Key findings from SONAAR report

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William Malcolm, Clinical Lead
Julie Wilson, Principal Healthcare Scientist (AMR)
SONAAR programme
ARHAI Scotland
COVID-19 has impacted healthcare delivery in both hospital and community settings in 2020 and 2021. Priorities were adjusted to respond to the pandemic, leading to changes to delivery of services and to the patient population, including a new cohort of patients being treated for COVID-19. This will make comparisons with previous years difficult, therefore results presented in this report must be interpreted in the context of the pandemic and with due caution.

For further information on how COVID-19 has impacted healthcare delivery please see the ARHAI Scotland annual report.

nss.nhs.scot/publications/arhai-scotland-2021-annual-report
Antibiotic use in humans
There has been a 16.9% decrease in antibiotic use between 2017 and 2021.

Total breakdown of antibiotic use in 2021:
- Primary care: 69.8%
- Secondary care: 30.2%
  - Medical: 2.6%
  - Nurses: 13.7%
  - Dentists: 8.3%
  - Pharmacists: 4.2%
  - Acute hospitals: 1.3%
  - Non-acute hospitals: 6.6%
Total number of defined daily doses per 1,000 population per day (DDDs/1,000/day) for all antibiotics prescribed in Scotland, 2017 to 2021, by year.
Antibiotic use in primary care

There has been a **18.8% decrease** in antibiotic use in primary care between 2017 and 2021.

23.0% of the Scottish population had at least one course of antibiotics in 2021.

77.6% of antibiotic prescriptions in 2021 were Access (first line) antibiotic items.
Antibiotic prescribing in primary care (excluding dental prescribing) in Scotland, 2017 to 2021, by defined daily doses per 1,000 population per day (DDDs/1,000/Day) and items per 1,000 population per day (Items/1,000/Day), by year
Proportion of amoxicillin 500mg capsule prescriptions with five-day course durations in general practice, 2017 - 2021, by year.
Antibiotic prescribing by nurses in primary care in Scotland (items per 1,000 population per day; Items/1,000/Day), 2017 to 2021
Antibiotic prescribing by dentists in primary care in Scotland (items per 1,000 population per day; Items/1,000/Day), 2017 to 2021
Antibiotic use in acute hospitals

There has been a **8.6% decrease** in antibiotic use in acute hospitals between 2017 and 2021.

62.4% of antibiotic use in 2021 was Access (first line) antibiotics.

There has been a **20.6% decrease** in the use of Watch and Reserve group antibiotics between 2017 and 2021.
Antibiotic prescribing in acute hospitals in Scotland (defined daily doses per 1,000 occupied bed days; DDDs/1,000 OBDs), 2017 to 2021, by year
Percentage of all antibiotics prescribed (DDDs) in acute hospitals in Scotland that belonged to the 'Access' group, 2017 to 2021.
'Watch' and 'Reserve' group antibiotic prescribing in acute hospitals in Scotland (defined daily doses per 1,000 Occupied Bed Days; DDDs/1,000 OBDs), 2017 to 2021, by year
Antibiotic use in animals
17.4% of consultations for companion animals resulted in prescriptions of antibiotics in 2021.

There was a 7.3% increase between 2020 and 2021.

There was a 1.8% year-on-year decrease over the last 5 years.
91.9% of antibiotics prescribed to companion animals are not critical to human health.

There was a 3.9% year-on-year reduction in the percentage of highest priority critically important antibiotics (HP-CIA) prescribed for companion animals over the last 5 years.
Trends in prescribing of antibiotics (including HP-CIAs) for all companion animals, in veterinary practices in Scotland contributing to SAVSNET, 2017 to 2021.
Percentage of total antibiotics prescribed, by antibiotic family, for cats and dogs in veterinary practices in Scotland contributing to SAVSNET for 2021.
Antimicrobial resistance in humans
Estimated number of drug resistant bacteraemia in Scotland, 2021, by organism.

