an SHV ESBL+ K. pneumoniae, a TEM/CTX-M ESBL+ E. coli and a TEM/SHV+ ESBL+ E. coli. There is no immediate explanation for these results, particularly since several TEM, SHV and CTX-M ESBL+ isolates were correctly identified as ‘exhibiting another resistance mechanism’. The ESBL activity might have been masked by the AmpC inducer (incorporated into all three discs), and hence these results highlight an important limitation of the D69C kit, i.e. it is solely a method for AmpC detection, and its use cannot be extrapolated to ESBL detection. The ESBL inhibitor is incorporated into discs B and C to improve the performance of the kit in detecting AmpC, not to adapt it for ESBL detection.

In conclusion, this study indicates that the D69C AmpC Detection Disc Set provides a simple, economical, convenient and accurate means of detecting AmpC production by organisms exhibiting plasmid-mediated as well as chromosomal AmpC, whether inducible or derepressed. Results are easily interpreted, and the methodology is suitable for use by any clinical microbiology laboratory. The D69C kit is a promising development in a difficult area—broader experience will hopefully pave the way for its wide adoption in routine laboratories.

Acknowledgements
This work was presented at the Fifty-first Interscience Conference on Antimicrobial Agents and Chemotherapy, Chicago, IL, USA, 2011 (Poster D-697).

Funding
No external funding was provided for this study. The D69C AmpC Detection Disc Sets used were provided without charge by Mast Group Ltd. Data have been generated as part of the routine work of the Royal Free Hampstead NHS Trust.

Transparency declarations
None to declare.

References

Audit of Staphylococcus aureus bacteraemia management in NHS Tayside and comparison with European Antibiotic Strategies study group international quality standards

Thomas Johnston, Thomas Yeoman, Susan Chapman, Charis Marwick and Dilip Nathwani*

Infectious Disease Department, Ninewells Hospital and Dundee Medical School, Dundee DD1 9SY, Scotland, UK

*Corresponding author. Tel: +44-1382-496459; Fax: +44-1382-496547; E-mail: dilip.nathwani@nhs.net

Keywords: S. aureus, MRSA, MSSA

Sir,

Staphylococcus aureus bacteraemia (SAB) remains a significant cause of morbidity and mortality.\(^1\) National emphasis on SAB prevention has been successful in reducing the incidence, but there were still >14,000 episodes in the UK in 2007.\(^2\) The European Antibiotic Strategies (ABS) study group (http://www.
abs-international.eu/index.php?id=1265) proposed SAB management indicators to investigate quality of care and tested these in five European countries.\(^3\)

Our study is the first in the UK to compare current clinical practice for SAB management against the proposed ABS quality indicators, which are not yet in use in the study hospital.

We performed a retrospective medical case note audit of all adult patients with SAB in Ninewells Hospital, Dundee, over a 12 month period (December 2009 to December 2010). The ABS quality indicators are as follows: (i) echocardiogram within 10 days; (ii) intravascular device removal within 10 days; and (iii) appropriate antibiotic (determined by local policy) for ≥14 days. Additional data included the following: demographics; whether the isolate was methicillin-susceptible S. aureus (MSSA) or methicillin-resistant S. aureus (MRSA); if microbiology (phone call within 24 h) and/or infectious disease (ID) team (ward visit within 48 h) review was documented; mortality (30 day); and readmission within 2 weeks (deaths excluded) from the time of discharge. An episode of SAB was defined as isolation of S. aureus from at least one blood culture bottle. Patients with more than one episode were included if the time between episodes was >2 weeks.

Exclusion criteria for each indicator were as follows: patients who died before microbiology (within 24 h) or ID team (within 48 h) review was possible, before an echocardiogram could be performed (within 10 days) or before an intravascular device could be removed (within 10 days); and when case notes were unavailable or incomplete.

Three SAB episodes were excluded due to insufficient information in the medical notes, leaving 95 eligible SAB episodes in 92
Intravenous catheter related SAB has emerged as a major nosocomial infection problem. In this study, 17/95 (18%) of SAB episodes were related to an intravenous catheter, of which 76% were removed within 10 days. This was similar to the ABS group’s findings. The numbers who did not have catheters removed were too small to determine any adverse effect of this.

The ABS group and the BSAC recommend a minimum treatment duration of 14 days for uncomplicated SAB. Most patients in this study (83%) received initial appropriate therapy and most completed 14 days (72%). This is comparable to previous studies, where 30%–74% of patients received 14 days of therapy, but still reflects unsatisfactory performance.

Adherence to additional indicators of patient outcomes and specialist infection review was also assessed. Our case fatality rate was 27% (25/92), which was comparable to the range of 16%–40% in recent observational studies. In addition, 84% (21/25) of the case fatalities had received ≥14 days of appropriate antibiotics at the time of death.

The benefit of specialist infection input into the management of SAB has been described previously. In NHS Tayside, clinicians managing SAB are supported in antimicrobial management by infection specialists. Initially, microbiology provides telephone advice as soon as a positive culture is detected and the ID team subsequently carries out a bedside review. While 78% of SAB episodes in this study had documented microbiology advice, it is likely that additional episodes had advice that was not documented. A previous study suggested that recording of telephoned blood culture advice occurs in less than two-thirds of cases. Surprisingly, only 70% of episodes had a documented ID team review as this team would normally write the findings of the clinical consult in the notes. Potential reasons behind this require further investigation.

We are currently considering the most effective means of improving communication between ID and attending teams to ensure advice is adhered to; options include the infection prevention nurse carrying out a root cause analysis of the SAB episode or a further call/visit from the infection team. The latter is now facilitated by the use of a generic ID e-mail address, which provides a clinical or e-mail response within 24 h. Other possible interventions include an educational meeting for new clinicians, providing antibiotic advice on laboratory reports and feedback of audit results.

