An evaluation of different methods to recover methicillin-resistant *Staphylococcus aureus* from hospital environmental surfaces

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**Introduction**

The hospital environment has been shown to be contaminated with nosocomial pathogens, such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococci (VRE).

Healthcare premises mainly evaluate their cleaning regimens by means of visual assessment, which is ineffective. An optimised method of sampling the environment would shed light on the actual extent of environmental contamination.

We compared different recovery methods of MRSA from two common healthcare environmental surfaces.

**Materials and Methods**

Known concentrations of MRSA were spread onto 100 cm\(^2\) areas of normal laboratory bench (used to mimic patient bedside locker) and a mattress cover.

Sampling of contaminated surfaces was performed using:

- Cotton-tipped swabs were moistened with sterile saline before use.
- Macrofoam Critical swabs (European article no: 149-0234; VWR International) were used as described for cotton swabs.
- Viscose (rayon) tipped neutralising buffer swabs (Technical Service Consultant, UK) were moistened in 5ml of neutralising media before use.
- The eSwab transport system (Copan, Italy), consists of a flocked swab and 1 ml of modified Amies liquid media. The swab was moistened with Amies media before swabbing.
- Brillance MRSA contact plates (Oxoid, U.K.) were pressed to the surface for 10 s and incubated at 37ºC for 24 h.

Swab methods were enriched in TSB with 5% NaCl at 140rpm for 18h at 37ºC and subcultured onto MRSA Select Agar (BIO-RAD).

Swabs were compared to a series of different contact plates, such as the Oxoid MRSA contact plates used to determine the lowest MRSA cm\(^2\) to generate a positive result.

- eSwabs and Macrofoam swabs showed similar, highly sensitive results, requiring as little as 3.9x10\(^{-1}\) MRSA cm\(^2\) to generate a positive result.
- Contact plates had a sensitivity of 2.4 for mattress and 2.1 MRSA cm\(^2\) for bench surface. In addition it provides the most rapid result (24 h) for a presumptive MRSA positive.
- Saline moistened cotton swabs had the poorest sensitivity, requiring 1.1x10\(^{3}\) MRSA cm\(^2\), over 1000 times less sensitive than eSwabs or Macrofoam swabs (Figure 1).
- With most of the methods used, the number of bacteria required to induce a positive result was less for the bench surface.

**Results**

The sensitivity of each sampling method was evaluated (Table 1), i.e. the lowest MRSA cm\(^2\) to generate a positive result.

- eSwabs and Macrofoam swabs showed similar, highly sensitive results, requiring as little as 3.9x10\(^{-1}\) MRSA cm\(^2\) to generate a positive result.
- Contact plates had a sensitivity of 2.4 for mattress and 2.1 MRSA cm\(^2\) for bench surface. In addition, it provides the most rapid result (24 h) for a presumptive MRSA positive.
- Saline moistened cotton swabs had the poorest sensitivity, requiring 1.1x10\(^{3}\) MRSA cm\(^2\), over 1000 times less sensitive than eSwabs or Macrofoam swabs (Figure 1).
- With most of the methods used, the number of bacteria required to induce a positive result was less for the bench surface.

**Table 1:** Mean sensitivities (MRSA cm\(^2\)) for each sampling method to detect MRSA on two surfaces

<table>
<thead>
<tr>
<th>Method</th>
<th>Mattress</th>
<th>Bench</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact plate</td>
<td>2.4x10(^0)</td>
<td>2.1x10(^2)</td>
</tr>
<tr>
<td>Neutrilising swab</td>
<td>5.4x10(^{-1})</td>
<td>2.6x10(^1)</td>
</tr>
<tr>
<td>Saline swabs</td>
<td>1.1x10(^{-3})</td>
<td>2.8x10(^{-2})</td>
</tr>
<tr>
<td>eSwab</td>
<td>2.0x10(^{-3})</td>
<td>6.1x10(^{-1})</td>
</tr>
<tr>
<td>Macrofoam swab</td>
<td>1.0x10(^{-5})</td>
<td>3.9x10(^{-4})</td>
</tr>
</tbody>
</table>

**Conclusions**

- eSwabs and Macrofoam swabs displayed high sensitivity and should be considered for routine screening of the hospital environment.
- Direct contact plates are very sensitive and quick to perform but they can only cover a small surface area.
- Saline moistened cotton swabs had very poor sensitivity and are unsuitable to detect bacterial numbers outlined in proposed standards. This is of concern since it is the standard method used in the majority of publications covering surface contamination in the hospital.

**Bibliography**

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