NHS National Services Scotland

Healthcare Associated Infection.

Annual Report 2018

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Health Protection Scotland

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Acronyms

ABHR	Alcohol Based Hand Rub
ACP	Augmented Care Period
AFM	Acute Flaccid Myelitis
AMR	Antimicrobial Resistance
AMRHAI	Antimicrobial Resistance and Healthcare Associated Infections
AMT	Antimicrobial Management Team
AMU	Antimicrobial Use
BBV	Bloodborne Virus
BSI	Bloodstream Infection
CARS	Controlling Antimicrobial Resistance in Scotland
CAUTI	Catheter Associated Urinary Tract Infection
CDI	*Clostridioides difficile* Infection
CET	Current and Emerging Threats
CF	Cystic Fibrosis
CLABSI	Central Line Associated Blood Stream Infection
CRA	Clinical Risk Assessment
CPE	Carbapenemase-Producing Enterobacterales
CPO	Carbapenemase-Producing Organism
CR-BSI	CVC-Related Bloodstream Infection
CVC	Central Vascular Catheter
DARC	Defra Antimicrobial Resistance Coordination
ECB	*Escherichia coli* Bacteraemia
ECDC	European Centre for Disease Prevention and Control
ECOSS	Electronic Communication of Surveillance in Scotland
EiC	Excellence in Care
ESPAUR	English Surveillance Programme for Antimicrobial Utilisation and Resistance
EWS	Early Warning System
FFP3	Filtering Face Piece 3
GI	Gastrointestinal
GCU	Glasgow Caledonian University
GP	General Practitioner
HAI	Healthcare Associated Infection
HBV	Hepatitis B Virus
HCAI	Healthcare Associated Infection
HCV	Hepatitis C Virus
HCW	Healthcare Worker
HDL	Health Department Letter
HEI	Healthcare Environment Inspectorate
HFS	Health Facilities Scotland

HIIAT	Healthcare Infection Incident Assessment Tool
HIV	Human Immunodeficiency Virus
HPS	Health Protection Scotland
HPT	Health Protection Team
ICBED	Infection Control in the Built Environment and Decontamination
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
IPCT	Infection Prevention and Control Team
IRIC	Incident Reporting and Investigation Centre
ISD	Information Services Division
KPC	*Klebsiella pneumoniae* Carbapenemase
KPI	Key Performance Indicator
MDRO	Multidrug Resistant Organism
MRSA	Meticillin Resistant *Staphylococcus aureus*
MSSA	Meticillin Sensitive *Staphylococcus aureus*
NDC	National Distribution Centre
NDM	New Delhi Metallo-Beta-lactamase
NES	NHS Education for Scotland
NHS	National Health Service
NIPCM	National Infection Prevention and Control Manual
NNU	Neonatal Unit
NP	National Procurement
NPGO	National Policies, Guidance and Outbreaks
NRS	National Records of Scotland
NSS	National Services Scotland
PCR	Polymerase Chain Reaction
PDS	Post Discharge Surveillance
PHE	Public Health England
PHWCAMU	Pig Health and Welfare Council AMU
PIS	Prescribing Information System
PN	Pneumonia
PNE	Patient Notification Exercise
PPS	Point Prevalence Survey
PWID	People Who Inject Drugs
QIT	Quality Improvement Tool
RPE	Respiratory Protective Equipment
SAB	*Staphylococcus aureus* Bacteraemia
SAPG	Scottish Antimicrobial Prescribing Group
SGHSCD	Scottish Government Health and Social Care Directorate
SHAIPI	Scottish Healthcare Associated Infection Prevention Institute

SICPs	Standard Infection Control Precautions
SICSAG	Scottish Intensive Care Society Audit Group
SIRN	Scottish Infection Research Network
SMR	Scottish Morbidity Records
SMVN	Scottish Microbiology and Virology Network
SOE	Significant Occupational Exposure
SONAAR	Scottish One Health AMR and AMU Report
SSI	Surgical Site Infection
SSSCDRL	Scottish *Salmonella*, *Shigella* and *Clostridioides difficile* Reference Laboratory
SSTI	Skin and Soft Tissue Infection
SSIRS	Surgical Site Infection Reporting System
SULSA	Scottish Universities Life Sciences Alliance
SUTIN	Scottish UTI Network
TBPs	Transmission Based Precautions
TOBDs	Total Occupied Bed Days
UKAP	UK Advisory Panel for Healthcare Workers Infected with Bloodborne Viruses
UTI	Urinary Tract Infection
WHO	World Health Organisation
WTE	Whole Time Equivalent
VAD	Vascular Access Device
VAP	Ventilator Associated Pneumonia

NHS board abbreviations

AA Ayrshire & Arran

BR Borders

DG Dumfries & Galloway

FF Fife

FV Forth Valley

GGC Greater Glasgow & Clyde

GR Grampian

HG Highland

LN Lanarkshire

LO Lothian

NWTC National Waiting Times Centre

OR Orkney

SH Shetland

TY Tayside

WI Western Isles

Executive Summary

NHS National Services Scotland

Healthcare associated infections (HCAIs) continue to represent a threat to patient safety in NHSScotland and to safe care, wherever that is delivered. The threat of antimicrobial resistance (AMR) remains a key focus for current and future health protection strategies.

Gram-negative Bacteraemia

Incidence rate of *E. coli* bacteraemias (ECB) in patients of all ages was 87.3 per 100,000 population. ↔

There was a stable year on year trend in the incidence of ECB in the period 2014-2018. ↔

Incidence rate of healthcare associated ECB was 37.4 per 100,000 bed days.

Incidence rate of community associated ECB was 45.1 per 100,000 population.

Lower urinary tract infections accounted for 34.2% of *E. coli* bacteraemia primary infections.

Proportions of ECB non-susceptible to commonly used antibiotics were generally stable over the last five years. ↔

Susceptibility in *Klebsiella pneumoniae* and Pseudomonas aeruginosa has remained stable since 2014. ↔

Prevention of Healthcare Associated Bloodborne Viruses

2,223 sharps-related injuries were reported in 2017 giving a rate of 1.88 sharps injuries per 100 WTE staff. ↔

There were 71 exposures to a source known to be infected with a BBV. Zero BBV seroconversions were reported.

The number of safety devices purchased increased significantly from 37% in 2013 to 79% in 2017.

Clostridioides difficile Infection

Clostridioides difficile infection (CDI) incidence rate in patients aged ≥15 years was 24.2 per 100,000 population ↔

There was a decreasing year on year trend of 7.5% in the incidence rate between 2014 to 2018. ↓

Incidence rate of healthcare associated CDI was 15.2 per 100,000 bed days. ↔

Incidence rate of community associated CDI was 7.0 per 100,000 population. ↔

Surgical Site Infection

Caesarean Section: Overall surgical site infection (SSI) incidence to day 10 was 1.5%. ↔

Hip Arthroplasty: Overall SSI incidence to day 30 was 0.7%. ↔

Staphylococcus aureus Infection

Incidence rate of *S. aureus* bacteraemias (SAB) was 29.2 per 100,000 population. ↔

There was a decreasing year on year trend of 17.1% in the MRSA incidence rate between 2014 to 2018 ↓ however the incidence rate of SAB and MSSA has not changed over this time period. ↔

Incidence rate of healthcare associated SAB was 17.6 per 100,000 bed days. ↔

Incidence rate of community associated SAB was 9.3 per 100,000 population. ↔

Norovirus Outbreaks

Norovirus spreads very easily and there is a risk of outbreaks in shared living spaces such as in hospitals.

From October 2017 to July 2018 there were a total of 88 wards closed with an additional 139 bays closed giving a total of 227 closures.

HCAI in Intensive Care Units

The incidence of HCAI in 2017 in intensive care units (ICU) was 2.7%. ↔

There was no increase in the incidence of ventilator associated pneumonia (VAP) between 2016 and 2017. ↔

Carbapenemase-producing Organisms

The emergence and spread of Gram-negative organisms which have acquired the ability to produce carbapenemase enzymes that inactivate carbapenem antibiotics, is concerning.

In Scotland in 2018, a total of 101 carbapenemase-producing organisms (CPOs) were reported.

There was an increasing year on year trend of 22.7% in the incidence rate between 2014 and 2018. ↑

Urinary Tract Infection

Urinary tract infections (UTI) and catheter associated-UTI (CAUTI) are amongst the most prevalent healthcare associated infections in Scotland today.

The annual incidence of *E. coli* urinary isolates was 2,285 per 100,000 population in 2018.

There was an increasing year on year trend of 0.7% in the incidence rate between 2014 and 2018. ↑

↑ Statistically significant increase*
↔ No change*
↓ Statistically significant decrease*
* From previous year, or year on year where stated.

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Controlling Antimicrobial Resistance in Scotland (CARS)

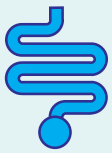
The Controlling Antimicrobial Resistance in Scotland (CARS) team within HPS, aims to provide a strategic response to antimicrobial resistance (AMR) in Scotland. In 2018, the second Scottish One Health Antimicrobial Use and Antimicrobial Resistance (SONAAR) report was published; the CARS Team contributed to the international surveillance of AMR and antimicrobial use (AMU) through submission of Scottish data, and introduced quarterly GP practice reports on antibiotic use. In animal health, Scotland's Healthy Animals website now includes Scotland's Poultry Hub which has guidance and information about keeping poultry health, and the CARS Team have explored potential future collaborations for data analysis and stewardship tools for veterinary practices. Additionally, funded by the Scottish Government and commissioned by HPS, Glasgow Caledonian University (GCU) has produced a report which provides insights on AMR/AMU related behaviours in the 'One Health' context. In the last year, the CARS Team has continued to engage with stakeholder groups and represented regularly on a number of UK groups.

Surgical Site Infection

The overall incidence of surgical site infection (SSI) following hip arthroplasty surgery and C-section procedures did not change between 2017 and 2018. HPS continue to work to reduce these clinically significant infections further. HPS has evaluated data collected on large bowel and major vascular procedures since implementation of these new procedures and will report within Discovery. HPS will review and evaluate the SSI surveillance programme to improve its performance and effectiveness and ensure it continues to meet its objectives efficiently.

Healthcare Associated Infections in Intensive Care Units

The incidence of HCAI in ICU during 2017 was 2.7%. The incidence of ventilator associated pneumonia has increased between 2015 and 2017 but there has been no increase between 2016 and 2017. HPS and the Scottish Intensive Care Society Audit Group (SICSAG) continue to work in partnership to reduce HCAI in the critical care setting. An evaluation of the surveillance system is planned to take place during 2019. The objective of the evaluation is to establish whether the objectives of the system are being met and engage with stakeholders to assess attributes of the surveillance system.



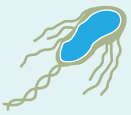
Clostridioides difficile infection

Clostridioides difficile Infection (CDI) is an important healthcare associated infection which causes diarrhoea and contributes to a significant burden of morbidity and mortality. Prevention of CDI is therefore essential and an important patient safety issue. The trend in annual incidence rates for CDI in patients aged ≥15 years has continuously declined between 2014 and 2018 from 32.0 to 24.2 per 100,000 population. Much of the decline in CDI incidence rates can be attributed to a decrease in healthcare associated CDI, though a significant burden exists which is community-associated. Further work is being undertaken to identify additional interventions to reduce CDI rates in both hospitals and community settings. There was a decreasing trend in the proportion of people dying of any cause within 30-days of CDI diagnosis between 2013 and 2017. HPS will continue to investigate factors associated with improved survival among CDI patients.

Staphylococcus aureus Infection

Staphylococcus aureus bacteraemia (SAB), is a serious systemic form of infection which leads to increased morbidity and mortality. During 2018, 1,585 cases of SAB reported in Scotland with 4.8% reported as meticillin resistant *S. aureus* bacteraemias (MRSA) and 95.6% were meticillin sensitive *S. aureus* bacteraemias (MSSA). Overall there was a decreasing year on year trend in MRSA between 2014-2018 however the incidence rate of SAB and MSSA has not changed over this time period.

In 2018, the incidence rate of healthcare associated SAB was 17.6 per 100,000 bed days, while the incidence rate of community associated SAB was 9.3 per 100,000 population. The main entry point for healthcare associated cases was relating to a device whereas skin and soft tissue infection were the main entry point for community associated cases. In 2018, 83% of patients audited underwent a clinical risk assessment in line with national MRSA screening policy. This remains below the 90% key performance indicator.



Gram-negative Bacteraemia

Gram-negative bacteria continue to be an emerging threat to health worldwide. During 2018, there were 4,738 cases of *Escherichia coli* Bacteraemia (ECB) in Scotland with a rate of 87.3 per 100,000 population. These infections are predominately from a community origin with a rate of 45.1 cases per 100,000 population in 2018. Given the changes to the way care is delivered and will be delivered in the future, it is appropriate that a broader public health approach which focuses on reducing the risk of infection before admission to hospital is developed. Developments to surveillance systems are underway to ensure areas for improvement are highlighted to guide the best use of national resources (e.g. Scottish Urinary Tract Infection Network) and facilitate implementation of quality improvement and preventative measures both locally and nationally. The proportions of ECB non-susceptible to commonly used antibiotics were generally stable over the last five years; however, resistance to some antibiotics was consistently high over this period. Susceptibility in *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* has remained stable since 2014.

Urinary Tract Infection

Urinary tract infections (UTI) are amongst the most commonly encountered infections in healthcare. The majority of UTIs in Scotland are caused by *E. coli*. In 2018, there were 123,955 *E. coli* urinary isolates reported to HPS. In addition, findings from the ECB enhanced surveillance dataset indicate that a third of these bloodstream infections had a lower urinary tract infection as their primary infection.

Using a population health approach, Scottish UTI Network (SUTIN) has continued to promote shared learning and targeted UTI reduction strategies across health and social care. The National Hydration Campaign and the National Catheter Passport are examples of this collaborative approach to reducing UTI and catheter associated UTI (CAUTI). This in turn supports reduction of ECB and prudent antimicrobial prescribing.

Carbapenemase-producing Organisms

The number of carbapenemase-producing organisms (CPOs) overall remains low, however in Scotland a total of 101 CPO were reported in 2018. Incidence of CPO isolates increased from 0.8 per 100,000 population in 2014 to 1.9 per 100,000 population in 2018. This increase may be temporally associated with improved awareness of CPO, continued carbapenemase-producing Enterobacterales (CPE) screening in Scotland, and the launch of the Scottish AMR Satellite Reference service. In April 2018, the MRSA screening uptake monitoring tool was extended to include CPE. These data are monitored by HPS and feedback is provided to boards on a quarterly basis.

Prevention of Healthcare Associated Bloodborne Viruses

Bloodborne virus (BBVs) transmission can occur in the healthcare setting after exposure to staff or patients to infected blood or body fluids. Healthcare workers (HCWs) are at greatest risk of acquiring BBV infection following sharps related injuries. HPS has a programme of work to prevent these risk events and infections from occurring. The programme has established that, in 2017, the rate of sharps injuries per 100 whole time equivalent (WTE) in healthcare workers employed in Scotland is 1.9. Of the occupational exposures reported between January 2017 and June 2018 that were sustained from a bloodborne virus infected source, less than 40% were known to involve a safer sharps device. Uptake of safer sharps devices has increased significantly from 37% in 2013 to 79% in 2017 with increasing uptake (though smaller volumes) of non sharp alternative devices.

HPS also works with local health protection teams to support the public health response following identification of BBV infected HCWs with five risk assessments undertaken. All of them were referred to the UK Advisory Panel for Healthcare Workers Infected with Bloodborne Viruses (UKAP), who did not recommended a patient notification exercise (PNE).

Neonatal units

In 2018 the HPS Neonatal Unit (NNU) Infection Prevention Health Protection Programme continued to work towards preventing HCAI in NNUs across Scotland; facilitating national oversight and co-ordination. This programme is led by the Neonatal Unit Infection Reduction steering group, chaired by a Consultant Neonatologist, with representation from key stakeholders across NHSScotland. The key outputs for this year have included the production of tools and information resources for the prevention and management of incidents and outbreaks in NNU settings.

Development of Guidance

HPS collaborate with local Infection Prevention and Control and Health Protection Teams in the development and review of guidance documents for the prevention and control of infection across all care settings. This year, an Addendum for Infection Prevention and Control within Neonatal Settings (NNU) was published to provide additional guidance to Chapters 1, 2 and 3. HPS also published a draft version of an Addendum for Infection Prevention and Control for Patients with Cystic Fibrosis (CF) following a review of the scientific literature.

HPS continued to maintain and update the NIPCM website; new organisms such as Monkeypox and Nipah virus were added to the A-Z of pathogens guide. Improvements continued to be made to the HAI compendium; in 2018 all pathogen specific guidance and supporting materials were moved to the A-Z of Pathogens to ensure all pathogen specific information could be accessed in one place.

HPS supports the 5th of May WHO ‘SAVES LIVES: Clean your hands campaign’. The 2018 call to action was ‘It’s in your hands – Prevent Sepsis in Healthcare’. HPS supported this through the creation of a sepsis webpage and adding sepsis to the HAI Compendium; promoting sepsis awareness information to healthcare staff and the public.

Hospital Outbreaks and Incidents

HPS support local Infection Prevention and Control and Health Protection Teams to prevent, prepare for and manage outbreaks and incidents, as well as share lessons learned throughout Scotland. In the last year, 170 outbreaks and incidents were reported to HPS compared to 167 in the previous year. Respiratory and gastrointestinal infections were most commonly reported in 2018.

Norovirus Outbreaks

From October 2017 to July 2018 there were a total of 88 wards closed and an additional 139 bays closed giving a total of 227 closures. Bay closures can assist NHS boards in reducing service impact without compromising patient safety during norovirus season.

A new norovirus reporting system was launched for NHS boards at the beginning of 2018 in addition to a supporting public facing dashboard that provides a robust reflection of norovirus impact across acute hospital settings in NHSScotland.

The 'Stay at Home' Campaign was re-launched by HPS in partnership with Health Scotland and Scottish Government Health and Social Care Directorate (SGHSCD).

Infection Control in the Built Environment and Decontamination

Outbreaks and incidents related to the healthcare environment, the built environment, reusable medical devices and surgical instruments continue to represent a threat to patient safety.

HPS has commenced the built environment programme where guidance and available evidence is being searched to inform the infection prevention interpretation of current technical guidance documents regarding the physical environment in healthcare.

Infection prevention in the care environment and for reusable patient care equipment work has continued within the ICBED programme this year including the submission of an assessment of the financial impact of mandating a protected time to clean a bed space (40mins general bed space and 60mins for a specialist bed space). Also as part of the work the development of a national monitoring framework for the monitoring of healthcare cleanliness and clinical practice was delivered and has been published. This is available for all health boards to use and provides a minimal standard for NHSScotland. A follow up study to estimate the time spent by nursing staff cleaning reusable communal patient care equipment was completed and the findings submitted to the Scottish Government. Guidance for the decontamination and testing of cardiac heater cooler units was also published this year following the international *Mycobacterium chimaera* outbreak related to cardiac heater cooler units.

Future work will include continued development of built environment guidance regarding water and ventilation in healthcare settings. Work will continue to searching for novel and new technologies for the decontamination of the healthcare setting using scientific literature reviews. Guidance for the decontamination of dental handpieces has been planned to clarify and standardise practice for NHSScotland.

Controlling Antimicrobial Resistance in Scotland

Antimicrobial resistance (AMR) is the ability of microbes such as bacteria to develop resistance to antimicrobials. This means that infections are more difficult and in some rare instances, can be impossible to treat. AMR is recognised as a global public health threat and in recent years, this threat has been met with an intensified response both nationally and internationally.[1-4]

The UK has published a five-year national action plan 'Tackling antimicrobial resistance 2019–2024'[3] as well as a vision for AMR in 20 years 'Contained and controlled: The UK's 20-year vision for antimicrobial resistance'.[4] The five-year national action plan[3] focuses on three key aims to tackle AMR: reducing the burden of infection, optimising the use of antimicrobials, and developing new diagnostics, therapies, vaccines and interventions. Health Protection Scotland (HPS) will support and implement components of the action plan, ensuring Scotland is better equipped to control AMR now and in the future.

Surveillance

Following many years of reporting solely on human antimicrobial use (AMU) and AMR, data relating to resistance among organisms from animals are now published by HPS.[5] This move recognised the importance of the 'One Health' ethos to the sustainable control of AMR, i.e. the concept that the interconnectedness of the health of humans, animals, and the environment necessitates an approach which takes all spheres into account rather than focusing on one to the exclusion of others.

In November 2018, the second 'Scottish One Health Antimicrobial Use and Antimicrobial Resistance' (SONAAR) Report was published.[5] This report describes AMU in humans in Scotland and AMR in a broad range of human and animal infections. These data are used by organisations such as the Scottish Antimicrobial Prescribing Group (SAPG) to inform antimicrobial prescribing policy and develop initiatives for antimicrobial stewardship and the Scottish Microbiology and Virology Network (SMVN) to support the development of testing strategies for NHS diagnostic laboratories in Scotland.

In the past year, HPS has contributed to the international surveillance of AMR and AMU through submission of Scottish data. These include European Antimicrobial Resistance Surveillance Network (EARS-Net), European Surveillance of Antimicrobial Consumption Network (ESAC-Net), Global Antimicrobial Resistance Surveillance System (GLASS) and the UK One Health Report.[6]

As part of ongoing improvements to the national early warning system (EWS) for emerging resistant pathogens, reports on exceptional phenotypes are now issued twice weekly to NHS boards. This approach facilitates rapid distribution of information and enables the prompt implementation of infection control interventions to prevent the emergence or transmission of resistant pathogens in healthcare facilities and/or the community.

In 2018, work was implemented to maximise the utility of national AMU surveillance data by providing all GP practices with quarterly reports on their antibiotic prescribing alongside NHS board and national benchmarks. Additionally these reports contain suggested actions

and links to resources and evidence to optimise their AMU. This is intended to support the ambition to reduce AMU to minimise the development of AMR.

Control of Antimicrobial Resistance in Animal Health

Scotland's Healthy Animals website provides guidance for animal keepers, animal health professionals and the general public as countryside users. The website signposts trusted sources on keeping animals healthy and provides guidance on disease avoidance and antimicrobial stewardship as a 'one-stop shop'. Included on the website is Scotland's Poultry Hub which is a 'go to' resource that was developed for poultry keepers, especially smallholders, signposting guidance and helpful up-to-date information about keeping poultry healthy so as to avoid the need to treat disease.

The Scottish Animal Health and AMR Group, formed in 2015, and the Scottish Veterinary Antimicrobial Stewardship Group, formed in early 2017, bring together stakeholders from veterinary, veterinary nursing and the broader animal health community. The purpose of these groups is to agree collaborative action plans and highlight and share common initiatives on keeping animals healthy and controlling AMR. Preliminary scoping and analysis of veterinary practice prescribing data was made possible via these groups. HPS is exploring potential future collaborations for data analysis and stewardship tools for veterinary practices with partners VetCompass and the Small Animal Veterinary Surveillance Network (SAVSNET), who hold extensive animal health data repositories, particularly for companion animals.

Research Facilitation

Funded by the Scottish Government and commissioned by HPS, Glasgow Caledonian University (GCU) has produced a report which describes the drivers, pressures and behaviours underpinning clinical decisions to prescribe antimicrobial drugs in primary and secondary care and the treatment expectations of patients. In addition, the level of understanding and awareness of AMR among farm animal veterinarians and farmers was described. This complements earlier work with companion animal owners and their veterinarians. Literature reviews of the current research landscape were scoped by GCU and, along with expert opinion, explored understanding and awareness of the 'One Health' concept. The findings from the research will now be translated into actions to improve prescribing practices.

HPS worked in collaboration with the Scottish Universities Life Sciences Alliance (SULSA) and other partners to develop, facilitate and contribute to delivery of a two day AMR research conference at the University of Strathclyde, 26th to 27th April 2018.

Engagement and Education

HPS has promoted the work of stakeholder groups and Scotland's Healthy Animals at conferences throughout the UK and Europe. Results and findings from the SONAAR report have been presented to various organisations, these include: Controlling Antimicrobial Resistance in Scotland (CARS) policy group, SAPG, Scottish Veterinary Antimicrobial Stewardship Group, Directors of Public Health Group, Consultants in Public Health Medicine Group, and at events across Europe. As part of World Antibiotic Awareness Week

in November 2018, HPS participated in an Antibiotic Awareness Symposium for staff and students at the University of Glasgow Veterinary School. HPS will continue to develop long-term relationships with veterinary and veterinary nurse educators and their professional bodies and to support the identification of knowledge gaps and support teaching of antimicrobial stewardship and AMR to students. In addition, HPS will work with veterinary practices to promote tools to aid antimicrobial stewardship.

HPS continues to be represented regularly on the English Surveillance Programme for Antimicrobial Utilisation and Resistance (ESPAUR) Oversights Group, the Department for Environment, Food and Rural Affairs (Defra), Antimicrobial Resistance Coordination (DARC) Group, and the Pig Health and Welfare Council AMU (PHWCAMU) Subgroup.