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Percentage resistant to at least one key antibiotic</th>
<th>Estimated number of resistant bacteraemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gram-negative bacteraemia (n = 5,600)</td>
<td>19.9%</td>
<td>1,113.4</td>
</tr>
<tr>
<td><em>Escherichia coli</em> (n=4,292)</td>
<td>22.4%</td>
<td>962.5</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em> (n=743)</td>
<td>15.0%</td>
<td>111.8</td>
</tr>
<tr>
<td><em>Klebsiella oxytoca</em> (n=247)</td>
<td>5.3%</td>
<td>13.1</td>
</tr>
<tr>
<td><em>Acinetobacter</em> species (n=57)</td>
<td>0.0%</td>
<td>0.0</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em> (n=261)</td>
<td>10.0%</td>
<td>26.1</td>
</tr>
<tr>
<td>Gram-positive bacteraemia (n = 2,646)</td>
<td>6.6%</td>
<td>174.2</td>
</tr>
<tr>
<td><em>Enterococcus faecium</em> (n=276)</td>
<td>40.4%</td>
<td>111.4</td>
</tr>
<tr>
<td><em>Enterococcus faecalis</em> (n=516)</td>
<td>0.6%</td>
<td>3.2</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em> (n=1,590)</td>
<td>3.6%</td>
<td>57.0</td>
</tr>
<tr>
<td><em>Streptococcus pneumoniae</em> (n=264)</td>
<td>1.0%</td>
<td>2.6</td>
</tr>
<tr>
<td>Total number of bacteraemia (n = 8,246)</td>
<td>15.6%</td>
<td>1,287.6</td>
</tr>
</tbody>
</table>

[Data source: Electronic Communication of Surveillance in Scotland (ECOSS)]
E. coli bacteraemia (ECB)

In 2021, *Escherichia coli* (*E. coli*) was the **most common** cause of Gram-negative bacteraemia. The incidence of ECB was **78.5 per 100,000 population**.

The incidence has **remained stable** between 2020 and 2021.

- There has been a **3.4% year-on-year decrease** in incidence over the last 5 years.

- Non-susceptibility in ECB isolates has **remained stable** between 2020 and 2021.

- Other than non-susceptibility to co-amoxiclav which has **decreased**.
Urinary tract infections

Urinary tract infections (UTI) are common in both community and healthcare settings. The development of resistance in urinary isolates can act as an early warning of resistance in bacteria causing more serious infections.

*Escherichia coli* (*E. coli*) is the most common cause of UTI

In 2021, there were 127,377 cases of *E. coli* in urinary isolates

Non-susceptibility in *E. coli* urinary isolates has decreased between 2020 and 2021

Other than non-susceptibility to fosfomycin which has increased
**Carbapenemase-producing organisms**

Carbapenemase-producing organisms (CPOs) can inactivate carbapenem antibiotics, leaving few therapeutic options for treatment.

In 2021, there were **55** CPOs compared to **59** CPOs in 2020.

The incidence of CPO has remained **stable** between 2020 and 2021.

There has been a **14.3%** year-on-year **decrease** in CPO incidence over the last 5 years.

Of those identified in 2021, **94.9%** were carbapenemase-producing *Enterobacterales* (CPE).
CPO incidence and most common enzymes

In 2021, the annual incidence rate of CPO was 1.0 per 100,000 population.

In 2021, the most frequently isolated enzymes were OXA-48, NDM and VIM.
Enterococcal bacteraemia

Enterococci cause a range of infections in both humans and animals.

In 2021, the incidence of *Enterococcus faecalis* bacteraemia was 9.4 per 100,000 population and *Enterococcus faecium* bacteraemia was 5.0 per 100,000 population.

