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Surveillance of Healthcare Associated Infections in Scottish Intensive Care Units

Annual report of data from January 2010 to December 2010

August 2011

Scottish Intensive Care Society Audit Group

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Glossary

AMR	Antimicrobial Resistance
APACHE II	Acute Physiology and Chronic Health Evaluation II
BSI	Bloodstream Infection
CI	Confidence Intervals
CR-BSI	Central Venous Catheter-Related Bloodstream Infection
CRI	Central Venous Catheter-Related Infection
CRI-1	Central Venous Catheter-Related Infection- Local
CRI-2	Central Venous Catheter-Related Infection- General
CVC	Central Venous Catheter
ECDC	European Centre for Disease Control
GISA	Glycopeptide-Intermediate *Staphylococcus aureus*
HAI	Healthcare Associated Infection
HDL	Health Department Letter
HDU	High Dependency Unit
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
HPS	Health Protection Scotland
IAP	Intubation Associated Pneumonia
ICU	Intensive Care Unit
IQR	Interquartile Range
LRT	Lower Respiratory Tract
LOS	Length of Stay
MRSA	Meticillin Resistant *Staphylococcus aureus*
MSSA	Meticillin Sensitive *Staphylococcus aureus*
NHS	National Health Service
PN	Pneumonia
SD	Standard Deviation
SICSAG	Scottish Intensive Care Society Audit Group
SSHAIP	Scottish Surveillance of Healthcare Associated Infection Programme
SPSP	Scottish Patient Safety Programme
VAP	Ventilator-Associated Pneumonia

Summary Report

- This report represents a significant achievement by Health Protection Scotland (HPS), the Scottish Intensive Care Society Audit Group (SICSAG) and the Scottish Critical Care clinical workforce. It is a report of Healthcare Associated Infection (HAI) surveillance in Scotland's entire general adult Intensive Care Unit (ICU) population.
- Surveillance data relating to central venous catheter-related infection (CRI), central venous catheter-related bloodstream infection (CR-BSI), pneumonia (PN) and bloodstream infection (BSI) were collected in accordance with the Hospitals in Europe Link for Infection Control through Surveillance (HELICS) methodology.
- Data from 5284 patients admitted to 23 Scottish Intensive Care Units (one neurological and all adult general ICUs) were collected and a total of 348 infections were reported from 295 (5.6%) patients.
- Of the 348 infections reported 181 (52.0%) were PN, 148 (42.5%) were BSI (including CR-BSI) and 19 (5.5%) were Local CRI (CRI-1) and General CRI (CRI-2).
- Of the 181 pneumoniae reported, 80.1% were ventilator-associated pneumonia (VAP). The incidence density of VAP was 5.1 per 1000 invasive respiratory device days.
- A total of 148 BSI were reported from 139 (2.6%) patients. The incidence of CR-BSI was 0.8 per 1000 central venous catheter (CVC) days.
- Analysis shows that in 91.5% of BSIs (excluding CR-BSI), the patient had a CVC *in situ* on the day of, or in the 48 hours preceding onset. This suggests that some of these infections may have been CR- BSI, which were not reported due to a lack of availability of microbiology to fulfil the strict HELICS definitions of CR-BSI.
- HAI surveillance in ICU is central to quality improvement in Scottish critical care services. The Scottish Patient Safety Programme (SPSP) has driven process audit as a means to improve outcomes, but the surveillance data gives us additional important outcome data as evidence for this through time. The data presented is national, but each unit uses their own data locally for improvement. While we have attempted to standardise data collection and infection definitions, there will still be variability in diagnostic tests used within this from unit to unit.
- The findings presented in this report are consistent with the data presented from the pilot study published earlier this year and the data published by the European Centre for Disease Control (ECDC).
- As the data set matures it is anticipated that risk factor analysis for HAI will be carried out in order that preventive strategies can be further developed.

1. INTRODUCTION

1.1 Surveillance of Healthcare Associated Infections in Scottish Intensive Care Units

This is the first report from the Healthcare Associated Infections (HAI) in Scottish Intensive Care Units (ICU) surveillance programme developed by the Scottish Intensive Care Society Audit Group (SICSAG) and Health Protection Scotland (HPS).

An initial pilot study in 2005 assessed the feasibility of using the Hospitals in Europe Link for Infection Control through Surveillance (HELICS) data definitions[1] for HAI surveillance in the intensive care setting and WardWatcher software as a data collection tool. A further pilot with 19 of 23 ICUs in Scotland contributing surveillance data was carried out in 2009/2010 and the findings from this were published thereafter.

Since the pilot, all general adult ICUs in Scotland collect HAI surveillance data continuously as part of this collaborative surveillance programme. As such, this is the first annual report from this programme.

1.2 Aims and Objectives of HAI surveillance in Scottish ICUs

- To monitor the incidence and trends of HAI in the ICU setting.
- To increase awareness of HAI among clinical staff in ICU setting.
- To gain information on quality of care.
- To prioritise the allocation of resources.
- To establish and contribute to a national database of HAI surveillance data for the ICU setting in Scotland.
- To contribute to the European surveillance dataset and provide a benchmark for Scottish data in the context of other European countries.

2. DATA COLLECTION

2.1 Data collection

Demographic, invasive device exposure and HAI data were collected in accordance with the methods and data definitions set out in the HELICS protocol for surveillance of HAI in the intensive care setting[1]. All surveillance data were collected either via WardWatcher or HELICSwin data collection software.

Data were collected by a wide range of clinical staff and the methods for data collection varied between units, although the same protocol was used. In units using HELICSwin for data collection, a dedicated data collector was employed[2].

2.2 Patient population

Data were collected from adult patients (aged 16 years or over) admitted to participating ICUs between 01/01/2010 and 31/12/2010, with a stay of more than two days in the ICU[1].

2.3 Infections included in the surveillance programme

Data relating to central venous catheter-related infection (CRI) which includes Local CRI (CRI-1), General CRI (CRI-2) and central venous catheter-related bloodstream infection (CR-BSI), pneumonia (PN) and bloodstream infection (BSI) were collected. All infections reported were identified in accordance with the HELICS surveillance methodology[1].