Surgical Site Infection

Surgical site infection (SSI) is the third most common Healthcare Associated Infection (HCAI) in Scotland, estimated to account for 16.5% of inpatient HCAI within NHSScotland.[7] A systematic review of the impact of SSI on health care costs and patient outcomes in 2017 showed that SSI can have serious consequences for patients with resulting negative outcomes such as longer recovery periods, additional surgical intervention and readmission, loss of earnings, suffering, and some cases result in death.[8] SSIs are estimated on average to double the cost of treatment, mainly due to the resultant increase in length of stay.[9]

Epidemiological Data

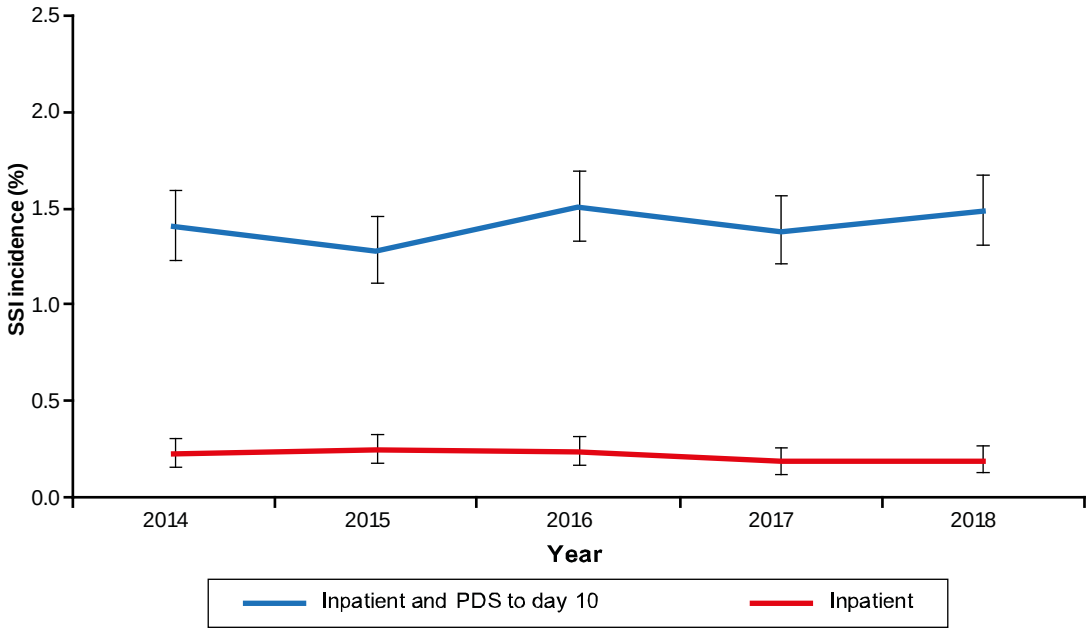
HPS coordinate the SSI national surveillance programme that is mandatory across all NHS boards in Scotland. All NHS boards are currently required to undertake surveillance for caesarean section, hip arthroplasty, planned large bowel and vascular procedures as per the mandatory requirements of HDL 2006 (38) and HAI DL (2015) 19.[10, 11] SSI surveillance is conducted according to the HPS SSI surveillance protocol.[12]

Caesarean Section

Caesarean sections are routinely carried out within 14 NHS boards across Scotland. Caesarean section surveillance is performed during the patient's inpatient stay and post discharge surveillance (PDS) is carried out by community midwives until day 10 post operatively. A total of 16,804 caesarean sections were performed in Scotland during 2018 with 250 SSIs being reported to HPS. During 2018, there were 32 (12.8%) SSIs diagnosed during the inpatient stay, with 87.2% of SSI (n= 218) being diagnosed following discharge from hospital using post discharge surveillance methods.

The incidence of inpatient SSI was 0.2% (95% CI: 0.13 to 0.27) and the overall SSI incidence including the PDS period to day 10 was 1.5% (95% CI: 1.32 to 1.68). The incidence of the inpatient and overall SSI to day 10 remained stable between 2014 and 2018 (p=0.25, p=0.36 respectively) (FIGURE 1).

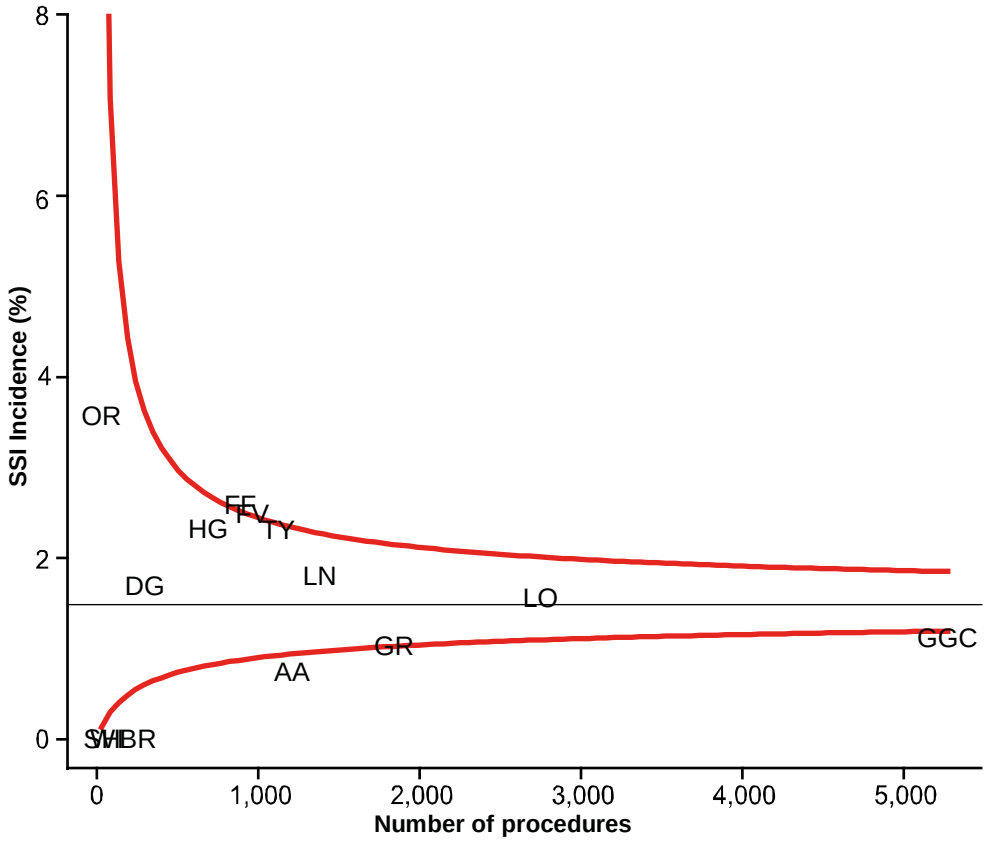
FIGURE 1: Caesarean section SSI incidence (per 100 procedures) in Scotland (inpatient and post discharge to day 10), 2014 to 2018.



[Source of data is Surgical Site Infection Reporting System (SSIRS).]

The annual incidence of SSI following caesarean section for each NHS board is presented through funnel plot (FIGURE 2). NHS Fife and NHS Forth Valley incidence were above the 95% confidence upper limit in 2018.

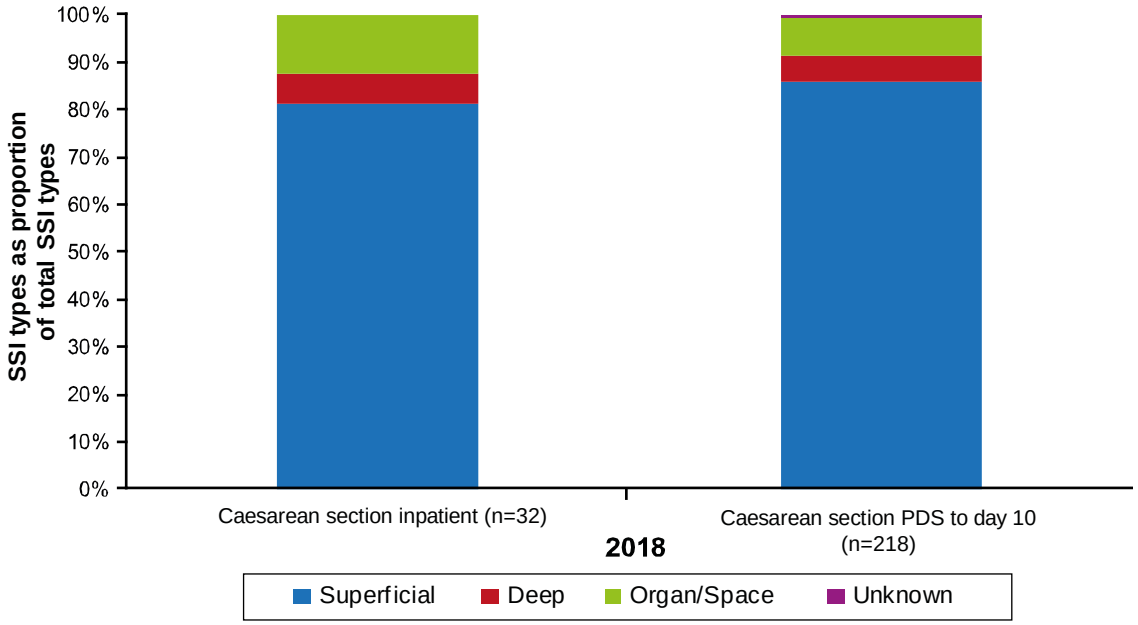
FIGURE 2: Caesarean section SSI incidence (per 100 procedures) in inpatients and PDS to day 10 for all NHS boards in Scotland in 2018.



[Source of data is Surgical Site Infection Reporting System (SSIRS).
NHS Orkney and NHS Shetland overlap as do NHS Fife and NHS Forth Valley.]

The majority of SSI occurring following caesarean section surgery were superficial (n=213). A total of six (18.8% of all inpatients SSIs) deep or organ space SSIs were reported during the inpatient phase of the SSI surveillance (FIGURE 3).

FIGURE 3: Proportion of SSI following caesarean section procedures (inpatients and PDS to day 10) in Scotland by SSI type, 2018.



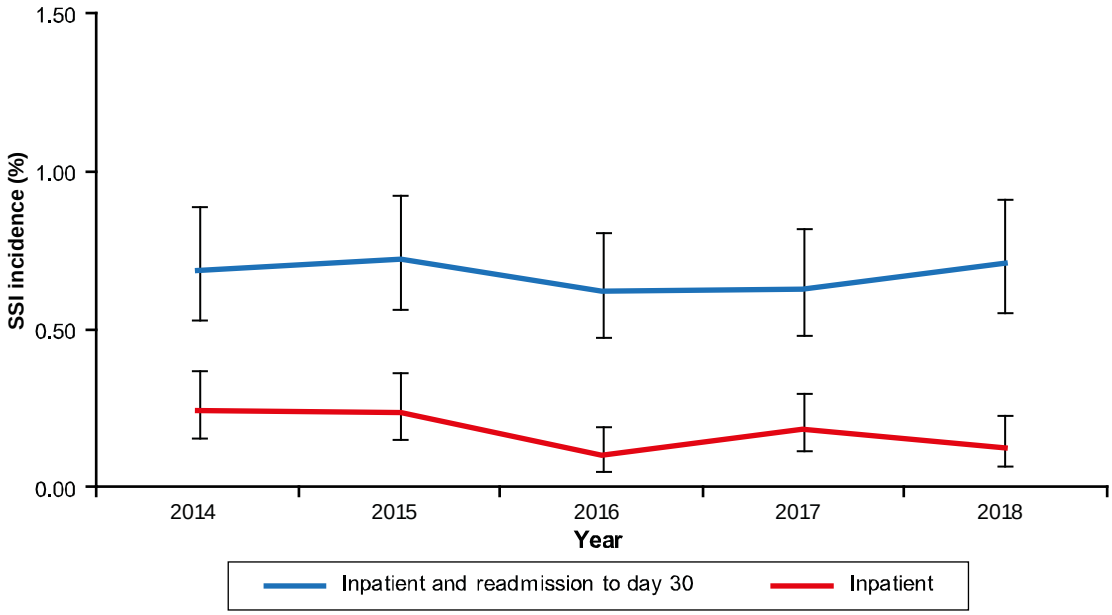
[Source of data is Surgical Site Infection Reporting System (SSIRS)]

Hip Arthroplasty

Hip arthroplasty procedures are carried out routinely across 14 NHS boards in Scotland. Hip arthroplasty SSI surveillance is performed during inpatient stay and readmission surveillance is carried out until day 30 post operatively. A total of 8,707 procedures were recorded through the hip arthroplasty SSI surveillance programme during 2018. SSI were reported in 62 cases of which 17.7% (n= 11) were diagnosed during the inpatient stay and the remainder were identified on readmission to hospital in the 30 days following the procedure (n=51).

The inpatient incidence of SSI was 0.1% (95% CI: 0.07 to 0.23) and the overall incidence of SSI was 0.7% (95% CI: 0.56 to 0.91). The incidence of SSI for inpatient and overall inpatient and readmission to day 30 remained stable between 2014 and 2018 (p=0.047, p=0.88 respectively) (FIGURE 4).

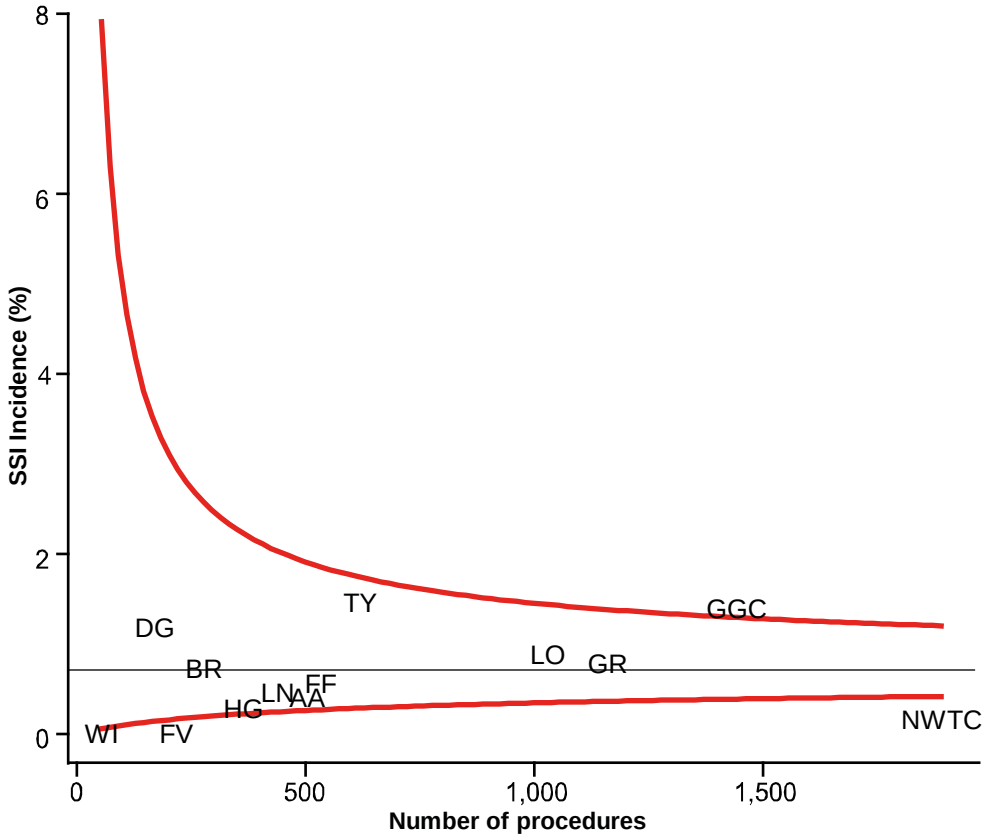
FIGURE 4: Hip arthroplasty SSI incidence (per 100 procedures) in Scotland (inpatient and on readmission to day 30), 2014 to 2018.



[Source of data is Surgical Site Infection Reporting System (SSIRS).]

The annual incidence of SSI following hip arthroplasty for each NHS board is presented through funnel plot (FIGURE 5). NHS Greater Glasgow and Clyde incidence was above the 95% confidence upper limit in 2018.

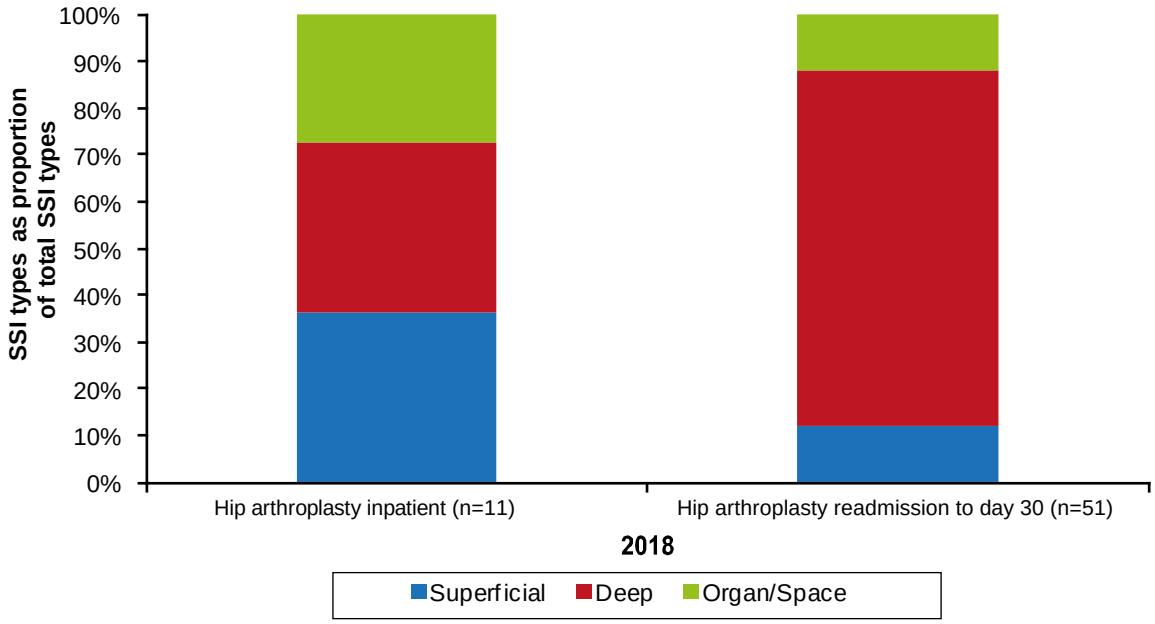
FIGURE 5: Hip arthroplasty SSI incidence (per 100 procedures) in inpatients and on readmission to day 30 for all NHS boards in Scotland in 2018.



[Source of data is Surgical Site Infection Reporting System (SSIRS).]

The majority of SSI detected on readmission to day 30 following hip arthroplasty surgery were deep infections (n=39). This higher proportion of deep infections for readmission surveillance is due to patients with this type of SSI being more likely to be readmitted to hospital compared to patients with a superficial SSI (FIGURE 6). The number of SSI following hip arthroplasty is small therefore these data should be interpreted with due caution.

FIGURE 6: Proportion of SSI following hip arthroplasty procedures (inpatient and readmission to day 30) in Scotland by SSI type, 2018.



[Source of data is Surgical Site Infection Reporting System (SSIRS).]

Quality Improvement and Interventions to Reduce Surgical Site Infection

HPS monitor the SSI incidence within each NHS board on a quarterly basis. Whilst national surveillance systems do not replace the need for local surveillance, these data and quarterly publications ensure that outcomes from the national SSI surveillance programme are shared widely allowing Infection Prevention and Control (IPC) staff, hospital managers and clinical staff access to local and national data for improvement. The literature review for SSI improvement bundle has been updated in 2018.[13]

SSI surveillance data is published quarterly as part of commentary on quarterly epidemiological data for Scotland. This publication includes quarterly reporting on the mandatory programmes for *Clostridioides difficile* infection (CDI), *Escherichia coli* bacteraemia (ECB), *Staphylococcus aureus* bacteraemia (SAB) in addition to SSI in Scotland. SSI data are also published on NSS Discovery allowing boards to view their SSI incidence at board and hospital level and compare with other NHS boards and Scotland overall. This interactive report currently includes NHS board and hospital level SSI incidence data views for hip arthroplasty and caesarean section procedures.

Large bowel and major vascular procedures have been included in the surgical site surveillance programme since April 2017. HPS has evaluated data collected since implementation of these new procedures and these data will be included within NSS Discovery on the SSI surveillance report dashboard from July 2019. HPS will also continue to support NHS boards through development of the NSS Discovery platform to enable monitoring of SSI risk factors.

HPS has planned to review and evaluate the SSI surveillance programme to improve its performance and effectiveness and ensure it continues to meet its objectives efficiently. The

evaluation of the surveillance system also allows HPS to define whether it is achieving the overarching goals of the public health program. HPS will update the SSI surveillance protocol following the evaluation to reflect any possible changes that might be identified during the evaluation process.

Healthcare Associated Infections in Intensive Care Units

The Scottish Point Prevalence Survey (PPS) carried out in 2016 found that one in nine intensive care unit (ICU) patients had an HCAI at the time of survey. The prevalence of HCAI in ICU patients was higher compared with patients receiving care in general wards.[7] Patients cared for in ICU are particularly vulnerable to infection due to their multiple co-morbidities and the extrinsic risk factors such as surgical procedures and invasive devices to which they are exposed. Therefore, patients in ICU are a priority for HCAI surveillance and prevention programmes.

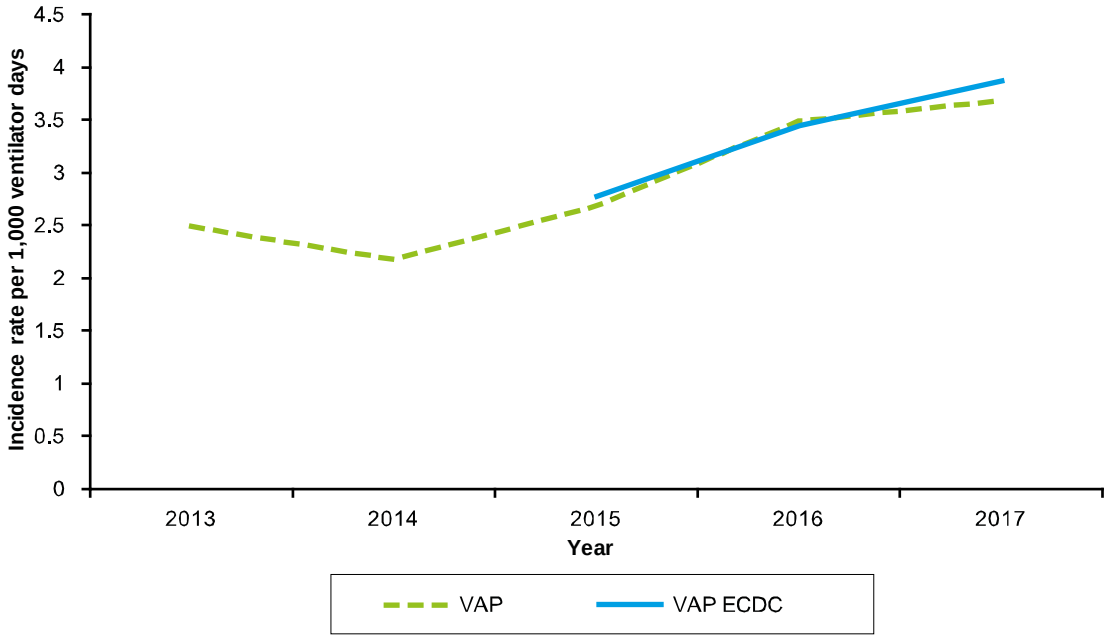
Data from 2018 are not yet available for publication in this report. These data will be published as part of the annual Scottish Intensive Care Society Audit Group (SICSAG) report of data in August, 2019. During 2017, 22 adult ICUs collected data for this surveillance programme, in accordance with the national mandatory surveillance requirements. All data were collected in accordance with the European Centre for Disease Prevention and Control (ECDC) protocol for Surveillance of Healthcare associated Infections in Intensive Care Units. Data relating to bloodstream infection (BSI), central vascular catheter (CVC) related infection (CRI), central line associated bloodstream infection (CLABSI) and pneumonia (PN) were collected.[14] Where year on year comparisons are made, these must be interpreted with caution as changes at individual units may result in an altered case-mix.

Data were collected from 8,729 admissions to ICU and in total 261 infections were reported from 234 ICU admissions (2.7%) (95% CI: 2.4 to 3.0). Of the infections 51.3% were PN, 42.5% were BSI and 6.1% were Local and General CRI. A total of 2.7% of ICU admissions developed an HCAI during their stay in ICU. This remains unchanged from 2016 (p=0.2).

The variables which are used to determine whether PN and BSI are device associated have been redefined to provide more robust measures of device use around the time of HCAI and to align to ECDC methods for analysis.[14] Data collected on the Ward Watcher Augmented Care Period (ACP) screen are now used to determine device use around the time of infection rather than specific questions relating to device use.

Incidence rates of ventilator associated pneumonia (VAP) (aligned to the ECDC methodology for analysis for 2015 to 2017) are shown in FIGURE 7.

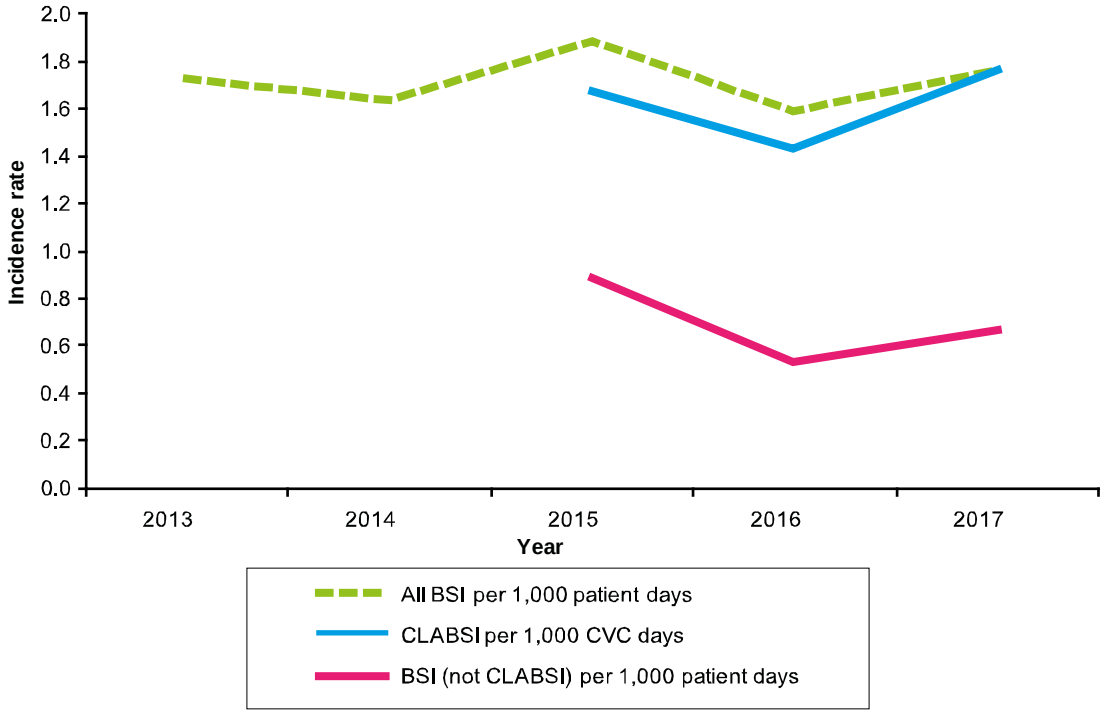
FIGURE 7: Incidence rate of VAP within NHSScotland from 2013 to 2017.



[Source: WardWatcher.]

The rate of VAP from 2013 - 2017 (as previously defined) is shown by the dashed green line. Analyses of these data show that VAP has increased between 2015 and 2017 (p=0.02), but there has been no increase between 2016 and 2017 (p=0.7). Incidence rates of BSI for 2013 - 2017 are shown in FIGURE 8.

