Multi-drug resistant organisms (MDROs) often result in severe adverse complications and are increasingly challenging to manage in the neonatal intensive care unit (NICU). Between January–February 2017, an increase of MDROs, especially extreme drug resistant Acinetobacter baumannii (XDR-AB) were isolated from clinical and screening samples of infants in a 25-bed level III tertiary NICU. Based on daily MDRO surveillance, there were no MDROs isolated in the previous 6 months.

### Objective

To investigate the source, mode of transmission and assess control measures for an MDROs outbreak affecting 9 preterms between January-February 2017.

### Methods

An outbreak investigation was performed with concurrent assessment of infection control measures. Intensive surveillance of clinical isolates, screening of contacts and the environment.

Environment samples were obtained from high touch points in the infant care areas (eg. incubator, monitor, mini syringe pumps). The sink in the milk handing room, expressed breast milk (EMB), refrigerator and fingers of health care workers (HCWs). XDR-AB was defined as **Acinetobacter baumannii** resistant to all antibiotics except colistin.

A review of protocols and direct observation of patient care practices was conducted and findings were communicated to the NICU staff.

### Results

Nine preterm infants were colonised or infected with a total of 13 MDROs. The mean gestation age (GA), body weight (BW) and age at which MDROs were isolated was 30.7±SD 2.49 weeks, 1347±SD 403 gm and 16±SD 8.81 days respectively. All 9 neonates harboured XDR-AB. (Table 1)

XDR-AB was isolated from surveillance swabs (Table 2). The XDR-AB isolated from the neonates and surveillance swabs had similar sensitivity patterns.

Patient care and adherence to infection control guidelines were not standardised. Non critical equipment (ie. syringe drives) were shared between patients and cleaning of equipment between patients was inadequate. Environmental cleaning was poor and dilution of disinfectant (sodium hypochlorite) was incorrect.

### Table 1: Summary of infants harbouring XDRAB January-February 2017

<table>
<thead>
<tr>
<th>No</th>
<th>BW (gm)</th>
<th>GA (weeks)</th>
<th>Age during isolation of MDRO(days)</th>
<th>Invasive device or procedure</th>
<th>Side of isolate</th>
<th>Other MDRO infection/colonised</th>
<th>Outcome (30 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>845</td>
<td>27</td>
<td>10</td>
<td>Yes</td>
<td>TA</td>
<td>ESBL Kp</td>
<td>HAC Alive</td>
</tr>
<tr>
<td>2</td>
<td>1305</td>
<td>30</td>
<td>13</td>
<td>Yes</td>
<td>NPS</td>
<td>-</td>
<td>Alive</td>
</tr>
<tr>
<td>3</td>
<td>570</td>
<td>27</td>
<td>6</td>
<td>Yes</td>
<td>Blood</td>
<td>-</td>
<td>HAI Dead</td>
</tr>
<tr>
<td>4</td>
<td>1265</td>
<td>33</td>
<td>14</td>
<td>Yes</td>
<td>Swab -</td>
<td>omphalocoe</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>1515</td>
<td>31</td>
<td>14</td>
<td>Yes</td>
<td>Blood</td>
<td>-</td>
<td>HAI Dead</td>
</tr>
<tr>
<td>6</td>
<td>1635</td>
<td>33</td>
<td>28</td>
<td>Yes</td>
<td>Throat swab</td>
<td>ESBL Kp, CR-Kp</td>
<td>HAC Alive</td>
</tr>
<tr>
<td>7</td>
<td>1730</td>
<td>31</td>
<td>16</td>
<td>Yes</td>
<td>Rectal swab</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>1535</td>
<td>31</td>
<td>24</td>
<td>Yes</td>
<td>TA</td>
<td>ESBL Kp</td>
<td>HAI Alive</td>
</tr>
<tr>
<td>9</td>
<td>1725</td>
<td>34</td>
<td>5</td>
<td>No</td>
<td>Eye swab</td>
<td>-</td>
<td>HAC Alive</td>
</tr>
</tbody>
</table>

K=Klebsiella pneumoniae, CR= carbapenem resistant, ESBL=extended spectrum beta lactamases, XDR-AB= extreme drug resistant Acinetobacter baumannii; TA=Tracheal aspirate; NPS= Nasopharyngeal secretion; HAC= Hospital acquired colonisation, HAI= Hospital acquired Infection, EBM= Express breast milk, HCW= Health care worker, SS= sensitive strain.

### Table 2: Surveillance Swabs January-February 2017

<table>
<thead>
<tr>
<th>Surveillance swabs</th>
<th>Isolation of XDRAB</th>
<th>Other organisms isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectal swab</td>
<td>2</td>
<td>Acinetobacter baumannii</td>
</tr>
<tr>
<td>TA</td>
<td>2</td>
<td>Acinetobacter baumannii</td>
</tr>
<tr>
<td>Blood swab</td>
<td>0</td>
<td>Acinetobacter baumannii</td>
</tr>
<tr>
<td>EMB swab</td>
<td>0</td>
<td>Acinetobacter baumannii</td>
</tr>
<tr>
<td>Finger print from 10 HCW</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

### Intervention

**Environmental cleaning & disinfection**

- Regular multidisciplinary meetings & leadership support
- Equipment cleaning & dedicated to individual patient
- Re-emphasize hand hygiene compliance, PPE, cohorting & care bundles (VAP, CRBBI)
- Milk handling practices
- Environment cleaning

**Regular multidisciplinary meetings & Leadership/Management support:**

NICU doctors, matrons, ward managers, infection control link nurses and cleaning staff.

**Reemphasise on compliance to infection prevention protocols to NICU staff,** visiting doctors, medical students and visitors.

- HH, PPE, proper attire, cohorting, care bundles
- Non critical equipment: dedicated to individual patient; proper cleaning & disinfection between patients.

**Milk handling practices**

- Revised protocol and supervised practice, identified a suitable room
- Educating mothers

**Environment cleaning**

- Revised cleaning protocol, developed a cleaning video and checklist. Retrained cleaning supervisors, competence assessed and cleaning practices audited.

**Infection control interventions & reinforcement of protocols** resulted in reduction of MDROs and no further XDR-AB isolated. (Figure 1)

**Infection control interventions & reinforcement of protocols**

- VAP= ventilator associated pneumonia, CRBBI= catheter related blood stream infection, HH=hand hygiene, PPE= personal protective equipment

### Conclusion

Daily surveillance for MDROs is necessary to identify an outbreak promptly. A rapid and thorough investigation of the environment during an outbreak is essential to find the source of the infection. The spread of XDR-AB was suspected to have arisen from contaminated equipment and pathogen transmission via close contact. Revision of protocols and rigorous infection control enforcement by a multidisciplinary team, resulted in outbreak containment.

### Acknowledgements

1. Funded by FRGS, MOE (FP0014-0)
2. Infection Control Nurses, NICU staff, Hospital cleaning Team and Laboratory Technicians involved in the management of the outbreak.

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**An outbreak of multidrug resistant organisms in a neonatal intensive care unit in Malaysia.**

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