2.4 Antimicrobial resistance data

Antimicrobial resistance (AMR) data were collected for *Staphylococcus aureus* isolates as determined by the organism/antibiotic resistance combinations detailed in the HELICS protocol[1]. Full details can be found in Appendix 1 of this report.

2.5 Exclusion criteria and data cleansing

The process followed for exclusion and data cleansing was as follows:

(i) Records with essential data missing, such as discharge date were removed.

(ii) Duplicate records were identified and removed.

(iii) Duplicate infections were excluded. Criteria for determining possible duplicates were based on those specified by HELICS. Infection episodes were defined by a minimum of a four day interval between PN episodes and a seven day interval for BSI and CRI episodes[3].

(iv) Any patients not discharged at the time of data transfer were arbitrarily discharged (censored) in accordance with the HELICS protocol[1].

2.6 Data analysis methods

Data analyses were carried out using STATA version 9. The Wilson method was used to calculate 95% confidence intervals (CI)[4].

3. RESULTS

3.1 Participating ICUs

A total of 23 adult general ICUs in Scotland contributed HAI surveillance data for the period January 2010 and December 2010. Of the 23 participating units, 19 contributed data for the complete time period, one for eight months, one for seven months and two for three months.

Of the units contributing data 16 (69.6%) were solely ICUs, six (26%) were combined ICU/High Dependency Units (HDU) and one (4.4%) was a neurological ICU. The size of the contributing units ranged from three to 18 beds. For the purpose of this report all units including the combined ICU/HDU will be referred to as ICUs.

3.2 Patient population

Data from 5284 patients (aged 16 years or over) admitted to the participating ICUs between 01/01/2010 and 31/12/2010 with a stay of more than two days in the ICU were included. All patients admitted within the timeframe of the report had been discharged at the time of data analysis and all required data fields were complete, therefore no patient records had to be deleted or censored.

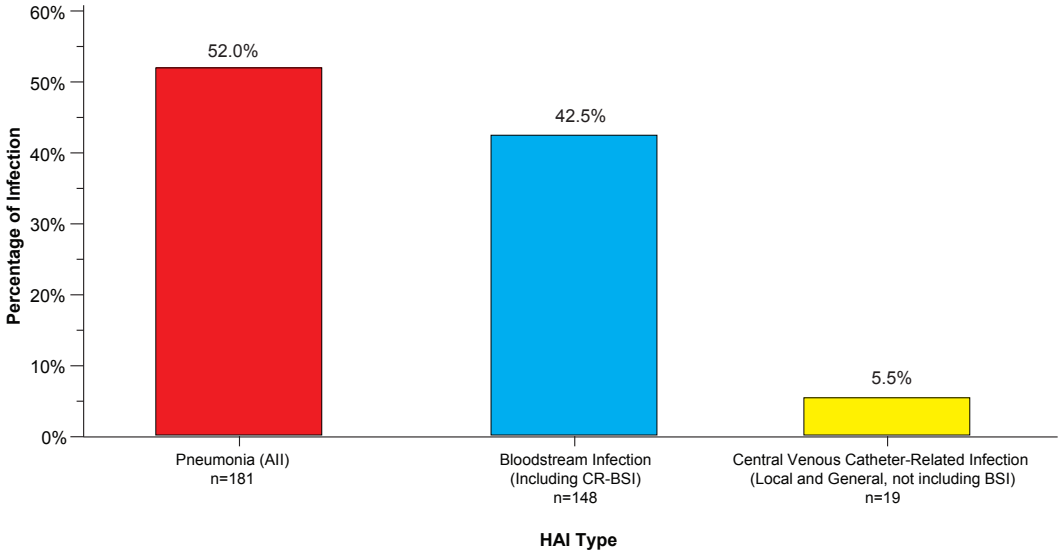
Of the 5284 admissions, 2988 (56.6%) were male, 2290 (43.3%) were female and for six patients (0.1%), gender was not recorded. The median length of stay was five days (interquartile range [IQR] 3, 9), the mean Acute Physiology and Chronic Health Evaluation II (APACHE II)[5] score performed within the first 24 hours of the patient stay was 19.3 (standard deviation [SD], 7.4) and the median age was 62 (IQR: 48,72).

3.3 HAI epidemiology

In total 348 HAIs (PN, CRI and BSI) were reported from 295 (5.6%, 95% CI: 5.0-6.2) patients and met the criteria for inclusion in the analysis, (four duplicate infections were removed from the database – see section 2.5).

Of the 348 HAIs, 181 (52.0%) were PN, 148 (42.5%) were BSI (including CR-BSI) and 19 (5.5%) were CRI-1 and CRI-2. Figure 1 shows the percentage of each HAI type reported.

Figure 1: Percentage of each HAI Type (n=348)



Comparison of age, APACHE II[5] score (performed within the first 24 hours of the patient stay) and length of stay for patients with an HAI and patients without an HAI is shown in Table 1. The median age of patients with an HAI and patients without an HAI was not significantly different. The mean APACHE II[5] score for patients with (21.7) and without an HAI (19.1) was significantly different ($p<0.0001$, Student T-test). The median length of stay (LOS) for patients with an HAI (16 days) and patients without an HAI (5 days) was significantly different ($p<0.0001$, Mann Whitney U test).

Table 1. Comparison of age, length of stay and APACHE II[5] score for patients with and without an HAI.

	No HAI (n=4989)		HAI (n=295)		
Variable	**Median**	**IQR**	**Median**	**IQR**	**P value (Mann Whitney U)**
Length of stay (days)	5	3, 8	16	11, 27	<0.0001
Age (years)	62	48, 72	62	49, 70	0.28
	Mean	**95% CI (Lower CI, Upper CI)**	**Mean**	**95% CI (Lower CI, Upper CI)**	**P value (Student T-test)**
APACHE II[5]	19.1	18.9, 19.3	21.7	20.9, 22.5	<0.0001

3.4 Pneumonia

A total of 181 pneumoniae were reported from 166 (3.1%) patients. Of these infections, 145 (80.1%) were considered to be ventilator-associated pneumonia (VAP)[a]. Of the remaining 36 infections, 33 (18.3%) pneumoniae were not considered to be VAP and three (1.7%) were not able to be classified as device data were missing for these infection records. Incidence density rates for pneumonia are shown in Table 2.

