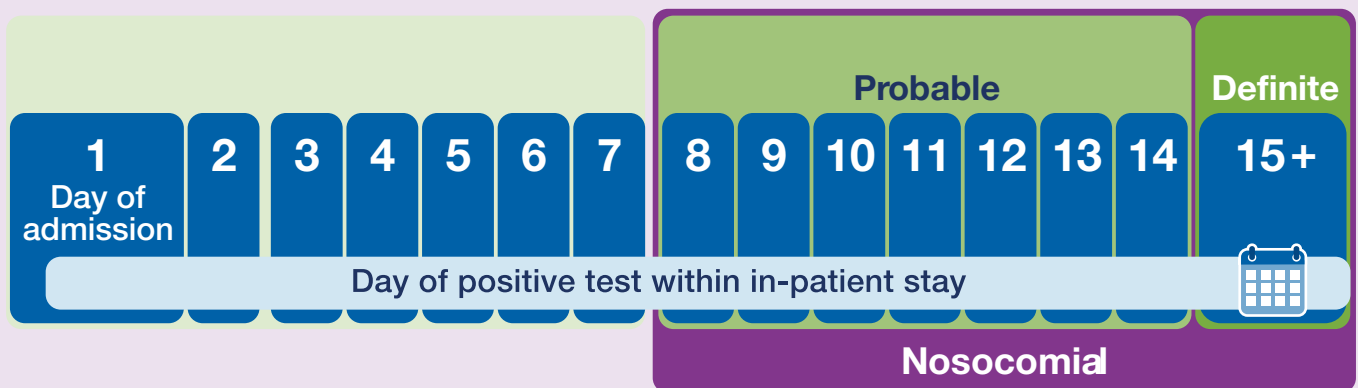


ARHAI Scotland continued to monitor COVID-19 using the hospital onset COVID-19 surveillance system during 2022. Reporting focused on nosocomial cases of COVID-19 (those testing positive for COVID-19 on day eight of admission onwards). The intelligence was used throughout the pandemic to provide critical evidence to inform infection prevention and control measures, guidance and policy within hospitals.

**Hospital onset status** is determined by calculating the number of days between admission and positive COVID-19 sample.

