# Table of Contents

Acronyms and Abbreviations iv  
Foreword 1  
Surgical Site Infection 3  
Healthcare Associated Infections in Intensive Care Units 8  
*Clostridium difficile* Infection 10  
*Staphylococcus aureus* Infection 14  
*Escherichia coli* Bacteraemia 20  
Urinary Tract Infections 22  
Carbapenemase-producing Bacteria 25  
Norovirus Outbreaks 28  
Hospital HAI Outbreaks and Provision of Support to Boards 30  
Hand Hygiene 32  
Development of Infection Prevention and Control Guidance 33  
Decontamination 35  
References 37
List of Figures

Figure 1: Incidence of SSI following caesarean section procedures in Scotland (inpatient and PDS to day 10), 2009 to 2013 4

Figure 2: Proportion of SSI following caesarean section procedures (inpatient and PDS to day 10) in Scotland by SSI type, 2013 4

Figure 3: Incidence of SSI following hip arthroplasty procedures in Scotland (inpatient and readmission to day 30), 2009 to 2013 5

Figure 4: Proportion of SSI following hip arthroplasty procedures (inpatient and readmission to day 30) in Scotland by SSI type, 2013 5

Figure 5: Annual CDI incidence rates in patients aged ≥65 and 15-64 years in Scotland per 100 000 bed days (2007 to 2013) 10

Figure 6: Incidence rates of S. aureus, MRSA and MSSA bacteraemias in Scotland per 100 000 total AOBDs (four rolling quarters with 95% confidence intervals), April 2005 to December 2013 15

Figure 7: Mupirocin use in primary and secondary care in Scotland, 2009 to 2012 16

Figure 8: Percentage resistance to mupirocin (high level and low level) in MRSA bacteraemia isolates in Scotland, 2009 to 2012 17

Figure 9: Carbapenemase producers reported in Scotland by AMRHAI (PHE) 26

Figure 10: Number of wards closed on a Monday morning due to presumed or confirmed norovirus in Scotland by season, 2008 to 2014 29

Figure 11: Types of outbreaks (number of events) reported to HPS during 2013 31
List of Tables

Table 1: Incidence rates in Scottish ICUs by HAI type, 2012

Table 2: Scottish PCR ribotypes isolated from mild, moderate or severe CDI cases (snapshot), or from severe cases and/or outbreaks between 2012 and 2013

Table 3: Resistance (%) in *E. coli* urinary isolates from January 2012 - September 2012 and January 2013 - September 2013
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMR</td>
<td>Antimicrobial Resistance</td>
</tr>
<tr>
<td>AMT</td>
<td>Antimicrobial Management Team</td>
</tr>
<tr>
<td>AOBDs</td>
<td>Acute Occupied Bed Days</td>
</tr>
<tr>
<td>BSI</td>
<td>Bloodstream Infection</td>
</tr>
<tr>
<td>CARS</td>
<td>Controlling Antimicrobial Resistance in Scotland</td>
</tr>
<tr>
<td>CEL</td>
<td>Chief Executive Letter</td>
</tr>
<tr>
<td>CDI</td>
<td><em>Clostridium difficile</em> Infection</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Intervals</td>
</tr>
<tr>
<td>CRA</td>
<td>Clinical Risk Assessment</td>
</tr>
<tr>
<td>CNO</td>
<td>Chief Nursing Officer</td>
</tr>
<tr>
<td>CPE</td>
<td>Carbapenemase-producing Enterobacteriaceae</td>
</tr>
<tr>
<td>CRI</td>
<td>Catheter-Related Infection</td>
</tr>
<tr>
<td>CR-BSI</td>
<td>CVC-Related Bloodstream Infection</td>
</tr>
<tr>
<td>CVC</td>
<td>Central Vascular Catheter</td>
</tr>
<tr>
<td>EARS-Net</td>
<td>European Antimicrobial Resistance Surveillance Network</td>
</tr>
<tr>
<td>ECDC</td>
<td>European Centre for Disease Prevention and Control</td>
</tr>
<tr>
<td>ECOSS</td>
<td>Electronic Communication of Surveillance in Scotland</td>
</tr>
<tr>
<td>EMRSA</td>
<td>Epidemic Meticillin Resistant <em>Staphylococcus aureus</em></td>
</tr>
<tr>
<td>ESBL</td>
<td>Extended Spectrum Beta-lactamase</td>
</tr>
<tr>
<td>EuSCAPE</td>
<td>European Survey on Carbapenemase-producing Enterobacteriaceae</td>
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<td>HAI</td>
<td>Healthcare Associated Infection</td>
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<tr>
<td>HAITF</td>
<td>HAI Task Force</td>
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<td>Healthcare Worker</td>
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<td>HDU</td>
<td>High Dependency Unit</td>
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<td>HDL</td>
<td>Health Department Letter</td>
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<tr>
<td>HEI</td>
<td>Healthcare Environment Inspectorate</td>
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<tr>
<td>HELICS</td>
<td>Hospitals in Europe Link for Infection Control through Surveillance</td>
</tr>
<tr>
<td>HIAT</td>
<td>Hospital Infection Incident Assessment Tool</td>
</tr>
<tr>
<td>HPS</td>
<td>Health Protection Scotland</td>
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<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
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<tr>
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</tr>
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<td>Infection Prevention and Control Team</td>
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<tr>
<td>ISD</td>
<td>Information Services Division</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
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</table>
MDR  Multidrug Resistant
MRSA  Meticillin Resistant *Staphylococcus aureus*
MSSA  Meticillin Sensitive *Staphylococcus aureus*
nCoV  Novel Coronavirus
NDM  New Delhi Metallo-Beta-lactamase
NHS  National Health Service
NNU  Neonatal Units
NWTC  National Waiting Times Centre
OPCS  Office of Population Censuses and Surveys
PCR  Polymerase Chain Reaction
PDS  Post Discharge Surveillance
PHE  Public Health England
PPS  Point Prevalence Survey
PVC  Peripheral Vascular Catheter
PVL  Panton-Valentine Leukocidin
QIT  Quality Improvement Tools
RPE  Respiratory Protective Equipment
SAPG  Scottish Antimicrobial Prescribing Group
ScotMARAP  Scottish Management of Antimicrobial Resistance Action Plan
SEHD  Scottish Executive Health Department
SGHSCD  Scottish Government Health and Social Care Directorate
SICPs  Standard Infection Control Precautions
SICSAG  Scottish Intensive Care Society Audit Group
SIGN  Scottish Intercollegiate Guideline Network
SIRN  Scottish Infection Research Network
SMRSARL  Scottish MRSA Reference Laboratory
SMVN  Scottish Microbiology and Virology Network
SPSP  Scottish Patient Safety Programme
SSHAIP  Scottish Surveillance of HAi Programme
SSI  Surgical Site Infection
SSSCDRL  Scottish *Salmonella, Shigella and Clostridium difficile* Reference Laboratory
TBP  Transmission Based Precautions
UTI  Urinary Tract Infection
WHO  World Health Organisation
WSG  Water Safety Group
WSP  Water Safety Plans
VAP  Ventilator Associated Pneumonia
Foreword

Healthcare associated infections (HAI) continue to represent a significant threat to patient safety in NHSScotland and to safe care, wherever that is delivered. The inpatient cost of HAI originating in NHS acute care hospitals was estimated during a study carried out in 2013 and reported to be £137 million with an additional 318 172 bed days required in order to care for patients with HAI, the equivalent of a large teaching hospital occupied for a year. The burden outside of acute hospitals is currently unknown, but with the integration of health and social care, can be anticipated to be a public health concern based on initial work by Health Protection Scotland (HPS) in care homes and other settings.

Over the last decade, significant reductions in the incidence of HAI, monitored by the mandatory surveillance systems, have been reported. However this report indicates that, for the second year in a row, these rates of infection continue to plateau. Last year we reported a plateau for the first time in key HAI types. This year’s data present similar findings wherein the incidence of surgical site infection following hip arthroplasty and caesarean section surgery, S. aureus infection bacteraemia had not changed significantly in 2013 compared with 2012. Reductions in C. difficile infection in the over 65 years age group continue, but not in under 65 years.