Table 2. Incidence density for pneumonia.

Invasive respiratory device present[b]	Number of Pneumonia	Incidence Rate for Pneumonia	95% CI (Lower CI, Upper CI)
Yes (VAP)	145	5.1 per 1000 invasive respiratory device days[c]	4.3, 6.0
No (non-VAP)	33	0.8 per 1000 patient days	0.6, 1.1
Unknown	3	-	-
All	181	4.3 per 1000 patient days	3.7, 4.9

a Infections were considered to be VAP if the patient had an invasive respiratory device present in the 48 hours preceding the onset of infection.

b Invasive respiratory device present in the 48 hours preceding the onset of infection.

c VAP incidence- Total number of VAP as a proportion of the sum of the invasive respiratory device days (days that a patient required intubation) contributed by each patient in the study population. The proportion is expressed as the number VAP per 1000 invasive respiratory device days. It should be noted that in the pilot report published in 2011, the incidence rate was calculated using invasive ventilator days only as the denominator. This and future reports will use all invasive respiratory device days.

3.4.1 Diagnostic categories of pneumonia

Pneumonia is categorised (for surveillance purposes) according to the microbiology methods (and clinical signs) used to identify the infection[1], details are given in Table 3.

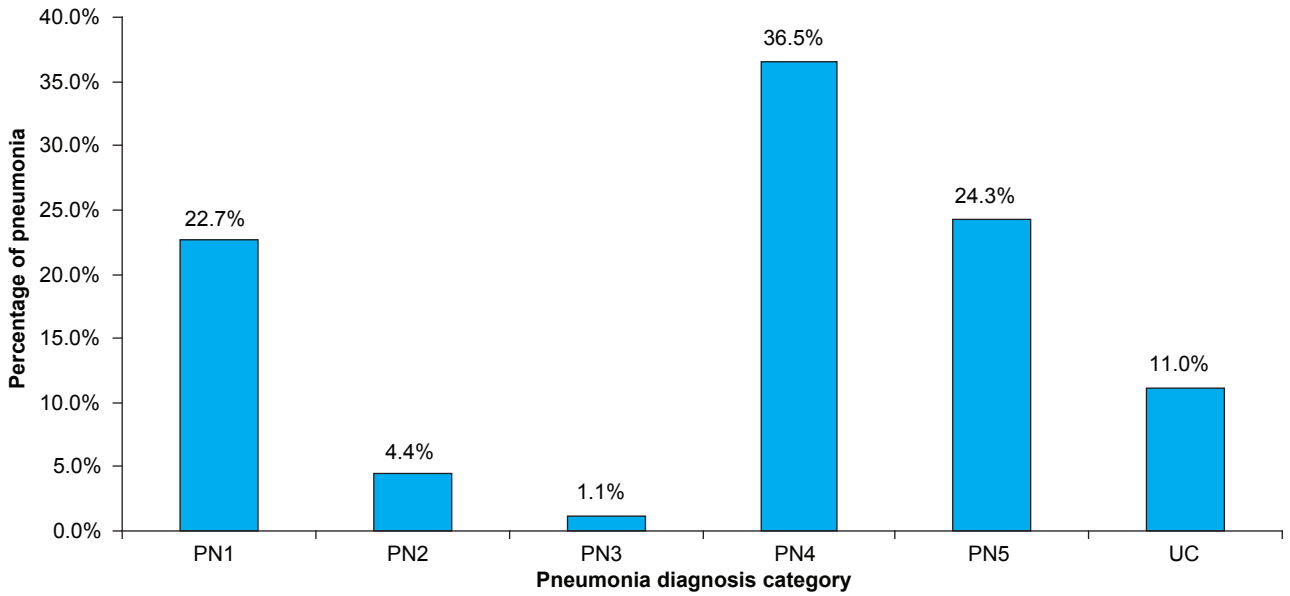
Microbiology methods used across Scotland are not standardised, therefore there is variation across units within Scotland. The majority of units use non-quantitative methods (PN3 and PN4) routinely, only a small number of units routinely use quantitative methods (PN1 and P2).

Table 3. Diagnostic categories and microbiology method for pneumonia.

Diagnosis category	Microbiology Method
PN1	Positive quantitative culture from minimally contaminated lower respiratory tract (LRT) specimen e.g. broncho-alveolar lavage.
PN2	Positive quantitative culture from possibly contaminated LRT specimen e.g. endotracheal aspirate.
PN3	Alternative microbiology methods
PN4	Positive sputum culture or non-quantitative LRT specimen culture
PN5	No positive microbiology (Clinical diagnosis only)
UC	Unclassified- This category covers discrepant data where the pneumonia was reported as PN5 however a microbiology result was recorded for that patient.

The distribution of pneumonia reported by diagnostic category is shown in Figure 2.

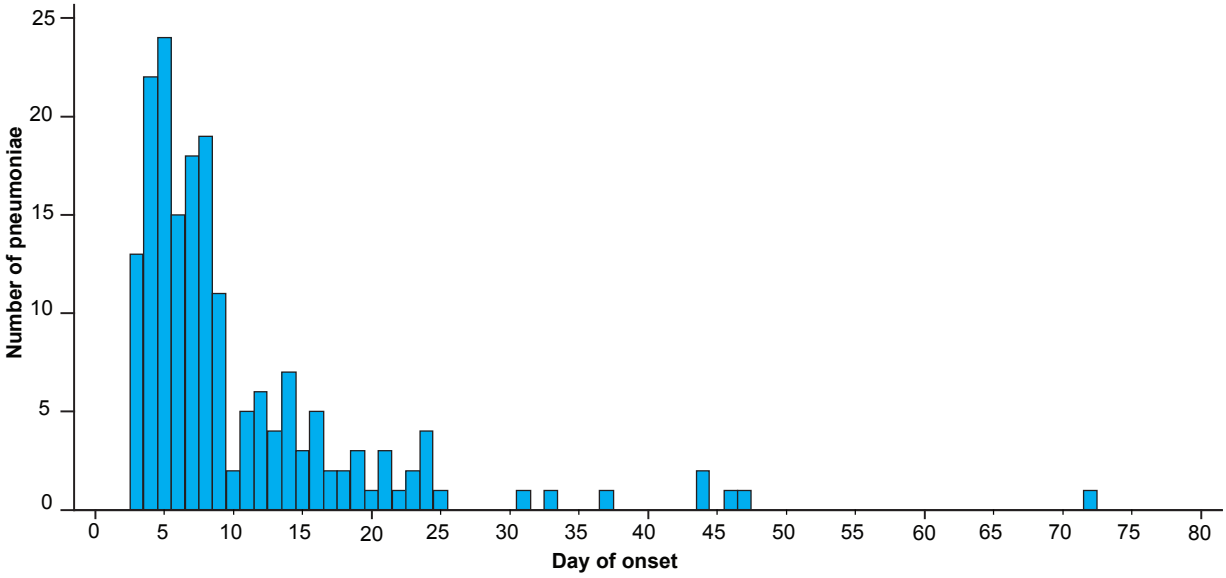
Figure 2: The distribution of diagnostic categories of all pneumonia reported



