

**Quality Improvement Program to Reduce  
Multi-resistant *Acinetobacter baumannii* (MRAB)  
Transmission in a Tertiary Intensive Care Unit (ICU)**

**Acute Care**

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[Hunter New England]

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# The Team

## Infection Prevention & Control Unit

**Dr J Ferguson,**  
Microbiology &  
Infectious Diseases  
**Dr S Tiley, Microbiologist**  
**S Berenger, Area IC CNC**  
**M Gorton, IC CNS**  
**S Woitala, IC CNS**  
**C West, IC CNS**  
**K Farrar, IC CNC**  
**Clerical Support IPCU**

## Intensive Care Unit

**Dr K Havill, Intensivist**  
**Dr M Rowley, Intensivist**  
**L West, NUM**  
**B Bilney, Liaison Nurse**  
**C Levey, Acting Manager**  
**H Chislett, Manager**  
**J Whitson, Liaison Nurse**

Other stakeholders: Engineering, Patient Support Services, Infectious Diseases Service, Pharmacy, Hunter Area Pathology, Executive Staff, JHH and Division of Surgery

# Aim

- To establish and analyse the possible factors enabling patient cross-transmission of Multi-resistant Acinetobacter baumannii (MRAB)
- Implement and maintain preventative strategies to eliminate MRAB acquisition and morbidity
- Ensure safe patient care environment within the ICU

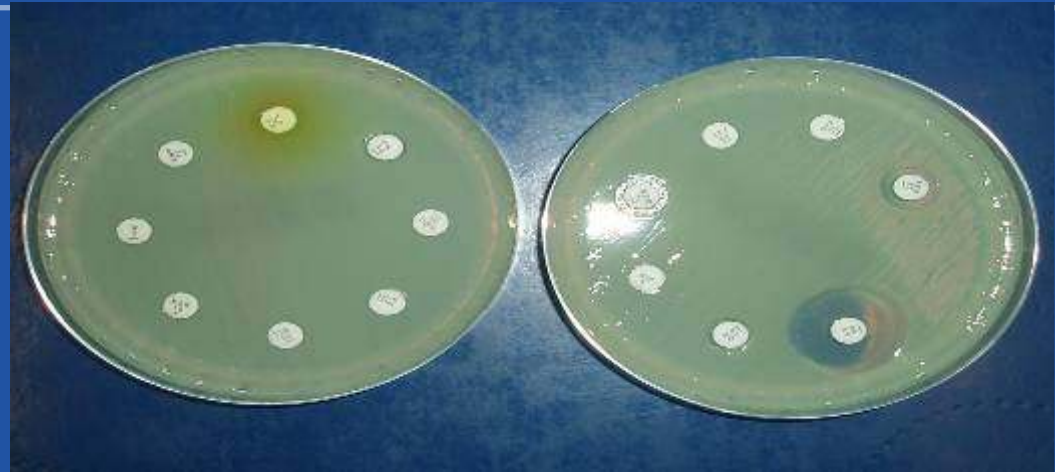
# Nature and Extent of the Problem

- **John Hunter Hospital ICU is an adult/paediatric unit that caters for medical and surgical cases. It consists of 16 beds (single rooms with sliding glass doors) with an additional two rooms used in exceptional circumstances. It is associated geographically with a 4 bed cardiothoracic ICU recovery unit. More than 170 staff**
- **In August 2000, MRAB was identified from 3 clinical specimens from 3 patients by IPCU staff during routine surveillance. ICU was notified and put onto an outbreak footing**
  - **Retrospective review of colonised patients indicated that 10% developed infection. At least 14 patients suffered significant morbidity as a result of infection with 8 deaths**

# Nature and Extent of the Problem

Infection requiring treatment	Comments and contribution of MRAB to mortality	Outcome
Central-line related bacteraemia	MRAB infected decubitus ulcers, contributed to death	Died
Ventilator acquired pneumonia	Multiple problems, partial contribution	Died
Intracranial shunt infection	Minimal contribution	Died
Intracranial shunt infection	Partial contribution	Poor
Mediastinitis	Became secondarily infected with MRAB	Survived
Empyema	Chest injuries – became secondarily infected with MRAB	Survived
Organ donor: recipients of lungs	Multiple problems, MRAB only partial contribution	Died
Organ donor: recipient of liver	MRAB contribution	Died
Intracranial infection (neurosurg.)	MRAB contribution	Died
Central-line related bacteraemia	Minimal morbidity	Survived
Intracranial infection (neurosurg.)	Minimal contribution	Died
Sternal wound infection	MRAB contribution	Died
Line related bacteraemia	Multiple problems, MRAB minimal contribution	Died
Peritonitis	Multitrauma, open abdomen	Survived