Collaborative work with the Scottish Intensive Care Society Audit Group (SICSAG) has resulted in continuing success in the reduction of HAI occurring in some of the most vulnerable hospital patients in the Intensive Care Unit (ICU). The reported rates of bloodstream infection and ventilator associated pneumonia have decreased year on year since 2010. A project to describe the organisms responsible for HAI in ICU patients will be undertaken in 2014 further informing the agenda to reduce HAI.

HPS activities over the last year have focused on improving the understanding of the current epidemiology of key HAI types with: enhanced surveillance, record linkage, and collaborations with the National Reference Laboratories. The findings from these studies will come to fruition in the coming year enabling HPS to support the NHS and beyond in designing new interventions to reduce risk and to ensure that interventions are targeted to populations most at risk, wherever in healthcare that may be.

HPS continued to provide outbreak and incident support to boards via the Chief Nursing Officer’s national framework algorithm. In total, 49 outbreaks and incidents were reported to HPS. The intelligence obtained in the support of these outbreaks and incidents is used to develop a knowledge base that can be used to better prevent, prepare for and control outbreaks in the future in an intelligent and evidence based way.

Evidence based infection prevention and control practice is essential in ensuring safe care. Building on the publication of Chapter One of the National Infection and Control Manual, Standard Infection Control Precautions (SICPs), Chapter Two of the manual was launched in April 2014. The Transmission Based Precautions (TBPs) are intended for frontline staff in the management of infections that are suspected or known to be due to an infectious agent or disease. The National Manual is a practice guide to be used by all staff and provides the best approach to minimising the risk of all infection and cross transmission.
A programme of work aimed at standardising decontamination practices and gathering intelligence to inform practice will continue in 2014. Other guidance published during 2013 focused on specific HAI types and risks and included guidance on non-prescribing measures for the prevention of cross-transmission of carbapenemase-producing Enterobacteriaceae (CPE).

HPS published our annual Antimicrobial Use and Resistance report in January 2014 and one of the emerging concerns is CPE. Whilst reported carbapenemase-producing bacteria did not increase during 2013, the current state of epidemic spread in Scotland moved from sporadic spread to single hospital outbreaks. This was a result of two events of transmission in 2013. The interim HPS CPE guidance includes recommendations for screening patients at high risk of CPE colonisation enabling them to be managed appropriately. This management is intended not only to prevent cross-transmission but also to enable early identification of the most effective treatment should an infection occur. Work will be undertaken by HPS in 2014/15 to assist the boards in implementation of screening, including further development of the evidence base with regards to epidemiology, testing, interventions to contain the spread and patient acceptability of screening.

The continuing spread of resistant organisms, such as CPE, within Scotland and across many other countries, will focus much attention on the containment of antimicrobial resistance (AMR) in the coming year. HPS will be integral in developing and coordinating a containment programme to protect health in Scotland. This will be important as the World Health Organisation (WHO) indicated in their recent global report on surveillance of AMR, that a post-antibiotic era is a very real possibility for the 21st century.

In September 2013 the Department of Health and Department for Environment, Food and Rural Affairs published a UK-wide five year antimicrobial resistance strategy (agreed between the governments of the four UK nations and involving human and animal health agencies). This strategy is aimed at slowing the development and spread of antimicrobial resistance and will be co-ordinated across the UK. In Scotland, the Scottish Management of Antimicrobial Resistance Action Plan (ScotMARAP) has been refreshed and an overarching Controlling Antimicrobial Resistance in Scotland (CARS) group has been established to ensure that all areas of the strategy are implemented. Prevention of infection in healthcare is essential to reduce cross-transmission of resistant organisms and reduce the need for antibiotics.

The continuing plateau in the incidence of key HAIs, and the emerging threat from AMR, indicates the need for changes in strategy to ensure we have no harm from preventable infection in Scotland. HPS will continue to work with local infection prevention and control teams to ensure the intelligence gathered during 2013 will be translated into clinical practice and that interventions are informed by the evidence base. Strategies to contain AMR will become a real focus for work in the coming year and an integrated approach between this and the prevention of HAI in all care settings will be essential to ensure the safety of patients and the public and our continued ability to treat common infections.

Professor Jacqui Reilly
Lead Consultant HAI, AMR, IPC and Decontamination
Health Protection Scotland
Surgical Site Infection

Surgical site infection (SSI) is one of the most common types of healthcare associated infection (HAI), estimated to account for 18.6% of inpatient HAI within NHSScotland.\(^1\) SSI cause excess morbidity and mortality and are estimated on average to double the cost of treatment, mainly due to the resultant increase in length of stay.\(^2\) SSI can have serious consequences for patients affected as they can result in increased pain, social disruption and in some cases require additional surgical intervention.\(^3\)

Epidemiological Data

The Scottish Surveillance of HAI Programme (SSHAIP) within Health Protection Scotland (HPS) coordinates the SSI surveillance programme that is mandatory across all NHS boards in Scotland. All NHS boards are currently required to undertake surveillance for caesarean section and hip arthroplasty procedures as per the mandatory requirements of HDL 2006 (38) and CEL (11) 2009.\(^4,5\) SSI surveillance is conducted according to the HPS SSI surveillance protocol.\(^6\)

Caesarean Section

A total of 283 cases of SSI following caesarean section procedures (n=16,254) were reported during 2013. Forty-one of these SSI were diagnosed during the inpatient stay. The majority of SSI (n=242, 85.5%) were diagnosed following discharge from hospital using post-discharge surveillance (PDS) methods. The incidence of inpatient SSI was 0.25% (95% CI: 0.19 to 0.34) and the overall incidence for inpatient and PDS to day 10 SSI was 1.74% (95% CI: 1.55 to 1.95). The incidence of SSI decreased significantly between 2009 and 2013 (Figure 1) for inpatient SSI (year on year decrease of 11.0%, p=0.01) and inpatient and PDS to day 10 SSI (year on year decrease of 12.5%, p<0.001). The incidence of inpatient and PDS to day 10 SSI did not change between 2012 and 2013 (p=0.15).

The incidence of SSI following hip arthroplasty and caesarean section surgery did not change significantly between 2012 and 2013. Continued surveillance and implementation of improvement tools is necessary to reduce these clinically significant infections further.
The majority of SSI occurring following caesarean section surgery were superficial though 39% of SSI diagnosed during the inpatient stay were deep or organ space (n=16) (Figure 2).

Figure 2: Proportion of SSI following caesarean section procedures (inpatient and PDS to day 10) in Scotland by SSI type, 2013

Hip Arthroplasty
A total of 62 cases of SSI following hip arthroplasty procedures (n=8 191) were reported in 2013. Thirty two percent of these SSI were reported during the inpatient stay (n=20) and the remainder were identified if the patient was readmitted to hospital in the 30 days following the procedure (n=42). The inpatient incidence of SSI was 0.24% (95% CI: 0.16 to 0.38) and the overall incidence of SSI was 0.76% (95% CI: 0.59 to 0.97). The overall incidence of SSI had remained stable between 2010 and 2013 (p=0.45) with no significant change in 2013 compared with 2012 (p=0.80) (Figure 3).
Figure 3: Incidence of SSI following hip arthroplasty procedures in Scotland (inpatient and readmission to day 30), 2009 to 2013

Note: The decrease in incidence observed between 2009 and 2010 is partly due to the adjustment in 2010 of the Office of Population Censuses and Surveys (OPCS) classification of interventions and procedures codes.

The proportion of SSI that were deep and organ space identified post discharge was higher for hip arthroplasty than for caesarean section though this is likely due to the post discharge method of case ascertainment; only SSI where the patient is readmitted to hospital are captured post discharge thus the proportion of more severe SSI will be higher (Figure 4). The number of SSI following hip arthroplasty is small therefore these data should be interpreted with due caution.

Figure 4: Proportion of SSI following hip arthroplasty procedures (inpatient and readmission to day 30) in Scotland by SSI type, 2013
Quality Improvement and Interventions to Reduce SSI

HPS monitor the SSI rate within each NHS board on a quarterly basis and feedback is provided to Infection Prevention and Control Team (IPCTs). Whilst national surveillance systems do not replace the need for local surveillance, these data may assist IPCTs with analysis of local results. This may assist in the identification of potential issues, identify areas for investigation and process improvement, and facilitate benchmarking with the rest of Scotland.