3.4.2 Day of onset of pneumonia

The median day of onset of a pneumonia was seven days (IQR: 5, 13), the distribution of the day of onset of pneumonia (from day three of ICU stay onwards) is shown in Figure 3.

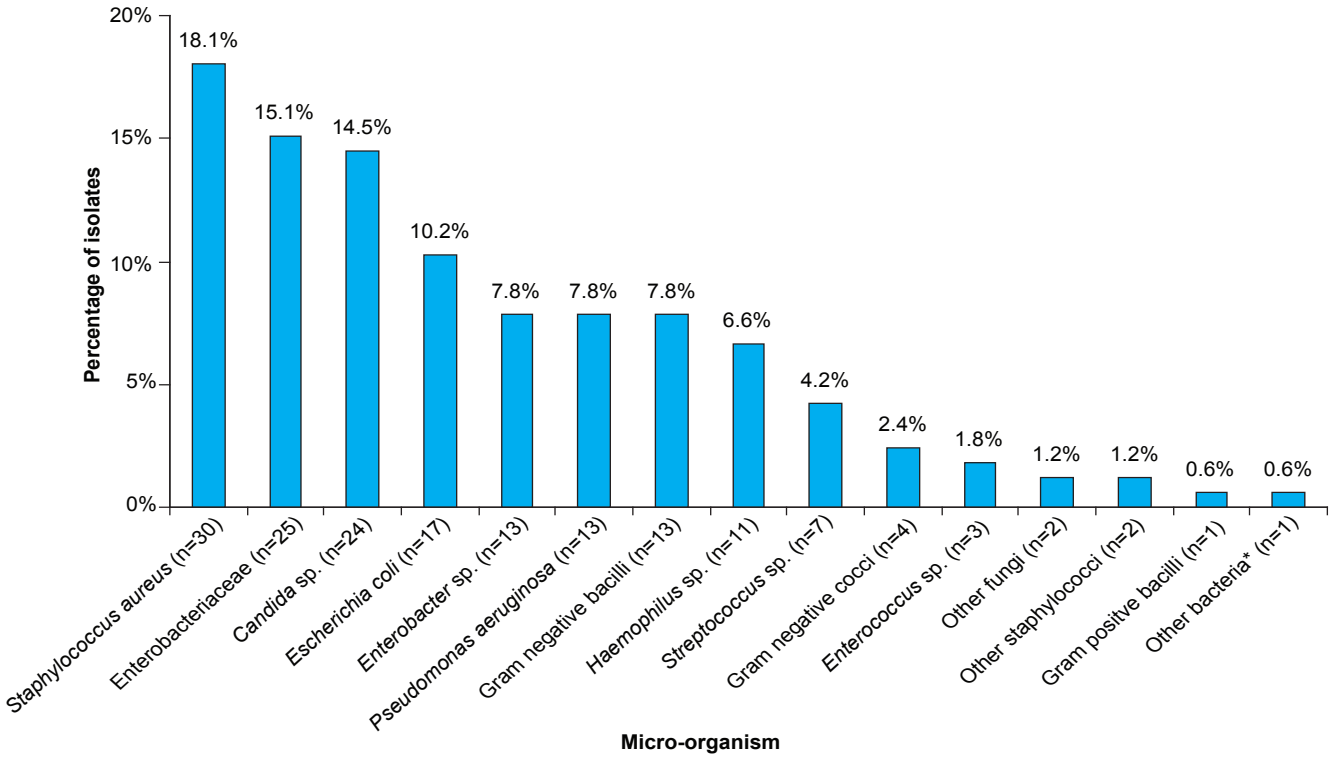
Figure 3. Frequency of pneumonia infections by the day of onset.



3.4.3 Distribution of micro-organisms isolated from pneumonia

Data for a total of 166 micro-organisms identified from patients with pneumonia were reported. Figure 4 shows the distribution of micro-organisms isolated from pneumoniae and a complete breakdown of micro-organisms is given in Appendix II.

Figure 4: The distribution of micro-organisms from pneumonia (n=166)



*Other bacteria - organism not specified

3.4.4 Key Summary Points - Pneumonia

- 3.1% of patients developed pneumonia during their stay in ICU.
- 80.1% of pneumoniae were VAP.
- The incidence density of VAP was 5.1 per 1000 invasive respiratory device days.
- The median day of onset for a pneumonia was seven days.
- The most frequently isolated micro-organisms from pneumoniae were *S. aureus* (18.1%), Enterobacteriaceae (15.1%), *Candida sp.* (14.5%) and *Escherichia coli* (10.2%).