FIGURE 8: Incidence rates of BSI within NHSScotland from 2013 to 2017.



[Source:WardWatcher.]

The rate for all BSI (includes all BSI and CLABSI) is shown by the green line. The CLABSI rate for 2015 - 2017 (aligned to the ECDC methodology for analysis)[14] is represented by the blue line and BSI which do not meet the ECDC definitions for CLABSI are represented by the pink line.

Antimicrobial Resistance Data in Intensive Care Units

AMR patterns for a number of micro-organisms (based on minimal AMR markers as per ECDC HAI-Net ICU protocol[14]) are reported through the surveillance system. Overall, AMR data were available from 29.2% (n=80) of all isolates reported as associated with HCAI through WardWatcher. The number of individual organisms reported is very small and therefore we are unable to draw any conclusions relative to AMR in intensive care. This highlights the need to ensure better capture of AMR surveillance data by improving the current system or exploring other methods such as linking to Electronic Communication of Surveillance in Scotland (ECOSS) data. A more complete AMR dataset would allow comparison of ICU patients with the general patient population to identify any potential epidemiological differences.

Quality Improvement and Interventions to Reduce Healthcare Associated Infections in Intensive Care Units

HPS and SICSAG continue to work in partnership to reduce HCAI in the critical care setting. An evaluation of the surveillance system is planned to take place during 2019. The objective of the evaluation is to establish whether the objectives of the system are being met and engage with stakeholders to assess attributes of the surveillance system including data quality, acceptability, simplicity and timeliness of reporting. Output from the evaluation will form the basis of recommendations to make improvements to the surveillance system.

Clostridioides difficile Infection

Clostridioides difficile infection (CDI) is an important HCAI, which causes diarrhoea in the patient and contributes to a significant burden of morbidity and mortality. Prevention of CDI is therefore essential and an important patient safety issue.

Mandatory surveillance of CDI in Scotland has been carried out in patients aged ≥65 years since October 2006. This was extended to include patients aged 15-64 years in April 2009. Full details of the methods may be obtained from the CDI surveillance protocol.[15]

Epidemiological Data

During 2018, there were 1,313 cases of CDI in patients aged ≥15 years in Scotland compared to 1,369 in 2017.

The annual incidence rate in patients ≥15 years in 2018 was 24.2 per 100,000 population compared to 25.2 per 100,000 population in 2017 (p=0.28). Between 2014 and 2018, there was a year on year decrease of 7.5% in the incidence rate (p<0.001) (FIGURE 9), which continues the decline in CDI rates in patients ≥15 years observed since 2010. Due to denominator changes introduced in October 2017, the CDI incidence rates presented here are not comparable with previous annual reports.[16]

CDI data is reported as part of the HPS Quarterly Epidemiological Commentary (that also publishes epidemiological trends of ECB, SAB and SSI). In this publication the burden and trends of CDI are reported using two categories:

- **Healthcare associated infection by NHS board of laboratory.** This is a CDI patient with onset of symptoms at least 48 hours following admission to a hospital or up to twelve weeks after discharge from a hospital.
- **Community associated infection by NHS board of residence for the case.** This is a CDI patient with onset of symptoms while outside a hospital and without discharge from a hospital within the previous 12 weeks – or with onset of symptoms within 48 hours following admission to a hospital without stay in a hospital within the previous 12 weeks.

The annual incidence rate of healthcare associated CDI for Scotland was 15.2 per 100,000 total occupied bed days (TOBDs) in 2018 compared to 16.3 per 100,000 TOBDs in 2017 (p=0.12). Between 2014 and 2018, there was a year on year decrease of 4.7% in the incidence rate (p<0.001) (FIGURE 10).

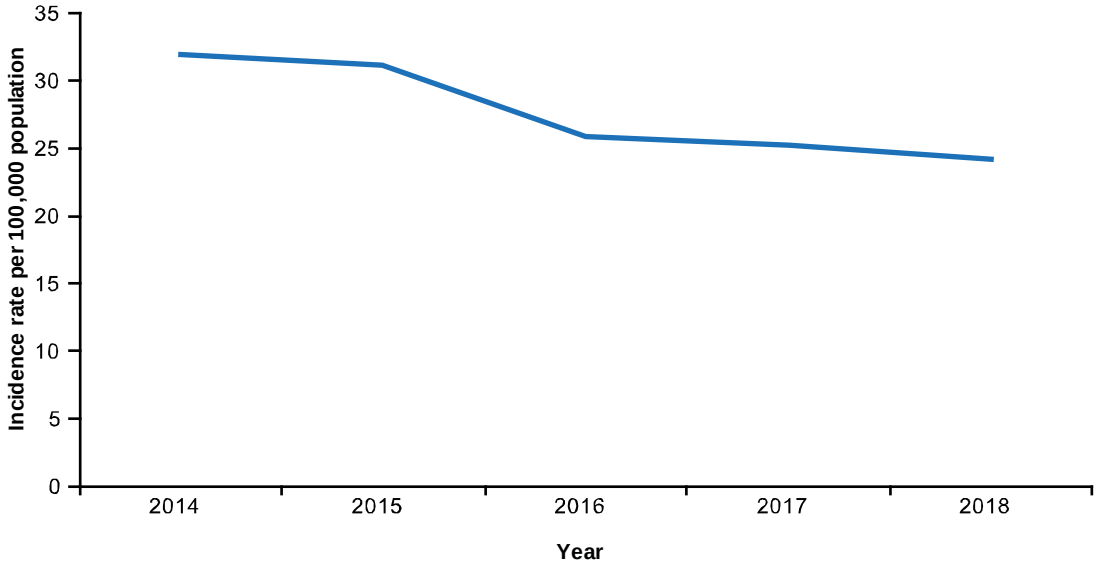
The annual incidence rate of community associated CDI was 7.0 per 100,000 population in 2018 compared to 6.5 per 100,000 population in 2017 (p=0.27). Between 2014 and 2018, there was a year on year decrease of 7.1% in the incidence rate (p<0.001) (FIGURE 10).

The results suggest that key interventions in the healthcare and community setting continue to be effective, though the rates appear to be levelling out.

In funnel plot analyses of CDI incidence rates for 2018 (comparing NHS boards to each other adjusted for hospital activity/population of health board of residence), NHS Dumfries & Galloway, NHS Grampian and NHS Greater Glasgow & Clyde were above the 95% confidence interval upper limit for healthcare associated CDI (FIGURE 11). NHS Highland

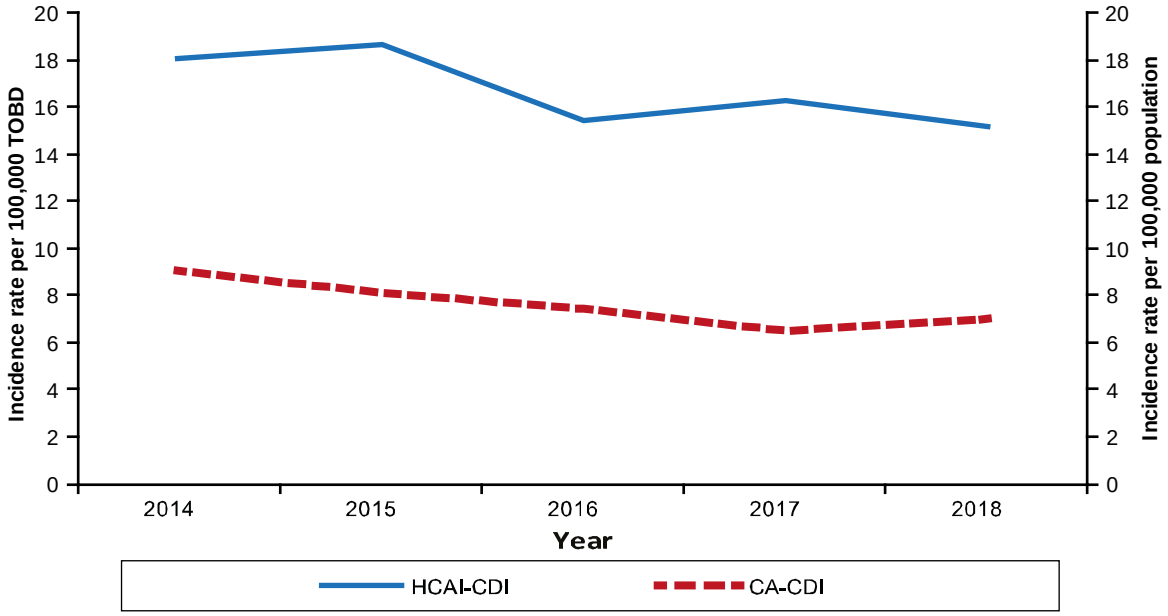
and NHS Grampian were above the 95% confidence interval upper limit for community associated cases (FIGURE 12). The funnel plot analysis incorporates the full year's data; as a result, some NHS boards may be above the 95% confidence interval upper limit in the annual funnel plot but not in the quarterly funnel plots (for full details please refer to **Appendix 2 – Publication Metadata**). NHS boards are monitored on a quarterly basis, for more information refer to published quarterly epidemiological data.

FIGURE 9: CDI incidence rate in patients aged ≥15 years per 100,000 population for Scotland, 2014 to 2018.



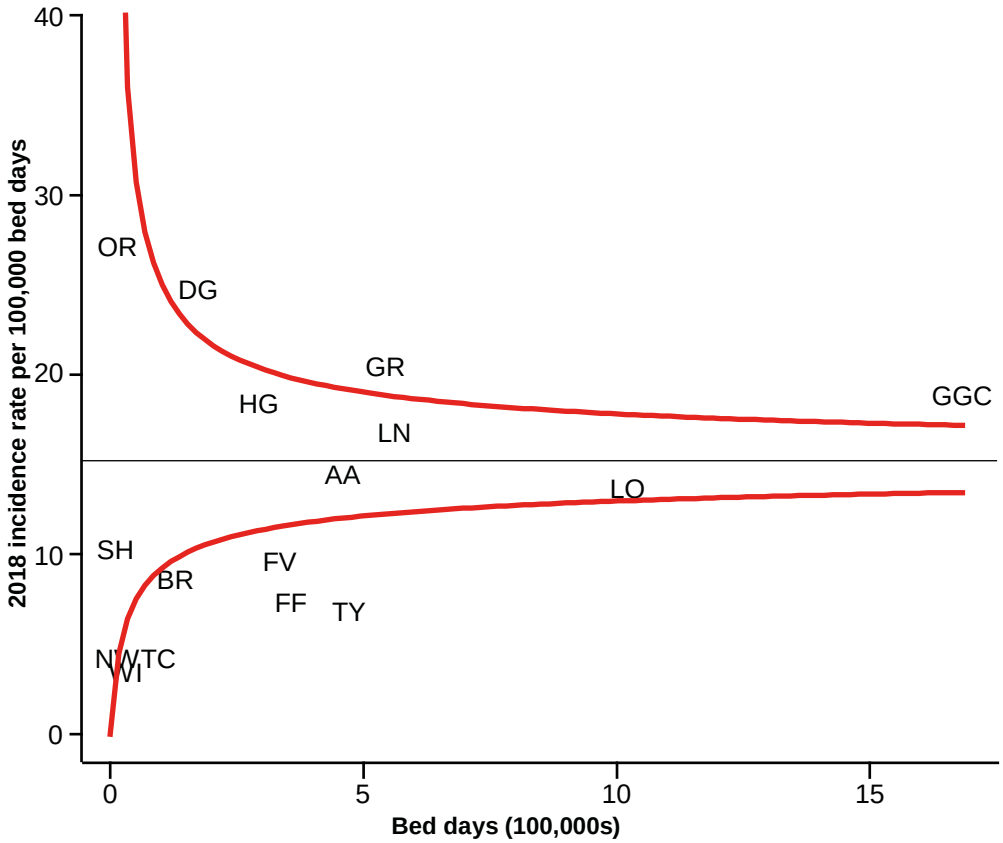
[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & NRS population estimates.]

FIGURE 10: Incidence rates of healthcare associated (HCAI-CDI) (per 100,000 TOBDs) and community associated (CA-CDI) (per 100,000 population) CDI in patients aged ≥15 years, 2014 to 2018.



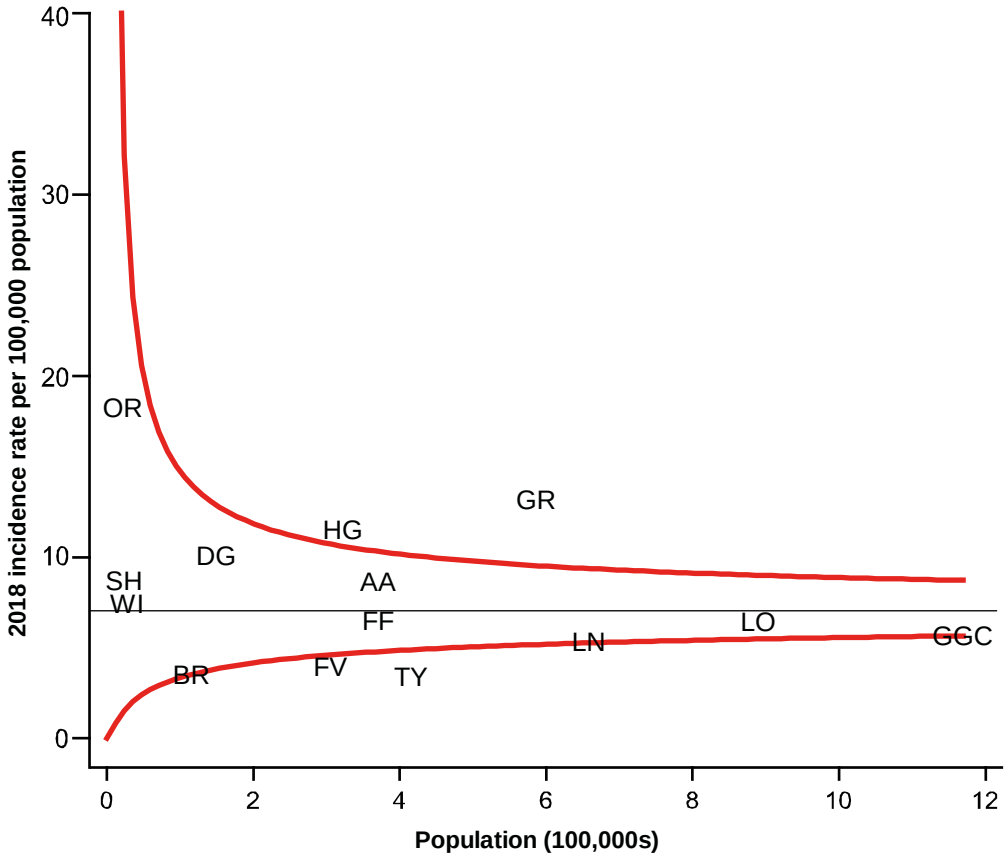
[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS).]

FIGURE 11: CDI incidence rates (per 100,000 TOBDs) in healthcare associated infection cases among patients aged ≥15 years for all NHS boards in Scotland in 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & Total occupied bed days: Information Services Division ISD(S)1.]

FIGURE 12: CDI incidence rates (per 100,000 population) in community associated infection cases among patients aged ≥15 years for all NHS boards in Scotland in 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & NRS population estimates.]

Molecular Epidemiological Data

As part of the epidemiological surveillance of CDI, the Scottish *Salmonella*, *Shigella* and *Clostridioides difficile* Reference Laboratory (SSSCDRL) carry out polymerase chain reaction (PCR) ribotyping of subsets of *C. difficile* isolates (under a snapshot, and severe cases and/or outbreaks typing schemes):

In 2018, the most common PCR ribotypes isolated in Scotland in the snapshot were 002 (12.9%), 078 (11.7%), 015 (9.7%), 014 (8.9%), 023 (8.0%), and 005 and 020 (both 7.4%), whereas 078 (12.8%), 002 (9.6%) and 015 (9.2%), 005 (7.3%), and 014 and 023 (both 6.9%) predominated among severe cases and/or outbreaks (TABLE 1). Those designated 'others' include PCR ribotypes each of which have a frequency <3%. Previously predominant PCR ribotypes 001, 027 and 106 remained at low levels in Scotland. These three types accounted for more than 50% of all types isolated in 2009. This suggests that interventions put in place to reduce CDI in Scotland continue to be successful in controlling these hospital epidemic types. A similar pattern has been reported from England with 001, 027 and 106 almost disappearing and 078 emerging.[17] In Europe, ribotypes 001, 014, 027 and 078 are commonly found.[18]

TABLE 1: Scottish PCR ribotypes isolated from mild, moderate or severe CDI cases (snapshot), or from severe cases and/or outbreaks (clinical) between 2017 and 2018.

Type	Snapshot 2017 n	Snapshot 2017 %	Snapshot 2018 n	Snapshot 2018 %	Clinical 2017 n	Clinical 2017 %	Clinical 2018 n	Clinical 2018 %
002	36	10.4	45	12.9	27	11.8	21	9.6
005	32	9.2	26	7.4	28	12.2	16	7.3
014	32	9.2	31	8.9	13	5.7	15	6.9
015	32	9.2	34	9.7	16	7.0	20	9.2
020	23	6.6	26	7.4	19	8.3	11	5.0
023	15	4.3	28	8.0	8	3.5	15	6.9
027	1	0.3	2	0.6	2	0.9	7	3.2
078	34	9.8	41	11.7	25	10.9	28	12.8
106	13	3.8	8	2.3	7	3.1	5	2.3
Others	128	37.0	108	30.9	84	36.7	80	36.7
Total	346		349		229		218	

Antimicrobial Use and Resistance

Any antibiotic use may increase the risk of CDI but this risk increases with longer duration of therapy and with use of broad spectrum antibiotics such as cephalosporins, clindamycin, co-amoxiclav, and fluoroquinolones. SAPG coordinates a national framework for antimicrobial stewardship to improve antibiotic use, to optimise patient outcomes and to minimise harm to individuals and to wider society.

Most infections are treated empirically, where the prescriber has not yet identified the bacteria causing the infection and does not know the suspected bacteria's susceptibility to antibiotics. Around 80% of all antibiotic use in humans originates in primary care (general practice) where the key approach to optimising antibiotic use is to reduce antibiotic use in minor infections such as sore throat, sinusitis and coughs, as antibiotics are seldom required in otherwise healthy individuals. Prescribing guidelines for treatment of infection in hospitals and the community have been developed by NHS board Antimicrobial Management Teams (AMTs) to provide clinicians with advice on empirical antibiotic choice and duration of treatment for common infections. In hospitals, it is important to optimise clinical review of patients prescribed intravenous antibiotics and to document the recommended duration of oral antibiotics. This is intended to minimise the inappropriate use of broad spectrum antibiotics which is a known risk for development of both CDI and AMR.

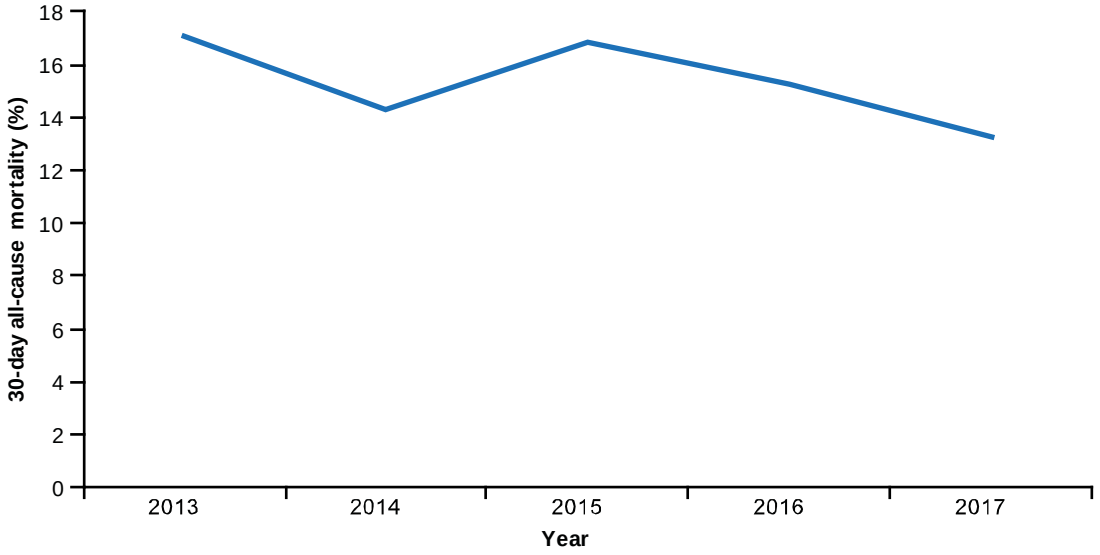
The most recently published national data on antibiotic use is available in the SONAAR Report (2018).[5]

To date, all isolates of *C. difficile* have been reported as being susceptible to metronidazole and vancomycin, the two antibiotics used to treat CDI. However, resistance to other commonly used antibiotics continues to be common among the Scottish *C. difficile* isolates, which has been suggested to give *C. difficile* an advantage to spread in healthcare environments. Cefotaxime (80.3%) and clindamycin (98.6%) resistance remained high among all ribotypes isolated.

Clostridioides difficile Infection Mortality

There was a decreasing year on year trend in the proportion of people dying of any cause within 30-days of CDI diagnosis between 2013 and 2017 (-4.0%, p=0.04) (FIGURE 13). In 2017, 30-day mortality was 13.3% compared to 15.2% in 2016 (p=0.17). The data are within the 30-day all-cause mortality range (3%-38%) reported by various studies from the UK, Europe and North America, though there is heterogeneity in terms of methods used and reporting.[19-21]

FIGURE 13: CDI 30-day all-cause mortality (%) among patients aged ≥15 years in Scotland, 2013 to 2017.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & NRS mortality records.]

A study published in 2018 using Scottish CDI data showed that CDI is associated with an almost 3-fold increase in 30-day all-cause mortality when compared to those without CDI, and places an increased burden on hospital resources by increasing mean length of stay beyond the infection date by 22.3%.[22] When comparing CDI patients who died with those who did not die (30-day all-cause mortality), increased age, a higher Charlson Score (which predicts the one-year mortality in patients with a range of comorbid conditions), healthcare associated CDI, and liver, heart and malignancy comorbidities were associated with having a higher mortality. The results underline the significant risk that CDI poses within the healthcare setting and the elderly population in particular.

Quality Improvement and Interventions to Reduce *Clostridioides difficile* Infection

Good antimicrobial stewardship, appropriate IPC measures, and the use of quality improvement tools (QITs) remain the cornerstones for controlling CDI.

Over the coming year, HPS will be assessing the burden of asymptomatic carriage of CDI in the healthcare setting, as well as evaluating the impact of recurrent CDI on survival.

Outcomes following faecal microbiota transplant for the treatment of CDI will also be a focus for the CDI programme in order to assess the value of this treatment for improving patient survival and reducing the burden of CDI. As the body of evidence for CDI continues to be published, HPS will be reviewing the national guidance on the prevention and control of CDI to determine whether an update is required.

Outputs from the CDI surveillance are being displayed through NSS Discovery. This NHS information system provides approved users with access to a range of comparative healthcare information. Following its launch, further improvements on the existing data views have been made including the addition of SPC charts to support performance and quality improvement in health boards across Scotland.

HPS continues to support local NHS boards in response to any indication that local quality improvements and reduction strategies are not being reflected in the rates of CDI within that NHS board. Collaboration with European partners also continues in terms of harmonisation of surveillance which is crucial for monitoring trends and benchmarking.

Staphylococcus aureus Infection

Staphylococcus aureus was identified as the second most common causative organism in the most recent Scottish Point Prevalence Study.[7] SAB is a serious systemic form of infection which leads to increased morbidity and mortality and requires exposure to antimicrobial therapy to treat.

Scotland has had a mandatory meticillin resistant *S. aureus* (MRSA) bacteraemia surveillance programme since 2001,[23] publishing quarterly reports of the numbers and rates of MRSA bacteraemias.[24] The programme was extended to include meticillin sensitive *S. aureus* (MSSA) bacteraemias in 2006 and in 2014 to include enhanced SAB surveillance.[10, 11] Full details of the surveillance methods may be found in the protocol.[25]

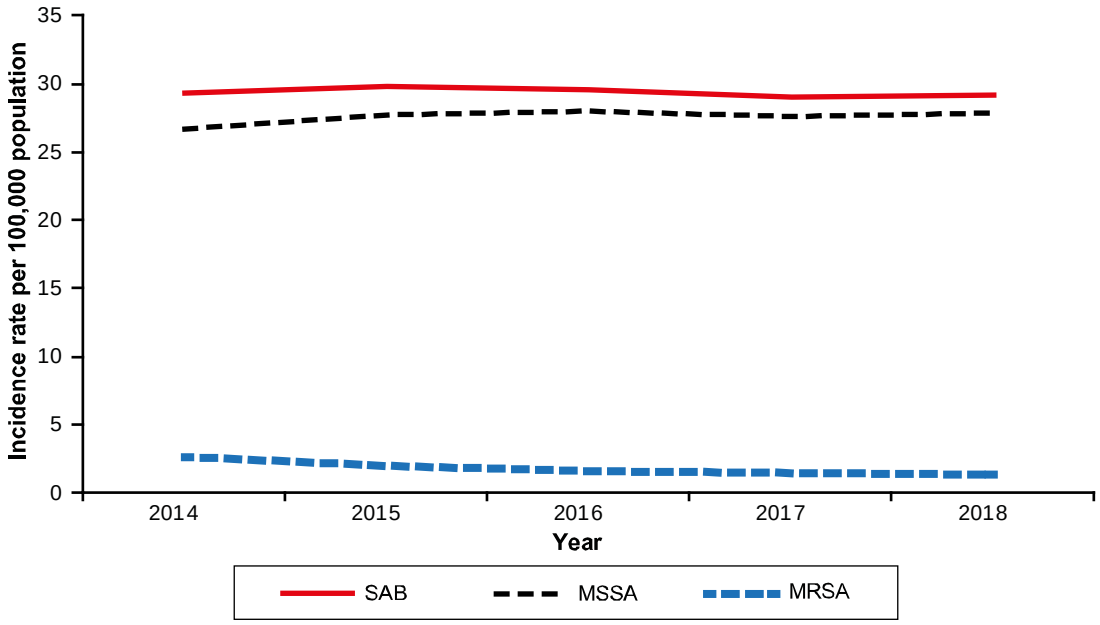
Epidemiological Data

During 2018, there were 1,585 cases of SAB reported in Scotland, 70 (4.4%) were MRSA bacteraemias and the remaining 1,515 (95.6%) were MSSA bacteraemias. This was compared to 1,574 in 2017, of which 76 (4.8%) were MRSA and 1,498 (95.2%) were MSSA.