Quarterly exception reports are issued to boards where the incidence of SSI is higher than expected, based on the national data, and HPS ask the board to provide an action plan outlining measures to reduce the incidence of SSI. In 2013, there were two exception reports issued to NHS boards. Both exception reports during 2013 were for caesarean section procedures with no exception reports issued for hip arthroplasty. These exceptions were investigated by local IPCTs with support provided by HPS.

In 2013, HPS facilitated meetings for NHS boards to explore collaborative SSI reduction working practices. The aim was to use SSI data, linked with improvement methodologies, to reduce SSI and share lessons learned. These meetings were highly evaluated and will continue in 2014.

SSI light surveillance was introduced for mandatory and non mandatory procedures from July 2011. This optional change reduced the resources required to deliver mandatory SSI surveillance during the data collection period of the 2011 HAI point prevalence survey (PPS). This was intended to ensure successful delivery of the PPS and continued participation in the mandatory SSI surveillance programme. This was subsequently extended after the PPS was completed. However NHS boards had the option to continue with full surveillance for any procedures of their choice. In order to ensure local mechanisms for conducting the light surveillance methodology are consistent, a case note validation exercise across NHSScotland was conducted by HPS during 2013/2014. SSI light surveillance data for 2012 were validated for all hospitals conducting light surveillance for caesarean section procedures. Local validation reports were issued to each board and a national report will be published later this year.

The proportion of caesarean section SSI detected by PDS to day 10 accounted for 85.5% of all the SSI detected following caesarean section during 2013. As part of ongoing work to assess and improve PDS for caesarean section procedures a number of initiatives were introduced within the last year by HPS. In October 2013, NHS boards carrying out SSI light surveillance for caesarean section were asked to record the number of completed PDS records to day 10. This allows HPS to determine whether patients were lost to follow up and if the percentage of patients being followed up post discharge is comparable between boards thus ensuring maximum case ascertainment.

A review of the methods used to collect caesarean section PDS data was also conducted by HPS in 2014 to ensure consistency and comparability between NHS boards. A telephone questionnaire on PDS methods was conducted by HPS with a surveillance
coordinator from each of the boards. Questions collected details of the methods used to capture PDS data (paper, electronic or telephone), definition training and level of midwife involvement. Results from this study, which will be published later this year, will help inform and improve practice by ensuring that current PDS methods adequately capture cases of SSI and that national data presented in the public domain are accurate and suitable for benchmarking between NHS boards.

In December 2013, HPS organised a SSI surveillance training session for both new and existing SSI surveillance staff. The purpose of this training was to ensure that the data collected by surveillance staff were robust and consistent across all NHS boards, providing confidence for clinical staff implementing improvement measures based on these data. Feedback from the training was extremely positive. In 2014, HPS in collaboration with NHS Education for Scotland (NES) will develop an online surveillance training module which will be based on the content of the training session.

The surveillance programme will be further developed in 2014 to include the collection of SSI organism and antimicrobial resistance (AMR) data. Intelligence regarding the organisms causing SSI and resistance profiles will further develop the understanding of the epidemiology in Scotland. This was introduced as a pilot for colorectal procedures in January 2014 to test the collection process and will be rolled out to all procedures later this year. Collection of these data will align with other national and international surveillance systems and facilitate benchmarking.

The SSI quality improvement tool is available on the HPS website http://www.documents.hps.scot.nhs.uk/hai/infection-control/evidence-for-care-bundles/literature-reviews/ssi-review.pdf. This literature review was published in 2012, following a review of previously issued care bundles and published literature. In October 2013 the bundle for preventing surgical site infections was published on the HPS website http://www.documents.hps.scot.nhs.uk/hai/infection-control/bundles/ssi/ssi-bundle-v1.pdf. The main audience for these documents include clinical staff responsible for performing surgical procedures, IPCTs working in NHSScotland and other groups with Infection Prevention and Control (IPC) remits. Implementation of these quality improvement tools should continue to contribute to reducing these clinically significant infections.
Healthcare Associated Infections in Intensive Care Units

Patients being treated in intensive care units (ICUs) are at an increased risk of developing infection due to invasive procedures, frequent underlying health problems and immunosuppression resulting from their critical illness and co-morbidities. The 2011 PPS reported the prevalence of HAI in Scottish ICUs was 25.3% and in combined intensive care and high dependency wards the prevalence was 11.9%. These were the highest prevalence estimates in acute care, and significantly higher than in general wards (4.8%).

Epidemiological Data

A total of 22 adult ICUs in Scotland collected data for a voluntary surveillance programme. All data were collected in accordance with the Hospital in Europe Link for Infection Control through Surveillance (HELICS) methodology. HAI data relating to bloodstream infection (BSI), central vascular catheter (CVC) related infection (CRI), CVC-related bloodstream infection (CR-BSI) and pneumonia were collected. Data were collected using the WardWatcher system which is an information technology (IT) system present in all ICUs.

In total, 217 HAI were reported from 197 patients in 2012. Data from 2013 are not yet available for publication in this report. These data will be published separately in August 2014. The incidence of HAI was 3.4% (95% CI: 2.9 to 3.9). This was a statistically significant reduction from 4.7% (95% CI: 4.2 to 5.2) reported in 2011 (p<0.001).

Table 1 describes the incidence rates for Ventilator Associated Pneumonia (VAP), non-VAP, BSI, CR-BSI and CRI.

The incidence of HAI in Scottish ICUs decreased between 2011 and 2012. Continued collaboration with the Scottish Intensive Care Society Audit Group ensures that HAI continues to be a priority for patient safety in ICU.
Table 1: Incidence rates in Scottish ICUs by HAI type, 2012*

<table>
<thead>
<tr>
<th>HAI Type</th>
<th>Incidence Rate</th>
<th>95% CI (Lower to Upper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilator Associated Pneumonia (VAP)</td>
<td>3.0 per 1000 invasive respiratory device days</td>
<td>2.4 to 3.7</td>
</tr>
<tr>
<td>Pneumonia (VAP and non-VAP)</td>
<td>2.4 per 1000 patient days</td>
<td>2.0 to 2.9</td>
</tr>
<tr>
<td>Bloodstream infection (All)</td>
<td>2.0 per 1000 patient days</td>
<td>1.6 to 2.4</td>
</tr>
<tr>
<td>Bloodstream infection (excluding central vascular catheter related bloodstream infection)</td>
<td>1.6 per 1000 patient days</td>
<td>1.3 to 2.0</td>
</tr>
<tr>
<td>Catheter related bloodstream infection</td>
<td>0.5 per 1000 CVC days</td>
<td>0.3 to 0.9</td>
</tr>
<tr>
<td>Central vascular catheter related infection (Local and general [not bloodstream infection])</td>
<td>0.3 per 1000 CVC days</td>
<td>0.1 to 0.5</td>
</tr>
</tbody>
</table>

Note: *2013 data not available at time of analysis

The HAI data from 2010 to 2012 demonstrate that there have been significant decreasing year on year trends in the rates for Ventilator Associated Pneumonia (VAP) (21.3%, p<0.01) and all BSI (25.2%, p<0.01) since 2010, with the reduction in VAP occurring between 2011 and 2012. There was no change to the CR-BSI rates (p=0.19).

Quality Improvement and Interventions to Reduce HAI in ICUs

HPS and the Scottish Intensive Care Society Audit Group (SICSAG) continue to work collaboratively to reduce HAI in the critical care setting. In addition to the collaborative work between SICSAG and the surveillance programme, SICSAG continue to support the surveillance of HAI within the context of the Quality Indicators for Critical Care in Scotland. ICUs are required to have an HAI surveillance system and to report on a monthly basis to staff and to Scottish Patient Safety Programme (SPSP).

