NSW HEALTH

2007 NSW Health Awards Entry

Entry Title (50 characters or less)

Reducing Intensive Care Multi-resistant Organism (MRO) transmission

Abstract (120 Words)

The bacterium multi-resistant Acinetobacter baumannii (MRAB) causes outbreaks of infection in Intensive Care (ICU) that have proven to be extremely difficult to control.

In August 2000, MRAB was detected from clinical specimens from three patients in the 16 bed Intensive care unit serving a tertiary care hospital and an outbreak was declared.

A multi-disciplinary quality improvement effort commenced with implementation of many changes to patient and unit management. These included enhanced surveillance, cohorting of patients to one area of Intensive Care , extensive environmental cleaning, closer restriction of broad-spectrum antimicrobials, and the implementation of a within-unit hand hygiene campaign (December 2002). The highly motivated staff developed educational tools and embraced the introduction of an alcoholic hand rub.

The outbreak was not completely controlled by these interventions and continued until mid 2003. The air-conditioning system was implicated as an ongoing source, though this could not be proven microbiologically. Following cessation of recycling of air via the air conditioning system (July 02) and a thorough cleaning of the ducts (Nov 02), the outbreak was finally brought under control. The unit has remained free of endemic MRAB since that time.

Aim (30 Words)

To analyse the possible factors enabling patient cross-transmission of MRAB and implement preventative strategies to eliminate patient acquisition and morbidity from MRAB and ensure safe patient care within the Intensive Care environment.

Nature of the Problem (100 words)

Acinetobacter baumannii is a Gram negative environmental bacterium, that emerged relatively recently as an important healthcare-associated pathogen. MRAB is a major worldwide problem contributing significantly to adverse outcomes in Intensive Care patients, however, there has been no clear guidelines established as to how to effectively eliminate and control this organism in this high-risk environment. Standard infection control measures do not achieve control of transmission. MRAB is known to survive for extended periods within the environment and hence persistent undefined sources of MRAB within the Intensive Care environment needed to be identified and eliminated.

An MRAB outbreak was detected through routine surveillance of Intensive Care patient microbiological results (clinical specimens) by Infection Prevention and Control staff in a 16-bed Intensive Care .

This quality improvement program was designed to investigate all possible environmental sources of MRAB and behavioural/environmental factors associated with the transmission to patients. It also addressed strengthening of ongoing infection prevention and control measures to provide a safe patient experience in Intensive Care. A more systematic surveillance system to monitor MRAB acquisition and morbidity was also implemented.

Extent of the problem (150 words)
A multi-disciplinary working party was formed to progress outbreak measures. This group was supported strongly by Unit staff and executive. Feedback to Intensive Care staff was provided daily-weekly as required to keep them advised of developments. Extensive environmental auditing took place to assess unit design problems, equipment issues and cleaning adequacy. Environmental samples were submitted for microbiological testing in November and December 2000. Results indicated that 16 of the 39 sampled ward surfaces, patient equipment and flooring were positive for MRAB. Patient colonisation: routine twice weekly patient surveillance cultures for MRAB commenced November 2000 - this was done to detect undisclosed colonised patients and to provide ongoing surveillance of acquisition. Patient MRAB acquisition served as the major indicator of outbreak control. Figure 1 illustrates MRAB acquisition in Intensive Care from 2000 to date. This shows that extended nature of the outbreak that occurred. A case-control study of patients (from 21/11/00) acquiring MRAB was undertaken that highlighted prior exposure to the broad spectrum antibiotic, meropenem as a significant risk factor for MRAB acquisition. Antibiotic utilisation data for Intensive Care was examined closely (Figure 2). Infectious Diseases service rationalised existing clinical indications for carbapenem antibiotics. MRAB detection in clinical samples- the Microbiology Laboratory introduced use of a selective agar to enable detection of MRAB in all Intensive Care respiratory and wound/pus/tissue samples. Under previous methodology, MRAB may have been missed from these samples. MRAB Morbidity: clinical cases of MRAB infection were reviewed to analyse influence of MRAB on death outcome. There were 137 cases of colonisation detected up to December 2003. Approximately 10% of these colonisations developed an infection requiring treatment. A proportion of the initial patients developing infection died 8 / 14 (57%), where MRAB was found to be a contributing factor to their death, 6 patients (43%) survived.
Strategic importance (100 words)
This quality project fits with the NSW Health Strategic Direction: Make prevention everyone's business. NSW State Infection Control Quality Monitoring Policy Directive PD2005/414 specifies that Intensive Care Units report surveillance data on MRSA and MRAB acquisition and morbidity six-monthly. This outbreak antedated this circular (central reporting commenced in 2003). However, surveillance was occurring for these measures locally. It also fits with the strategic goals of Hunter New England Health's Strategic Map - Focus Area: Communities and Patients: 5: A quality health service experience. - Focus Area: Internal Networking and Processes: 3, Safe and evidence-based healthcare. 4, Disease prevention and health promotion. 5, Organisational Risk Management. - Focus Area: Resource accountability: 2, Effective management of resources and assets for maximum health benefit - Focus Area: Our People, Culture and Capability: 4, Effective consultation and communication. 5, Demonstrating innovative healthcare