3.5 Bloodstream Infection

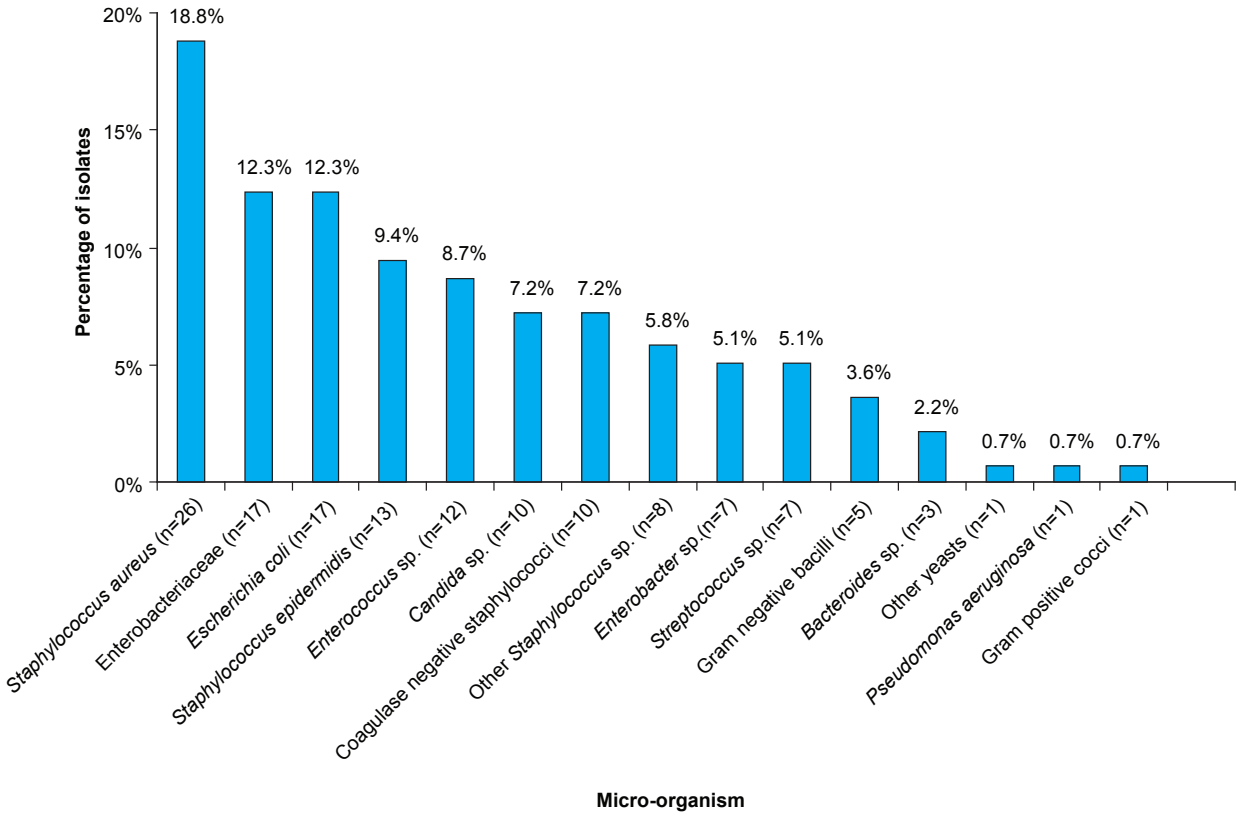
A total of 148 BSI were reported from 139 (2.6%) patients. The median day of onset was day 9 (IQR: 5, 14.5). Of these, 23 (15.5%) were CR-BSI, the incidence density of CR-BSI was 0.8 per 1000 central venous catheter (CVC) days (95% CI: 0.5, 1.2).

The incidence density of BSI (excluding CR-BSI) was 2.9 per 1000 patient days, (95% CI: 2.5, 3.5).

3.5.1 Distribution of micro-organisms isolated from BSI.

The distribution of micro-organisms from all BSI (CR-BSI and non CR-BSI) is shown in Figure 5 and a complete breakdown of micro-organisms is given in Appendix II.

Figure 5: The distribution of micro-organisms isolated from bloodstream infections (n=138)



3.5.2 Presence of CVCs in patients with BSI

Data from 94 of 125 BSIs (excluding CR-BSI) were analysed for the presence of a CVC on the day of onset or in the 48 hours prior to the BSI onset. Of these, 86 (91.5%) were reported to have had a CVC *in situ* on the day of onset, or in the 48 hours prior to the date of onset.

3.5.3 Key Summary Points- BSI

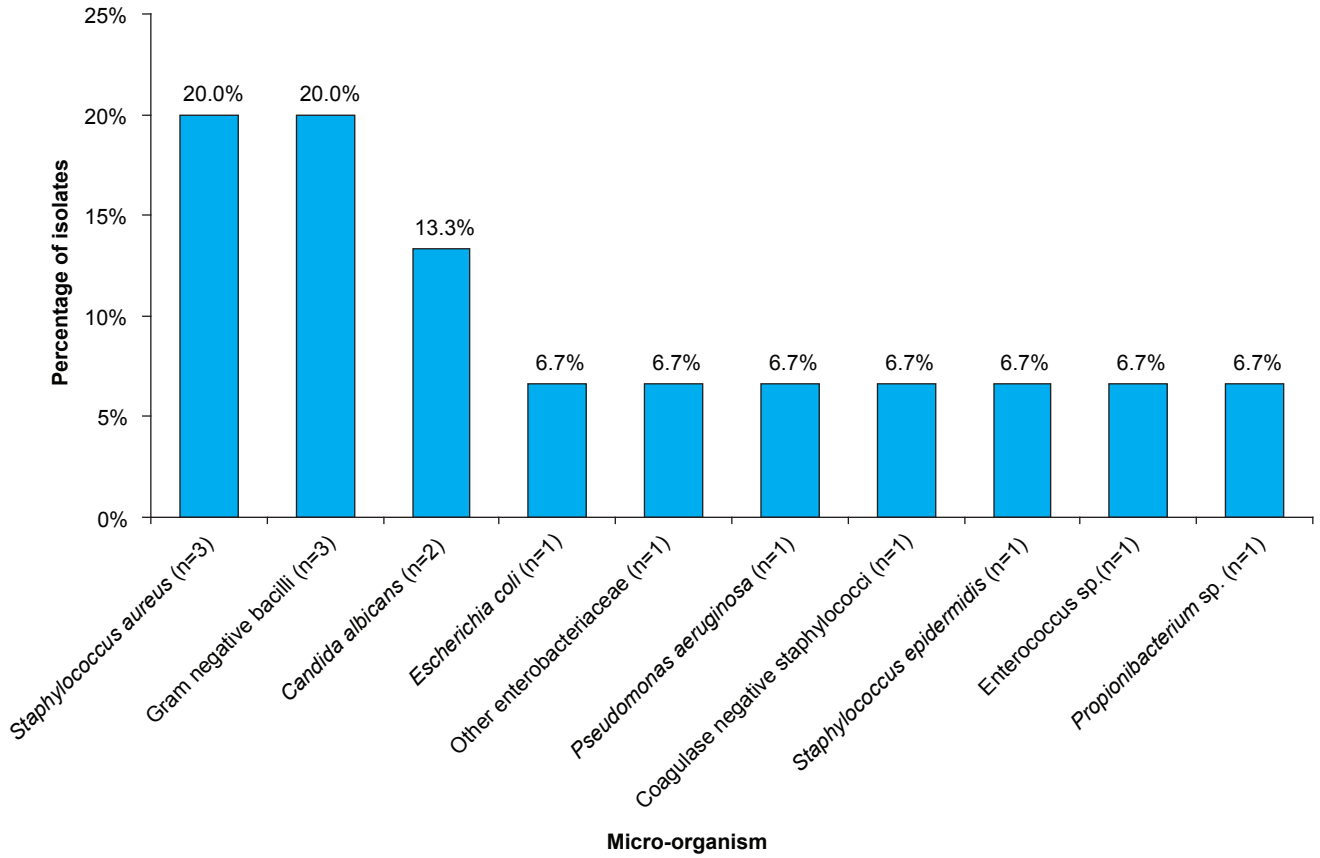
- 2.6% of patients developed a BSI.
- The incidence density of BSI was 2.9 BSI per 1000 patient days.
- The incidence density of CR-BSI was 0.8 per 1000 CVC days.
- Of the 94 non CR-BSI further analysed, a CVC was *in situ* or removed in the 48 hours prior to onset of BSI in 91.5% of cases.
- The most frequently isolated micro-organisms from BSI were *S. aureus* (18.8%), Enterobacteriaceae (12.3%) and *E. coli* (12.3%).