Future work for the surveillance programme will include a data linkage project to investigate the possibility of expanding the surveillance dataset to include causative organism and antimicrobial resistance (AMR) data.
Clostridium difficile infection (CDI) remains an important cause of morbidity and mortality globally. 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.12

Epidemiological Data

In Scotland, the trend in annual incidence rates for CDI has been one of continuous decline between 2007 and 2013. However, the rate of decline in incidence rates was lower between 2011 and 2013 compared to the decline observed between 2008 and 2010 (Figure 5).

Figure 5: Annual CDI incidence rates in patients aged ≥65 and 15-64 years* in Scotland per 100 000 bed days (2007 to 2013)

Incidence rates decreased significantly from 2012 to 2013 only in patients aged 65 years and above. Further work is being undertaken to identify additional interventions to reduce CDI rates in both hospitals and community settings.

The annual incidence rate for 2013 in patients aged ≥65 years was 34.5 per 100 000 total bed days. This is a significant decrease of 8.7% compared to the 2012 rate of 37.8 per 100 000 total bed days (p=0.02). Between 2007 and 2013, there has been an overall 77% decrease in the annual incidence rate, with a significant year on year reduction of 22.7% (p<0.001).

In patients aged 15-64 years, the annual incidence rate for 2013 was 35.0 per 100 000 acute occupied bed days (AOBDs) which is unchanged from 2012. Between 2009
and 2013, there has been an overall 54% decrease in the annual incidence rate, with a year on year reduction of 17.0% (p<0.001).

**Molecular Epidemiological Data**

Polymerase chain reaction (PCR) ribotyping of *C. difficile* isolates has been carried out by the Scottish Salmonella, Shigella and Clostridium difficile Reference Laboratory (SSSCDRL) since November 2007. Initially, isolates were typed from severe cases and/or outbreaks. This was followed by the introduction of an additional snapshot programme in 2009 in which a sample of isolates were typed regardless of the severity of disease.

In 2013, the two most common ribotypes isolated in Scotland were 002 (12%) and 078 (14%) followed by 005 and 015 (Table 2). Compared to 2012, the prevalence of 078 has declined in both the snapshot and severe cases/outbreak surveillance, though this type remains the predominant one in Scotland. Ribotype 078 has been identified as an emerging type across Europe and has been associated with more severe disease (as a result of increased toxin production). Previously epidemic ribotypes 001, 027 and 106 remain at low levels in Scotland. These three types accounted for more than 50% of all types isolated in 2009 but have decreased to less than 10% in 2013, while increasing diversity of types has developed. The other major ribotypes found in Scotland include 023, 014 and 020. Those designated ‘others’ include 110 different ribotypes which have a frequency <3%. Of particular interest is the temporal association between the decline in CDI incidence rates and disappearance of epidemic strains in the period 2009-2013. The increasing diversity of *C. difficile* types and declining rates suggest a reduction in cross-transmission between patients in healthcare settings. However, further molecular characterisation of the Scottish *C. difficile* strains and analysis of patient data is required to confirm this.
Table 2: Scottish PCR ribotypes isolated from mild, moderate or severe CDI cases (snapshot), or from severe cases and/or outbreaks between 2012 and 2013

<table>
<thead>
<tr>
<th>Type</th>
<th>Isolates</th>
<th>%</th>
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<tr>
<td>106</td>
<td>14</td>
<td>3.2%</td>
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Antimicrobial Use and Resistance

To date, all isolates of *C. difficile* have been reported as susceptible to metronidazole and vancomycin, the two antibiotics used to treat CDI. However, resistance to other commonly used antibiotics are common among the Scottish *C. difficile* isolates.

Good antimicrobial stewardship is one of the key factors in controlling CDI as the use of any antimicrobial agent is a risk factor for the development of disease due to disturbance of the natural gut flora. Resistance to certain antibiotics has also been suggested to give *C. difficile* an advantage to spread in healthcare environments. In order to further reduce the risk of CDI through prudent use of antimicrobials, HPS continues to work with the clinical community via the Scottish Antimicrobial Prescribing Group (SAPG).

A key priority for SAPG, since its establishment in 2008, has been to drive a reduction in the use of broad-spectrum antimicrobials associated with a high risk of CDI (including clindamycin, co-amoxiclav, cephalosporins and ciprofloxacin, also referred to as the ‘4Cs’).

Recently published primary care data shows there has been continued progress towards reduction in the use of the 4Cs, potentially reducing the risk of developing CDI.\(^\text{13}\) However, there has been a 3% increase in the use of all antibiotics in primary care. In secondary care, following several years of reduction in the use of 4Cs, increases in the 4Cs and in total use of all antibiotics were reported for 2012.\(^\text{13}\) Further investigation is required to assess whether there are any links between the change in use of 4Cs in secondary care and the levelling trends in CDI incidence rates. There may be the potential to reduce the burden of CDI further as a result of decreasing the use of high-risk antibiotics in secondary care.
CDI in the Community
Recent reports from the UK, Europe and North America have noted that a significant proportion of CDI cases have been found to be community associated (CA-CDI), or have onset in the community which requires hospitalisation. A study from Oxfordshire has reported that no more than 25% of CDI cases in hospital could be linked to other known inpatient cases, which suggest a substantial unknown reservoir of infection, one of which may be related to community exposures. Additional exposures include associations with asymptomatic carriers, food and water, and contact with animals (domestic and/or agricultural), which raises the possibility of the requirement for different interventions to reduce CA-CDI.

HPS has been carrying out a sentinel community surveillance project in collaboration with six NHS boards across Scotland since April 2013 to help describe the incidence and epidemiology of CDI in the community and its relationship with the acute sector. The information gathered, in conjunction with typing and sequencing data may help to identify possible interventions to further reduce CDI incidence rates in Scotland.

Quality Improvement and Interventions to Reduce CDI
Important factors in reducing the rates of CDI in Scotland include extensive efforts by the NHS boards to improve infection prevention and control measures, and by implementing targeted interventions. HPS has supported these measures through development of national guidance on prevention and control of CDI (a revised version was published in January 2014 on the HPS website), and introduction of quality improvement tools, as well as additional support provided during outbreak/incident investigations. Moreover, the national co-ordination of all stakeholders via SAPG has supported the implementation of antimicrobial stewardship in all NHS boards since 2008 in order to reduce the risk of CDI.

Impact of CDI on Patient Outcome
A pilot study examining the feasibility of linking outcome data (including morbidity and mortality) with CDI case data has been completed for all cases aged ≥65 years reported by HPS between 2007 and 2009. Data linkage is a powerful tool for enhancing information available from routinely collected data and can be used as an effective method for describing the demographics, estimating case-fatality rates and establishing risk factors for death in patients with CDI. HPS will continue to link CDI case data, molecular data and outcome data to develop a more detailed picture of the epidemiology and impact of CDI on patient health, and to inform interventions to further reduce the burden of CDI in Scotland.
Staphylococcus aureus Infection

Staphylococcus aureus (S. aureus) is a Gram positive bacterium which colonises the nasal cavity of about a quarter of the healthy population. This colonisation is usually harmless. However, healthcare interventions may allow the bacterium to gain entry into body sites which are normally sterile, leading to infections. When this bacterium infects the bloodstream, this is known as a bacteraemia. S. aureus bacteraemias are serious, often life-threatening infections.

Colonisation with meticillin resistant S. aureus (MRSA) is associated with a fifteen times higher risk of MRSA infection. The current national MRSA screening policy was introduced in March 2012. This risk-based approach to screening requires a clinical risk assessment (CRA) to be applied to every patient admitted to an acute care hospital in Scotland. The CRA-based approach to screening is considered as effective as universal nasal screening when compliance with application of the CRA is a minimum of 90%. The aim of screening is to identify patients who are colonised with MRSA so they can then be managed appropriately to reduce the risk of self-infection and of transmitting this organism to other patients.

The incidence of S. aureus bacteraemia in Scotland did not change significantly during 2013. Further investigations into the differences between MRSA and MSSA bacteraemias are necessary to support continued reductions in S. aureus infections in Scotland.