Between 2014 and 2018, there has been no change in the overall incidence of SAB in Scotland ($p=0.69$). When looking at the trends of MRSA and MSSA during this period there has been a year on year decrease of 17.1% ($p<0.001$) in MRSA rate however there has been no change in the MSSA annual incidence rate ($p=0.29$).

The annual incidence of SAB for Scotland in 2018 was 29.2 per 100,000 population, with no change from the previous year ($p=0.84$). The annual incidence rates of MRSA and MSSA bacteraemia in 2018 were 1.3 per 100,000 population and 27.9 per 100,000 population, respectively. Neither of these incidence rates have changed between 2017 and 2018 ($p=0.62$ and $p=0.76$, respectively). FIGURE 14 describes the national incidence rates of MRSA, MSSA and SAB. The incidence rates of MRSA continue to decline however the incidence rates of MSSA and overall SAB rate have stabilised.

FIGURE 14: Incidence rates of *S. aureus*, MRSA and MSSA bacteraemias (per 100,000 population) in Scotland: 2014 to 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & National Records of Scotland (NRS) mid-year population estimates.]

Patient outcome data has been linked (all cause mortality at 30 days) with SAB case data for all MRSA and MSSA bacteraemias reported by HPS between 2013 and 2017. This showed there was no change in the proportion of people dying within 30 days of acquiring an MRSA or MSSA bacteraemia (p=0.96 and p=0.84, respectively) over this time period. In 2017, the 30-day mortality was 18.9% for MRSA bacteraemias and 19.0% for MSSA. These figures are comparable to those reported by Public Health England (PHE) for the period 2017/18.[26]

SAB data is reported as part of the HPS Quarterly Epidemiological Commentary (that also publishes epidemiological trends of CDI, ECB and SSI). In this publication the burden and trends of SAB are reported using two categories (see Methods and Caveats):

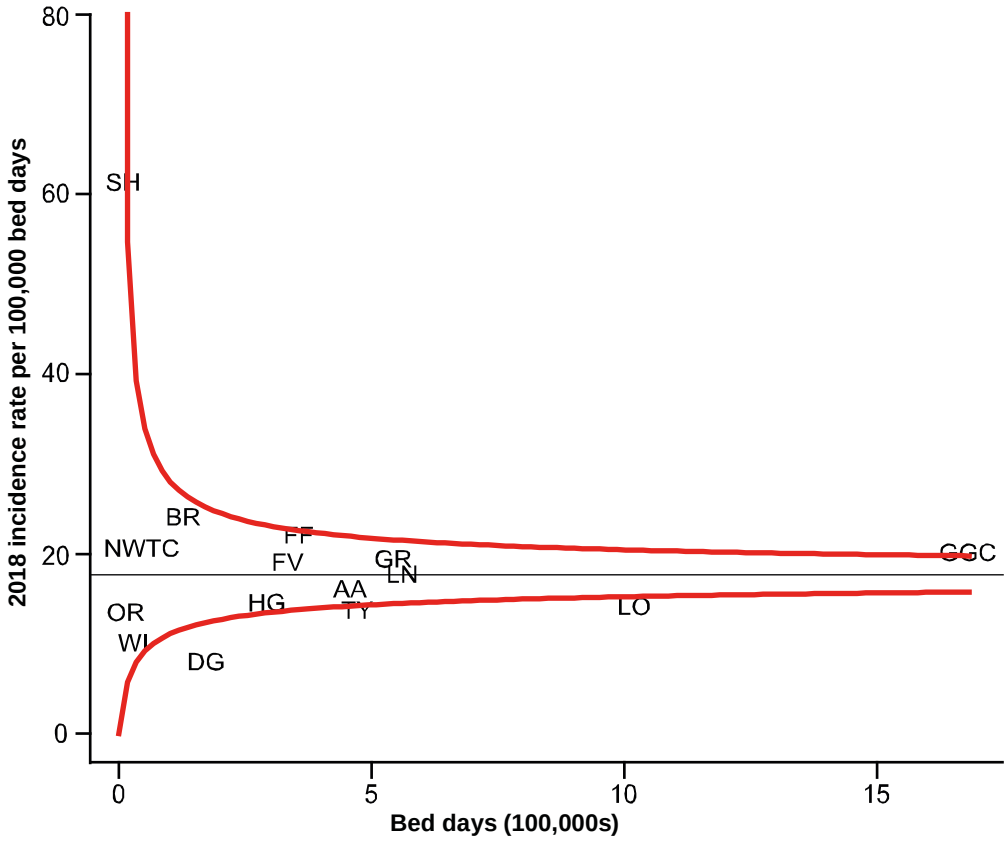
- **Healthcare associated infection by NHS board of aspiration.** Cases are categorised as healthcare associated when the case has had contact with healthcare either in hospital or while receiving care in the community.
- **Community associated infection by NHS board of residence of the case.** Cases are categorised as community associated when the case has had no known contact with healthcare.

In 2018, there were 1,082 (68.3%) healthcare associated cases of SAB reported in Scotland with a rate of 17.6 per 100,000 total bed days. The remaining 503 (31.7%) were community associated with a rate of 9.3 per 100,000 population. There was no change in healthcare or community incidence rate between 2017 and 2018 (p=0.25 and p=0.46, respectively).[27]

In funnel plot analyses of SAB incidence rates for 2018 (comparing NHS boards to each other adjusted for hospital activity/population of health board of residence), NHS Greater Glasgow & Clyde was above the 95% confidence interval upper limit in healthcare associated cases (FIGURE 15).

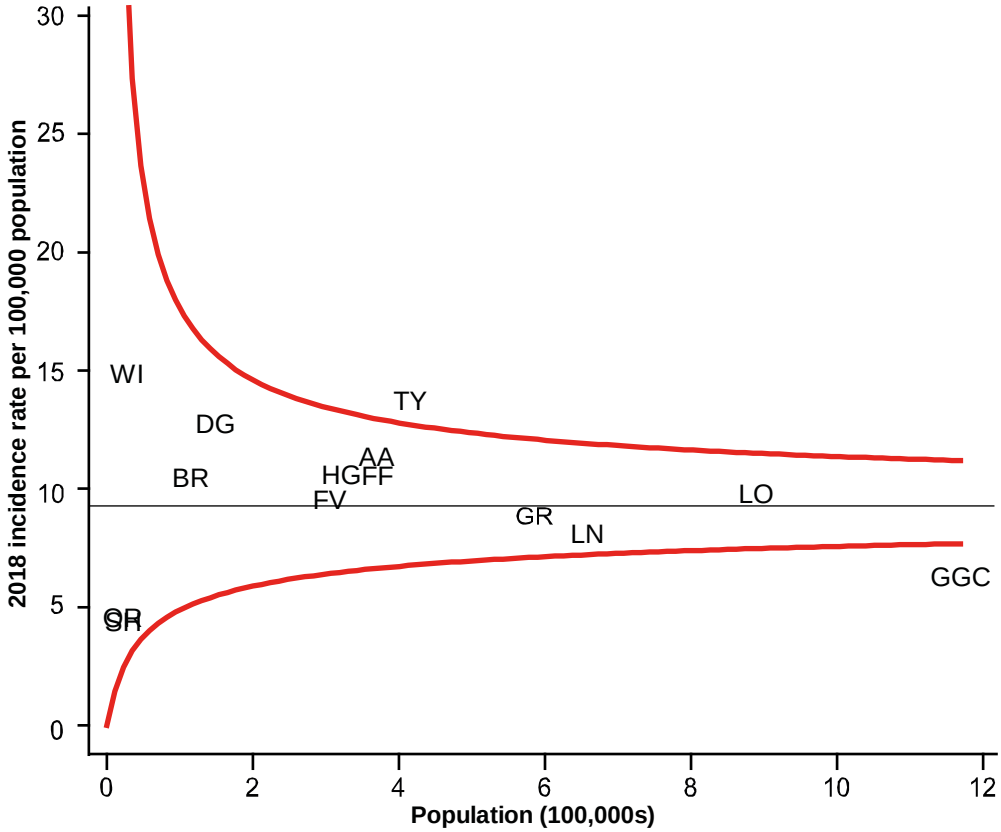
NHS Tayside was above the 95% confidence interval upper limit for community associated cases (FIGURE 16). The funnel plot analysis incorporates the full year's data; as a result, some NHS boards may be above the 95% confidence interval upper limit in the annual funnel plot but not in the quarterly funnel plots (for full details please refer to **Appendix 2 – Publication Metadata**). NHS boards are monitored on a quarterly basis, for more information refer to published quarterly epidemiological data.

FIGURE 15: SAB incidence rates (per 100,000 TOBDs) in healthcare associated infection cases for all NHS boards in Scotland in 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & Total occupied bed days: Information Services Division ISD(S)1.]

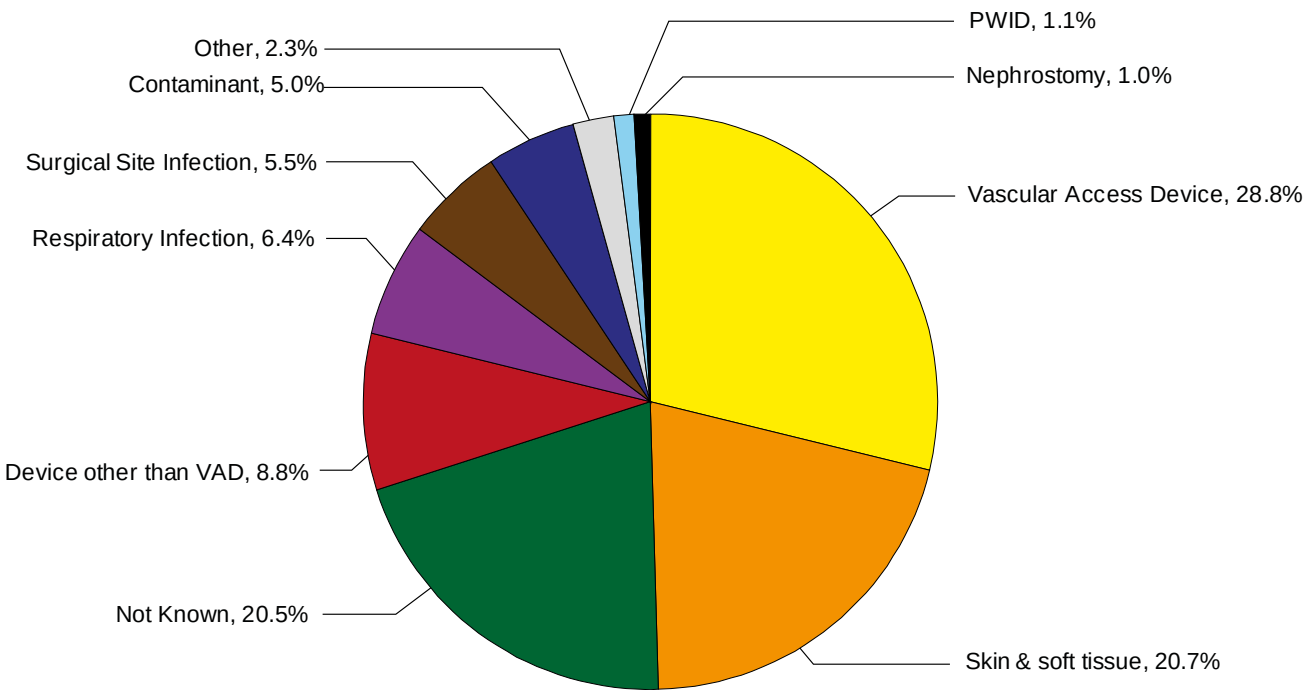
FIGURE 16: SAB incidence rates (per 100,000 population) in community associated infection cases for all NHS boards in Scotland in 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & National Records of Scotland (NRS) mid-year population estimates. NHS Orkney and NHS Shetland overlap.]

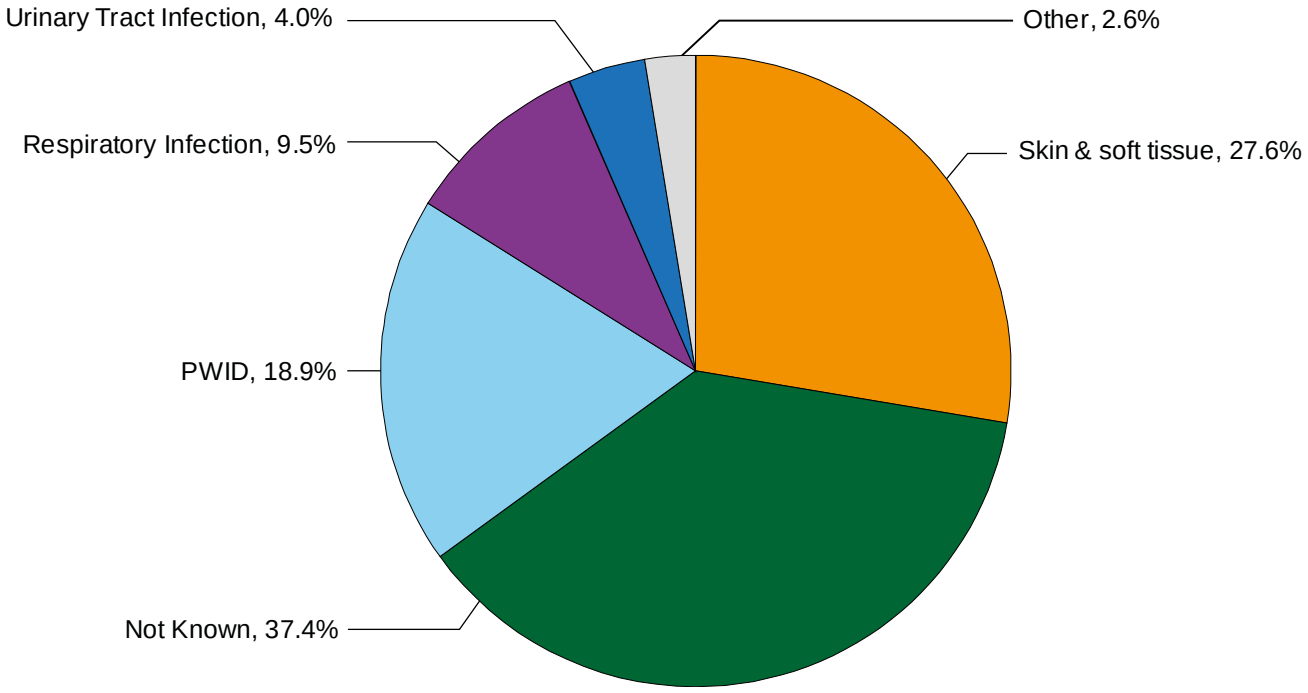
In the healthcare associated cases, 37.6% of SAB are recorded as being related to a device entry point (vascular access device (VAD) or device other than VAD) (FIGURE 17). The second most common known entry point was skin and soft tissue infection (20.7%). In some cases (20.5%) it is not possible to identify the entry point of the bacteraemia. Cases identified as community associated had the most common known entry points recorded as skin and soft tissue infection (27.6%), people who inject drugs (PWID) (18.9%) and respiratory infection (9.5%) (FIGURE 18). It was not possible to establish entry point in 37.4% of the community associated cases.

FIGURE 17: SAB healthcare associated cases (n=1,082) for Scotland in 2018 by entry point.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS).]

FIGURE 18: SAB community associated cases (n=503) for Scotland in 2018 by entry point.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS).]

Quality Improvement and Interventions to Reduce *Staphylococcus aureus* Bacteraemia

Research and Surveillance

HPS continues to support local NHS boards with local and national quality improvements and reduction strategies. Outputs from the enhanced surveillance are being displayed through NSS Discovery. This NHS information system provides approved users with access to a range of comparative healthcare information. Further improvements of the SAB dataset includes the addition of statistical process control (SPC) charts to support performance and quality improvement in health boards. The risk factor dashboard has also been developed allowing comparisons of device, skin and other risk factors, and detailed breakdown of entry points, between NHS boards and overall Scotland.

Research is ongoing in collaboration with Scottish Healthcare Associated Infection Prevention Institute (SHAIPI) using genome sequencing to analyse strain patterns in conjunction with risk factors to identify any association between community and hospital acquired SAB. One of the aims of this research is to better understand the specific clinical epidemiology of MSSA bacteraemias and any interventions to reduce these infections, which now represent the majority of all SAB in Scotland. HPS will continue to work with specialities where patient populations, through the inventions and treatment they receive, are at risk of acquiring a SAB to develop improvement plans for reduction of bacteraemia.

Meticillin Resistant *Staphylococcus aureus* Acute Admission Screening in Scotland

Screening for MRSA on admission to hospital is a key component of strategies to prevent infection and reduce the spread of MRSA in acute hospital settings. Clinical risk assessment (CRA) based admission screening policy was introduced in NHSScotland in March 2012.[28, 29] This two stage process includes a CRA to identify patients at high risk of colonisation or infection, followed by a swab or sample screen for microbiological testing. Screening on admission to hospital ensures high risk patients are identified early and are managed effectively to prevent onward transmission of MRSA to other patients and to minimise risk to the individual patient.

Uptake of the CRA is a level 3 HCAI Key Performance Indicator (KPI).[29] In 2018, 83% of patients audited were risk assessed in line with national MRSA screening policy. This remains below the KPI of 90% and reflects a 2.1% decrease ($p = 0.02$) from 2017 when compliance was 85%.

Although the CRA KPI system and sample size were designed to be representative of uptake at the national level annually, uptake at board level is monitored each quarter to identify boards with uptake below 90%. In April 2018, the CRA KPI system was extended to include monitoring of carbapenemase-producing Enterobacterales (CPE) CRA screening and CPE screening uptake is reported in the carbapenemase-producing organisms (CPO) chapter of this report.

Since October 2017, HPS have participated in the development of new HCAI outcome measures for the nursing assurance framework Excellence in Care (EiC). Multidrug resistant organism (MDRO) admission screening was selected, with three EiC measures to be collected at ward level by frontline ward staff. The three measures are:

- completion of the CRA;
- collection of appropriate samples for testing, if required;
- appropriate placement of the patient, if required.

Once fully implemented, these measures will replace the current system of monitoring screening uptake for MRSA and CPE. The EiC measures will be more representative and provide additional information on collection of samples and appropriate patient placement. These measures, collected by frontline staff, aim to facilitate ongoing and timely quality improvements.

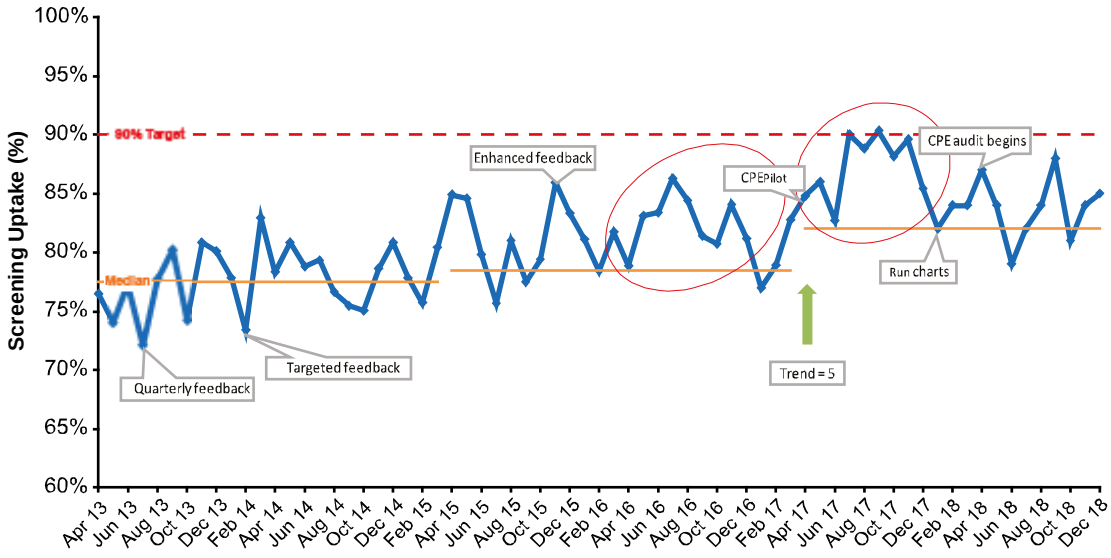
HPS continues to work in collaboration with NHS boards to provide support in facilitating ongoing improvement with uptake of MDRO screening. In 2018 a screening coordinators' forum for board stakeholders, facilitated by HPS was established. This group meets quarterly and activities include:

- sharing best practice and local experiences to support the implementation of screening;
- feedback on the new MDRO screening tool;
- co-production of quality improvement methods;
- communication and implementation of research findings;
- updates on the EiC HCAI measures.

Run charts provided to the boards display CRA uptake by month, annotated to show changes or interventions that may impact uptake. Research has indicated that such feedback is an important driver in the successful implementation of screening.[30, 31]

FIGURE 19 below shows Scotland's MRSA screening uptake by month from April 2013 to the end of December 2018**.** The run chart describes the trend in uptake since the CRA KPI began, highlighting shifts in the trend above the median in red, and notes an upward trend across five data points between January and May 2017.

FIGURE 19: Scottish MRSA Screening Uptake by month of admission. April 2013 - December 2018.



[Source of data is National MDRO HAI Admission Screening Uptake Monitoring Tool data from April 2013 to December 2018, extracted January 2019.]

Antimicrobial Resistance

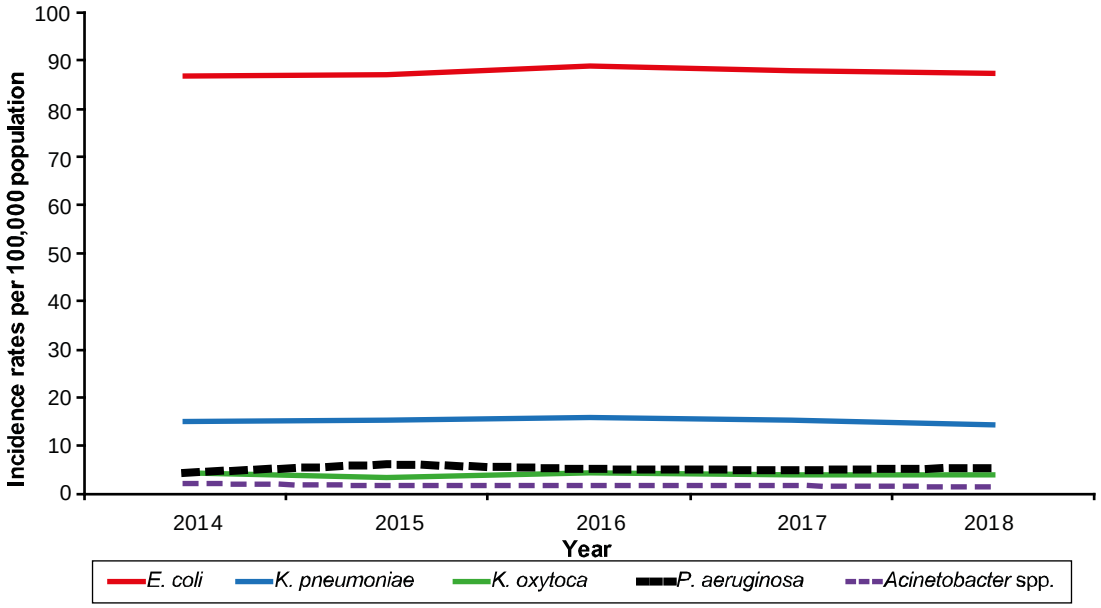
Mupirocin is used for nasal decolonisation of MRSA. Resistance to mupirocin is categorised as low-level resistance and high-level resistance. Treatment with mupirocin is unlikely to be effective in the presence of high-level mupirocin resistance, and there are concerns that low-level resistance will also lead to nasal decolonisation failure. During 2018, there were no high or low level mupirocin resistant isolates reported in MRSA bacteraemia isolates.

Gram-negative Bacteraemia

Gram-negative bacteria are an important cause of serious infections in healthcare and community settings. One of the main drivers of AMR is a rise in the incidence of infections, particularly Gram-negative infections which is highlighted in the UK's five-year national action plan 'Tackling antimicrobial resistance 2019–2024'[3] and 'Contained and controlled. The UK's 20-year vision for antimicrobial resistance'.[4] The UK has targeted a 25% reduction of healthcare associated Gram-negative bacteraemias by 2021/2022 with a 50% reduction by 2023/2024.

Escherichia coli was the most common cause of Gram-negative bacteraemia in Scotland in 2018 followed by *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Incidence rates over the last five years have remained stable for Gram-negative bacteraemia (FIGURE 20).

FIGURE 20: Incidence (per 100,000 population) of Gram-negative bacteraemia due to the most commonly reported pathogens within Scotland, 2014 to 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & National Records of Scotland (NRS) mid-year population estimates.]

Escherichia coli Bacteraemia

E. coli is a frequent cause of bacteraemia in community and healthcare settings. *E. coli* bacteraemia develops usually as a complication of other infections, including urinary tract infection (UTI), surgery and use of medical devices including urinary catheters and vascular access devices.

During 2018, there were 4,738 cases of ECB in Scotland compared to 4,763 in 2017. The annual incidence of ECB for Scotland in 2018 was 87.3 per 100,000 population with no change from the previous year (p=0.80). The incidence rate in England was 76.3 per 100,000 population for the year 2018.[32] There was a stable year on year trend in the incidence of ECB in the period 2014-2018 (FIGURE 20).

In 2017, the 30-day all-cause mortality was 14.2% and is comparable to PHE for the period 2017/18.[26] ECB case data reported by HPS between 2013 and 2017 demonstrated a 2.2% decrease in the proportion of people dying within 30 days of acquiring an ECB (p=0.047).