3.6 CVC related infection (excluding CR-BSI)

In total nine CRI-1 and 10 CRI-2 were reported, the incidence density of CRI-1 and CRI-2 was 0.7 per 1000 CVC days, (95% CI: 0.4, 1.0). The median day to infection was 14 days (IQR: 9, 15).

Figure 6 shows the distribution of micro-organisms isolated from CRI-1 and CRI-2 and a complete breakdown of micro-organisms is given in Appendix II.

Figure 6: The distribution of micro-organisms isolated from CRI-1 and CRI-2 (n=15)



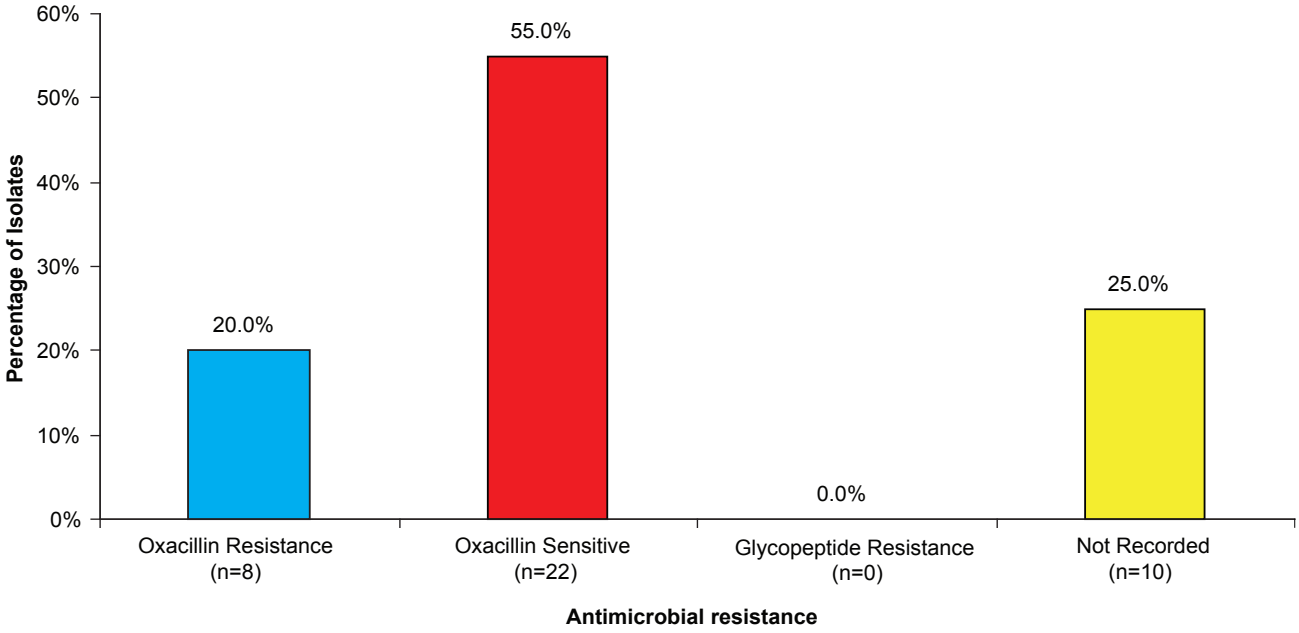
3.6.1 Key Summary Points- CRI (excluding CR-BSI)

- The incidence density of CRI (CR-1 and CR-2) was 0.7 per 1000 CVC days.
- *S. aureus* (20.0%) and Gram negative bacilli (20.0%) were the most frequently isolated organisms from CRI-1 and CRI-2 infections.

3.7 Antimicrobial resistance of organisms

Figure 7 shows the antimicrobial resistance (AMR) phenotypes of *S. aureus* isolates from the infections detailed in this report.

Figure 7: Percentage of Staphylococcus aureus isolates by antimicrobial resistance profile (n=40)



N.B. The AMR phenotype data was reported from 21 of the 23 contributing units.

3.7.1 Key Summary Points- AMR

- 20.0% of *S. aureus* isolated were meticillin resistant *S. aureus* (MRSA).