**Nosocomial** cases are split into:

**probable hospital onset** and **definite hospital onset**



## Epidemiological data

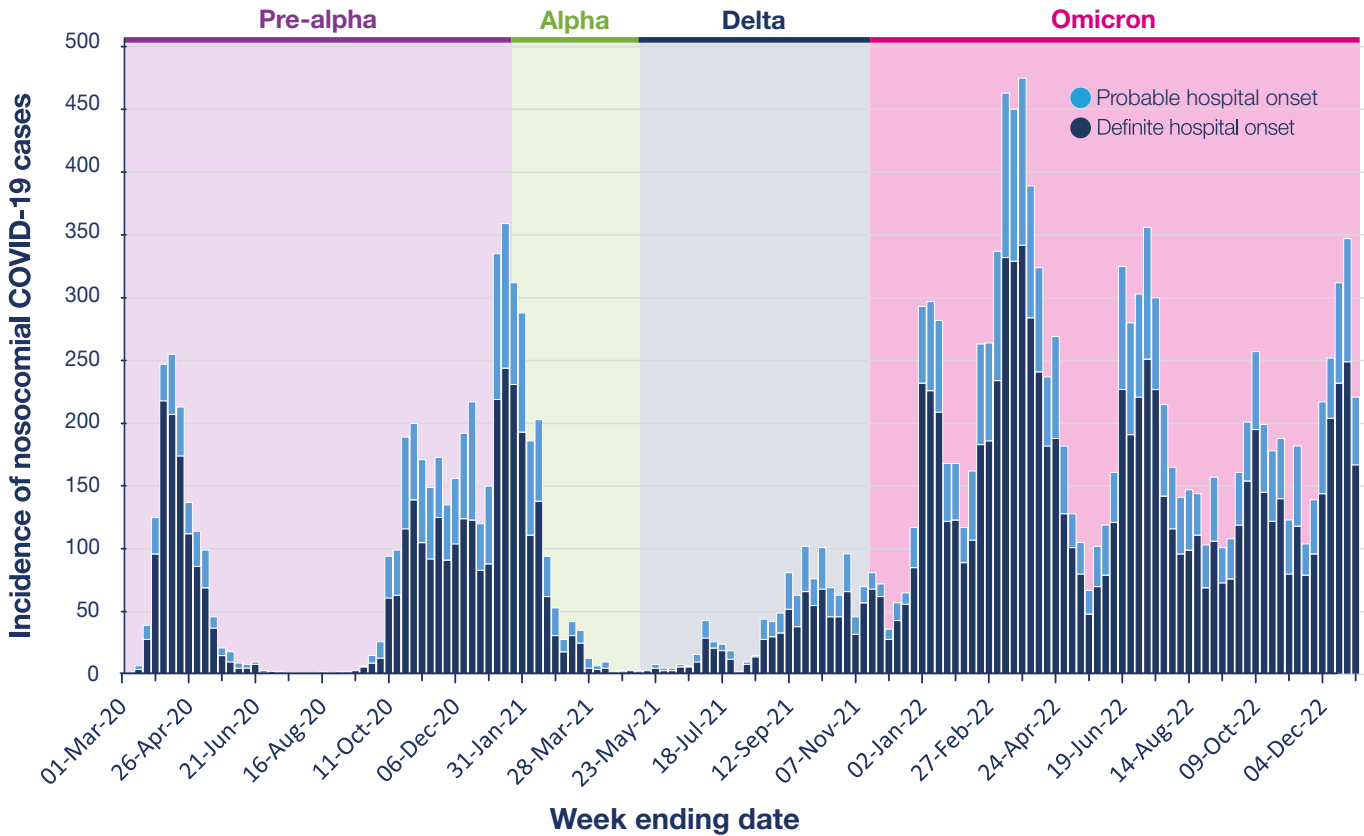


In **2022** there were **11,566 cases** of **nosocomial COVID-19 infection**, where **3,218** were **probable hospital onset (27.8%)** and **8,348** were **definite hospital onset (72.2%)**. Patients with **nosocomial COVID-19 infection** in **2022** had a **median age of 78** and **50.8%** were **female**.

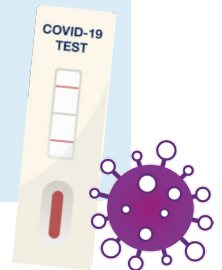


## Incidence of nosocomial cases of COVID-19 over time

Incidence of nosocomial cases of COVID-19 have followed trends observed in the population overall, which largely corresponded to the emergence of new variants.



**Testing availability** and **testing policy** has evolved through the pandemic **in hospitals** and **the community**. **Wider population** testing **ceased in April 2022** followed by the **majority of asymptomatic** patient testing in **September 2022**, therefore **comparison** between **COVID-19 pandemic years** should be treated with **caution**.



## Multi-drug resistant organism admission screening

Screening for multi-drug resistant organisms (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.

Clinical risk assessment (CRA) based screening policies for early detection and management of **meticillin-resistant *Staphylococcus aureus* (MRSA)** and **carbapenemase-producing Enterobacterales (CPE)** 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.

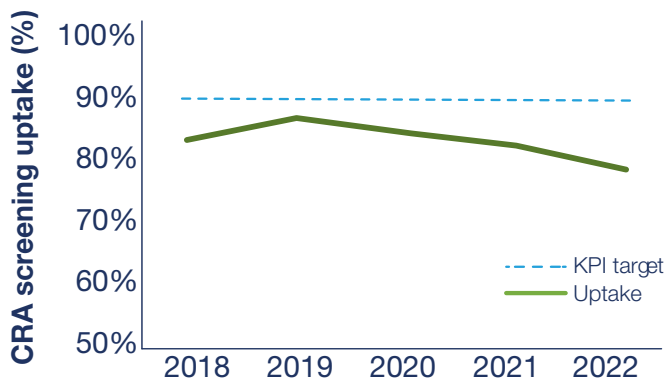
Uptake of the MRSA CRA has been a **level 3 HCAI Key Performance Indicator (KPI)** since 2013. The MRSA screening uptake monitoring tool was extended in 2018 to include assessment of CPE CRA uptake.

## MRSA CRA screening

In **2022**, **78.6%** of patients audited underwent a **clinical risk assessment** for **MRSA**.