ECB data are reported as part of the HPS Quarterly Epidemiological Commentary which also includes epidemiological trends of SAB, CDI and SSI). In this publication the burden and trends of ECB are reported using two categories (see Methods and Caveats):

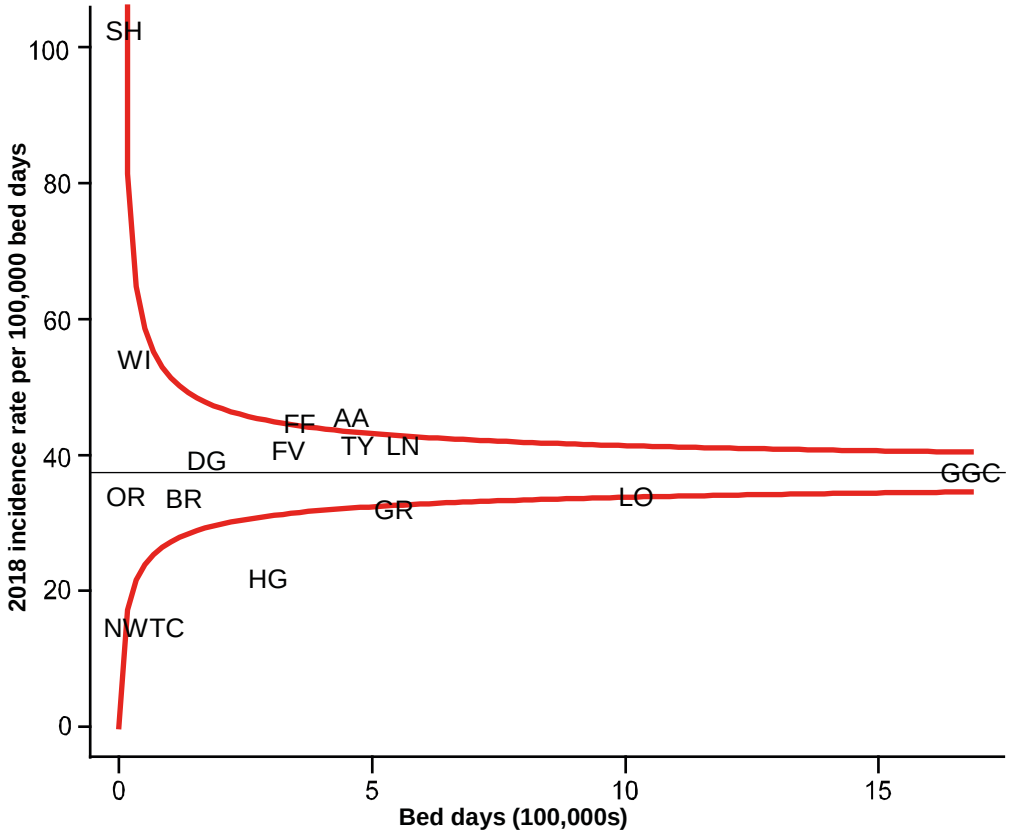
- **Healthcare associated infection by NHS board of aspiration.** Cases are categorised as healthcare associated when the case has had contact with healthcare either in hospital or while receiving care in the community.
- **Community associated infection by NHS board of residence of the case.** Cases are categorised as community associated when the case has had no known contact with healthcare.

In 2018, the rate of healthcare associated ECB for Scotland was 37.4 per 100,000 total bed days and the rate of community associated infections was 45.1 per 100,000 population. Although there was no overall increase between 2017 and 2018, there was an increase in healthcare associated ECB for Scotland (p=0.04).[27]

In funnel plot analyses of ECB incidence rates for 2018 (comparing NHS boards to each other adjusted for hospital activity/population of health board of residence), two NHS boards were above the 95% confidence interval upper limit in healthcare associated cases: NHS Ayrshire & Arran and NHS Fife (FIGURE 21); and two NHS boards were above the 95% confidence interval upper limit in community associated cases; NHS Ayrshire & Arran and NHS Lanarkshire (FIGURE 22).

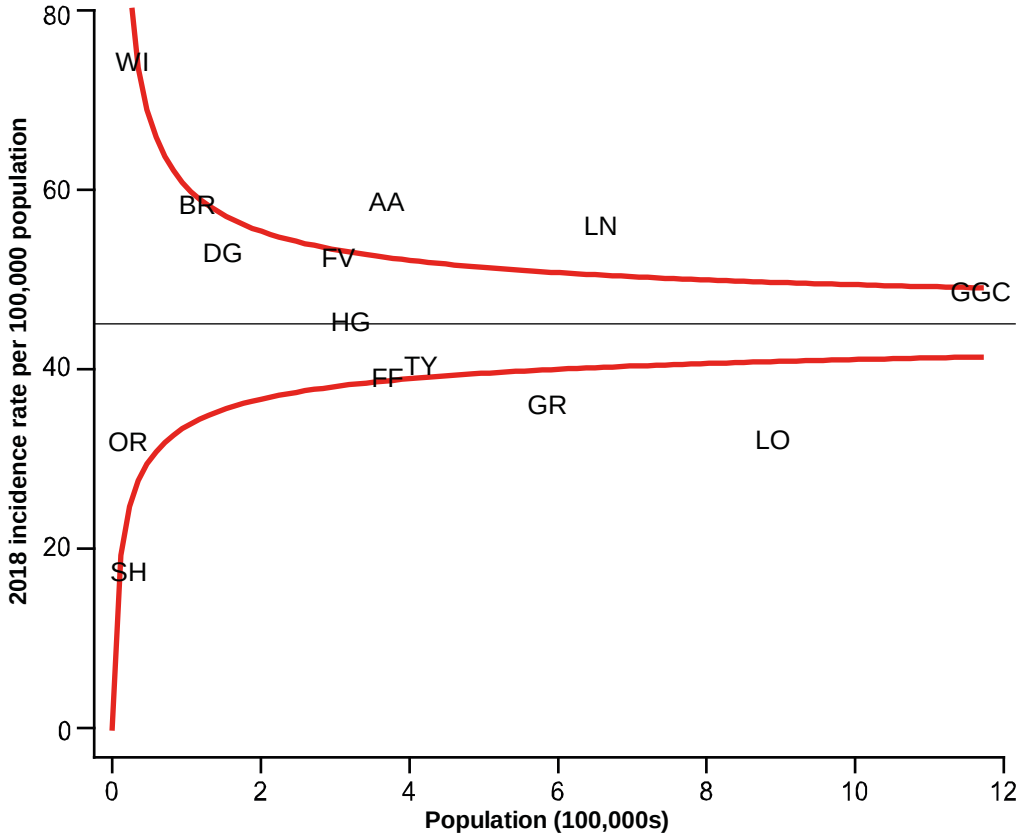
The funnel plot analysis incorporates the full year's data; as a result, some NHS boards may be above the 95% confidence interval upper limit in the annual funnel plot but not in the quarterly funnel plots (for full details please refer to **Appendix 2 – Publication Metadata**). NHS boards are monitored on a quarterly basis, for more information refer to published quarterly epidemiological data.

FIGURE 21: ECB incidence rates (per 100,000 TOBDs) for healthcare associated cases for all NHS boards in Scotland in 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & Total occupied bed days: Information Services Division ISD(S)1.]

FIGURE 22: ECB incidence rates (per 100,000 population) for community associated cases for all NHS boards in Scotland in 2018.

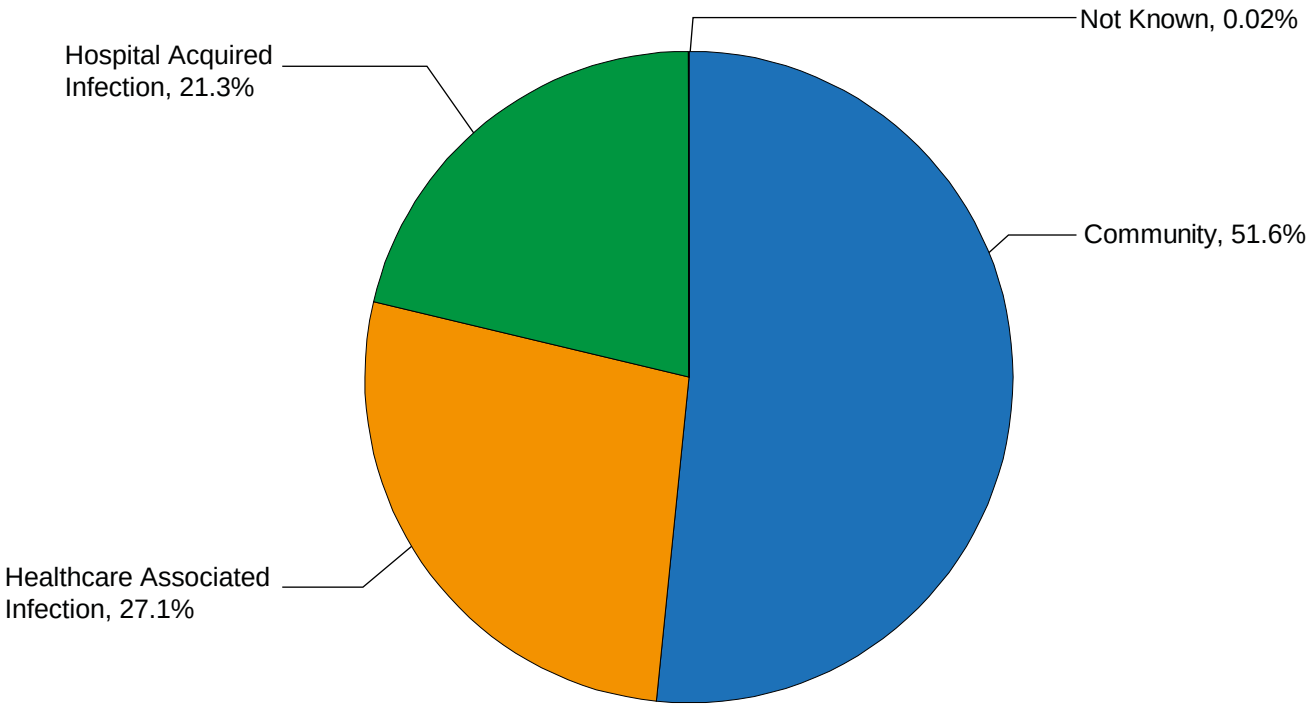


[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & National Records of Scotland (NRS) mid-year population estimates.]

The enhanced surveillance component of the national surveillance programme captures detailed clinical information through local case reviews. These additional data on all cases of ECB help identify where the bacteraemia occurred as well as the primary infection and/or healthcare procedures that are thought to have contributed to the development of bacteraemia.

In 2018 around half of the cases of ECB reported were ‘community associated’ (FIGURE 23) i.e. the case had no known contact with healthcare prior to developing an ECB.

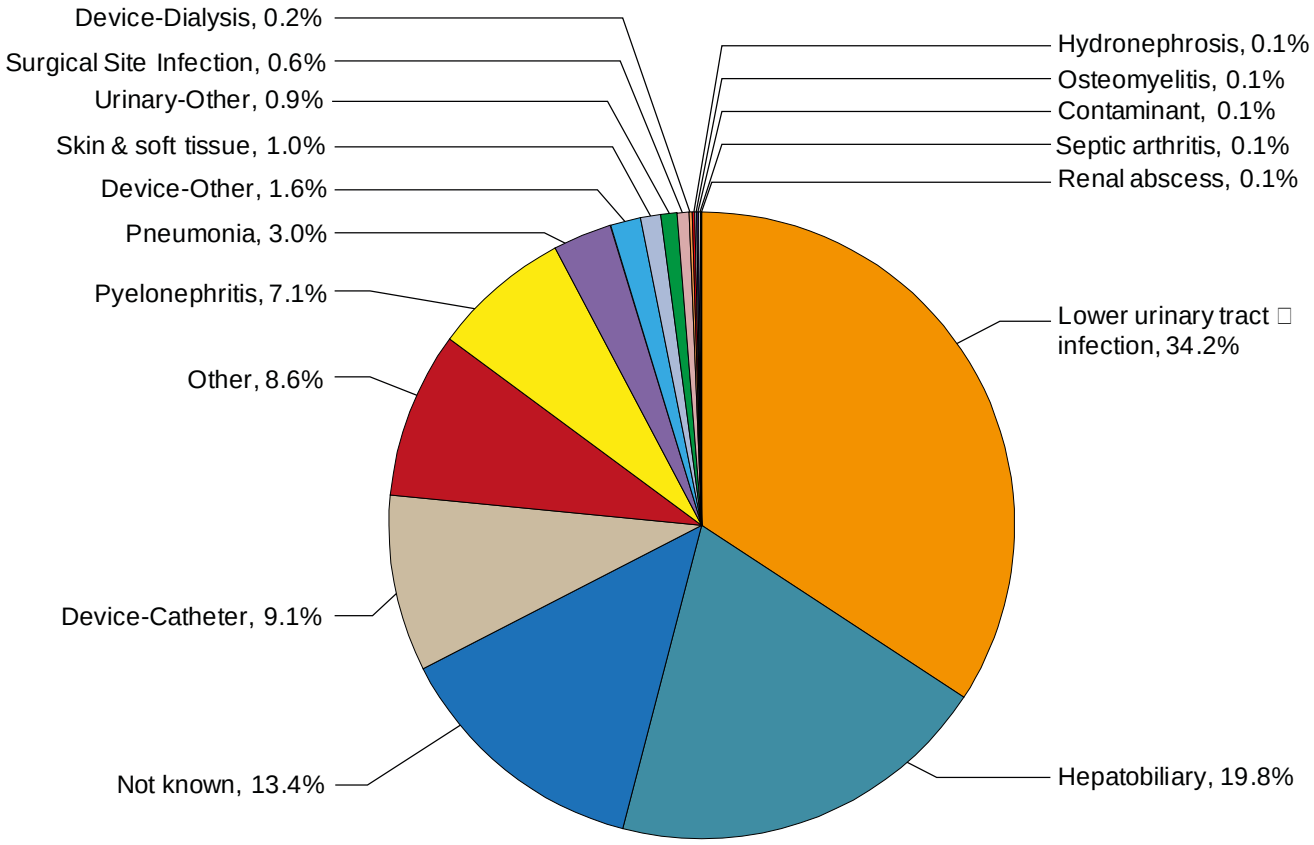
FIGURE 23: ECB cases (n=4,738) for Scotland in 2018 by origin of infection.



[Source of data is derived from the Electronic Communication of Surveillance in Scotland system (ECOSS).]

A third of cases of ECB reported had a lower UTI as their primary infection that may have led to the bacteraemia (FIGURE 24). Other common primary infections included: hepatobiliary infections (19.8%), pyelonephritis (7.1%) and those associated with urinary catheters (9.1%). For some cases (13.4%) it was not possible to establish the source of the ECB.

FIGURE 24: ECB cases (n=4,738) for Scotland in 2018 by primary infection.



[Source of data is derived from the Electronic Communication of Surveillance in Scotland system (ECOSS).]

Development of Surveillance and Interventions to Reduce *Escherichia coli* Bacteraemia

The overarching aim of the National Gram-negative bacteraemia programme is to monitor the burden of Gram-negative bacteraemia and to inform interventions / changes in practices. This has been achieved in part by implementing a mandatory surveillance programme for ECB. As UTIs and hepatobiliary infections continue to be the most commonly recorded primary infections, national risk factors have now been developed for these infections and the information from these will aid the development of local and national improvement plans. Although the highest number of infections is caused by *E. coli*, *Klebsiella* species and *P. aeruginosa* also form a large burden of Gram-negative bacteraemia. The current enhanced surveillance is to be expanded in 2019 to include voluntary surveillance for *Klebsiella* species and *P. aeruginosa* bacteraemia cases within the existing ECOSS enhanced surveillance web tool.

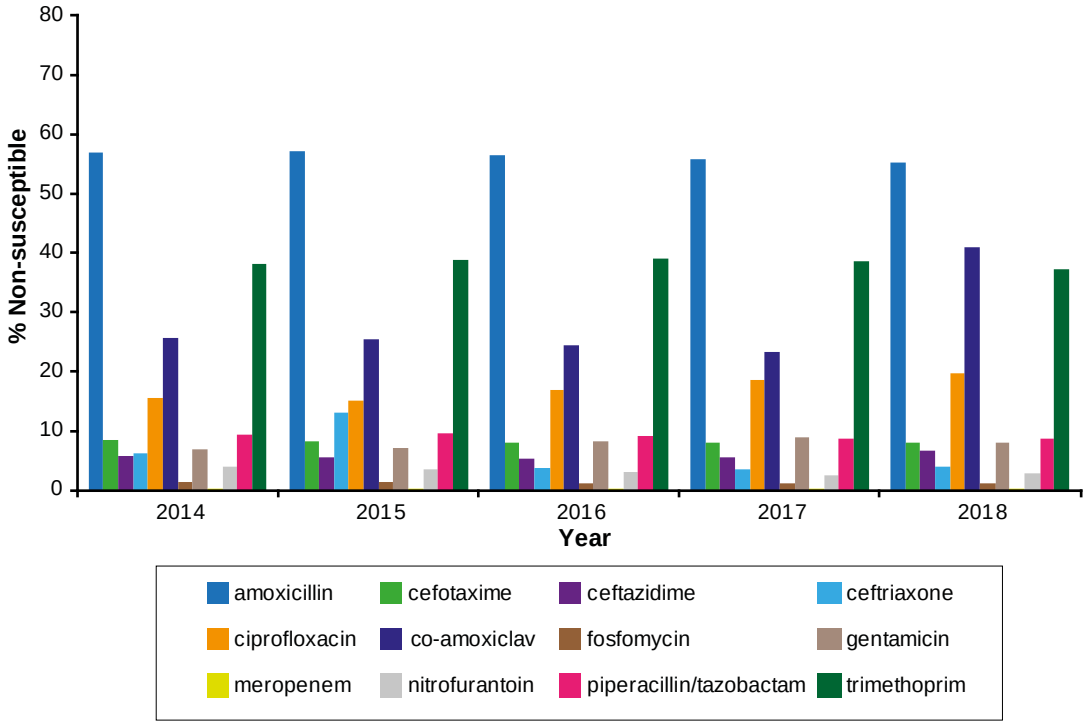
Outputs from the enhanced surveillance are being displayed through NSS Discovery. This NHS information system provides approved users with access to a range of comparative healthcare information. Following its launch, further improvements on the existing data views have been made including the addition of SPC charts to support performance and

quality improvement in health boards across Scotland. Further improvements are underway to ensure areas for improvement are highlighted to guide the best use of national resources (e.g. Scottish Urinary Tract Infection Network) and facilitate implementation of quality improvement and preventative measures both locally and nationally.

Antimicrobial Susceptibility in *Escherichia coli* Bacteraemia Isolates

The proportions of ECB isolates non-susceptible (resistant or intermediate) to antibiotics commonly used were stable over the last five years with the exception of year on year increases observed for ceftazidime (6.4%, p=0.003), cefuroxime (8.4%, p<0.001), and ciprofloxacin (5.9%, p<0.001) (FIGURE 25). There was also an increase observed for co-amoxiclav; however this increase is influenced by a change in susceptibility testing method, and may not represent a true increase in non-susceptibility.

FIGURE 25: Proportions of ECB isolates non-susceptible to commonly used antibiotics, 2014 to 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS).]

Antimicrobial Susceptibility in *Klebsiella pneumoniae and Pseudomonas aeruginosa* Bacteraemia Isolates

Antimicrobial susceptibility among *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* bacteraemia isolates have remained stable over the last five years.

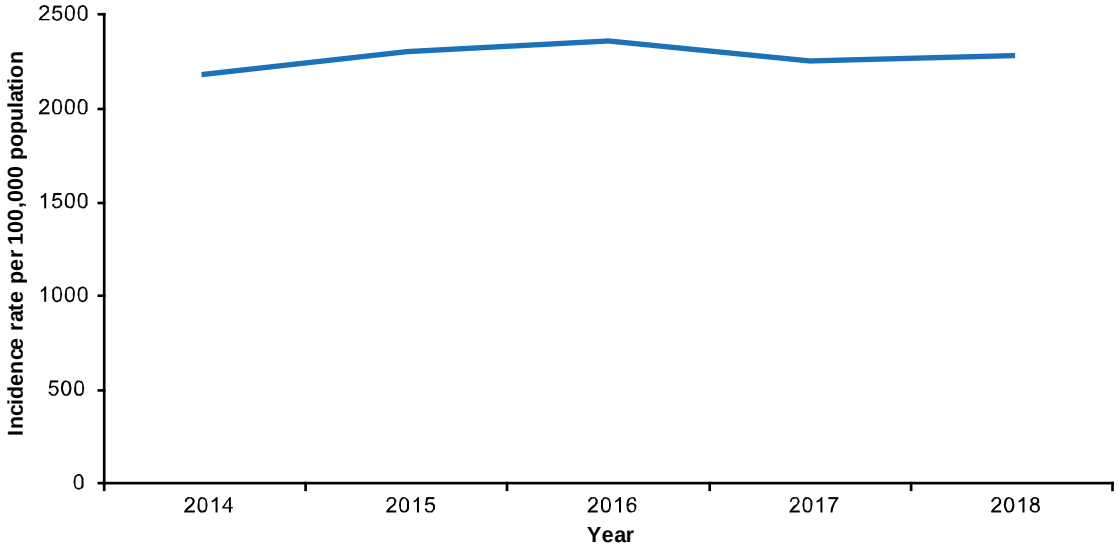
Urinary Tract Infection

An important aspect of reducing the incidence of Gram-negative bacteraemia is the prevention and management of primary infections, including UTIs. Within Scotland; UTIs are the most prevalent HCAI within inpatient adult care and the second most prevalent infection, after PN, within community health and care settings.[7, 33] AMR in urinary bacteria is increasing worldwide and can result in treatment failure and increased healthcare costs.[34, 35]

Epidemiological Data

The majority of UTIs in Scotland are caused by *E. coli*. In 2018, there were 123,955 *E. coli* urinary isolates reported into ECOSS, compared with 122,447 in 2017. The annual incidence of *E. coli* urinary isolates has increased by 0.7% over a five year period (p<0.001) and was 2,285 per 100,000 population in 2018 (FIGURE 26).

FIGURE 26: Incidence (per 100,000 population) of *E. coli* urinary isolates, 2014 to 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & National Records of Scotland (NRS) mid-year population estimates.]

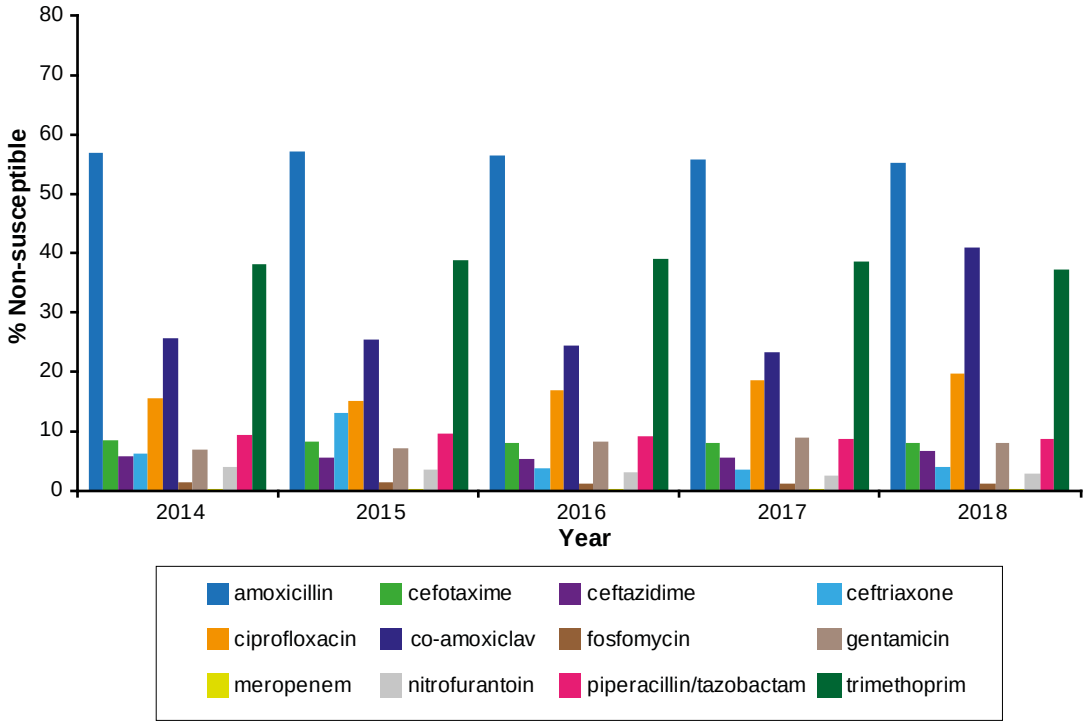
Antimicrobial Susceptibility of *Escherichia coli* Urinary Isolates

Resistance in urinary bacteria can act as an early warning of resistance in organisms causing more serious infections. AMR surveillance data can be used locally by NHS boards to inform evidence based prescribing guidelines for empirical treatment of commonly encountered infections.

Non-susceptibility of *E. coli* urinary isolates to the majority of antibiotics commonly used has decreased over the last five years (FIGURE 27). Exceptions to this include non-susceptibility to fosfomycin, which has remained stable, and ceftazidime, ciprofloxacin and gentamicin where there was an overall increase of 3.2%, 8.6% and 5.6% respectively (p<0.001) since 2014. There was also an increase observed for co-amoxiclav; however this increase is influenced by a change in susceptibility testing method, and may not represent a true increase in non-susceptibility.

Bias can also occur in this dataset as urine samples tend to be obtained more frequently from patients with failed empirical treatment.

FIGURE 27: Proportions of *E. coli* urinary isolates non-susceptible to commonly used antibiotics, 2014 to 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS).]

National Urinary Tract Infection Programme

The Scottish UTI Network (SUTIN) was established in 2015 by HPS with the aim of achieving a cohesive approach for all UTI reduction work, to ensure shared learning from outputs by all stakeholders. The SUTIN board includes representatives from a wide range of organisations across health and social care with a shared interest in UTI reduction. An important part of their role as SUTIN board members has been to act as a conduit between the network and their various professional bodies.

National Hydration Campaign

The SUTIN developed a national hydration campaign to raise awareness of the benefits of good hydration within a whole health population. Although there has been little research evidencing the role of hydration in the reduction of UTI, a recent randomised clinical trial in a specific population, suggests that increased hydration in premenopausal women with recurrent UTI can reduce the risk of UTI's within this section of the population.[36] The hydration campaign launched in April 2018 used a staged approach to ensure the required information was communicated effectively.

- Stage 1 aimed at the general public, displayed the hydration poster and leaflet in every community pharmacy across Scotland.

- Stage 2 provided National Hydration Campaign Materials such as information and aides for patients, relatives and staff in adult healthcare within acute and care settings. This was then linked to work of other national health programmes where good hydration can be beneficial e.g. falls, pressure ulcer prevention, delirium and acute kidney injury.
- Stage 3 will be launched in May 2019 and will direct the hydration message specifically to children and young people.

Evaluation of stages 1 and 2 of the hydration campaign has been conducted using online surveys and during 2019 HPS will publish the results. Stage 3 of the hydration campaign targeting children in collaboration with local education authorities will be launched in May 2019. Printed material and reusable water bottles using the slogan think2drink H2O were distributed to participating Local Education Authorities in addition to community and healthcare settings engaged with children.