4. DISCUSSION

The findings in this report represent a significant achievement by HPS, SICSAG and the Scottish Critical Care clinical workforce. It is a report of HAI surveillance in Scotland's entire general adult ICU population.

The HAI surveillance data were collected by 23 ICUs in Scotland over a 12 month period. Not all units contributed data for the full 12 month period, however, all have contributed data for at least three calendar months. HAI surveillance in intensive care is a voluntary programme and all units in Scotland are now carrying out continuous surveillance. The contribution of data from all ICUs is a major step to achieving the objective of a national database for Scottish HAI data and Scotland's future contribution to the European dataset for HAI.

Overall, the findings are consistent with the previous pilot report of surveillance data from 2009 which was published in March 2011[2]. There are some minor variations in infection rates which may or may not be attributable to the different time period and/or the variation in the patient population represented in these reports. The previous report presented data from only 19 units for a nine-month time period and therefore the findings should not be compared with this report.

When compared with data published from the European Centre for Disease Control (ECDC) in 2010[6], the Scottish infection rates appear lower than the average for Europe. The European report for 2010 represents data from 2008 for eleven European countries and whilst infection rates are not shown by country, it has been shown in previous reports that there are considerable variations between countries[6].

In 2010, ECDC reported that 7.4% of patients in Europe developed a pneumonia during their stay in intensive care and that 90.1% of these were intubation (invasive respiratory device) associated[6]. The Scottish data indicate that 3.1% of patients developed pneumonia and 80.1% were ventilator (invasive respiratory device) associated pneumonia (VAP).

The incidence of VAP in Scotland was 5.1 per 1000 invasive respiratory device days compared to rates reported by ECDC ranging from 3.3 to 9.4 per 1000 invasive respiratory device days. In Scotland, 75% of patients with a stay of more than two days in the ICU had an invasive respiratory device *in situ* at some point during their stay, this makes the Scottish VAP rate comparable with the rate published by ECDC[6] for ICUs with ≥ 60% of patients intubated. The Scottish rate is considerably lower than the 9.4 pneumonia per 1000 invasive respiratory device days reported by ECDC[6]. This relatively low VAP rate may in part reflect the SICSAG VAP Prevention Bundle that has been used by all Scottish ICUs since 2008.

A total of 2.6% of patients developed a BSI during their stay, this is low in comparison to the European average of 3.4% of patients[6]. ECDC reported that 27.3% of BSIs were catheter-related, compared to 15.5% in Scotland. It was identified in the pilot report of Scottish data[2] that the proportion of CR-BSI and BSI in Scotland is different to that reported by ECDC. The reasons for this are not yet clear.

When the Scottish BSI data were investigated more closely we found that 91.5% had evidence of a CVC *in situ* on, or in the 48 hours prior to, the day of onset, therefore suggesting that some of these BSIs may be catheter-related. This may represent a significant underestimation of CR-BSI incidence due to lack of the microbiology sampling required to fulfil the strict HELICS definitions[1].

On a more positive note we cannot exclude the effect of the SICSAG Central Line Insertion Bundle and the Scottish Patient Safety Programme established across Scottish ICU's since 2008 that may have helped to prevent CR-BSI in Scotland.

S. aureus was the most frequently isolated organism from all infections and 20% of these isolates were MRSA. The "Surveillance of *Staphylococcus aureus* bacteraemias in Scotland" system reported that 19.0% of all *S. aureus* isolates from blood cultures were MRSA in 2010[7], and UK wide data reported by ECDC show that 27.8% of all *S. aureus* isolates from blood cultures are MRSA[8]. These data suggest that the proportion of MRSA reported here are consistent with rates in Scotland as a whole and lower than the proportion for the UK as a whole. It is noted that isolates reported here are from all HAI and not just blood cultures.

Limitations of the data

As discussed, not all units have participated for the full time period and therefore some units may be over or under represented in the data. Likewise, the variation in size of units across Scotland may also influence the results and have the effect of over or underestimating the infection rates.

The data in this report has been presented as a national data set. The individual ICUs have monthly reports of their HAI incidence to inform quality improvement in each unit through time. We are conscious of a temptation to use these data for comparisons between units for judgement and this should be avoided. The definitions within HELICS are standardised, but units will vary in the methods used for microbiology sampling. An example is the investigation of suspected VAP. The 22.7% of pneumoniae recorded as PN1 are from a small number of units that carry out routine quantitative cultures with bronchoalveolar lavage. The incidence of VAP in these units will be different to other units for this reason and other variation may also exist. We have also highlighted that lack of sampling may underestimate the incidence of HAI and cannot exclude differences in this to explain variation in incidence rates between units.

Future Reporting

The aim of this surveillance programme is to reduce infection rates to a minimum. To achieve this we must better understand the risks for developing HAI whilst in intensive care and contribute to informing appropriate clinical interventions for the prevention of HAI.
As the Scottish HAI database continues to grow and all ICUs continue to contribute data, it is anticipated that statistical analysis may be carried out to identify some of the risks for developing HAI, and inform the development of further clinical interventions to prevent and reduce infection.

As discussed, the data are limited by variation in unit size, demographics and available microbiological methods. Therefore future reporting should look towards possible methods of stratifying infection rates to provide more meaningful output.

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6. READER'S NOTES

Confidence Intervals

A range of values within which we are fairly confident the true population value lies. A 95% CI means that we can be 95% confident that the population value lies within the lower and higher confidence limits.

Incidence Density

Incidence Density for BSI and PN

Total number of BSI/PN as a proportion of the sum of the ICU in-patient days contributed by each patient in the study population. The proportion is expressed as the number of BSI/PN per 1000 patient days.

Incidence Density for CRI and CR-BSI

Total number of CRI/CR-BSI as a proportion of the sum of the CVC days (days that a patient had a CVC *in situ*) contributed by each patient in the study population. The proportion is expressed as the number of CRI/CR-BSI per 1000 CVC days

Incidence density for VAP

Total number of VAP as a proportion of the sum of the invasive respiratory device days (days that a patient required intubation) contributed by each patient in the study population. The proportion is expressed as the number VAP per 1000 invasive respiratory device days.

Interquartile range

The interquartile range for a distribution is the distance between the first and third quartiles.