Epidemiological Data

S. aureus Bacteraemia Data

Scotland has had a mandatory MRSA bacteraemia surveillance programme since 2001, publishing quarterly reports of the numbers and rates of MRSA bacteraemias. In 2006, this programme was extended to include meticillin sensitive S. aureus (MSSA) bacteraemias. The Scottish S. aureus surveillance programme differs from similar programmes in many other countries by including both MRSA and MSSA bacteraemias and also by reporting on all S. aureus bacteraemias, rather than only those presumed to be associated with delivery of healthcare. Full details of the surveillance methods may be found in the protocol.
There has been a significant reduction in the overall incidence of S. aureus bacteraemias in Scotland since 2006 (p<0.001) (Figure 6). A total of 1 584 cases of S. aureus bacteraemia were reported in Scotland during 2013; 154 (9.7%) were meticillin resistant and the remaining 1 430 (90.3%) were meticillin sensitive. In 2013, the total number of S. aureus bacteraemias in Scotland increased by 5.0% compared with the number reported in 2012 (n=1 509).

The annual incidence of S. aureus bacteraemia for Scotland in 2013 was 31.1 per 100 000 AOBDs. This was not significantly different compared to the previous year (p=0.25). The annual incidences of MRSA and MSSA bacteraemia in 2013 were 3.0 per 100 000 AOBDs and 28.0 per 100 000 AOBDs, respectively. Neither of these incidence rates had changed significantly between 2012 and 2013 (p>0.05).

Figure 6 describes the incidence rates of MRSA, MSSA and S. aureus bacteraemia. The rates of decline in the incidence rates of MRSA and MSSA have differed over time. Whilst there have been large reductions in the rates of MRSA bacteraemias since 2006, the rates of MSSA bacteraemias have remained largely unchanged.

**Figure 6**: Incidence rates of S. aureus, MRSA and MSSA bacteraemias in Scotland per 100 000 total AOBDs (four rolling quarters with 95% confidence intervals), April 2005 to December 2013
Mupirocin Use and Resistance in MRSA

The *S. aureus* programme also monitors mupirocin use and resistance following implementation of the MRSA screening policy in Scotland. As data for 2013 are currently incomplete trends between 2009 and 2012 are given. Mupirocin use in both primary and secondary care has generally decreased between 2009 and 2012.

There was however increase of 2% related to the use of mupirocin in primary care between 2011 and 2012. A reduction of 11.2% was seen in secondary care for the same time period (Figure 7).

**Figure 7:** Mupirocin use in primary and secondary care in Scotland, 2009 to 2012

High level and low level resistance to mupirocin are monitored by HPS, as both are likely to result in treatment failure. The resistance results presented here are only for bacteraemia-related isolates, as submission of *S. aureus* bacteraemia isolates to the Scottish MRSA Reference Laboratory (SMRSARL) is mandatory. During 2012, high level mupirocin resistance was observed in 2.9% (n=5) of these isolates, with low level resistance in 1.2% (n=2). No significant changes in resistance proportions (including high and low level resistance) have been observed since 2009 (Figure 8).
Initial concerns that changes in patterns of mupirocin use through changing national MRSA screening practices might lead to increasing resistance have not yet been realised. Mupirocin resistance will remain under surveillance in order to identify and communicate to the clinical community any early signals of changes in susceptibility to mupirocin.

PVL-positive *S. aureus*

Panton Valentine Leukocidin (PVL) is a toxin produced by some strains of *S. aureus* which has the potential to confer a degree of increased virulence. It is a common cause of skin and soft tissue infections, however, it can occasionally be implicated in more serious conditions such as necrotising pneumonia. The SMRSARL has tested all *S. aureus* isolates for the presence of the PVL gene since mid-2012.

HPS routinely monitors the numbers of PVL positive *S. aureus* isolates. This is performed on a monthly basis however monitoring is increased during the influenza season (particularly in lower respiratory tract specimens). In December 2012 to May 2013, Public Health England (PHE) reported an increase in PVL-positive *S. aureus* pneumonia and advised that healthcare staff should remain vigilant for these cases and consider influenza co-infection. However, there have been no recorded cases of PVL-positive *S. aureus*/influenza co-infection in Scotland to date.

In 2013, a total of 266 PVL-positive *S. aureus* were reported to HPS, the majority of which were MRSA (n=216, 81.2%). More isolates were reported for males (n=149; 56.0%) than females (n=116; 43.6%). (The gender was unknown for one isolate.) The age distribution for males ranged from under 1 year to 90 years (median age 36.0 years) and from under 1 year to 98 years in females (median age 40.5 years).
The isolates were distributed across numerous specimen sites. Ninety one of these isolates were from wound samples, 91 from skin swabs, 20 were from bloodstream infections and ten from lower respiratory tract specimens. The remaining isolates were from the eyes, upper respiratory tract and urine.

**Quality Improvement and Interventions to Reduce S. aureus Bacteraemias**

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 S. aureus bacteraemias within that NHS board. As part of the ongoing HPS support for several NHS boards, in-depth analyses of local NHS boards’ data have been carried out to identify potential local areas for service improvement.

HPS, in conjunction with the Infection Control Network, completed a pilot study of national enhanced S. aureus bacteraemias surveillance. The success of this study has allowed the development of a two year project to undertake enhanced S. aureus bacteraemia surveillance across NHSScotland. The main aims of this project are to further understand the epidemiology of S. aureus bacteraemia and use the data both locally and nationally to increase the awareness of the clinical risk factors associated with S. aureus bacteraemias. These data will provide an evidence base for development of healthcare quality improvements and interventions to reduce S. aureus bacteraemias.

HPS is also undertaking a two-year case-control study which has been funded by the Scottish Infection Research Network (SIRN), with colleagues at Glasgow University. This study aims to further identify risk factors for patients developing S. aureus bacteraemias in Scotland. This study will lead to a better understanding of the epidemiology of these infections and enable improved targeting of interventions to reduce the incidence of bacteraemias.

Both the enhanced surveillance project and the case control study outlined above will help to identify differences in clinical epidemiology between MRSA and MSSA bacteraemias and elucidate reasons for differing rates of decline. Knowledge gained from these projects should enable better targeting of interventions to reduce all S. aureus bacteraemias. Moreover, a better understanding of the specific clinical epidemiology of MSSA bacteraemias may lead to interventions to reduce these infections, which now represent the majority of all S. aureus bacteraemias in Scotland.

**Compliance with CRA-based MRSA Screening**

A Key Performance Indicator (KPI) for compliance with CRA-based MRSA screening was introduced in April 2013. The compliance reported during 2013/14 was 78%, below the Scottish Government Health and Social Care Directorate (SGHSCD) target of 90%. This has implications for the number of colonised patients identified on admission to hospital. The number of colonised admissions identified is reduced by an estimated 1000 per year. Patients colonised with MRSA are at a 15 times higher risk of developing MRSA infection, therefore this prevents appropriate management of colonised patients and poses a threat to patient safety.
The reduced compliance in 2013/14 also has implications for the effectiveness of the current MRSA screening policy in Scotland. An audit of implementation of universal nasal screening in England reported that compliance was 60%. The percentage of MRSA colonised patients identified using universal nasal screening with this level of compliance is equivalent to CRA-based screening with 78% compliance. Consequently, as the percentage of colonised patients identified is equivalent, and patients at a high risk of colonisation can be pre-emptively isolated, CRA-based screening has performed favourably compared to universal screening in the clinical setting. This is important as the added benefits of pre-emptive isolation and significantly lower cost of CRA mean it is a clinically and cost-effective policy. HPS will continue to work with boards to provide support in facilitating improvement with compliance during 2014/15.
In Scotland, *Escherichia coli* (*E. coli*) is the most common pathogen implicated in bacteraemia in community and healthcare settings. Bacteraemia develops usually as a complication of other infections, including urinary tract infection (UTI) and use of medical devices including vascular access devices.

**Epidemiological Data**

Laboratory reports on Gram-negative bacteraemia and antimicrobial susceptibility are submitted to HPS via the Electronic Communication of Surveillance in Scotland (ECOSS) system and analysed in line with EARS-Net (European Antimicrobial Resistance Surveillance Network) surveillance definitions.

During 2013, there were 4,321 cases of *E. coli* bacteraemia in Scotland compared to 3,924 in 2012. The incidence increased from 66.6 per 100,000 persons in 2009 to 81.3 per 100,000 persons in 2013. There was an increasing year on year trend of 4.9% in the incidence in this period (p<0.001). The increase in the rates between 2012 and 2013 was 10.1% (p<0.001).