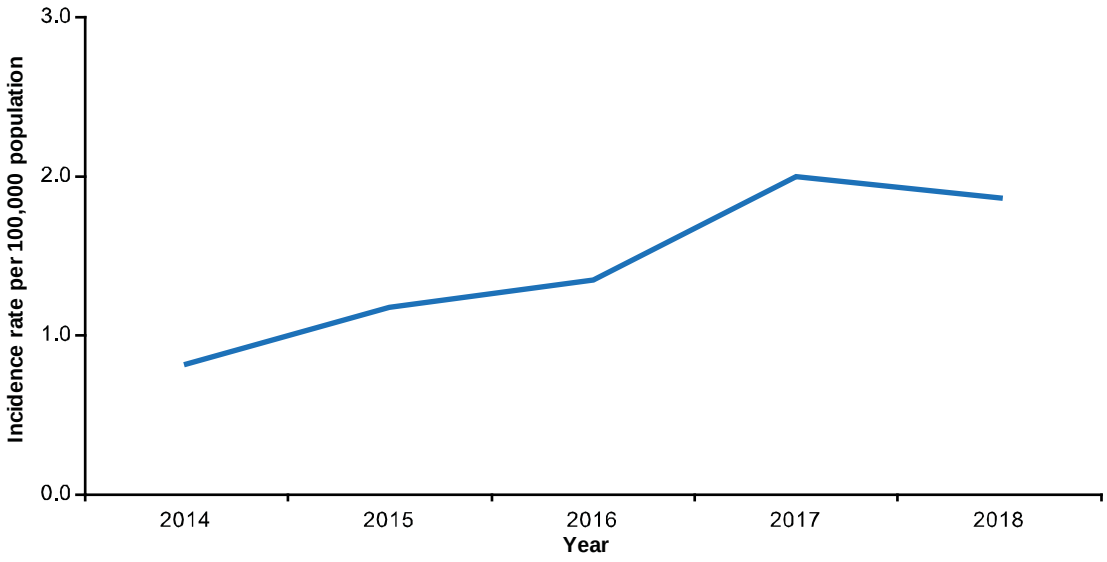
Carbapenemase-Producing Organisms

Carbapenems are very broad-spectrum antibiotics which are used almost exclusively in the hospital setting for the treatment of suspected or confirmed multidrug resistant Gram-negative infections. Enzymes produced by carbapenemase-producing organisms (CPOs) can inactivate carbapenem antibiotics, leaving few therapeutic options for treatment of CPO infections. CPOs have been reported worldwide in healthcare and community settings, with increased global travel, particularly exposure to healthcare abroad, contributing to their spread.[37-39]

Epidemiological Data

The CPO isolates included in this report are from screening and clinical specimens from all body sites including urine, respiratory and blood. In 2018, a total of 101 CPO isolates were reported from the Scottish AMR Satellite laboratory, and the Antimicrobial Resistance and Healthcare Associated Infection (AMRHAI) Reference Unit, PHE. This compares to 108 isolates reported in 2017. The majority of CPOs identified in 2018 were CPE (90.1%, n=91). Over the last five years there was a year on year increase (22.7%, p<0.001) in the incidence of CPO, from 0.8 per 100,000 population in 2014 to 1.9 per 100,000 population in 2018 (FIGURE 28). However, the incidence did not change between 2017 and 2018.

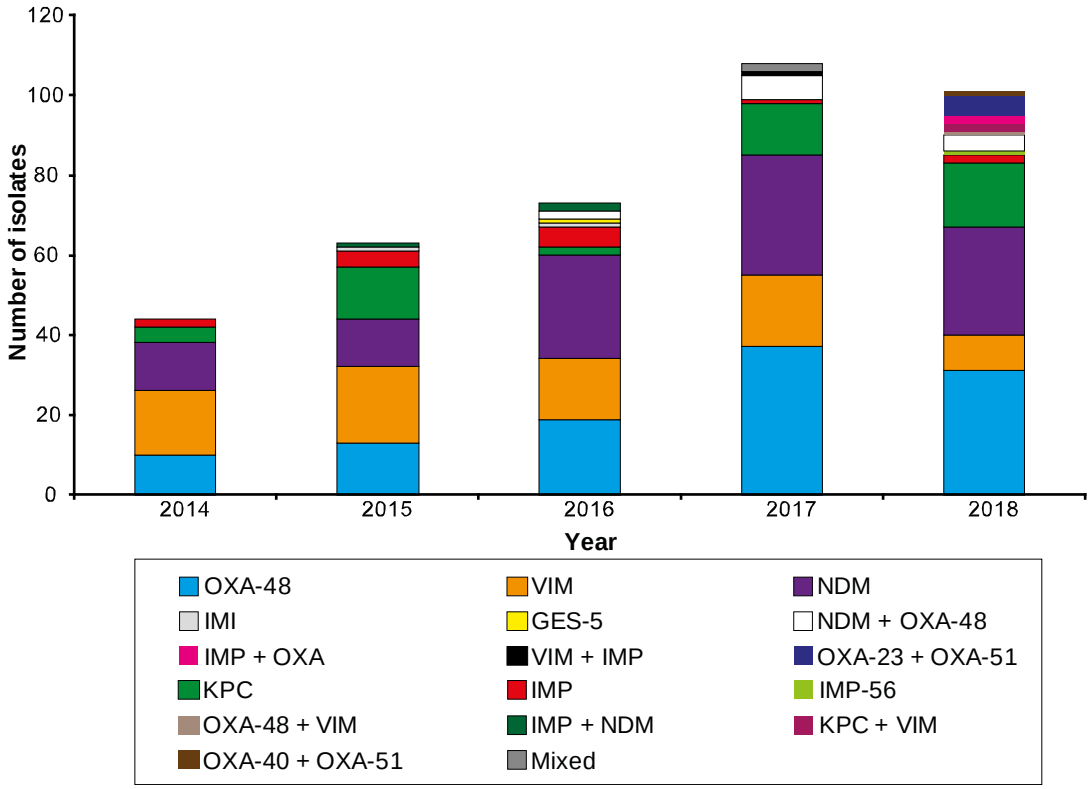
FIGURE 28: Incidence of CPO isolates (per 100,000 population), 2014 to 2018.



[Source of data is Electronic Communication of Surveillance in Scotland (ECOSS) & National Records of Scotland (NRS) mid-year population estimates.]

In 2018, the most frequently isolated enzyme was OXA-48 like enzymes (30.7%; n = 31) followed by NDM (New Delhi Metallo-beta-lactamase) (26.7%; n=27) and KPC (*Klebsiella pneumoniae* carbapenemase) (15.8%; n=16) (FIGURE 29).

FIGURE 29: Number of CPO isolates by enzyme type (2014 to 2018).



[Source of data is ECOSS, the Scottish AMR Satellite Laboratory, and AMRHAI Reference Unit Public Health England (PHE).]

Antimicrobial Use

Antimicrobial stewardship is the implementation of a programme of coordinated activities to optimise antibiotic prescribing to improve patient outcomes, reduce antibiotic resistance, and decrease the spread of infections caused by MDROs. In 2018, SAPG started to work with clinicians to standardise the review of patients receiving carbapenems and other intravenous antibiotics to ensure antibiotics are stepped down to oral treatment and/or stopped as soon as they are no longer needed.

The most recently published national data on antibiotic use in acute hospitals were published in SONAAR.[5]

Quality Improvement and Interventions to Reduce Carbapenemase-Producing Organisms

Carbapenemase-Producing Enterobacterales Acute Admission Screening in Scotland

Screening for MDRO on admission to hospital is a key intervention to reduce the opportunities for infections to develop and spread in healthcare.[40, 41] Screening on admission to acute hospitals for CPE was introduced in Scotland in 2013.[42] The HPS "Toolkit for the early detection, management and control of carbapenemase-producing Enterobacterales in Scottish acute settings"[43] provides guidance on the two-step CRA

based screening policy to identify and manage patients considered to be at high risk of CPE colonisation or infection. This allows the appropriate IPC measures to be implemented to prevent transmission. There are staff, patient and public information leaflets, available on the HPS webpages, to accompany the toolkits for CPE screening and management in acute and non-acute settings.

In April 2018, the MRSA screening uptake monitoring tool was extended to include CPE. These data are monitored by HPS and feedback is provided to boards on a quarterly basis. Approximately three quarters of patients audited had undergone CPE screening in line with national policy (76.1%).

Since October 2017, HPS have participated in the development of HCAI outcome measures for the nursing assurance framework, EiC for which MDRO admission screening was selected as the HCAI measure. Three EiC measures will be collected at ward level by frontline ward staff:

- completion of the CRA;
- collection of appropriate samples for testing, if required;
- appropriate placement of the patient, if required.

Once fully implemented, these measures will replace the current system of monitoring screening uptake for MRSA, and CPE. The EiC measures will be more representative and provide additional information on collection of samples and appropriate patient placement. These measures, collected by frontline staff, aim to facilitate ongoing and timely quality improvements.

A Screening Coordinators' Forum for the board stakeholders was established in 2018 to support the implementation of the national screening policies for both CPE and MRSA. This group, facilitated by HPS, meets quarterly with the aim of sharing of best practice and local experiences, quality improvement methods, and updates on the EIC developments.

Research

A research study was conducted by GCU, and sponsored by the Scottish Infection Research Network (SIRN) between February 2016 and December 2017. This aimed to identify the barriers to, and enablers of, the implementation of acute hospital admission screening. It included an evaluation of staff and patient acceptability of CPE screening. Recommendations from the research were translated into evidence based practice points by HPS to support implementation of screening in Scotland. The following recommendations were presented to and approved by the ARHAI programme board:

- development of best practice guidelines for local teams to improve compliance;
- provision of details of educational requirements to support screening to NES;
- promotion of the existing MDRO HCAI screening module;
- and feedback to the boards using quality improvement methodologies to enhance screening uptake.

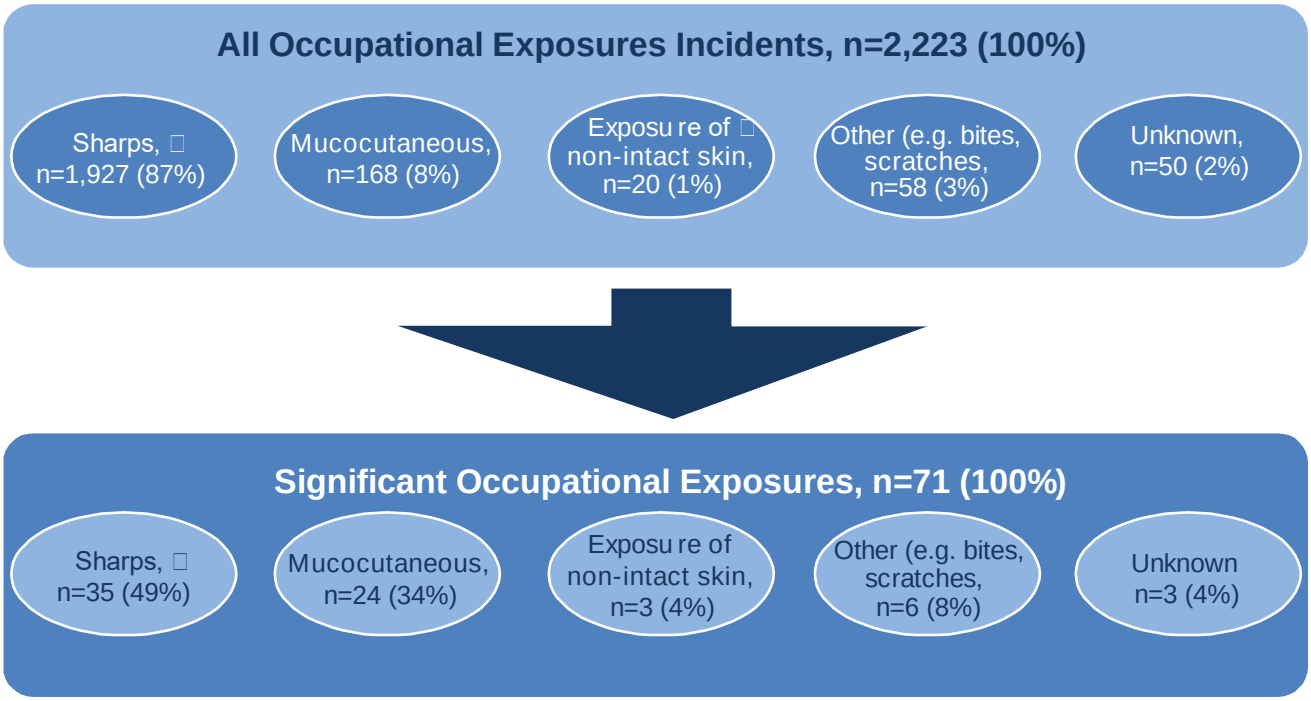
Prevention of Healthcare Associated Bloodborne Viruses

Annual Surveillance of Significant Occupational Exposures

The latest information on significant occupational exposures (SOEs) collated by HPS relate to those reported between January 2017 and 30 June 2018. Only mid-year data were collected for 2018, as six months should elapse to ensure that complete information on a seroconversion event associated with an injury is available.

Between January and December 2017, a total of 2,223 occupational exposure incidents were reported (FIGURE 30). The majority of these incidents were needle stick injuries (87%, n=1927). Seventy one of the 2,223 occupational exposure incidents were classed as SOEs[1] (3%). Although the incidence of occupational exposures varied across Scotland, the overall incidence per 100 whole time equivalent (WTE) for sharps-related occupational exposures did not change between 2016 and 2017 (from 1.90 to 1.88, p=0.38).

FIGURE 30: Occupational exposure incidents by exposure type, all Scotland, 2017.



[Source of data is voluntary anonymous returns from Occupation Health and Safety leads in health and applicable special boards in NHSScotland.]

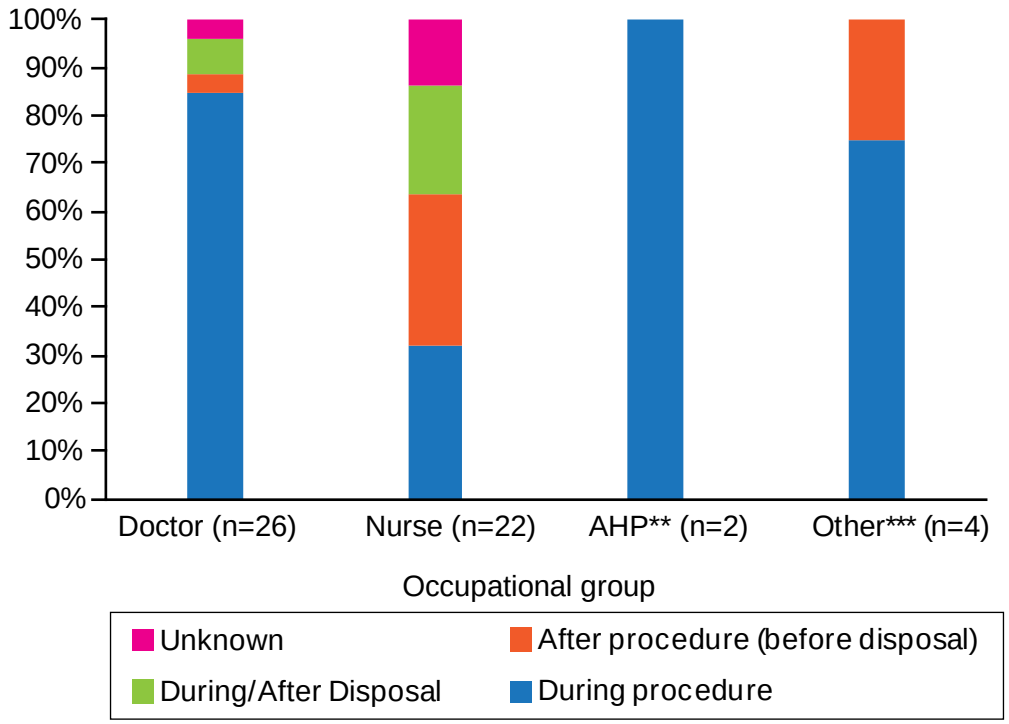
In the first half of 2018, 1,070 occupational exposures were reported and similarly to 2017, the majority of occupational exposures were sharps-related injuries (n=934, 87%). Thirty six of the occupational exposures were reported as SOEs (3%). The majority of exposures were to body fluids from patients known to have been exposed to the hepatitis C virus (HCV) (i.e. HCV antibody positive), both in 2017 and up to mid-2018 (n=60, 85% and n=30,

[1] Significant Occupation Exposure is defined in the National Infection Prevention and Control Manual as "a percutaneous, mucocutaneous exposure or non-intact skin (abrasions, cuts, eczema) exposure to blood/other body fluids from a source that is known (or later found to be) positive for a bloodborne virus infection".

83% respectively). This is not unexpected as the prevalence of HCV in Scotland is higher than that of human immunodeficiency virus (HIV) or hepatitis B virus (HBV).

As in previous years the majority of SOEs (89%, n=48/54) were reported by nurses and doctors (FIGURE 31and FIGURE 32).[44, 45] In 2017, almost 55% of the SOEs reported by nurses occurred after a procedure.

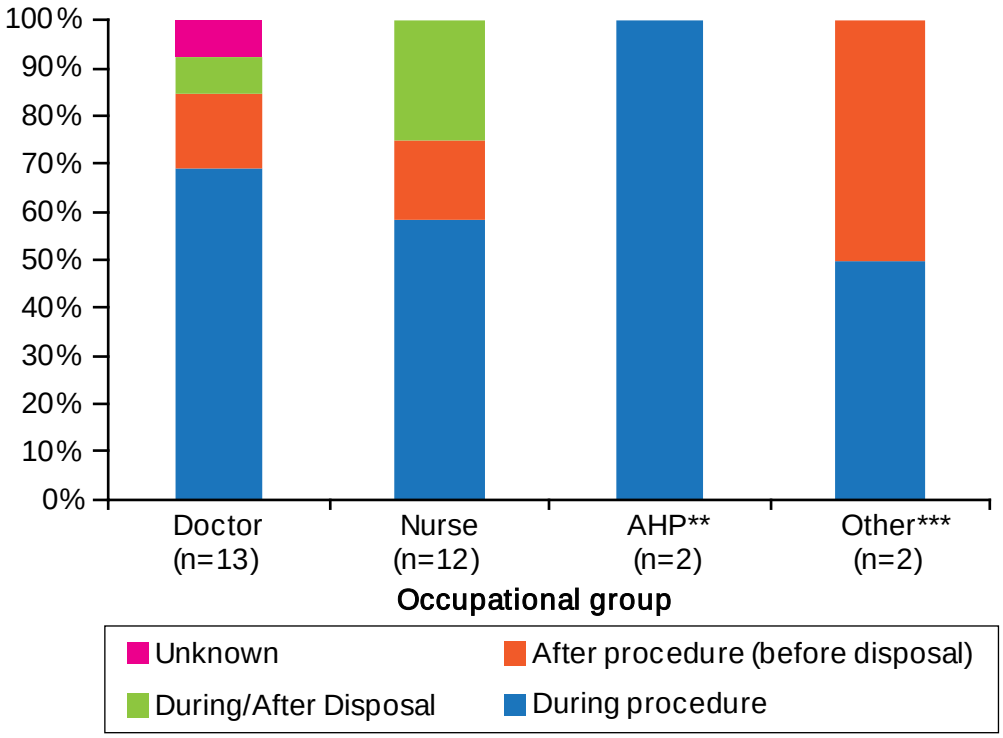
FIGURE 31: SOE by procedure phase and occupational group, all Scotland, 2017 (n=54*).



* There were 17 SOEs that did not occur at the time of a procedure and were excluded from this figure.
These exposures were attributed to incidents such as assaults.
** AHP= Allied Health Professionals
*** Other= dentists, other dental and healthcare support workers

[Source of data is voluntary anonymous returns from Occupation Health and Safety leads in health and applicable special boards in NHSScotland.]

FIGURE 32: SOE by procedure phase and occupational group, all Scotland, mid-2018 (n=29*).

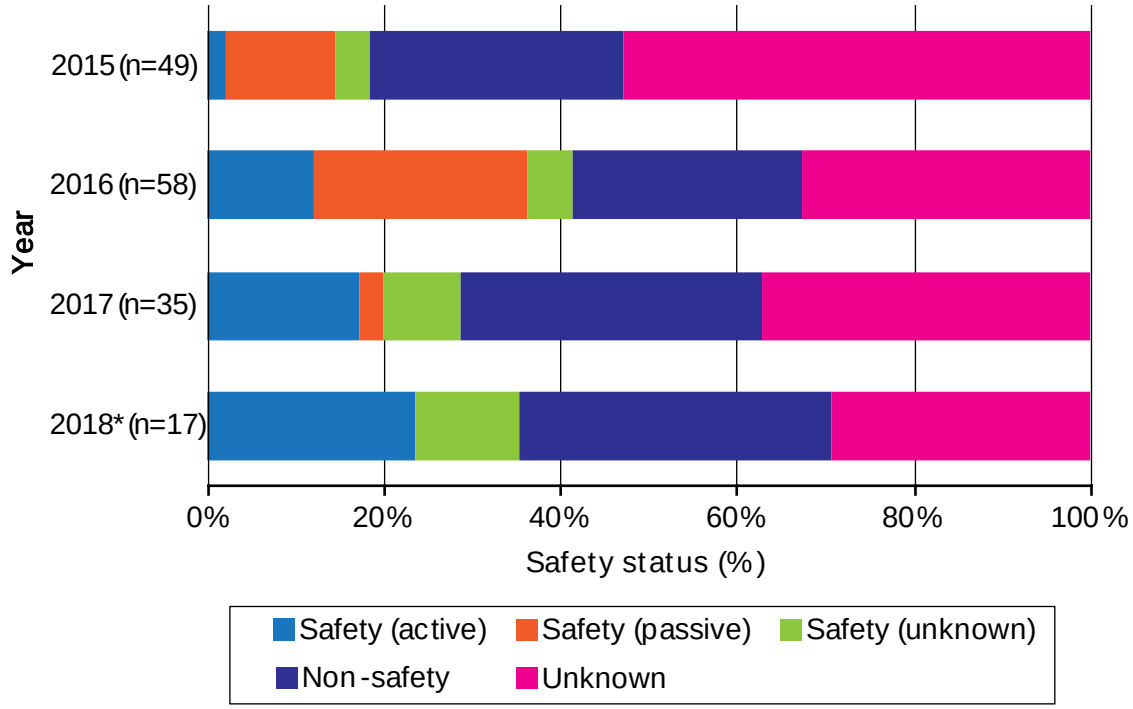


* There were 7 SOEs that did not occur at the time of a procedure and were excluded from this figure.
These exposures were attributed to incidents such as assaults.
** AHP= Allied Health Professionals
*** Other= dentists, other dental and healthcare support workers

[Source of data is voluntary anonymous returns from Occupation Health and Safety leads in health and applicable special boards in NHSScotland.]

Between January and December 2017, the majority of SOEs involving a safety device were due to active safety devices (FIGURE 33).[45] In the first half of 2018, a similar pattern was observed and no incidents involving a passive safety device had been reported (FIGURE 33). NHS boards should ensure that injuries sustained from a safety device are investigated locally. Any lessons learned and interventions stemming from the investigation should be shared with all appropriate stakeholders, including national procurement (NP) and the Incident Reporting and Investigation Centre (IRIC), to help monitor these incidents nationally and take action as required. Engineering faults with the device, if identified should be reported through the NHSScotland Incident Reporting and Investigation Centre.

FIGURE 33: Sharps SOEs by safety status of sharps device, from 2015 to mid-2018.



*Only mid-year data available.

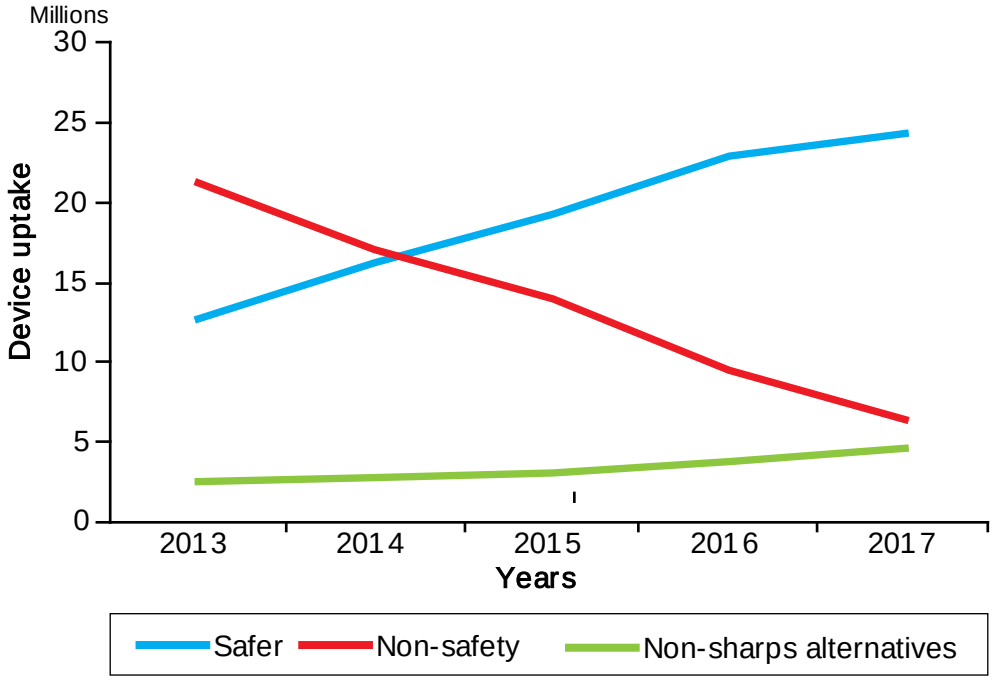
[Source of data is voluntary anonymous returns from Occupation Health and Safety leads in health and applicable special boards in NHSScotland.]

Sharps Device Data

The uptake of safety devices has increased significantly in NHSScotland from 37% (12,657,777) in 2013 to 79% (24,345,158) in 2017 ($p<0.01$) (FIGURE 34).

Non-sharp alternative devices, such as filter straws, which can be used instead of hypodermic needles for medication withdrawal from ampoules, can also be used as substitutes for traditional sharps. Purchasing of non-sharp alternative devices has also increased over the same time period ($p<0.01$) (FIGURE 34).

FIGURE 34: Safer and non-safety sharps, and non-sharps devices uptake in Scotland for the period 2013-2017.