This **remains below** the **90%** KPI and is a **4.7%** **reduction** in **uptake since 2021** when **82.5%** of patients had **CRA** undertaken.

There has been a **1.5%** **year-on-year decrease** in reported **uptake** over the **last five years**.

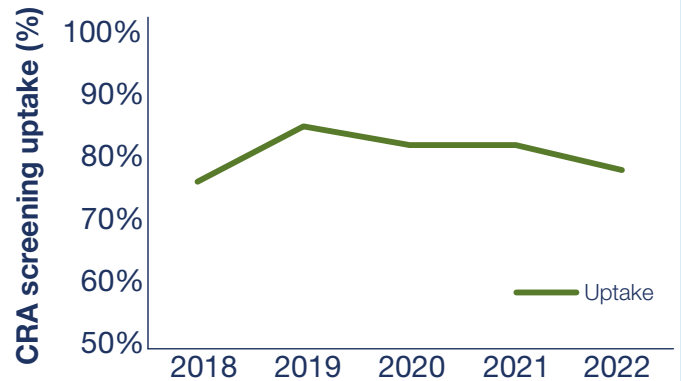


## CPE CRA screening

In **2022**, **78.2%** of patients audited underwent a **clinical risk assessment** for **CPE**.

This is a **4.5%** **reduction** in **uptake since 2021** when **81.9%** of patients had **CRA** undertaken.

Uptake has **remained stable** over the **last five years**.



These **MRSA** and **CPE CRA** uptake data continue to be monitored by **ARHAI Scotland** and fed back 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 support local Infection Prevention and Control Teams to prevent, prepare for, and manage incidents and outbreaks, as well as share lessons learned throughout Scotland.

The ARHAI Scotland Outbreak Reporting Tool (ORT) is used to collect incident and outbreak data, including COVID-19 cluster data. Incidents are assessed using the **Healthcare Infection Incident Assessment Tool (HIIAT)** in line with Chapter 3 of the National Infection Prevention and Control Manual (NIPCM). This system has continued to evolve and has enabled comprehensive and timely reporting of incidents and outbreaks across NHSScotland, allowing the sharing of best practice in managing and preventing incidents.



In **2022**, there were **155 healthcare infection incidents and outbreaks** (excluding COVID-19 clusters and norovirus outbreaks).

**Incidents and outbreaks** reported as **HIIATs** are **categorised** as **Red, Amber or Green**. Of the **total number** of reports, there were

**19 Red**

**34 Amber**

**102 Green**

## Development of incident and outbreak assessment

The HIIAT tool requires Infection Prevention and Control Teams (IPCT) within NHS boards to assess all healthcare incidents and outbreaks including decontamination incidents and near misses in any area as outlined in Chapter 3 of the NIPCM.

During 2022, in collaboration with key stakeholders, work began to revise the format of the HIIAT. This work will continue to progress throughout 2023. The aim is to address potential variation that may occur with the assessment criteria. This will provide a more structured approach for the NHS boards in determining the risks associated with an incident or outbreak and consistency in the subsequent reporting across Scotland. The review will also focus on improving the intelligence available to inform evidence and quality improvement strategies.