**Quality Improvement and Interventions to Reduce *E. coli* bacteraemia**

In 2012, HPS presented options for national surveillance of *E. coli* bacteraemia to the SGHSCD, aimed at characterising the epidemiology in more detail and identifying the primary causes leading to bacteraemia, to enable targeted interventions aimed at preventing and controlling this infection. A pilot study was undertaken in 2013 in order to:

1. Identify ways to measure and monitor the burden of *E. coli* bacteraemia in a range of different settings
2. Describe the epidemiology of *E. coli* bacteraemia in Scotland
In collaboration with NHS boards a protocol and an electronic data collection form were developed. Within the specified three month data collection period (October to December 2013), surveillance coordinators in the eight participating NHS boards coordinated the completion of the HPS *E. coli* enhanced surveillance forms.

This pilot study has demonstrated that it is possible to collect enhanced data items relating to *E. coli* bacteraemia and that there is the potential for a national enhanced surveillance programme to be developed. The pilot has provided a basis for developing an enhanced surveillance programme. A data linkage project is to commence in the summer of 2014; this linkage will provide HPS with the additional risk factor data required to assist in the targetting of interventions to reduce *E. coli* bacteraemia.
Urinary Tract Infections

Urinary tract infections (UTIs) are among the most commonly encountered infections in primary care, care home and hospitals. UTIs are one of the most common reasons for empirical use of antimicrobials across all settings. As such, the treatment and prevention of UTI remains a clinical priority for national antimicrobial stewardship and IPC.

UTI AMR Surveillance

AMR in urinary pathogens are increasing worldwide. In 2012, surveillance of AMR in a representative sample of all urinary isolates was introduced in Scotland in order to detect emergence, cause and spread of resistance. To date, 34,315 reports have been received from 13 NHS boards. *E. coli* accounted for the majority of the reports (70.9%) and the numbers reported have remained high throughout the surveillance period. Susceptibility patterns in the *E. coli* urinary isolates were very similar to those observed in the *E. coli* bacteraemia isolates. *E. coli* resistance to the first-line agent trimethoprim increased from 38.0% in 2012 to 40.3% in 2013 (*p*<0.001). In 2013, resistance to nitrofurantoin also increased to 4.7% as compared to 3.9% in 2012 (*p*<0.001).

Resistance to the majority of antimicrobials tested increased from 2012 to 2013 (Table 3). The only exceptions to this were resistance to ciprofloxacin and gentamicin which remained relatively unchanged. Resistance to the third-generation cephalosporins varied from 4.8% for ceftazidime to 9.7% for cefotaxime in the urinary isolates.
Table 3: Resistance (%) in E. coli urinary isolates from January 2012 - September 2012 and January 2013 - September 2013

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Quality Improvement and Interventions to Reduce UTI
Due to the high prevalence and wide range of medical complications associated with UTIs a number of national UTI related activities have been developed in NHSScotland since 2012.

Reducing antibacterial use for prophylaxis of UTI (also referred to as ‘medical prophylaxis’) remains a key clinical priority area for SAPG. A key component of the national approach to antimicrobial stewardship co-ordinated by SAPG has included the development of frameworks to support the development of prescribing guidance in primary and secondary care. Trimethoprim and nitrofurantoin are recommended for the empirical treatment of UTI.\textsuperscript{21,22} From 2011 to 2012, there was an increase in use of trimethoprim (and sulphonamides) (4.1%) and nitrofurantoin (20.6%) in primary care, continuing the upward trend in compliance observed in previous years.

Similarly, in secondary care there was an increase in use of trimethoprim (and sulphonamides) (4.9%) and nitrofurantoin (9.4%) compared to 2011, again continuing the upward trend since 2009. These increases in use of recommended agents are likely to reflect initiatives aimed at improving compliance with local prescribing guidelines.

Catheter Urinary Tract Infection ‘Bundle’
Urinary catheters are sometimes required to enable bladder drainage in the short or long term and are commonly used invasive devices in both acute and community settings. Their use is associated with an increased risk of infections by enabling microorganisms to gain entry to the bladder and cause a catheter associated urinary tract infection (CAUTI).
The key intervention to minimise the risk of CAUTI is to avoid inserting an indwelling urinary catheter in the first place. However when a urinary catheter is required it is important to optimise insertion and maintenance measures, and monitor on a daily basis whether it is still required and remove as early as possible. ‘Bundles’ (i.e. short guidelines) have been produced by HPS on inserting and maintaining urinary catheters and using these may assist in reducing CAUTI. These bundles have been produced for use in hospital settings (published in October 2013) and community settings (published in January 2014) and are available at: http://www.hps.scot.nhs.uk/haiic/ic/bundles.aspx

The HPS work to date on CAUTI and the CAUTI bundles have been integrated into the Scottish Patient Safety Programme 2 (SPSP2) in NHSScotland. The SPSP2 programme has identified CAUTI as a measure of harm and adopted the CAUTI bundles to improve the safety of acute hospital care.

**UTI Surveillance in Health and Social Care Facilities**

During 2013, HPS conducted a UTI surveillance pilot study in a range of health and social care facilities. The Short Life Working Group (SLWG) included representatives from relevant national bodies including Scottish Care, the Care Inspectorate and SAPG, as well as those working in these settings. The SLWG was tasked with ensuring the appropriateness of the methodology for collection of UTI data from health and social care facilities for older people; testing the feasibility of using the protocol and data collection in these facilities; and to finalise the UTI surveillance protocol and support materials.

Eight care homes and seven community hospitals (from five NHS boards) volunteered to participate in the UTI surveillance pilot study. Training was provided to all participants and data were collected from September to November 2013. The use of the SAPG ‘Decision aid for diagnosis and management of suspected UTI in older people’ was promoted during this pilot study. Based on this pilot study it was concluded that conducting UTI surveillance in these settings is feasible but requires adequate training of the staff collecting the information.

UTI are among the most commonly encountered infections in patients in all healthcare settings and therefore pose a major challenge not only with regards to treatment and management of the individual patients, but also due to patient safety aspects. These include the risk of developing further clinical complications often associated with UTIs and the wider development of AMR. In order to target all of these aspects of UTI a coordinated approach at a national level that involves both primary and secondary care and the relevant national health organisations is needed. Therefore in the coming year HPS will develop a UTI national health protection programme.
Carbapenemase-producing Bacteria

Multidrug resistance among Gram-negative organisms continues to be a major threat to public health and patient safety. In particular, the emergence of carbapenemase producing bacteria is concerning as this leaves few options to treat severe infections. Carbapenemases are bacterial enzymes that can degrade and inactivate the potent group of carbapenem antibiotics. Carbapenemase-producing bacteria are often resistant to the majority of available antibiotics. Since 2009, carbapenemase producers have spread rapidly across healthcare and community settings of selected countries and regions around the world. Increasing globalisation leading to frequent intercontinental travel is playing a major role in the spread of carbapenemases. The spread of carbapenemases is facilitated by plasmid transfer and dissemination of successful clones.

Epidemiological Data

In 2013, a total of 22 carbapenemase producers were reported to HPS from the Antimicrobial Resistance and Healthcare Associated Infection (AMRHI) Reference Laboratory at Public Health England (PHE), bringing the total number of reports in Scotland to 101 since 2003. In a summary report from PHE, it was estimated that confirmed carbapenemase producers from Scotland accounted for 3.2 % of all UK carbapenemase producers in this period.

Figure 9 shows the distribution of phenotypes among carbapenemase producers in Gram-negative bacteria in the period 2003 to 2013. Reports of carbapenemase producers have been geographically widespread across Scotland since 2009. To date, 11 out of 14 NHS boards have now reported at least one carbapenemase producer.