[Source of data is the NSS Sharps Dashboard.]

Incidents Associated with Bloodborne Virus Infected Healthcare Workers

HPS works with Health Protection Teams (HPTs) in NHS boards to support the public health response following the identification of a healthcare worker (HCW) infected with one or more bloodborne viruses (BBVs). In line with guidance from the UK Advisory Panel for Healthcare Workers Infected with Bloodborne Viruses (UKAP), NHS boards are required to undertake a number of steps to determine if patients have been put at risk of infection and whether they should be traced, notified and offered testing: a patient notification exercise (PNE). In 2018, HPS supported NHS boards to undertake five risk assessments related to the identification of BBV infected HCWs. All of the assessments were referred to UKAP who did not recommend a PNE for any.

Quality Improvement and Interventions to Reduce Blood Borne Viruses

The prevention of BBV infections occurring as a consequence of healthcare requires a comprehensive approach that includes:

- education and training,
- surveillance,
- reporting and management of sharps injuries including post exposure prophylaxis(PEP),
- use of safer sharp devices,
- HBV immunisation,
- consistent application of Standard Infection Control Precautions (SICPs) and Transmission Based Precautions (TBPs),
- monitoring and evaluating the implementation of policies, guidance and recommendations and their impact.

Development of Guidance

National Infection Prevention & Control Manual

The National Infection Prevention and Control Manual (NIPCM)[46] 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 and Chapter 3: Healthcare Infection, Incidents, Outbreaks and Data Exceedance in 2017.

In July 2018 an addendum for IPC within Neonatal Settings was published to provide additional guidance to Chapters 1, 2 and 3 for neonatal settings. This addendum is supported by a scientific literature review specific to infection prevention and control measures applicable to NNUs not already covered by Chapters 1, 2 and 3 of the NIPCM.

In November 2018 a draft version of an addendum for IPC for patients with CF was published following a review of the scientific literature. This addendum aims to provide additional guidance to Chapters 1, 2 and 3 for patients with CF.

The literature review process ensures that the ethos of the NIPCM is consistent with the original methodology and that practice recommendations remain applicable and evidence based. The methodology for the literature reviews has been developed throughout 2018 with the aim being to reduce reviewer bias and improve the overall quality and robustness of the reviews and the recommendations made. As such, a double reviewer methodology has been developed and will be adopted for all future reviews including the six hand hygiene literature reviews due to be published in 2019.

In September 2018, the Patient Placement, Isolation and Cohorting: Standard Infection Control and Transmission Based Infection Control Precautions literature review (previously two separate reviews) was published. This underpins the practice recommendations in Chapters 1 and 2. The Infection Prevention and Control During Care of the Deceased literature review was also updated and published in September 2018. This underpins practice recommendations in Chapter 2. Both of these literature reviews were conducted by two reviewers as a trial of the revised NIPCM literature reviewing methodology.

National Infection Prevention & Control Manual Website Development

The A-Z of Pathogens is a reference guide for pathogen specific information and includes:

- a summary of the infectious agent/disease;
- incubation period;
- infectivity;
- transmission route;
- notifiable status;
- guidance and supporting materials.

Pathogens and diseases are added to the A-Z in response to reported incidents and outbreaks, current and emerging threats, including rare pathogens/disease. In 2018, Monkeypox and Nipah virus were added to the A-Z.

To ensure that the A-Z content remains current, quarterly reviews of the published scientific literature and guidance are undertaken.

Healthcare Associated Infection Compendium

The HAI Compendium is a directory of guidance and supporting materials relevant to IPC in Scotland. HPS source new content for the Compendium on a monthly basis using scientific alerts and guidance from reputable national and international organisations.

In 2018 all pathogen specific guidance and supporting materials were moved to the A-Z of Pathogens to ensure all pathogen specific information could be accessed in one place.

Sepsis guidance and supporting materials were added to the HAI Compendium in 2018. This includes materials produced as part of Sepsis awareness campaigns in the UK and internationally e.g. the 2018 World Health Organisation (WHO) World Hand Hygiene Day campaign 'It's in your hands – Prevent Sepsis in Healthcare'.

Hand Hygiene

HPS continue to support the 5th May WHO 'SAVE LIVES: Clean your hands campaign.' The 2018 call to action was 'It's in your hands – Prevent Sepsis in Healthcare'. HPS supported this through the creation of a sepsis webpage and adding sepsis to the HAI Compendium; promoting sepsis awareness information to healthcare staff and the public.

Alcohol Based Hand Rub Proxy Measure

HPS have collaborated with NP colleagues since 2014 utilising purchasing data for alcohol based hand rub (ABHR) and soap products distributed by the National Distribution Centre (NDC). This collaboration has established a commodity indicator for hand hygiene which has been validated in volunteer NHS boards as suitable for use as a national proxy measure for hand hygiene compliance in NHSScotland (similar to that used in other European countries). In 2018, HPS launched an interactive dashboard displaying ABHR sales via the NDC on the NSS Discovery platform; this allows NHS boards to access their data on demand and compare it to national figures.

NHS Dumfries and Galloway, NHS Highland, NHS Lothian and the National Waiting Times Centre do not make all ABHR purchases via the NDC and so the available data may underestimate usage. In 2017, the national average ABHR consumption was 18.3 litres per 1,000 bed days, which equates to around 18 hand hygiene opportunities taken per bed day. The 2012 European PPS and 2016 Scottish PPS surveys reported averages of 23.9 L/1,000 bed days and 33.5 L/1,000 bed days, respectively.[7, 47] However, it is important to note that the point prevalence surveys and the proxy measure use different methods for hand hygiene data collection and so are not directly comparable.

Information Leaflets

The leaflet 'Group A Streptococcal infection – Information for patients' was published in May 2018 and provides information including what the infection is, how it is treated and how to stop the infection spreading to friends and family.

Respiratory Protective Equipment

The Scotland wide Respiratory Protective Equipment (RPE) group continues to support the development of guidance and provide expert opinion on RPE. Each year HPS carries out a survey to gather intelligence on RPE usage across NHSScotland. The information gathered is used to inform NHSScotland pandemic preparedness and provide information for procurement and resilience teams in Scotland.

Responses from this year's survey were similar to those received last year. All NHS boards, with the exception of one, have FFP3 respirators available. In contrast, one of the boards exclusively uses powered respirators.

In order to ensure that FFP3 respirators adequately protect HCWs, fit-testing is required to ensure the respirator seals correctly around the HCW's face. Fit-testing can be done using quantitative or qualitative methods. In the 2016 RPE survey report (unpublished literature) HPS advocated that NHS boards should consider the use of quantitative fit-testing methods. This year three NHS boards have started using quantitative methods in addition to qualitative methods. HPS will seek feedback from these boards on the use of quantitative methods for fit-testing.

Norovirus Outbreaks

Although norovirus incidents and outbreaks are reported all year round, a typical norovirus season extends from October through April, when there is a peak in reported outbreaks by NHS boards. As there is no long lasting immunity to norovirus, the public remain susceptible every year to the virus. In 2018 the '*Stay at home'* campaign was re-launched by HPS in partnership with Health Scotland that provided information to the public on preventing the spread of norovirus. In addition, this campaign aimed to reduce the impact and burden that norovirus creates on individuals and services as much as possible.

Recognising the unique environment of care homes, the norovirus guidance for care homes was reviewed and published in November 2018, providing key information to assist with prevention and control of norovirus outbreaks in care homes. The guidance contains a pack of resources, including staff and resident information leaflets, checklists and posters. An information sheet 'What should you do during norovirus season – advice for medical and healthcare students' was published on the HPS website in December 2018. It provides advice on hand hygiene and actions to be taken if a student has norovirus or is working in a clinical area during a norovirus outbreak. The information sheet was shared with all Medical and Nursing schools in Scotland.

Epidemiological Data

In October 2017, prior to norovirus season start a revised reporting system was launched by HPS capturing norovirus incidence data. From 1st October 2017 to 9th July 2018, NHS boards reported a total of 227 closures consisting of 88 ward and 139 bay closures. Within these closures a total of 1,221 suspected or confirmed patient cases were reported. In season 2016/2017 a total of 200 ward and bay closures were reported, however no comparisons can be drawn as the reporting mechanism during this time period captured prevalence data only. FIGURE 35 shows the public facing, interactive HPS hosted dashboard that displays all ward closures, bay closures, total number of patients affected and total number of days, wards and bays that were closed due to norovirus.[48]

FIGURE 35: Summary of norovirus activity between 01/10/2017 to 09/07/2018.

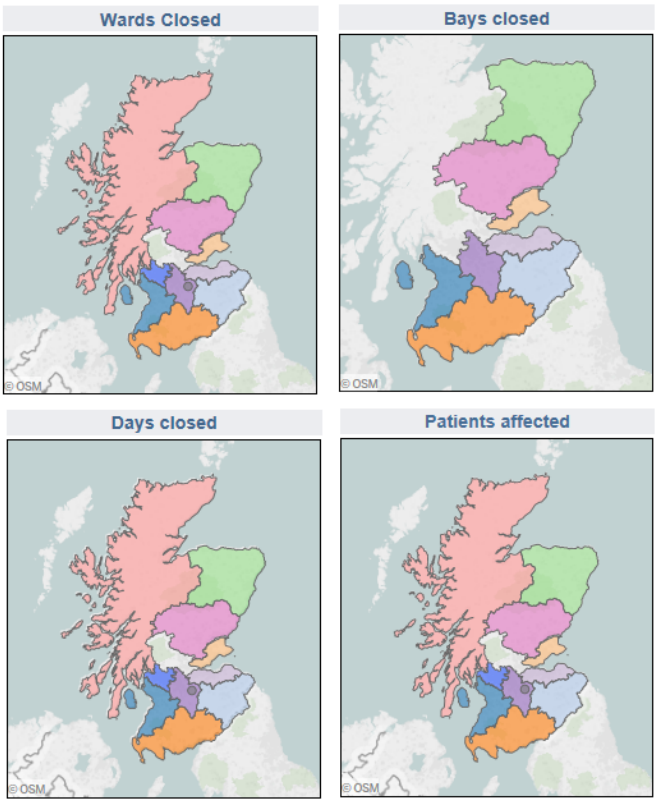
First date period 01/10/2017 **Last date period** 09/07/2018

As at **23/01/2019**, for period **01/10/2017** to **09/07/2018, 11** NHS board(s) within Scotland reported a total of **88** ward closure(s) and **139** bay closure(s) due to confirmed or suspected norovirus.
Within these ward/bay areas a total of **1,221** confirmed or suspected patient cases were identified.

Interpretation: information for awareness
These data represent the incidence of Norovirus activity in NHS boards in Scotland in as close to real time as possible. These data are accurate at the time of publication, however the data collection method has capacity to be retrospective, therefore these data may be subject to change. In addition they are not, and should not be interpreted as data for benchmarking or comparison. For NHS Boards the data can be used for the assessment of risk and Norovirus outbreak preparedness.

NHS Board	Ward or bay closed	No.Closed	Days closed	Patients Affected
Ayrshire and Arran	Bay	4	15	18
	Ward	3	15	30
Borders	Bay	41	230	90
	Ward	2	9	20
Dumfries and Galloway	Bay	2	4	2
	Ward	2	13	10
Fife	Bay	11	42	46
	Ward	8	46	60
Grampian	Bay	20	88	118
	Ward	19	85	118
Greater Glasgow and Clyde	Ward	38	214	287
Highland	Ward	3	40	29
Lanarkshire	Bay	8	21	25
	Ward	5	26	46

HPS Norovirus report
Published by: Health Protection Scotland
Meridian Court, 5 Cadogan Street, Glasgow G2 6QE
Report produced by: HPS Infection Control Team
For information on ward closures contact HPS Infection Control Team on 0141 300 1175 or NSS.HPSInfectioncontrol@nhs.net



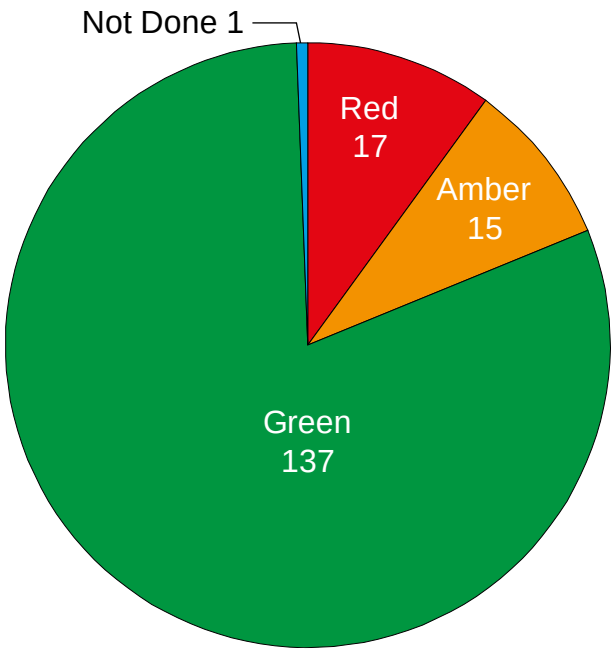
[Source of data is direct reporting to HPS by NHS boards.]

Hospital Outbreaks and Incidents

HPS continue to support and work with Infection Prevention and Control Teams (IPCTs) and HPTs in the management of incidents and outbreaks. All NHS boards are required to assess outbreaks and incidents associated with healthcare using the Healthcare Infection Incident Assessment Tool (HIIAT). The mandatory HIIAT Green (non-norovirus) reporting system implemented in early 2016 is now embedded within NHS boards across Scotland. This has been pivotal in providing a more robust epidemiological picture of all HIIAT assessed incidents and outbreaks across NHSScotland.

In 2018 there were a total of 170 outbreaks and incidents reported, a similar picture to 2017 when there were 167 reports. Seventeen of the outbreaks and incidents in 2018 (10%) were assessed as red; 8.8% (n=15) as amber; and 80.6% (n=137) as green (FIGURE 36). No HIIAT assessment was made for 0.6% (n=1) of reported outbreaks and incidents; this was recorded as a potential decontamination incident (FIGURE 36).

FIGURE 36: All incidents and outbreaks reported in 2018 by HIIAT status (n=170).

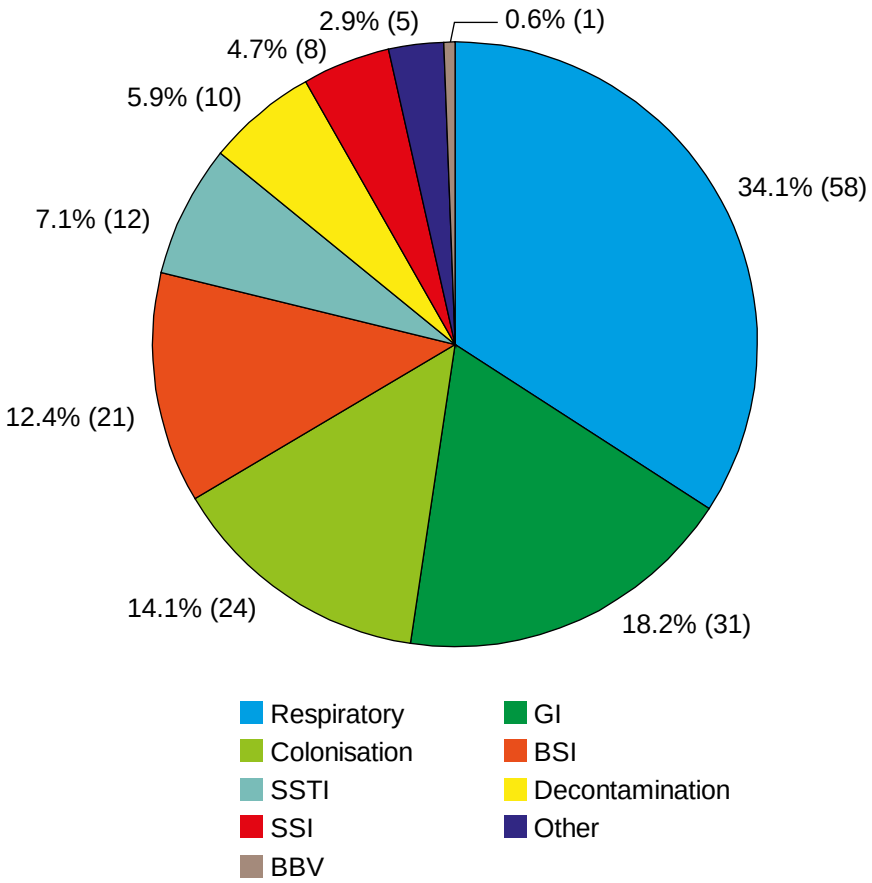


[HIIAT data are reported by NHS boards directly to HPS.]

FIGURE 37 shows the total number of incidents and outbreaks reported by NHS boards for 2018 by infection category. These incidents and outbreaks have occurred in various healthcare settings.

Respiratory and gastrointestinal infection incidents and outbreaks accounted for more than half of those reported (n=89, 52.3%). A third of respiratory incidents reported (n=34/58, 58.6%) were attributed to influenza virus and were predominantly reported in the first three months of 2018 (data not shown). *C. difficile* accounted for the majority of gastrointestinal incidents and outbreaks (n=20/31, 64.5%).

FIGURE 37: All incidents and outbreaks reported in 2018 by infection category (n=170).



[Infection category data is reported by NHS boards directly to HPS via the HIIAT reporting system.]

Current and Emerging Threats/Horizon Scanning

The current and emerging threats (CET) report provides a continuous assessment of HCAI/AMR threats in or to NHSScotland; it also contributes to horizon scanning and threat reporting within the wider organisation through the HPS Emerging Hazards Report. The CET report includes a formalised risk assessment and gap analysis to identify the need for any additional guidance, tools or health protection programmes (including surveillance) in NHSScotland. In addition, the CET report provides a summary of HIIAT assessed outbreaks or incidents reported to HPS (FIGURE 36 and FIGURE 37). In 2018, 14 'threats' were identified in the published literature; these included novel pathogens, antimicrobial resistance modes and disease symptoms; five of the 'threats' were carried over from the previous financial year (2017/18), these were:

- Middle Eastern Respiratory Syndrome Coronavirus (MERS-CoV);
- *Mycobacterium chimaera;*

- Plasmid-mediated colistin resistance;
- Plasmid-mediated fosfomycin resistance;
- *Candida auris.*

Nine new threats were identified in 2018, these were:

- Increased incidence and unusual clinical presentation of *Neisseria meningitidis;*
- Plasmid-mediated meticillin-resistance in *Staphylococcus aureus;*
- Increasing prevalence of multidrug resistance in *Staphylococcus epidermidis;*
- Increased incidence of Group A streptococcal infection in NHSScotland;
- Acute flaccid myelitis (AFM) associated with enteroviruses (D68 and A71);
- Increase in detection of echovirus 30 in the EU in 2018;
- Ebola virus disease (Outbreak in Democratic Republic of Congo);
- Nipah virus (Outbreak in India);
- Monkey pox (cases were imported into the UK from an ongoing outbreak in Nigeria).

HPS highlighted and monitored the service risk from these identified threats in the CET report to IPCTs via the HPS National Policies, Guidance and Outbreaks (NPGO) steering group and the ARHAI programme board. These were also reported to the Scottish Antimicrobial Resistance and Healthcare Associated Infection (SARHAI) group for national oversight and consideration.

Neonatal Units

In 2018 the HPS Neonatal Unit (NNU) Infection Prevention Health Protection programme continued to work towards preventing HCAI in NNUs across Scotland by facilitating national oversight and co-ordination. This programme is led by the Neonatal Unit Infection Reduction steering group, chaired by a Consultant Neonatologist with representation from key stakeholders across NHSScotland.

The key outputs for this year have included:

- Production of an NIPCM addendum for IPC within the NNU and an associated literature review 'Management of Incidents and Outbreaks in Neonatal Units'.
- Production of an information leaflet for parents/guardians on providing infection control information and advice to help prevent infection in the NNU setting.
- Development of a CRA tool for microbiological screening of neonates on admission and transfer to NNUs across Scotland.
- This programme of work is complete. Any further deliverables will be progressed in the NPGO Health Protection Programme.

Infection Control in the Built Environment and Decontamination

The Infection Control in the Built Environment and Decontamination (ICBED) programme provides expert advice related to the public health, infection control, clinical and scientific aspects of the built environment and decontamination. The programme works in partnership with Health Facilities Scotland (HFS) to deliver the NHSScotland decontamination and built environment agenda which is clinically led and technically informed.

The ICBED programme continues to review emerging technologies and infection control strategies for management of the healthcare environment and decontamination of the patient environment and patient related equipment; this ensures that literature reviews remain extant and that their recommendations are fit for purpose.

The Built Environment

The built environment work stream of the programme covers all HCAI aspects of the physical healthcare environment including ventilation, water and environmental cleanliness. A planned programme of review of existing guidance, scientific literature and emerging evidence was commenced in early 2018 to ensure the current evidence base relating to the built environment is maintained. Work has continued this year with reviewing existing guidance, scientific literature and emerging evidence regarding water systems in healthcare settings.

Assessment of Financial Impact Protecting Time for Standard Discharge Cleans

Following the HPS survey carried out in 2015 highlighting the average time taken to clean a standard bedspace and a specialist bedspace,[49] HPS undertook further work to review/assess the financial impact of ensuring there were protected times for discharge bedspace cleaning. The limited data received identified the boards who returned information were allocating the required time or exceeding the bedspace cleaning times (40 minutes standard bedspace and 60 minutes specialist bedspace).

Infection Prevention and Control Team Audit Tools and Processes: National Monitoring Tool

In 2018, the National IPC Monitoring Framework for Audit to support Safe and Clean Care Audit Programmes was co-produced and co-designed by HPS, HFS and IPC representatives from every NHS board. The framework was designed to provide an organisational approach to auditing IPC practices whilst incorporating a quality improvement approach within the methodology for use across both primary and secondary care settings.[50] The framework was published in September 2018. http://www.nipcm.hps.scot.nhs.uk/documents/national-monitoring-framework-to-support-safe-and-clean-audit-programmes/

Mycobacterium chimaera in Heater Cooler Units

Following identification of an international issue related to increased risk of *Mycobacterium chimaera* linked to cardiac heater cooler units HPS undertook a review to establish whether there were any clinical cases in Scotland. *M. chimaera* is a non-tuberculous mycobacterium

which is an environmental organism commonly found in tap water. Clinically the bacterium is associated with respiratory disease or disseminated disease in immunocompromised patients. *M. chimaera* has been implicated in over 100 cases of prosthetic valve endocarditis and disseminated mycobacterium disease throughout Europe and the USA since 2011 which has been linked to contaminated water heater cooler units (HCUs) used during cardiac surgery.[51] Whilst no clinical cases were identified in Scotland a national incident team recommended the production of national guidance for the decontamination of HCUs. A rapid review of the scientific literature was undertaken for the decontamination of HCUs. All four cardiac centres in Scotland were visited, processes were observed and discussed and manufacturer's instructions reviewed. A number of recommendations will be made for the decontamination of HCUs which covers; risk assessments, technical requirements water supply management, infection control management, decontamination, microbiological testing and testing result actions.[52]

Future Work

There are a number of projects planned for the ICBED programme including a review of HCAI aspects of guidance relating to water and ventilation systems within healthcare settings. An NHSScotland wider review of water testing within healthcare facilities is planned and is aligned to the recent Summary of Incident and Findings of the NHS Greater Glasgow and Clyde: Queen Elizabeth University Hospital/Royal Hospital for Children water contamination incident and recommendations for NHSScotland produced by HPS in December 2018.

Inadequate decontamination of communal reusable patient care equipment has continued to feature in Healthcare Environment Inspectorate (HEI) reports. In 2016, HPS undertook an observational study to determine the time required for HCWs to physically clean items of communal care equipment.[53] The total estimated time nursing staff (trained and untrained) spend cleaning was 25% for a general ward area, however data were limited. HPS, at the request of the Scottish Government Health and Social Care Department (SGHSCD), were asked to develop further intelligence related to cleaning and validate the findings of the original study. The follow up study also found nursing staff (trained and untrained) within a general area cleaned approximately 25% of their time on shift. This work was submitted to the SGHSCD in April 2019.

Future work for 2019 will also include:

- Updated scientific literature review for existing and emerging technologies for environmental decontamination for; microfibre, electrolysed water, hydrogen peroxide vapour and steam technologies. These scheduled updates ensure that the evidence bases for these reviews remain extant and that their recommendations are fit for purpose.

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Appendices

Appendix 1 – Background Information

The purpose of this report is to present the outputs of HPS health protection programmes to reduce HCAI including surveillance and development of guidance and tools. This report details the progress made by HPS to support the reduction of HCAIs in NHSScotland as well as providing data to inform local and national HCAI reduction activities.

- UK comparisons

Improved collaboration with the other UK nations has made comparisons and standardisation across the UK a high priority for all four nations' governments/health departments. The changes introduced in the Scottish HCAI surveillance, described here, facilitate benchmarking of the Scottish data against those of the rest of the UK.

Appendix 2 – Publication Metadata

Metadata Indicator	Description
Publication title	Healthcare Associated Infection. Annual Report 2018.
Description	This release provides information on healthcare associated infection in Scotland for the period January to December 2018; when this is not available, data from January to December 2017 has been used
Theme	Infections in Scotland
Topic	Healthcare Associated Infection Infection Prevention and Control
Format	Online resource (PDF)
Data source(s)	**Surgical Site Infection:** Case data source: Surgical Site Infection Reporting System (SSIRS) Number of procedures denominator: Surgical Site Infection Reporting System (SSIRS) **Healthcare Associated Infections in Intensive Care Units:** Source of data is Scottish Intensive Care Society Audit Group ***Clostridioides difficile* Infection:** Case data source: Electronic Communication of Surveillance in Scotland (ECOSS) Data linkage source: SMR01 General / Acute Inpatient and Day Case: Information Services Division Healthcare associated denominator: Total occupied bed days: Information Services Division ISD(S)1 Community associated denominator: National Records of Scotland (NRS) population estimates Antibiotic use in primary care numerator: Prescribing Information System (PIS) ISD Antibiotic use in primary care denominator: National Records of Scotland (NRS) population estimates Antibiotic use in acute hospitals numerator: Hospital Medicines Utilisation Database (HMUD) ISD. Includes only hospitals labelled as 'General Hospitals (mainly acute)' in HMUD. Antibiotic use in acute hospitals denominator: Acute hospital occupied bed days (OBDs): Information Services Division (ISD). Sum of OBDs for all

	hospitals in numerator. ***Staphylococcus aureus* Infection:** Case data source: Electronic Communication of Surveillance in Scotland (ECOSS) Enhanced Surveillance Web Tool Healthcare associated denominator: Total occupied bed days: Information Services Division ISD(S)1 Community associated denominator: National Records of Scotland (NRS) population estimates **Gram-negative Bacteraemia:** Case data source: Electronic Communication of Surveillance in Scotland (ECOSS) Enhanced Surveillance Web Tool Healthcare associated denominator: Total occupied bed days: Information Services Division ISD(S)1 Community associated denominator: National Records of Scotland (NRS) population estimates **Urinary Tract Infection:** ECOSS (Electronic Communication of Surveillance in Scotland) **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** ECOSS, Antimicrobial Resistance and Healthcare Associated Infections (AMRHAI) Reference Unit Public Health England (PHE) and the Scottish AMR Satellite Laboratory. Antibiotic use in acute hospitals numerator: Hospital Medicines Utilisation Database (HMUD) ISD. Includes only hospitals labelled as 'General Hospitals (mainly acute)' in HMUD. Antibiotic use in acute hospitals denominator: Acute hospital occupied bed days (OBDs): Information Services Division (ISD). Sum of OBDs for all hospitals in numerator. **Prevention of Healthcare Associated Bloodborne Viruses:** 1) Voluntary anonymous returns from Occupational Health services and Health & Safety leads in health and applicable special boards in NHSScotland. 2) NHS National Procurement.