Planning and implementing solutions (300 words)

Many different stakeholders were identified including: Staff and Management, Clinical visiting staff, Patient visitors, Housekeeping, Hospital Executive, Infectious Diseases, Microbiology, Infection Prevention and Control Unit (IPCU), Pharmacy, Staff Health and Engineering

With each of the areas of review and intervention, necessary stakeholders were consulted and involved in the decision-making. This ensured that interventions were managed in a timely manner.

The IPCU served as the coordinating group, supporting communication and providing expert advice on technical issues. An Intensive Care Infection Control working party convened. Management support was ensured by proactive liaison by IPCU and Intensive Care management with key stakeholders. Ongoing progress reports were provided to the Intensive Care Executive and the John Hunter Infection Control Committee.

Environmental interventions:

- provision of 4 hours extra cleaning per day by Hospital Executive to address deficiencies in equipment and environmental hygiene
- safer management of equipment reviewed (IPCU and Equipment Officer)
- linen management improved
- Possibility of aerosol spread of MRAB directly from rooms to common environment via recirculated air-conditioning system: air conditioning system (Engineering, Intensive Care and IPCU) reviewed and changes to management implemented- 100% exhaust to outside July 02. Thorough cleaning of the air conditioning ducts took place in Nov 02.
- Environmental microbiological surveillance - general sampling took place in 2000. Later on, the ventilation ducts were also sampled in Nov 02.
- Established strict environmental cleaning protocols and regular audits of environmental hygiene

Consumer engagement

- Patients and their relatives/carers provided with education about MRAB and its prevention. This occurred one-to-one and also through provision of an information pamphlet.

Epidemiology

- Identification of risk factors for MRAB acquisition (case-control study)
- monthly analysis of MRAB acquisition

Healthcare staff

- Review of clinical practices and policies (IPCU, Intensive Care Educator, IC Liaison Nurse)
- Inservice IPC education of all staff associated with Intensive Care
- Surveillance of hand hygiene practice of all staff (including visiting staff) and patient visitors
- Introduction 70% alcohol hand gel and education programme for staff and visitors