Our study confirms the practical value of the quality indicators proposed by the ABS group as an audit tool to measure the quality of the process of care in relation to SABs. However, this exercise is time consuming and has inherent limitations, particularly in terms of timeliness of feedback of the findings to clinicians and sustainability. A prospective and timely evaluation of SABs, e.g. through a root cause analysis, may be more meaningful in encouraging change and compliance with good practice. Indeed, our audit and a national survey of SAB management undertaken on behalf of the Scottish Antibiotic Prescribing Group precipitated the development of a consensus national Scottish algorithm for best practice for SAB management. It provides clear guidance for core aspects of SAB management and will be subject to future local and national audit. Our study adds to the current sparse literature regarding the

### Table 1. Comparison of SAB patient management against the ABS quality indicators

<table>
<thead>
<tr>
<th>Process of care</th>
<th>Excluded as died &lt;24 h</th>
<th>Number of episodes reviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbiology team review</td>
<td>3/95 (3%)</td>
<td>72/92 (78%)</td>
</tr>
<tr>
<td>ID team review</td>
<td>4/95 (4%)</td>
<td>64/91 (70%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management</th>
<th>Excluded as died &lt;10 days</th>
<th>Echo within 10 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echocardiogram</td>
<td>4/95 (4%)</td>
<td>42/91 (46%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appropriate antibiotic treatment and duration</th>
<th>Received appropriate antibiotic</th>
<th>and had ID review</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;14 days</td>
<td>79/95 (83%)</td>
<td>56/79 (71%)</td>
</tr>
<tr>
<td>&gt;14 days who had ID review</td>
<td>69/95 (72%)</td>
<td>52/69 (75%)</td>
</tr>
<tr>
<td>&gt;14 days who died within 30 days</td>
<td>11/72 (15%)</td>
<td>15/72 (21%)</td>
</tr>
<tr>
<td>&lt;14 days</td>
<td>26/95 (27%)</td>
<td>12/24 (50%)</td>
</tr>
<tr>
<td>&lt;14 days who had ID review</td>
<td>12/24 (50%)</td>
<td>10/24 (41%)</td>
</tr>
<tr>
<td>Intravenous catheter related</td>
<td>17/95 (18%)</td>
<td>13/17 (76%)</td>
</tr>
<tr>
<td>intravenous catheter related and removed within 10 days</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total number of deaths within 30 days</th>
<th>Died, but on appropriate antibiotic or received ≥14 days</th>
<th>Died, but on appropriate antibiotic</th>
<th>Died, but had received ≥14 days</th>
<th>Total number of MSSA deaths within 30 days</th>
<th>Total number of MRSA deaths within 30 days</th>
<th>Readmission within 2 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality within 1 month</td>
<td>25/92 (27%)</td>
<td>21/25 (84%)</td>
<td>10/21 (48%)</td>
<td>11/21 (52%)</td>
<td>21/25 (84%)</td>
<td>4/25 (16%)</td>
<td>6/67 (9%)</td>
</tr>
<tr>
<td>total number of readmissions within 14 days</td>
<td>6/67 (9%)</td>
<td>6/6 (100%)</td>
<td>0/6 (0%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number of MSSA readmissions within 14 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number of MRSA readmissions within 14 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Patients. The demographic characteristics of the study population are presented in Table S1 (available as Supplementary data at JAC Online), and performance against the study quality indicators (with exclusions) is given in Table 1.

Echocardiography, transoesophageal or transthoracic, within 10 days of positive blood culture is recommended in all SABs because metastatic infection develops in up to one-third of patients and many are not suspected clinically. In our study 46% (42/91) of SAB episodes achieved this standard, a finding similar to that of the ABS group; both findings were clearly substandard. Due to the limitations of this study we were unable to assess if the results of an echocardiogram changed management.

The ABS group subsequently carries out a bedside review. While 78% of SAB episodes in this study had documented microbiology advice, it is likely that additional episodes had advice that was not documented. A previous study suggested that recording of telephoned blood culture advice occurs in less than two-thirds of cases. Surprisingly, only 70% of episodes had a documented ID team review as this team would normally write the findings of the clinical consult in the notes. Potential reasons behind this require further investigation.

We are currently considering the most effective means of improving communication between ID and attending teams to ensure advice is adhered to; options include the infection prevention nurse carrying out a root cause analysis of the SAB episode or a further call/visit from the infection team. The latter is now facilitated by the use of a generic ID e-mail address, which provides a clinical or e-mail response within 24 h. Other possible interventions include an educational meeting for new clinicians, providing antibiotic advice on laboratory reports and feedback of audit results.

Our study confirms the practical value of the quality indicators proposed by the ABS group as an audit tool to measure the quality of the process of care in relation to SABs. However, this exercise is time consuming and has inherent limitations, particularly in terms of timeliness of feedback of the findings to clinicians and sustainability. A prospective and timely evaluation of SABs, e.g. through a root cause analysis, may be more meaningful in encouraging change and compliance with good practice. Indeed, our audit and a national survey of SAB management undertaken on behalf of the Scottish Antibiotic Prescribing Group precipitated the development of a consensus national Scottish algorithm for best practice for SAB management. It provides clear guidance for core aspects of SAB management and will be subject to future local and national audit. Our study adds to the current sparse literature regarding the
feasibility of quality indicators to evaluate the process of care for SAB in hospitals.

Acknowledgements
We would like to thank the Infection Prevention Team for their help in identifying patients with SAB.

Funding
This study was carried out as part of our routine work.

Transparency declarations
None to declare.

Supplementary data
Table S1 is available as Supplementary data at JAC Online (http://jac.oxfordjournals.org/).

References