# Nature and Extent of the Problem



*Acinetobacter baumannii* is a Gram negative environmental bacterium that is an important cause of healthcare-associated infection in Intensive care and surgical patients world-wide. These isolates are usually multi-resistant (MRAB).

Application of Standard Infection Control approaches to outbreak control are not usually successful. Patient and environmental reservoirs are significant factors as is patient antibiotic use.

MRAB survives for extended periods within the environment and has the capacity for airborne spread.

# Nature and Extent of the Problem

- **Environmental audits assessed:**
  - Unit design problems (carpet, airflow-positive pressure rooms)
  - Equipment issues (many potential issues identified)
  - Cleaning adequacy (hot-bedding, out of hours support deficient)
  - Linen storage (open air, adjacent to patient care areas)
- **Microbiological surveillance (Nov-Dec 2000):**
  - 16 of 39 surface swabs isolated MRAB in rooms of MRAB colonised patients
  - 0 of 36 samples from rooms of non-MRAB-colonised patients
  - Additional sites SS positive for MRAB:
    - Empty room: bedrail positive (1 of 6 samples)
    - Linen trolley – in corridor outside patient rooms
    - Carpet in corridor outside patient rooms (1 of 2 samples)
    - Computer keyboard in office area

# Nature and Extent of the Problem

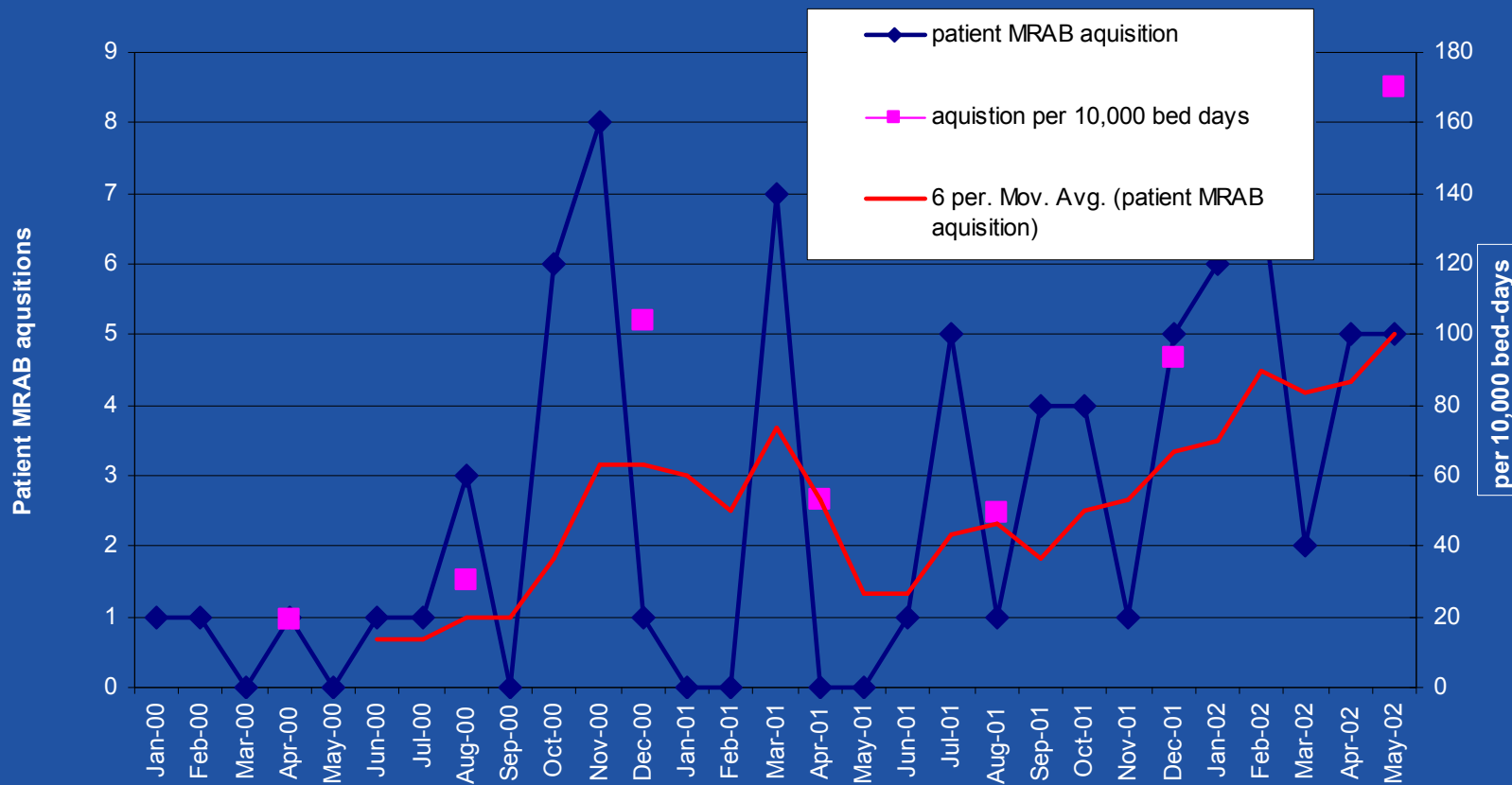


Sites of positive MRAB cultures marked by cross

# Nature and Extent of the Problem

- **During the period pre 2000 up to 2002 yrs**
- **Established surveillance process**
- **Standard infection control practices were encouraged within the unit : Including**
  - **Hand washing initiatives**
  - **Patient isolation and staff protective barriers (gowns and gloves for MRAB colonised patients)**
  - **Patient bed spaces and unit - increased environmental cleaning**
  - **Bed closures**
  - **Increased vigilance during outbreaks**