# List of Abbreviations and Acronyms

<b>A&amp;E</b>	Accident and Emergency
<b>AMR</b>	Antimicrobial Resistance
<b>ARHAI</b>	Antimicrobial Resistance and Healthcare Associated Infections
<b><i>C. difficile</i></b>	<i>Clostridioides difficile</i>
<b>CDI</b>	<i>Clostridioides difficile</i> Infection
<b>CDW</b>	Corporate Data Warehouse
<b>CHI</b>	Community Health Index
<b>CH IPCM</b>	Care Home Infection Prevention and Control Manual
<b>CNO</b>	Chief Nursing Officer
<b>COVID-19</b>	Coronavirus disease 2019 COVID-19
<b>CPE</b>	Carbapenemase-Producing Enterobacterales
<b>CRA</b>	Clinical Risk Assessment
<b><i>E. coli</i></b>	<i>Escherichia coli</i>
<b>ECB</b>	<i>Escherichia coli</i> Bacteraemia
<b>ECOSS</b>	Electronic Communication of Surveillance in Scotland
<b>GP</b>	General Practitioner
<b>HAI</b>	Hospital Acquired Infection
<b>HCAI</b>	Healthcare Associated Infection
<b>HIIAT</b>	Healthcare Infection Incident Assessment Tool
<b>HIIORT</b>	Healthcare Infection, Incident and Outbreak Reporting Template
<b>IPC</b>	Infection Prevention and Control
<b>IPCT</b>	Infection Prevention and Control Team
<b>ISD</b>	Information Services Division
<b>KPI</b>	Key Performance Indicator
<b>KSAR</b>	Key Stage Assurance Review
<b>MDRO</b>	Multi-Drug Resistant Organism
<b>MLST</b>	Multi Locus Sequence Type
<b>MRSA</b>	Meticillin-resistant <i>Staphylococcus aureus</i>
<b>MSSA</b>	Meticillin-sensitive <i>Staphylococcus aureus</i>
<b>NAP</b>	National Action Plan
<b>NCS</b>	National Cleaning Specification
<b>NDAP</b>	NHSScotland Design Assessment Process
<b>NES</b>	NHS Education for Scotland
<b>NHS</b>	National Health Service
<b>NIPCM</b>	National Infection Prevention and Control Manual
<b>NNU</b>	Neonatal Unit

<b>NRS</b>	National Records of Scotland
<b>NSS</b>	National Services Scotland
<b>ORT</b>	Outbreak Reporting Tool
<b>PCR</b>	Polymerase Chain Reaction
<b>PHS</b>	Public Health Scotland
<b>PIS</b>	Prescribing Information System
<b>PPE</b>	Personal Protective Equipment
<b>PWID</b>	People Who Inject Drugs
<b>RAPID</b>	Rapid Admission Preliminary Inpatient Data
<b>RT</b>	Ribotype
<b><i>S. aureus</i></b>	<i>Staphylococcus aureus</i>
<b>SAB</b>	<i>Staphylococcus aureus</i> Bacteraemia
<b>SAPG</b>	Scottish Antimicrobial Prescribing Group
<b>SG</b>	Scottish Government
<b>SICPs</b>	Standard Infection Control Precautions
<b>SMiRL</b>	Scottish Microbiology Reference Laboratories
<b>SMR</b>	Scottish Morbidity Record
<b>SONAAR</b>	Scottish One Health Antimicrobial Use and Antimicrobial Resistance
<b>SSI</b>	Surgical Site Infection
<b>TBPs</b>	Transmission Based Precautions
<b>TOBD</b>	Total Occupied Bed Days
<b>UK</b>	United Kingdom
<b>VAD</b>	Vascular Access Device
<b>WGS</b>	Whole Genome Sequencing



# Appendix 1 – Publication metadata

## Publication title

ARHAI Scotland 2022 Annual Report

## Description

This release provides information on activity within Antimicrobial Resistance and Healthcare Associated Infection (ARHAI) Scotland for the period January to December 2022.

## 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:** E-Prescribed items: ePrescribed messaging dataset, Prescribing Information System (PIS), Public Health Scotland (PHS).

**The changing patient population and HCAI risk:**

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

Elective admissions data: Public Health Scotland, Acute hospital activity and NHS beds information (<https://publichealthscotland.scot/publications/acute-hospital-activity-and-nhs-beds-information-quarterly/acute-hospital-activity-and-nhs-beds-information-quarterly-quarter-ending-31-december-2022/data-summary/>)

Emergency admissions data: Public Health Scotland, Acute hospital activity and NHS beds information (<https://publichealthscotland.scot/publications/acute-hospital-activity-and-nhs-beds-information-quarterly/acute-hospital-activity-and-nhs-beds-information-quarterly-quarter-ending-31-december-2022/data-summary/>)

Delayed discharges data: Public Health Scotland (PHS), Scottish Health and Social Care Open Data platform, Delayed discharges in NHSScotland (<https://www.opendata.nhs.scot/dataset/delayed-discharges-in-nhsscotland>)

A&E waiting times data: Public Health Scotland (PHS), Scottish Health and Social Care Open Data platform, Monthly A&E Activity and Waiting Times (<https://www.opendata.nhs.scot/dataset/monthly-accident-and-emergency-activity-and-waiting-times>)

### ***Clostridioides difficile* infection:**

Case data: ECOSS

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

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

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

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: total occupied bed days: Public Health Scotland ISD(S)1

Community associated denominator: NRS mid-year population estimates

Case fatality data: NRS

**Carbapenemase-producing Enterobacterales:** Electronic Communication of Surveillance in Scotland (ECOSS), Antimicrobial Resistance and the Scottish AMR Satellite Laboratory (Scottish microbiology reference laboratories (SMiRL), Glasgow).