Worldwide, Klebsiella pneumoniae carbapenemase-producing Klebsiella pneumoniae (KPC-producing K. pneumoniae) is the most widespread carbapenemase producer due to the clonal spread of a specific lineage of K. pneumoniae. Resistance to carbapenems among Gram-negatives remains rare. Further work is required to reduce the threat to public health posed by the development of carbapenem resistance in Gram-negative pathogens.
In Europe, KPC-producing *K. pneumoniae* also has the widest distribution overall, and is the most frequently reported carbapenemase producer in the majority of countries. In Scotland, *K. pneumoniae*-KPC have been reported on multiple occasions since 2003.

A total of seven New Delhi Metallo-Beta-lactamase (NDM)-producers including *E. coli* (n=5), *K. pneumoniae* (n=1) and *Enterobacter cloacae* (complex) (n=1) were reported across five different Scottish NHS boards. NDM-producers are still very rare in Europe, but the UK continues to report more NDM-positive isolates than other countries. Importation via travel from the Indian sub-continent is playing an important role in the spread of NDM in Europe and elsewhere.

Until recently, there had been no reported spread of carbapenemase producers within (or between) hospitals nor other settings in Scotland, but in 2013 two events of transmission, one in a hospital and one in the community, were reported to HPS. Thus, Scotland has progressed to the next epidemiological stage of spread from ‘sporadic’ to ‘single hospital outbreaks’ (as defined in Glasner et al, 2013).

**Figure 9:** Carbapenemase producers reported in Scotland by AMRHAI (PHE)

![Bar chart showing carbapenemase producers reported in Scotland by AMRHAI (PHE)]

In parallel with the increasing spread of carbapenemase producers, the use of carbapenems (primarily meropenem) has increased in Scottish hospitals continuously since 2009. Although carbapenem use accounted for only 1.3% of total antibacterial use in 2012, there has been a 23.1% increase in carbapenem use in Scotland since 2009. It may be that this increase could have been driven partly by initiatives to reduce the use of cephalosporins and fluoroquinolones as part of national approach to reduce CDI.

**Development of Guidance on Infection Prevention and Control and Use of Antimicrobials**

In 2013, HPS developed interim guidance on non-prescribing control measures to prevent the cross-transmission of carbapenemase producing bacteria in acute healthcare settings.
based on the currently available evidence.\textsuperscript{25} The guidance is intended to be used to inform local action plans and risk assessments.

Lack of detection of carbapenemases may play a significant role in the spread of carbapenemase producers as appropriate control measures are not implemented as a consequence. Two Scottish NHS boards currently participate in a Europe-wide exercise (under the European Survey on Carbapenemase-producing Enterobacteriaceae (EuSCAPE) programme) aimed at building diagnostic laboratory and surveillance capability and harmonising the approach in all member states. The results of this epidemiological survey, which will be available towards the end of 2014, will inform the further development of surveillance of carbapenemase producers in Scotland.

The previous national annual AMR report recommended the development of a strategy to preserve the effectiveness of carbapenems for future use, to include development of guidance on prescribing and non-prescribing (IPC) measures and strengthen local and national surveillance.\textsuperscript{26} To support this recommendation, SAPG developed national consensus guidance on treatment of multidrug resistant Gram-negative infections, which propose clinical areas where alternative antimicrobials are recommended options to be considered in order to reduce the use of carbapenems.\textsuperscript{27}

**Screening for Carbapenemase-Producing Enterobacteriaceae**

A review of the National Screening Criteria Public Health Principles of Screening\textsuperscript{28} as they apply to screening for carbapenemase-producing Enterobacteriaceae (CPE) was carried out by HPS. This review indicated that CPE is an important and emerging public health threat, although there remains a lack of evidence in terms of epidemiology, testing, interventions to contain the spread, and patient acceptability of screening. Further work to better understand the epidemiology of CPE in Scotland and to develop the evidence base for CPE screening and testing is necessary to ensure the successful implementation of a national CPE screening policy. Work will be undertaken by HPS in 2014/15 to assist the boards in the implementation of CPE screening.
Norovirus, like influenza, comes every year at winter time. There is no lasting immunity following infection so every year everyone is vulnerable to this infection. As norovirus spreads very easily there is a risk of outbreaks in all places where there is shared living. When norovirus is detected in more than one patient in a hospital ward, the bay or even the ward itself may be closed to minimise spread. As a consequence hospital outbreaks result in inconvenience and suffering to patients and can significantly disrupt service delivery.

Data on the numbers of wards closed due to confirmed or suspected norovirus are collected by HPS on a weekly basis. The number of closed wards on a Monday morning is reported by each NHS board. The data represents an indication of the impact norovirus ward closures are having on NHSScotland and are made available to all NHS boards and others for outbreak preparedness and impact assessment.

Figure 10 shows the number of ward closures due to presumed or confirmed norovirus on a Monday morning for each season from week 1, 2008 to week 10, 2014. The data are displayed from mid-year to mid-year (week 27 to week 26) due to the seasonality of norovirus.

The impact of norovirus as measured by ward closures has been lower in the 2013/14 season to date compared to previous seasons. Some of this may be the preparedness and response activity in NHS boards, but undoubtedly some will be due to aspects of the circulating virus.

The impact of norovirus as measured by ward closures has been lower in the 2013/14 season to date compared to previous seasons. HPS works with IPCTs in all boards to minimise the incidence and impact of norovirus outbreaks.
Quality Improvement and Interventions to Reduce Norovirus

All NHSScotland boards take part in an annual review of the norovirus season to identify and share lessons learned and to enhance preparedness for the next norovirus season. The norovirus season varies in size each year because the virus changes each year.

Annual preparedness is essential for minimising the impact and incidence of norovirus in any care setting. HPS will continue to work with boards in NHSScotland to improve learning, preparation and to assess impact.

HPS assisted in producing for the first time a public facing campaign ‘Stay at Home’. The purpose of the campaign was to communicate to the general public that when you have symptoms of norovirus it is very important to Stay at Home for at least 48 hours after the symptoms have stopped. The aim of this message is to stop people coming to visit relatives in hospitals or care homes when they are still infectious.

The campaign consisted of posters, leaflets and e-banners directing people to ‘NHS Inform’ where detailed information on norovirus was available.

Evaluations of the campaign thus far have shown that the message has been very helpful. Feedback has been very positive and more materials than originally requested were utilised. The media have also helped publicised the campaign. It has been agreed that the materials will be available for the norovirus season 2014-2015.
In the event of an outbreak or incident in NHSScotland, boards are required to assess the situation using the Hospital Infection Incident Assessment Tool (HIIAT). This tool is used for assessing the severity of an incident or outbreak and facilitating effective communication between boards, HPS and the SGHSCD. Outbreaks that are either HIIAT Amber or Red should be referred to HPS for support and specialist advice. In some circumstances, outbreaks that are assessed as HIIAT green may still be referred for advice and support.

HPS works with IPCTs in NHS boards to support outbreak management, particularly for outbreaks that are referred following a red or amber HIIAT assessment, and to advise on outbreak preparedness.

The epidemiology of all outbreaks reported to HPS is reviewed to identify the locations and patient populations which are most vulnerable to outbreaks and the types of outbreaks that arise in these populations/locations. Sharing this information means the IPCTs can take actions to promote preparedness in outbreak-vulnerable locations in their boards.

In 2013, a total of 49 outbreaks were reported to HPS of which: seven were red, 30 were amber and nine were green. Three outbreaks were not HIIAT assessed as they arose in care homes or were awaiting laboratory confirmation of a category 4 pathogen which was subsequently not confirmed.

Figure 11 describes the outbreaks reported to HPS during 2013. The most commonly reported outbreaks were gastrointestinal and respiratory infection. The most common organism causing respiratory outbreaks was influenza (n=7) and causing gastrointestinal outbreaks was norovirus (n=11). The majority of these outbreaks occurred in Care of the Elderly wards.
Figure 11: Types of outbreaks (number of events) reported to HPS during 2013

- Gastro-intestinal infections 18
- Other 4
- Mixed 5
- Respiratory 12
- UTI 2
- Blood Borne Virus 2
- Colonisation 6

HPS also provides support services when the CNO 2010(I) National Support Framework for NHS boards algorithm has been invoked. The algorithm can be invoked by the SGHSCD, a NHS board or other national agency identifying the need for national expert HAI support. Such instances can include a post Healthcare Environment Inspectorate (HEI) report or a surveillance exceedance. Once the algorithm is invoked HPS undertakes an HAI infection control needs assessment and involves experts to support the NHS board. Such support may involve a single assessment visit or prolonged engagement with HPS or other national agencies, there were three of these during 2013.