	Development of Guidance: N/A **Norovirus Outbreaks:** NHS boards Infection Control Teams reported to HPS. **Hospital HCAI Outbreaks and Incidents:** Healthcare infection incidents reported to HPS. **Neonatal Units**: N/A **Infection Control in the Built Environment and Decontamination (ICBED):** N/A
Date that data are acquired	**Surgical Site Infection**: 19/02/2019 **Healthcare Associated Infections in Intensive Care Units:** 12/04/2018 ***Clostridioides difficile* Infection**: 24/01/2019 ***Staphylococcus aureus* Infection:** 15/02/2019 **MRSA Screening:** 14/01/2019 **Gram-negative Bacteraemia:** 25/02/2019 (with the exception of *Escherichia coli* bacteraemia) ***Escherichia coli* Bacteraemia:** 14/02/2019 **Urinary Tract Infection:** 27/02/2019 **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** 05/02/2019 **Prevention of Healthcare Associated Bloodborne Viruses:** Voluntary anonymous returns from Occupational Health services and Health Safety leads in health and applicable special boards in NHSScotland – collated in August 2018. National Procurement extracted data for 2013 to 2018 (inclusive). **Development of Guidance:** N/A **Norovirus Outbreaks:** 03/07/2018 **Hospital HCAI Outbreaks and Incidents:** 03/01/2019 **Neonatal Units:** N/A **Infection Control in the Built Environment and Decontamination (ICBED):** N/A
Release date	03 May 2019
Frequency	Annual
Timeframe of data and timeliness	The latest iteration of data is 04 May 2018, therefore 5 months in arrears **For the following chapters 2018 data has been reported:** **Healthcare Associated Infections in Intensive Care Units:** These data have a delayed publication (1 year 4 month arrears) due to the requirement for HPS publication to follow and not precede the Scottish Intensive Care Society Audit Group publication in August each year (8 months in arrears). **Norovirus:** The data is reported on a weekly basis by boards and the reporting method has capacity to be retrospective due to only being reported when the bay/ward has reopened. Therefore the data should not be used for benchmarking or comparison

	but only for NHS boards assessment for risk and outbreak preparedness. **Prevention of Healthcare Associated Bloodborne Viruses:** the delayed publication is due to BBV seroconversion data only being available 6 months post the last day of exposure in 2016 (i.e. 31st December 2016). While NP data is available up to the end of 2018, for comparison with sharps injury data this is only reported to the end of 2017.
Continuity of data	**Surgical Site Infection:** None **Healthcare Associated Infections in Intensive Care Units**: None ***Clostridioides difficile* Infection:** None ***Staphylococcus aureus* Infection**: None **Gram-negative Bacteraemia:** None **Urinary Tract Infection:** N/A **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** None **Prevention of Healthcare Associated Bloodborne Viruses:** None **Development of Guidance:** N/A **Norovirus Outbreaks:** None **Hospital HCAI Outbreaks and Incidents:** None **Neonatal Units:** N/A **Infection Control in the Built Environment and Decontamination (ICBED):** N/A
Revisions statement	These data are not subject to planned major revisions. However, HPS aims 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	**Surgical Site Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ ***Clostridioides difficile* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ ***Staphylococcus aureus* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Gram-negative Bacteraemia:** *Escherichia coli* bacteraemia: Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/

	Urinary Tract Infection: N/A **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** None **Prevention of Healthcare Associated Bloodborne Viruses:** There are no revisions to historical data. Commodity specialists identify and classify all sharps instruments available for purchase via National Procurement. New sharps devices including new safety versions and non sharp alternative products will be added by the National Procurement Product Specialist and incorporated into the data as applicable. **Development of Guidance:** N/A **Norovirus Outbreaks:** From 01 October 2017 the reporting process for norovirus ward and bay closures changed from Monday point prevalence to reporting on all bay and ward closures during the week. This report includes the figures from the new weekly reporting for the period 01 October 2017 to 03 July 2018. **Hospital HCAI Outbreaks and Incidents:** In April 2016 the mandatory reporting of non-norovirus HIIAT greens was introduced, therefore this dataset has an additional three months of mandatory HIIAT green reporting. **Neonatal Units:** N/A **Infection Control in the Built Environment and Decontamination (ICBED):** N/A
Concepts and definitions	**Statistical significance:** Where the text refers to a change in the data this denotes statistical significance. **Surgical Site Infection:** Details provided in quarterly publication hhttps://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Healthcare Associated Infections in Intensive Care Units:** The surveillance data are collected in accordance with the European Centre for Disease Prevention and Control protocol for HAI Surveillance in ICU. Ventilator Associated Pneumonia: Patients who are ventilated are at increased risk of developing a VAP. CVC related infection/Bloodstream infections: Patients in intensive care often have a CVC *in situ* and are at increased risk of developing a CVC related infection, including bacteraemia. ***Clostridioides difficile* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/

	Antibiotic use information in primary care presented as the number of items which represents the number of times an antibiotic appears on prescription. Antibiotic use information in acute hospitals is presented as the number of defined daily doses https://www.whocc.no/ddd/definition_and_general_considera/ ***Staphylococcus aureus* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Gram-negative Bacteraemia:** Gram-negative organisms including Enterobacterales, (comprising amongst others *Escherichia coli, Klebsiella oxytoca*, and *Klebsiella pneumoniae*), and non-fermenters, (comprising amongst others *Pseudomonas aeruginosa*, and *Acinetobacter spp*.), cause serious infections including bacteraemia, pneumonia, meningitis, and surgical site infections (SSIs). Gram-negative bacteraemia is a public health and clinical concern because of: • the severity of infection, commonly occurring among vulnerable patients often at the extremes of life and/or with comorbidities, • the large number of cases of Gram-negative bacteraemias each year, and high prevalence of Gram-negative infections, • the association with receiving healthcare in community and healthcare settings., • their ability to become resistant to multiple classes of antibiotics, limiting treatment options. For all antimicrobial susceptibility data published in this report, was aligned with the following definition: A new case of bacteraemia is a patient from whom an organism has been isolated from the patient's blood, and who has not previously had the same organism isolated from blood within a 14 day period (i.e. 14 days from date last positive sample obtained). % Non-susceptible= non-susceptible (resistant or intermediate) isolates divided by the total number of isolates tested *100. *Escherichia coli* bacteraemia: Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Urinary Tract Infection:** An important aspect of reducing the incidence of Gram-negative bacteraemia is the prevention and management of primary infections, including urinary tract infections (UTIs). As prescribing for UTIs is usually empirical, it is essential that resistance to commonly used antibiotics is monitored and reported to inform prescribing policy. The majority of UTIs in Scotland are caused by *E. coli.*

	For all antimicrobial susceptibility data published in this report, was aligned with the following definition: A new case of bacteraemia is a patient from whom an organism has been isolated from the patient's blood, and who has not previously had the same organism isolated from blood within a 14 day period (i.e. 14 days from date last positive sample obtained). % Non-susceptible= non-susceptible (resistant or intermediate) isolates divided by the total number of isolates tested *100. **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** Carbapenems are broad spectrum antibiotics that are generally used in hospitals for the treatment of suspected or confirmed multidrug resistant Gram-negative infections. They are often one of the few antibiotics left for treatment of these resistant infections. Important hospital acquired infection (HAI)/Healthcare Associated Infection (HCAI) -related Gram-negative organisms are; Enterobacterales, (comprising amongst others *E. coli*, *K. oxytoca*, and *K. pneumoniae*), and non-fermenters, (comprising amongst others *P. aeruginosa*, and *Acinetobacter* spp.). The emergence and spread of Gram-negative organisms which have acquired the ability to produce carbapenemase enzymes that inactivate carbapenem antibiotics, known as carbapenemase-producing organisms (CPOs), is increasingly concerning. CPOs have been reported globally with increased intercontinental travel and exposure to healthcare abroad contributing to their spread. The genes that code for carbapenemase enzymes spread between and within bacterial species via plasmids or transposons, and are commonly associated with other resistance determinants; this means that bacteria resistant to carbapenems are invariably resistant to most other broad spectrum antibiotics, leaving little in the way of treatment options. CPOs produce beta-lactamase enzymes which inactivate carbapenems and other beta-lactam antibiotics such as the penicillin and cephalosporin classes of antibiotics. Although the overall occurrence of carbapenem resistance in bacteraemia and UTIs is estimated to be low in Scotland but has been increasing over recent years. A national enhanced surveillance program for carbapenem resistance, with a focus on Gram-negative bacteria expressing acquired carbapenemases, was setup to improve understanding of the current situation across Scotland. Probable case- A case is any person in Scotland with Gram-negative bacteria isolated from a clinical or screening specimen, where resistance is suspected to be caused by the expression of an acquired carbapenemase. Confirmed case- A case is any person in Scotland with Gram-negative bacteria isolated from a clinical or screening specimen, where resistance is suspected to be caused by the expression of an acquired carbapenemase and with a reference laboratory confirmation of a CPO. CPE CRA screening uptake- The national policy for CPE screening on admission to

	hospital states all acute admissions must undergo a clinical risk assessment followed by a swab screen to test for CPE. At present, the degree of implementation of the mandatory policy across boards is not known as screening uptake is not currently measured. The data reported is from the pilot data collection and calculates uptake of application of CRA as a percentage, from an audit sample of patient admissions (within the pilot dates). **Prevention of Healthcare Associated Bloodborne Viruses:** Safer sharp device - A medical sharp device which has been designed to incorporate a feature or mechanism that minimises and/or prevents the risk of accidental injury. Other terms include (but are not limited to) safety devices, safety-engineered devices and safer needle devices. Sharps Injuries - An injury caused by a sharp instrument or object such as a needle or scalpel, cutting or puncturing the skin. Other terms include percutaneous injury. Significant Occupational Exposure - A percutaneous, mucocutaneous exposure or non-intact skin (abrasions, cuts, eczema) exposure to blood/other body fluids from a source that is known (or later found to be) positive for a bloodborne virus infection. **Development of Guidance:** N/A **Norovirus Outbreaks:** Outbreaks of norovirus are defined as two or more linked cases associated with the same healthcare setting over a specified time period. **Hospital HCAI Outbreaks and Incidents:** Healthcare infection incidents reported to HPS. Healthcare associated infection incidents are defined within chapter 3 of the National Infection Prevention and Control Manual as: An exceptional infection episode: A single case of any serious illness which has major implications for others (patients, staff and/or visitors), the organisation or wider public health e.g. infectious diseases of high consequence such as VHF or XDR-TB. A healthcare associated infection outbreak: Two or more linked cases with the same infectious agent associated with the same healthcare setting over a specified time period; or A higher than expected number of cases of HAI in a given healthcare area over a specified time period. A healthcare infection exposure incident: Exposure of patients, staff, public to a possible infectious agent as a result of a healthcare system failure or a near miss e.g. ventilation, water or decontamination incidents. A healthcare infection data exceedance: A greater than expected rate of infection compared with the usual background rate for that healthcare location

	http://www.nipcm.scot.nhs.uk/chapter-3-healthcare-infection-incidents-outbreaks-and-data-exceedance/ **Neonatal Units:** Neonates are defined as being under 28 days old, however, a large proportion of patients in NNUs will have been admitted at birth and will often have been born prematurely (<37 weeks gestation) and/or with life threatening conditions that require surgical or medical intervention resulting in increased vulnerability to infection. Patients in an NNU may be older than 28 days and therefore not technically neonates but would still be classed as such for the purposes of HPS guidelines, policy and tools. **Infection Control in the Built Environment and Decontamination (ICBED):** The built environment covers all aspects of the healthcare environment including healthcare premises, ventilation, water, physical layout/requirements, decontamination (reusable medical devices, equipment and environment). There is a wide variety of current technical guidance which applies to the built environment including Scottish Health Technical Memoranda (SHTM), Health Technical Memoranda (HTM) and Facilities/Health Planning notes. These guidance documents cover the engineering, control and technical aspects of the built environment, however the ICBED remit is to apply the Infection Prevention (clinical elements) to support the technical documents.
Relevance and key uses of the statistics	**Surgical Site Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Healthcare Associated Infections in Intensive Care Units:** Output from the surveillance system is intended to support units in reducing HAI and preventing HCAI. The data are intended to be used locally for improvement and the data are also used nationally to measure trends at this level and to benchmark against other European countries. ***Clostridioides difficile* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ ***Staphylococcus aureus* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Gram-negative Bacteraemia:** The outputs of the surveillance programme are intended to support the NHS boards in controlling and reducing the burden of Gram-negative bacteraemia.

	***Escherichia coli* Bacteraemia:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Urinary Tract Infection:** The outputs of the surveillance programme are intended to support the NHS boards in controlling and reducing the burden of E. coli urinary tract infections. **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** Output from the surveillance system is intended to support units in reducing and preventing CPOs. The data are intended to be used locally for improvement and the data are also used nationally to measure trends at this level and to benchmark against other European countries. Output from the CPE screening pilot data collection was primarily collected to test the feasibility amending the MRSA screening KPI collection protocol. The uptake figure may gave an indication of uptake, but this must be interpreted with caution, as the pilot covered only one annual quarter, and does not represent national uptake. The pilot will inform the development of a national data collection, and following roll out will allow a better assessment of the implementation of the CPE screening policy. **Prevention of Healthcare Associated Bloodborne Viruses:** The data will facilitate compliance with H&S legislation and reduce BBV infection risk events and infections occurring as a consequence of healthcare interventions through i) monitoring the incidence of occupational exposures, among HCWs and changes over time ii) monitoring exposure outcomes and an assessment of the impact of interventions such as post exposure prophylaxis (HIV and HBV) or disease treatment (HCV) iii) monitoring the circumstances surrounding occupational exposures, including the use of safer sharps devices iv) evaluating the impact of safer sharps devices on sharps injuries and v) informing local and national prevention strategies to reduce the number of sharps injuries sustained, and thus reduce the risk of contracting a bloodborne virus (BBV) occupationally. **Development of Guidance:** N/A **Norovirus Outbreaks:** Norovirus Outbreak data is used to provide more robust data on norovirus outbreaks thus assisting preparedness for future seasons. **Hospital HCAI Outbreaks and Incidents:** To identify risks or trends in the organisms, types of infection, procedures, patients, or medical specialities associated with healthcare infection incidents to inform the production of guidance, tools or policy to assist in preparing for, preventing, detecting and managing healthcare infection incidents. **Neonatal Units:** N/A

	Infection Control in the Built Environment and Decontamination (ICBED): N/A **Key to NHS boards** AA = Ayrshire & Arran BR = Borders DG = Dumfries & Galloway FV = Forth Valley FF = Fife GR = Grampian GGC = Greater Glasgow & Clyde HG = Highland LN = Lanarkshire LO = Lothian NWTC = National Waiting Times Centre OR = Orkney SH = Shetland TY = Tayside WI = Western Isles
Accuracy	**Surgical Site Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Healthcare Associated Infections in Intensive Care Units:** The data are collected within the Scottish Intensive Care Society Audit dataset. The HAI data are collected solely for the purpose of surveillance. Evidence from case note review validation indicate that units collect their data in a consistent way and an algorithm built into the electronic data collection system ensures that case definitions are applied consistently. However, it is likely that there is some level of under and over reporting from time to time. ***Clostridioides difficile* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ ***Staphylococcus aureus* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Gram-negative Bacteraemia:** Gram-negative bacteraemia data are the product of the Electronic Communication of Surveillance in Scotland (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 is 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. ***Escherichia coli* Bacteraemia:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Urinary Tract Infection:** Gram-negative urinary isolate data are the product of the Electronic Communication of Surveillance in Scotland (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 is 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. **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** CPO isolates are derived from a range of screening and clinical specimens including urine, respiratory and blood isolates submitted to the Antimicrobial Resistance and Healthcare Associated Infections (AMRHAI) Reference Unit Public Health England (PHE) and the Scottish AMR Satellite lab. Data from the CPE screening CRA uptake pilot, is an audit of patient admission based on the sampling strategy for the MRSA screening KPI protocol, and subject to the same validation checks. **Prevention of Healthcare Associated Bloodborne Viruses:** Validation of collated data includes assessing data completeness and quality. Sense check of expected codes, frequencies and patterns in the data, with resolution of any queries/data irregularities with the data originators. **Development of Guidance:** N/A **Norovirus Outbreaks:** Data is quality checked when it first comes in for accuracy and NHS boards are contacted if there are any data issues. The data is then added onto a spreadsheet holding all the 2018 figures. The data on this spreadsheet is checked again before being added to the Tableau file and any issues resolved. **Hospital HCAI Outbreaks and Incidents:** HPS are aware that the healthcare infection incident assessment tool (HIIAT) is subjective and that there is variation in how NHSScotland boards assess and therefore report healthcare infection incidents.

	Neonatal Units: N/A **Infection Control in the Built Environment and Decontamination (ICBED):** N/A
Completeness	**Surgical Site Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Healthcare Associated Infections in Intensive Care Units:** The data are collected within the Scottish Intensive Care Society Audit dataset. The HAI data are collected solely for the purpose of surveillance. Previous data validation exercises have concluded that the HAI data reported have a high level of sensitivity and accuracy when validated against the case notes. However, it is likely that there is some level of under and over reporting from time to time. ***Clostridioides difficile* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ Antibiotic use information in acute hospitals: data for NHS Shetland are incomplete for 2017 and all data on antibiotic use in NHS Shetland 2013-2017 have been excluded. ***Staphylococcus aureus* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Gram-negative Bacteraemia:** *Escherichia coli* bacteraemia: Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Urinary Tract Infection:** Susceptibility data in this report were derived from urinary isolates samples from cases from the diagnostic laboratories in each NHS board. VITEK 2 systems were used to determine the susceptibilities for the majority of isolates. Other methods (such as agar dilution and Etest®) may have been used for testing of some isolates/agents. Selective reporting may also have occurred, where laboratories have chosen only to test and/or report susceptibility results against certain agents for clinical reasons. Selective reporting potentially weakens comparisons of data between different

	laboratories and could also underestimate the occurrence of multidrug resistance. **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** CPO isolates are derived from a range of screening and clinical specimens including urine, respiratory and blood isolates. All potential CPOs isolated by Scottish diagnostic laboratories are referred the Scottish AMR Satellite Reference service and to the AMRHAI Reference Unit at PHE for confirmation. A study to review submission of CPO isolates is ongoing. CPE screening CRA uptake reported is based on one quarter, and represents only 12 NHS boards who participated in the pilot. **Prevention of Healthcare Associated Bloodborne Viruses:** Data for 2017 was returned from 15 boards, representing 93% of the applicable NHS workforce. 15 boards were able to supply detailed data on SigOccs, representing 93% of the applicable NHS workforce. Note, sharps incidents and occupational exposures are self-reported, thus open to bias. Sharps device data consists of products distributed throughout Scotland via the National Distribution Centre and is thought to represent the vast majority of products purchased. **Development of Guidance:** N/A **Norovirus Outbreaks:** NHS Boards only send in data when their ward has reopened so data is included in a retrospective way. **Hospital HCAI Outbreaks and Incidents:** HPS are aware that the healthcare infection incident assessment tool (HIIAT) is subjective and that 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. **Neonatal Units:** N/A **Infection Control in the Built Environment and Decontamination (ICBED):** N/A
Comparability	**Surgical Site Infection:** Details provided in quarterly publication hhttps://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Healthcare Associated Infections in Intensive Care Units:** Data comparable to equivalent data collected by other European countries where the ECDC protocol is utilised. ***Clostridioides difficile* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-

	epidemiological-commentary/ ***Staphylococcus aureus* Infection:** Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Gram-negative Bacteraemia:** Public Health England report on national data on antibiotic resistance https://www.gov.uk/government/publications/english-surveillance-programme-antimicrobial-utilisation-and-resistance-espaur-report **Surgical Site Infection, *Clostridioides difficile* infection, *Staphylococcus aureus* Infection and Gram-negative Bacteraemia:** The funnel plot analyses incorporate the full year's data; as a result, some NHS boards may be above the 95% confidence interval upper limit in the annual funnel plot but not in the quarterly funnel plots as the confidence limits are narrower. For CDI, SAB and ECB only, the annual funnel plot analyses also include Q1 data on healthcare associated infection and community associated infection. The publication of healthcare associated infection and community associated infection data was introduced in Q2 2017; therefore, there is no corresponding Q1 funnel plot. https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ ECDC report on Antimicrobial resistance surveillance in Europe https://ecdc.europa.eu/en/publications-data/antimicrobial-resistance-surveillance-europe-2016 *Escherichia coli* bacteraemia: Details provided in quarterly publication https://www.hps.scot.nhs.uk/data/healthcare-associated-infection-quarterly-epidemiological-commentary/ **Urinary Tract Infection:** Public Health England report on national data on antibiotic resistance https://www.gov.uk/government/publications/english-surveillance-programme-antimicrobial-utilisation-and-resistance-espaur-report. **Controlling Antimicrobial Resistance in Scotland (CARS):** N/A **Carbapenemase-Producing Organisms:** Public Health England report on Carbapenem resistance https://www.gov.uk/government/collections/carbapenem-resistance-guidance-data-and-analysis ECDC report on Carbapenem resistance https://ecdc.europa.eu/en/surveillance-atlas-infectious-diseases

	Prevention of Healthcare Associated Bloodborne Viruses: The data collected on sharps incidents and occupational exposures is comparable with that elsewhere in the UK (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/385300/EoN_2014_-_FINAL_CT_3_sig_occ.pdf) **Development of Guidance:** N/A **Norovirus Outbreaks:** PHE produce a national norovirus surveillance report, however, reporting is voluntary and not comparable to Scottish data collected through mandatory reporting https://www.gov.uk/government/statistics/norovirus-national-update **Hospital HCAI Outbreaks and Incidents:** N/A, reporting of all HCAI outbreaks is not mandatory elsewhere in the UK and comparable data are not published. **Neonatal Units:** N/A **Infection Control in the Built Environment and Decontamination (ICBED):** N/A
Accessibility	It is the policy of HPS to make its web sites and products accessible according to published guidelines.
Coherence and clarity	**Development of Guidance:** All NIPCM reviews and resources are produced using a defined process which ensures clarity and coherence. http://www.nipcm.scot.nhs.uk/resources/literature-reviews/development-process/
Value type and unit of measurement	Number of procedures and Surgical Site Infections and incidence per categories (per 100 procedures) for inpatients and post discharge surveillance. Incidence Rate: Number of HAI (CR-BSI/VAP) per 1,000 device days (Ventilator days/CVC days) or Number of HAI per 1,000 patient (bed) days. Healthcare associated cases and incidence rates (per 100,000 Total occupied bed days (TOBDs)) for *Clostridioides difficile* infection, *Escherichia coli* bacteraemia & *Staphylococcus aureus* bacteraemia. Community associated cases and incidence rates (per 100,000 population) for *Clostridioides difficile* infection, *Escherichia coli* bacteraemia & *Staphylococcus aureus* bacteraemia. Number of cases and incidence rates (per 100,000 population) for Gram-negative bacteraemia. AMR data includes percentage non-susceptible for antibiotics/organism combinations. Number of isolates, number of Carbapenemase-producers by organism and enzymes and incidence per 100,000 population.

	CPE CRA Uptake % = no.patients/records where CRA was applied/all patients/records in audit sample. Number and rate (per 100 WTE) of sharps related injuries per 100 WTE; number of significant occupation exposure. Volume (millions) sharps devices purchased. Total number of reported incidents is counted, often reported as a proportion of the total by infection type or organism. Number of patients affected and number of wards/bays closed.
Disclosure	The HPS protocol on **Statistical Disclosure Protocol** is followed.
Official Statistics designation	Not Assessed
UK Statistics Authority Assessment	Not Assessed
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Date form completed	01 May 2019

Appendix 3 – Early Access Details

Pre-Release Access

Under terms of the "Pre-Release Access to Official Statistics (Scotland) Order 2008", HPS 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 4 – Health Protection Scotland and Official Statistics

About HPS

HPS is a division of NHS National Services Scotland which works at the very heart of the health service across Scotland, delivering services critical to frontline patient care and supporting the efficient and effective operation of NHSScotland.

HPS was established by the Scottish Government in 2005 to strengthen and coordinate health protection in Scotland. It is organised into three specialist groups with expertise provided by a multi-disciplinary workforce which includes doctors, nurses, scientists and information staff, all of whom are supported by core business and IM&T teams. The specialist groups are:

- Healthcare Associated Infections and Infection Control;
- Blood Borne Viruses and Sexually Transmitted Infections, Immunisation, and Respiratory and Vaccine Preventable Diseases;
- Gastrointestinal and Zoonoses Travel, and Environmental Public Health.

Official Statistics

Our official statistics publications are produced to a high professional standard and comply with the Code of Practice for Official Statistics. The Code of Practice is produced and monitored by the UK Statistics Authority which is independent of Government. Under the Code of Practice, the format, content and timing of statistics publications are the responsibility of professional staff working within NHS National Services Scotland.

Our statistical publications are currently classified as one of the following:

- National Statistics (ie assessed by the UK Statistics Authority as complying with the Code of Practice)
- National Statistics (ie legacy, still to be assessed by the UK Statistics Authority)
- Official Statistics (ie still to be assessed by the UK Statistics Authority)
- other (not Official Statistics)

Further information on NHS National Services Scotland's statistics, including compliance with the Code of Practice for Official Statistics, and on the UK Statistics Authority, is available on the ISD website.