Population denominator: National Records of Scotland (NRS) population estimates

### **Hospital onset COVID-19:**

Case data: ECOSS and Corporate Data Warehouse (CDW)

Admissions data: Rapid Admission Preliminary Inpatient Data (RAPID), validated/supplemented by local patient admissions systems.

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

**Incidents and Outbreaks:** healthcare infection incidents 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).

## Date that data are acquired

**Infection Prevention and Control Guidance:** N/A

**Reducing Risk in the Healthcare Built Environment:** N/A

**Antimicrobial Resistance:** 23 June 2023

**The changing patient population and HCAI risk:** 07 June 2023

***Clostridioides difficile* infection:** 30 May 2023

***Staphylococcus aureus* bacteraemia:** 30 May 2023

**Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter* species bacteraemia):**  
16 June 2023

**Gram-negative bacteraemia (*Escherichia coli* bacteraemia):**  
30 May 2023

**Carbapenemase-producing Enterobacterales:** 17 August 2023

**Hospital onset COVID-19:** 23 May 2023

**Multi-drug resistant organism admission screening:** 30 January 2023

**Incidents and Outbreaks:** 01 June 2023

## Release date

19 September 2023

## Frequency

Annual

## Timeframe of data and timeliness

The latest iteration of data are to 31 December 2022, therefore nine months in arrears.

## Continuity of data

**Infection Prevention and Control Guidance:** N/A

**Reducing Risk in the Healthcare Built Environment:** N/A

**Antimicrobial Resistance:** changes in healthcare activity during 2020/2021/2022 may have affected the number of e-prescribed items and comparison of results should be interpreted with caution.

**The changing patient population and HCAI risk:** None

***Clostridioides difficile* infection:** changes in the hospital population and activity during 2020/2021/2022 may have affected the epidemiology of *Clostridioides difficile* infection and comparison of results should be interpreted with caution.

During 2022, there was a shortage of the DNA polymerase required to carry out Polymerase Chain Reaction (PCR) ribotyping of *C. difficile* isolates. As an interim solution, *C. difficile* isolates that were sent to EBIS were typed using whole genome sequencing (WGS) derived multi locus sequence type (MLST). For most isolates, a single PCR ribotype could be inferred from the sequence type; where there was not complete congruence between a sequence type and only one ribotype, a group of corresponding PCR ribotypes was inferred.

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 2020/2021/2022 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 2020/2021/2022 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 2020/2021/2022 may have affected the epidemiology of Gram-negative bacteraemia and comparison of results should be interpreted with caution.

**Carbapenemase-producing Enterobacterales:** changes in the hospital population and activity during 2020/2021/2022 may have affected the epidemiology of carbapenemase-producing organisms and comparison of results should be interpreted with caution.

**Hospital onset COVID-19:** changes in the hospital population, hospital activity, COVID-19 testing, vaccination rates and circulation of different variants during 2020/2021/2022 may have affected the epidemiology of hospital onset COVID-19 cases; comparison of results should be interpreted with caution.

**Multi-drug resistant organism admission screening:** changes in the hospital population and activity during 2020/2021/2022 may have affected screening uptake; results of the clinical risk assessment (CRA) screening audits for methicillin-resistant *Staphylococcus aureus* (MRSA) and carbapenemase-producing Enterobacterales (CPE) should be interpreted with caution.

**Incidents and Outbreaks:** changes in the hospital population and activity during 2020/2021/2022 may have affected the epidemiology of healthcare outbreaks and incidents and comparison of results should be interpreted with caution.

## 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

**The changing patient population and HCAI risk:** N/A

***Clostridioides difficile* infection:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

***Staphylococcus aureus* bacteraemia:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**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 <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**Carbapenemase-producing Enterobacterales:** N/A

**Hospital onset COVID-19:** details provided in weekly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/hospital-onset-covid-19/>

**Multi-drug resistant organism admission screening:** N/A

**Incidents and Outbreaks:** 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 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 2022 is compared to the previous calendar year 2021 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 2018 to 2022.