Quality Improvement and Interventions to Reduce HAI Outbreaks
HPS has produced a suite of tools which have been devised to assist NHS boards in outbreak management. The tools include: the Outbreak Algorithm and Checklist, the Generic Control Measure Trigger Tool and a Debrief Tool. All these tools are designed to reduce errors and variation thereby enabling NHS boards to better prevent, prepare for and control outbreaks. These outbreak tools are accessible from the outbreak tool kit at: http://www.hps.scot.nhs.uk/haiic/ic/toolkits.aspx
Since 2006 HPS has been reporting bi-monthly audits of hand hygiene compliance within NHS boards as part of the National Hand Hygiene Campaign. During 2012-13 the results of the bi-monthly hand hygiene audits had stabilised with the majority of boards’ level of compliance being above the 90% requirement set by the SGHSCD in November 2007.

Since the introduction of the Scottish Patient Safety Campaign in 2007, many NHS boards were also carrying out local monitoring of hand hygiene compliance as well as undertaking bi-monthly audits for the National Hand Hygiene Campaign. In 2012, HPS analysed the quality of this local data compared with the bi-monthly data sent into HPS. Broadly speaking, the national bi-monthly compliance results were found to be comparable with the local data sent in by the boards to HPS. These results were reported to the SGHSCD and a decision was made that HPS would stop reporting bi-monthly national data with the final hand hygiene compliance report being published on 25 September 2013.

It is widely accepted that measurement is an important tool for driving large scale improvement in healthcare. The SGHSCD require improvement in hand hygiene compliance monitoring to be sustained as an integral part of reducing the risk of HAI. Monitoring and reporting arrangements for hand hygiene compliance changed on 1st October 2013; individual NHS boards are now responsible for the continuous monitoring of hand hygiene practice linked to local improvement and quality assurance processes, and for reporting of local hand hygiene compliance data direct to the SGHSCD via their Healthcare Associated Infection Reporting Templates (HAIRTs).

As part the discussions which led to this change, HPS undertook to consider what additional measures could be used as an indicator for hand hygiene compliance. A review of the scientific literature shows that hand hygiene product use is widely used as an alternative measure for hand hygiene compliance throughout Europe in support of their national Hand Hygiene Campaigns. During this coming year (2014/15) SGHSCD has commissioned HPS and National Procurement to develop a monitoring system that will assess hand hygiene product use across NHSScotland.

Hand hygiene is one of the most important ways to prevent infection transmission and continues to be a focus in NHSScotland.
Development of Infection Prevention and Control Guidance

boards and other care settings. To ensure these remain current, and evidence based, reviews of the latest scientific literature and input of NHS boards and other experts are required for practice implementation.

HAI Compendium of Guidance
The HAI Compendium provides a one-stop location to easily access all HAI guidance and supporting documentation/materials relevant to NHSScotland. As the Compendium has been on the HPS website since 2011 a review of its usage was undertaken during 2013 to assess its use and to ensure that it still met user needs. This review was undertaken as a telephone survey of Infection Control Nurses, Infection Control Doctors and Infection Control Managers.

The main finding of the survey was that the Compendium remains a valuable resource for IPCTs and Health Protection Teams and it would be beneficial to change the order of the documents to show the newest first. This change was implemented in Version 3.0, February 2014 of the Compendium.

HPS Guidance that has been added to the Compendium in the last year includes:
- Interim guidance: Non-prescribing control measures to prevent cross transmission of carbapenemase-producing Enterobacteriaceae in acute settings;
- NHSScotland Waste Prevention and Re-use Guide
- Norovirus: Information for patients and their relatives and carers.

The Compendium can be accessed at http://www.hps.scot.nhs.uk/haic/haicompendium.aspx

Quality Improvement Tools
HAI quality improvement tools (QITs) have been developed by HPS and are being implemented across care settings. These are designed to reduce infections and when performed collectively, reliably and continuously can improve patient outcomes in reducing HAI.
QITs updated during 2013-2014 were:
- Preventing contamination when taking a sample for blood culture
- Preventing catheter associated urinary tract infection - Acute settings
- Preventing catheter associated urinary tract infections - Community settings
- Preventing infections when inserting and maintaining a central vascular catheter (CVC)
- Preventing the transmission of *Clostridium difficile*
- Preventing infections when inserting and maintaining a peripheral vascular catheter (PVC)
- Preventing surgical site infections (SSI)

These are available to view at http://www.hps.scot.nhs.uk/haiic/ic/bundles.aspx

The CAUTI bundles were adopted by the acute care SPSP2 in 2013. It is planned to review the evidence base for the Quality Improvement Tools in 2014/15 to ensure the tools contain the most up to date best practice.


The National Manual is an evidence based practice guide intended for use by frontline healthcare and care staff supported when necessary by specialist IPCTs and health protection teams.

The National Manual is mandatory for the NHS under the auspices of two CNO letters.33,34

Moving forward into health and social care integration, where health boards and local authorities are required to integrate health and social care service, it is crucial that there is consistency in the application of infection prevention and control practices across Scotland. The National Manual aims to promote this consistent practice. Therefore the principles and practices within the National Manual are also considered good IPC practice for other care settings such as care homes or care at home.

Chapter 1 of the National Manual, Standard Infection Control Precautions (SICPs), was published on HPS website in January 2012. This chapter and supporting literature reviews have been adopted by NHSScotland over the last two years. This implementation has been supported by a National Consensus Group which has representation from every NHS board in Scotland and more recently has included representation from other care settings.

Chapter 2 of the National Manual, Transmission Based Precautions (TBPs), was published in April 2014. This new chapter includes: the additional precautions (to SICPs) that are required to be used by staff in all care settings when a patient has a suspected or known infection; a list of infectious agents/diseases; and recommendations for optimal patient placement and the use of Respiratory Protective Equipment (RPE). Chapter 2 was produced in conjunction with an Expert Steering Group including stakeholders from both health and social care settings around Scotland.

Decontamination

Decontamination is an umbrella term in infection control practice and healthcare, which covers: cleaning, disinfection and sterilisation, and applies to reusable medical devices, communal patient care equipment and the environment. These interventions are aimed at reducing the risk of infections associated with the healthcare environment and equipment. Currently there is no definitive method of assessing the quantitative impact decontamination failures may have on HAI. Nonetheless there is a growing evidence base within the scientific literature, and from outbreak intelligence, highlighting the importance of decontamination in reducing HAI.

HPS provides expert advice related to public health, infection control, clinical and scientific aspects of decontamination.

Endoscope and Surgical Instrument Incident Surveillance

A surgical instrument decontamination failures survey was undertaken by HPS in 2013 and the findings from the survey informed the development of a four week pilot study of surgical instrument decontamination surveillance within theatre departments of two NHS boards in January and February 2014. The outcomes of this pilot study will inform the development of a surgical instrument decontamination incident and near miss surveillance system.

A further survey was undertaken with regards to endoscope washer disinfector final rinse water sampling and current practice related to interpretation of the sampling results and their impact on endoscopy activity. It is anticipated that the outcomes of the survey will help inform guidance development which will be produced for clinicians and infection control staff and provide consistency across NHSScotland.

Decontamination of Reusable Non-Invasive Patient Care Equipment (Communal Equipment)

Since the introduction of the NHSScotland Code of Practice (2004) each board has been required to have an
A-Z for decontamination of equipment. However there is no consistency in the A-Zs across NHS boards. Over the past four years the HEI have repeatedly reported on poor cleanliness of patient equipment. In order to address this and to drive improvement in this area, HPS produced a national A-Z template in 2013.

The A-Z template was devised and piloted in four boards. Following the pilot the template was published on the HPS website in March 2014. The next stage of this project is to review tools for monitoring compliance with decontamination and to develop a tool which will support and enhance compliance with equipment decontamination. In addition a review of alternative approaches to communal equipment and environmental decontamination across the UK will be undertaken in 2014/15.
References