The quartiles split the distribution into four equal parts with the median being the second quartile. Consequently the inter quartile range is the range containing the middle 50% of the data.

Mean

The mean value is obtained by adding all the values in a population or sample and dividing the total by the number of samples that are added.

Median

The median of a finite set of values is that value which divides the set into two equal parts such that the number of values equal to or greater than the median is equal to the number of values equal to or less than the median. If the number of observations is odd, the median will be the middle value when all values have been arranged in order of magnitude, when the number of observations is even, the median is the mean of the two middle observations.

Standard Deviation

A measure of variation, it describes how spread out a set of values are around the mean. A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data are spread out over a large range of values.

Appendix I

Antimicrobial resistance phenotypes[1].

Organism(s)	AMR Phenotype		
Staphylococcus aureus (MSSA)	Oxacillin sensitive (MRSA)	Oxacillin resistant	Glycopeptide-Intermediate *S. aureus* (GISA)

Appendix II

Micro-organisms isolated from pneumonia.

Genus	Micro-organism	Number of isolates	Percentage of isolates
Enterobacteriaceae (n=55)	*Citrobacter freundii*	1	0.6%
	Citrobacter sp., (not specified)	1	0.6%
	Enterobacter cloacae	8	4.8%
	Enterobacter sp., (not specified)	5	3.0%
	Enterobacteriaceae, (not specified)	2	1.2%
	Escherichia coli	17	10.2%
	Klebsiella oxytoca	2	1.2%
	Klebsiella pneumoniae	10	6.0%
	Klebsiella sp., (not specified)	3	1.8%
	Klebsiella sp., other	1	0.6%
	Other enterobacteriaceae	1	0.6%
	Proteus sp., (not specified)	1	0.6%
	Serratia liquefaciens	1	0.6%
	Serratia marcescens	1	0.6%
	Serratia sp., (not specified)	1	0.6%
Fungi (n=26)	*Candida albicans*	7	4.2%
	Candida glabrata	2	1.2%
	Candida sp., not specified	13	7.8%
	Candida sp., other	2	1.2%
	Other	2	1.2%
Gram negative bacilli (n=37)	*Acinetobacter baumannii*	2	1.2%
	Aeromonas sp.	1	0.6%
	Burkholderia cepacia	1	0.6%
	Haemophilus influenzae	4	2.4%
	Haemophilus sp., (not specified)	7	4.2%
	Other Gram-neg Bacilli, non enterobacteriaceae	1	0.6%
	Pseudomonadaceae family, (not specified)	3	1.8%
	Pseudomonadaceae family, other	1	0.6%
	Pseudomonas aeruginosa	13	7.8%
	Stenotrophomonas maltophilia	4	2.4%
Gram negative cocci (n=4)	*Moraxella* sp., (not specified)	2	1.2%
	Other Gram-negative cocci	2	1.2%
Gram positive bacilli (n=1)	*Corynebacterium* sp.	1	0.6%
Gram negative cocci (n=42)	*Enterococcus faecalis*	1	0.6%
	Enterococcus sp., (not specified)	2	1.2%
	Staphylococcus aureus	30	18.1%
	Staphylococcus sp., (not specified)	2	1.2%
	Streptococcus pneumoniae	3	1.8%
	Streptococcus sp., (not specified)	3	1.8%
	Streptococcus sp., other	1	0.6%
Other bacteria (n=1)	Other bacteria (not specified)	1	0.6%

Micro-organisms isolated from BSI.

Genus	Micro-organism	Number of isolates	Percentage of isolates
Anaerobic bacilli (n=3)	*Bacteroides fragilis*	2	1.4%
	Bacteroides (other)	1	0.7%
Enterobacteriaceae (n=41)	*Citrobacter freundii*	1	0.7%
	Citrobacter koseri (diversus)	1	0.7%
	Enterobacter cloacae	4	2.9%
	Enterobacter sp. (not specified)	3	2.2%
	Escherichia coli	17	12.3%
	Klebsiella oxytoca	1	0.7%
	Klebsiella pneumoniae	5	3.6%
	Klebsiella sp. (not specified)	5	3.6%
	Serratia marcescens	4	2.9%
Fungi (n=11)	*Candida albicans*	5	3.6%
	Candida glabrata	1	0.7%
	Candida sp., not specified	4	2.9%
	Other yeasts	1	0.7%
Gram negative bacilli (n=6)	*Acinetobacter* sp. (not specified)	1	0.7%
	Burkholderia cepacia	1	0.7%
	Other Gram-negative Bacilli	1	0.7%
	Pseudomonas aeruginosa	1	0.7%
	Stenotrophomonas maltophilia	2	1.4%
Gram positive cocci (n=77)	Coagulase negative staphylococci (not specified)	7	5.1%
	Enterococcus faecalis	2	1.4%
	Enterococcus faecium	5	3.6%
	Enterococcus sp. (not specified)	5	3.6%
	Other coagulase-negative staphylococci	3	2.2%
	Other Gram-positive cocci	1	0.7%
	Staphylococcus aureus	26	18.8%
	Staphylococcus epidermidis	13	9.4%
	Staphylococcus sp., not specified	8	5.8%
	Streptococcus pneumoniae	3	2.2%
	Streptococcus sp. (not specified)	3	2.2%
	Streptococcus sp., (other)	1	0.7%

Micro-organisms isolated from CRI-1 and CRI-2.

Genus	Micro-organism	Number of isolates	Percentage of isolates
Anaerobic bacilli (n=1)	*Propionibacterium* sp.	1	6.7%
Enterobacteriaceae (n=2)	*Escherichia coli*	1	6.7%
	Klebsiella sp., (not specified)	1	6.7%
Fungi (n=2)	*Candida albicans*	2	13.3%
Gram negative bacilli (n=4)	*Acinetobacter* sp., (not specified)	1	6.7%
	Burkholderia cepacia	2	13.3%
	Pseudomonas aeruginosa	1	6.7%
Gram positive cocci (n=6)	Coagulase negative staphylococci (not specified)	1	6.7%
	Enterococcus sp., (not specified)	1	6.7%
	Staphylococcus aureus	3	20.0%
	Staphylococcus epidermidis	1	6.7%

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