# Nature and Extent of the Problem



# Strategic importance

- MRAB appeared to be endemic in the ICU and probably contributing to patient morbidity
- MRAB transmission within the ICU , could be considered a marker of infection control breakdown and indicate possibility of transmission of other organisms
- Standard infection control practices appeared ineffective
- ICU activity and patient categories may need to be restricted if transmission could not be contained

# Planning & Implementing solutions

- A multi disciplinary quality improvement program was undertaken by the ICU Infection Control Committee (working party). Strong support from ICU Staff and Intensive Care and Hospital Executives was given.
- Feedback to ICU staff provided frequently (daily/weekly) to keep them advised of any developments/actions.
- Where required, stakeholders were consulted and involved in the decision making.
- The IPCU served as the coordinating group, supporting communication and providing expert advice on technical issues.
- Progress reports were provided to the ICU Executive and the John Hunter Infection Control Committee.
- Identified from available evidence , strategic goals. Stepwise approach with additional measures based on outcomes achieved.

# Planning & Implementing solutions

- **Required change in culture within the unit regarding infection control management**
  - All patients managed the same irrespective of surveillance swab results.
  - Introduction alcoholic hand gel – changed usage culture
- **Introduction of twice weekly MRO surveillance of patients (Nov 2000)**
- **Selective agar to improve isolation of MRAB and other MROs from clinical samples introduced for ICU respiratory and wound/pus/tissue samples**
- **Enhanced Antimicrobial education antimicrobial policy; improved continuity of ID/ Micro liaison rounds**
- **Hospital wide approach: contact isolation of MRAB patients**