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 boards 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 2022, 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:** E-Prescribed Items within PIS: details provided by PHS <https://www.isdscotland.org/Health-Topics/Prescribing-and-Medicines/Prescribing-Datamarts/#pis>

**The changing patient population and HCAI risk:**

Total occupied bed days: total number of occupied bed days for years 2018 -2022, as per Public Health Scotland ISD(S)1.

Elective admissions data: details provided in Public Health Scotland publication <https://publichealthscotland.scot/publications/acute-hospital-activity-and-nhs-beds-information-quarterly/acute-hospital-activity-and-nhs-beds-information-quarterly-quarter-ending-31-december-2022/data-summary/>

Emergency admissions data: details provided in Public Health Scotland publication <https://publichealthscotland.scot/publications/acute-hospital-activity-and-nhs-beds-information-quarterly/acute-hospital-activity-and-nhs-beds-information-quarterly-quarter-ending-31-december-2022/data-summary/>

Delayed discharges data: details provided within Scottish Health and Social Care Open Data platform <https://www.opendata.nhs.scot/dataset/delayed-discharges-in-nhsscotland>

A&E waiting times data: details provided within Scottish Health and Social Care Open Data platform <https://www.opendata.nhs.scot/dataset/monthly-accident-and-emergency-activity-and-waiting-times>

***Clostridioides difficile* infection:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

***Staphylococcus aureus* bacteraemia:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**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.

**Gram-negative bacteraemia (*Escherichia coli* bacteraemia):** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**Carbapenemase-producing Enterobacterales:** 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 <https://www.nss.nhs.scot/publications/scottish-one-health-antimicrobial-use-and-antimicrobial-resistance-in-2021/>

**Hospital onset COVID-19:** details provided in weekly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/hospital-onset-covid-19/>

**Multi-drug resistant organism admission screening:** MRSA and CPE CRA screening policies are available at: <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/multi-drug-resistant-organism-admission-screening/>

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.

While audit data does not present the same robust scientific data as surveillance, it provides a nationally representative measure of 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.

**Incidents and Outbreaks:** healthcare infection incidents reported to NSS. Healthcare associated infection incidents are defined within Chapter 3 of the National Infection Prevention and Control Manual <http://www.nipcm.scot.nhs.uk/chapter-3-healthcare-infection-incident-outbreaks-and-data-exceedance/>

## 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 <https://www.nss.nhs.scot/publications/scottish-one-health-antimicrobial-use-and-antimicrobial-resistance-in-2021/>

**The changing patient population and HCAI risk:** figures provided are used for management information for resource planning, surveillance and research in NHSScotland.

***Clostridioides difficile* infection:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

***Staphylococcus aureus* bacteraemia:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**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 <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**Carbapenemase-producing Enterobacterales:** details provided in the SONAAR Annual Report <https://www.nss.nhs.scot/publications/scottish-one-health-antimicrobial-use-and-antimicrobial-resistance-in-2021/>

**Hospital onset COVID-19:** details provided in weekly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/hospital-onset-covid-19/>

**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.

**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.

## Accuracy

**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 <https://www.nss.nhs.scot/publications/scottish-one-health-antimicrobial-use-and-antimicrobial-resistance-in-2021/>

**The changing patient population and HCAI risk:** details available as per each data source.

***Clostridioides difficile* infection:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

During 2022, there was a shortage of the DNA polymerase required to carry out Polymerase Chain Reaction (PCR) ribotyping of *C. difficile* isolates. As an interim solution, *C. difficile* isolates that were sent to EBIS were typed using whole genome sequencing (WGS) derived multi locus sequence type (MLST). For most isolates, a single PCR ribotype could be inferred from the sequence type; where there was not complete congruence between a sequence type and only one ribotype, a group of corresponding PCR ribotypes was inferred. Caution is advised in interpretation of the annual ribotype distributions due to the differences in typing methods.

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.