- The incidence of *E. faecalis* and *E. faecium* bacteraemia has remained **stable** over the last 5 years

- Non-susceptibility in *E. faecium* bacteraemia isolates has remained **stable** between 2020 and 2021

- 40.4% of *E. faecium* bacteraemia isolates are non-susceptible to vancomycin
Salmonella in humans and animals

During 2021, 67.0% of the 333 human Salmonella isolates tested were fully susceptible by genotype due to the absence of any detectable AMR genes or genetic markers; this compares to 60.2% in 2020.

In 2021, a total of 230 (83.3%) of the 276 animal Salmonella isolates tested were fully susceptible by genotype. In 2020, 79.1% (n=227) of Salmonella reported from animals were fully susceptible as determined by phenotypic inference from WGS.
Amongst high priority critically important antimicrobials (HP-CIAs), non-susceptibility was not detected to ertapenem.

Nonsusceptibility to third generation cephalosporins remained low and was only detected from cattle (ceftazidime, 0.2%) and poultry (cefotaxime 0.9%; ceftazidime 0.9%).

In 2021, ciprofloxacin (fluoroquinolone) non-susceptibility was detected from cattle (0.4%), pigs (1.9%), but in 7.4% of poultry isolates, which is a decrease (p=0.001) from 15.5% in 2020.

As in previous years, there was again a notable proportion of isolates from poultry non-susceptible to gentamicin and isolates from pigs non-susceptible to chloramphenicol. These proportions are lower (p=0.003) in 2021 compared to those seen in 2020.
Monitoring AMR in the environment

Antimicrobial resistance (AMR) in the environment

UK National AMR Action Plan 2019-2024 (NAP)
SEPA is a member of the Scottish One Health National AMR Action Plan Group (SCHNAP) that is responsible for delivering Scotland’s work for the NAP. This group is chaired by ARHAI Scotland and comprises representatives from human health, animal health, food, and the environment. SEPA is also represented on an AMR in the Environment in Scotland Stakeholder Group (AES). SEPA has developed this Data Visualisation Tool as a platform for sharing its environmental AMR surveillance data.

Scotland’s bathing waters
SEPA has been monitoring and reporting on the bacteriological quality of designated bathing waters in Scotland for many years. There are currently 87 designated bathing water sites in Scotland and water samples are collected frequently (typically on 10 occasions) from each site during the designated bathing water season (1st June to 15th September). These water samples are tested for E. coli and intestinal enterococci and the results are used to classify water quality as excellent, good, sufficient, or poor (Bathing Waters (Scotland) Regulations 2008).

Antibiotic resistance in bathing waters
SEPA has been testing for antibiotic resistance in E. coli in bathing water samples since the start of the 2018 bathing water season as part of its contribution to Scotland’s work for the NAP. SEPA has adopted its standard method for counting E. coli in water samples so that it can be used to test for antibiotic resistance. It has added the antibiotic cefotaxime to the bacterial growth medium (to produce a resultant concentration of cefotaxime in the growth medium of 4 μg/L) and compared E. coli colony counts in standard medium (total E. coli) with those in cefotaxime-enriched medium (cefotaxime-resistant E. coli). SEPA has also been using an antibiotic susceptibility test to test the susceptibility of cefotaxime-resistant (CTX-R) E. coli isolates from environmental samples to a range of clinically relevant antibiotics.

Sampled locations

The map controls located in the top right hand corner of the map allow the user to zoom in and out and reset back to the full view. Click on a location (circle) to display data in the table at the bottom and click off the circle to unmark the location.

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Positive samples</th>
<th>Total samples</th>
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<tbody>
<tr>
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</table>

Cefotaxime Resistance
- Absent
- Present
- No. of positive samples
- ≥ 13
- ≤ 0
I’m pleased to see the continued reduction in overall antibiotic use in humans, that antibiotics are being used responsibly and that AMR is largely stable. This is testament to the continued efforts of clinicians and the public working together to understand that antibiotics should only be prescribed and taken on advice of health professionals.

William Malcolm, Clinical Lead, Scottish One Health Antimicrobial Use and Antimicrobial Resistance Programme