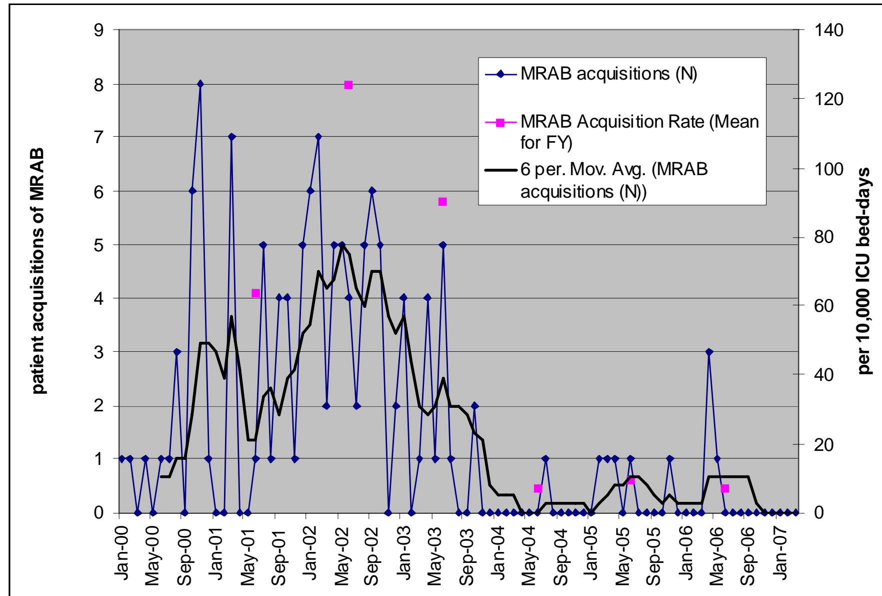
Patient management

- patient isolation (cohorting to one region of the Intensive Care)
- weekly and on discharge MRO screening of Intensive Care patients
- reducing use of broad spectrum antibiotics: the existing antibiotic and microbiology Intensive Care round (performed by Infectious Diseases and Microbiology services) was formalised to ensure better continuity and oversight over day-to-day patient antibiotic therapy. Particular emphasis was placed upon reducing carbapenem use (see Figure 2). Intensive Care Antibiotic use continued to be monitored monthly. Eventually the hospital joined the SA National Program to benchmark usage against other large Australian hospitals (Figure 3).

Outcomes and Evaluation (200 words)

Figure 1 indicates that MRAB transmission has been largely eliminated from the unit. Furthermore, there has only been one Intensive Care-associated MRAB blood stream infection since 2002 (in 2005). The John Hunter Hospital MRAB infection and colonisation rates remain well below recorded surveillance indicator figures for other Intensive Care Units in NSW (reference http://www.health.nsw.gov.au/health_pr/infection/pdf/mro_infections.pdf).

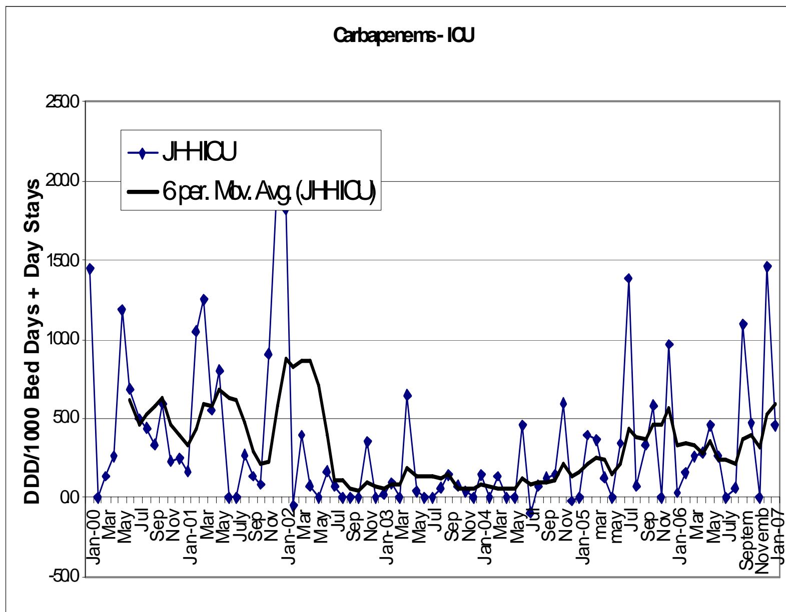
Figure 1: John Hunter Hospital, Intensive Care Unit MRAB Acquisition rate 2000-2007



The change in mean ICU MRAB acquisition from 2003 to subsequent years was highly significant ($p < 0.001$). There were 6 MRAB ICU-associated bloodstream events detected 2000-2002. **One** additional event occurred in 2005 and none since then.
Source: Hunter New England Infection Prevention and Control Unit

Reductions in carbapenem antibiotic use have been maintained (Figure 2). This has enabled significant cost-saving. Benchmarking of John Hunter Hospital Intensive Care overall antibiotic use against 15 other Australian Intensive Care Units indicates that use of key broad spectrum agents is much lower in John Hunter Hospital Intensive Care (Figure 3).