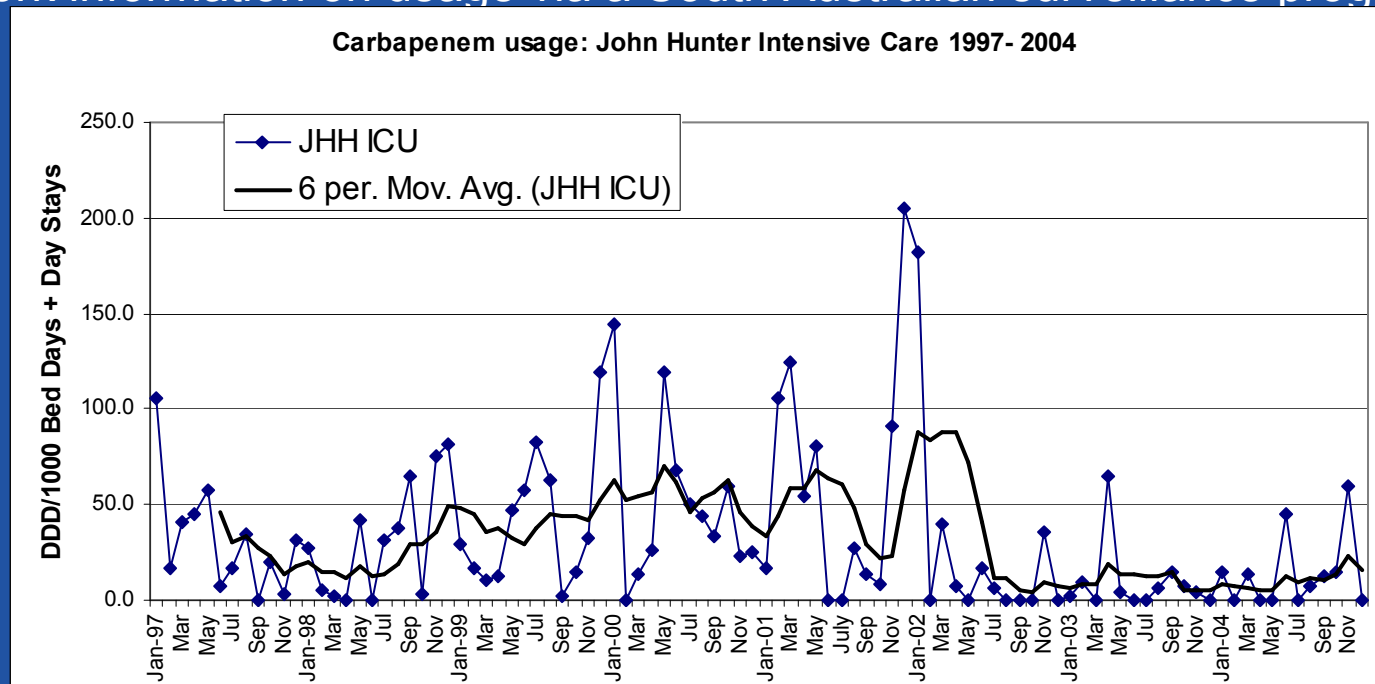
# Planning & Implementing solutions

## Continuing Issues

- **Cleaning:**
  - Enhanced cleaning enabled through increase in cleaning hours
    - Role enhancement of cleaners
    - Difficult environment to clean (electrical equipment)
  - Carpet (external to patient rooms) finally removed in February 2005
  - Selection of cleaning agents and standards for environment cleaning
- **Lack of suitable equipment storage and enclosed linen storage**
- **Air conditioning recirculated within the ICU due to capacity issues – no programme for cleaning until Nov 2002;**
- **Unable to properly isolate “high shedding” MRAB patients - no negative pressure rooms**

# Outcomes & Evaluation - Antibiotics

- Carbapenem (meropenem) antibiotic use had reduced significantly by January 2002, preceding the reductions in MRAB incidence (figure).
- Current ICU carbapenem use (average in 2006, 38 DDD/1,000 patient-days) remains well below 16 Intensive care units across Australia (mean 120) who network information on usage via a South Australian surveillance program.