<https://www.nss.nhs.scot/publications/protocol-for-the-clostridioides-difficile-snapshot-programme/>

***Staphylococcus aureus* bacteraemia:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

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

Gram-negative bacteraemia data are the product of 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 <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**Carbapenemase-producing Enterobacterales:** details provided in the SONAAR Annual Report <https://www.nss.nhs.scot/publications/scottish-one-health-antimicrobial-use-and-antimicrobial-resistance-in-2021/>

**Hospital onset COVID-19:** details provided in weekly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/hospital-onset-covid-19/>

**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.

**Incidents and Outbreaks:** NSS are aware that the healthcare infection incident assessment tool (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.



## Completeness

**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 <https://www.nss.nhs.scot/publications/scottish-one-health-antimicrobial-use-and-antimicrobial-resistance-in-2021/>

Total number of e-prescribed items excludes weeks 1, 52 and 53 due to the low availability of prescribing data and access to GPs and pharmacists around the Christmas and New Year bank holidays.

**The changing patient population and HCAI risk:** details available as per each data source.

***Clostridioides difficile* infection:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

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.

<https://www.nss.nhs.scot/publications/protocol-for-the-clostridioides-difficile-snapshot-programme/>

***Staphylococcus aureus* bacteraemia:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**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 <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**Carbapenemase-producing Enterobacterales:** details provided in the SONAAR Annual Report <https://www.nss.nhs.scot/publications/scottish-one-health-antimicrobial-use-and-antimicrobial-resistance-in-2021/>

**Hospital onset COVID-19:** details provided in weekly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**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.

**Incidents and Outbreaks:** NSS are aware that the healthcare infection incident assessment tool (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.

## Comparability

Changes in the hospital population and activity during 2020/2021/2022 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:** details provided in the SONAAR Annual Report [https://www.nss.nhs.scot/publications/Scottish One Health Antimicrobial Use and Antimicrobial Resistance in 2021 | National Services Scotland \(nhs.scot\)](https://www.nss.nhs.scot/publications/Scottish One Health Antimicrobial Use and Antimicrobial Resistance in 2021 | National Services Scotland (nhs.scot))

**The changing patient population and HCAI risk:** N/A

***Clostridioides difficile* infection:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

***Staphylococcus aureus* bacteraemia:** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**Gram-negative bacteraemia (*Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Pseudomonas aeruginosa* and *Acinetobacter* species bacteraemia):** details provided in annual publication <https://www.nss.nhs.scot/publications/scottish-one-health-antimicrobial-use-and-antimicrobial-resistance-in-2021/>

**Gram-negative bacteraemia (*Escherichia coli* bacteraemia):** details provided in quarterly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/guidance-protocols-and-reports/>

**Hospital onset COVID-19:** details provided in weekly publication <https://www.nss.nhs.scot/antimicrobial-resistance-and-healthcare-associated-infection/data-and-intelligence/hospital-onset-covid-19/>

**Multi-drug resistant organism admission screening:** N/A. There are no comparable data on Clinical Risk Assessment.

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

## 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. <https://www.nipcm.scot.nhs.uk/resources/development-process/>

## Value type and unit of measurement

Count of e-prescribed items for antibiotics commonly used for Group A Streptococcal infection, per week.

Total occupied bed days per year.

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

Percentage of emergency admissions per year (%) = count of emergency admissions / total new inpatient admissions (including emergency, elective and uncategorised admissions).

Percentage of elective admissions per year (%) = count of elective admissions / total new inpatient admissions (including emergency, elective and uncategorised admissions).

Total number of delayed discharges per 1,000 total occupied bed days.

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.

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 out of the total number of healthcare associated and community associated *Staphylococcus aureus* bacteraemia.

Percentage of each ECB primary infection source of the total number of healthcare associated and community associated *Escherichia coli* bacteraemia.

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

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

Count of nosocomial COVID-19 cases by hospital onset status.

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

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

Healthcare outbreaks and incidents: total number of reported incidents.

## Disclosure

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

## Official Statistics designation

Not Assessed

## UK Statistics Authority Assessment

Not Assessed

## Last published

20 September 2022

## Next published

September 2024

## Date of first publication

25 May 2015

## Help email

**[NSS.ARHAinfectioncontrol@nhs.scot](mailto:NSS.ARHAinfectioncontrol@nhs.scot)**

## Date form completed

19 September 2023

# 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'**.