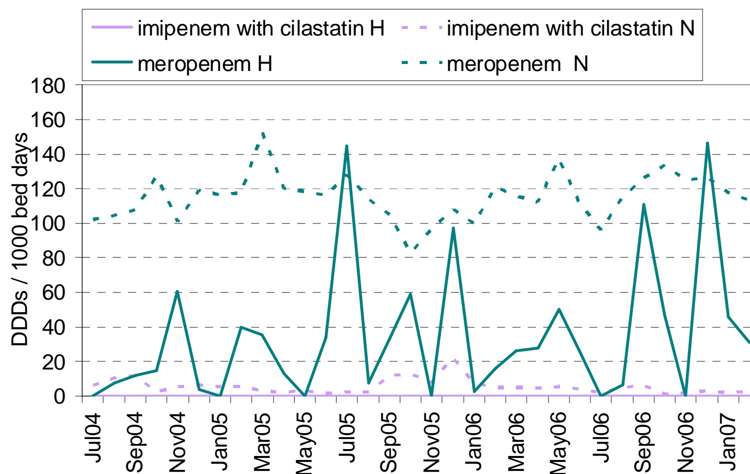
Figure 2: Significant reduction in carbapenem use in Intensive Care, JHH
DDD= Defined daily dose, a standardised measure of antibiotic usage.



Source: John Hunter Hospital Pharmacy

Figure 3: John Hunter Hospital ICU Carbapenem (meropenem/imipenem) Use Compared to other Australian Tertiary Hospitals

JHH= solid lines (H). National hospital average = broken lines (N)
DDD= Defined daily dose, a standardised measure of antibiotic usage.



Source: National Antimicrobial Utilisation Surveillance Program, Health Department, South Australia.

Hand hygiene compliance is regularly audited and alcohol gel use is monitored. This shows continued high levels of compliance by Intensive Care staff.

The success of the John Hunter Hospital Intensive Care in controlling this outbreak had a significant cost saving impact. A recent Australian case control study (Playford et al, J Hosp Inf 2007:65:204) indicates that Intensive Care MRAB infection is independently associated with increased Intensive Care stay (median stay difference 15 days, 95% confidence interval 9-21d) and prolonged hospital stay (30d, CI 11-38d). The cost of each additional Intensive Care bed-day is currently $3,100. The

prevention of even one MRAB infection in the Intensive Care would be associated with a reduction in Intensive Care costs of $46,500.

Sustaining change (100 words)

An Infection Prevention and Control group meets monthly in the Intensive Care, chaired by the Intensive Care Director. There is a very active intensive care infection control liaison nurse (trained by the IPCU) who acts as the secretary and coordinates ongoing audits and communication within the Unit. Surveillance data and infections are monitored. Environmental audits are reviewed. Equipment issues are also examined. Staff education is ongoing, supported by IPCU.

A refurbishment of the Intensive Care in 2004 was identified as an opportunity for some of the outstanding Infection prevention issues to be addressed. These included removal of carpet and cloth chairs, provision of standard sign posting for visitors and alcohol gel brackets.

Future Scope (100 words)

The experience of the John Hunter Hospital Intensive Care in controlling MRAB transmission provides a model for other Australian Intensive Cares to follow, given that MRAB infection/colonisation is endemic in many units across Australia.

Within the Area Health Service, appropriate systems of infection prevention, surveillance and antibiotic control are being implemented in the other intensive care units. Those units have not had MRO (MRAB) cross-infection problems identified. The same MRO quality indicators are being tracked across all Intensive Cares consistent with NSW Health requirements.