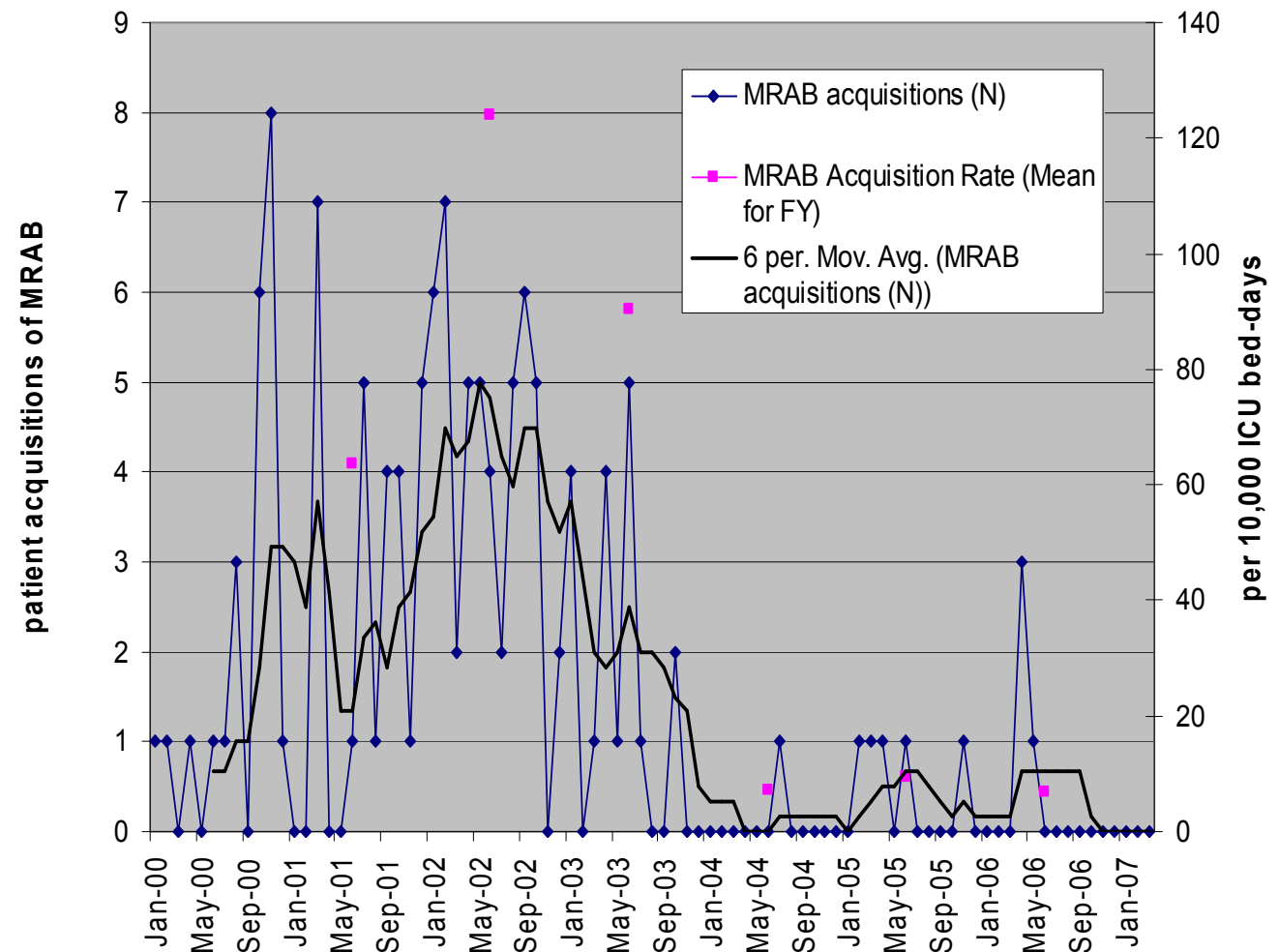


DDD= defined daily dose, a standardised measure for adult antibiotic usage.

# Outcomes & Evaluation - patients

## John Hunter ICU MRAB acquisition 2000- 2007

Reduction in ICU  
MRAB acquisition  
rate highly  
significant ( $p$   
 $<0.001$ ).



# Outcomes & Evaluation - environment

- Air-conditioning – balance achieved with internal ICU condition control and fully exhausting to outside
- Environmental audits detail continuing attention to cleaning and housekeeping by Patient Support Services and ICU staff
  - Removal of carpet and cloth chairs
  - Provision of standard sign posting for visitors and visibility / convenience of alcohol gel
  - Improvements to equipment storage area

# Outcomes & Evaluation - cost

- **Australian case-control study\*:**
  - ICU MRAB infection independently associated with increased ICU stay (median stay difference 15 days, 95% confidence interval 9-21d)
  - and prolonged hospital stay (30 days, CI 11-38d).
- Furthermore, the current ICU bed-day cost is A\$3,100.

*Therefore, one ICU-associated MRAB infection is estimated to increase a patient's ICU expense by A\$46,500.*

*Levels of antibiotic use across John Hunter Hospital compared with national benchmarks, estimate recurrent annual savings of A\$278,000\*\*.*

\* Playford, G et al, J Hospital Infection 2007:65:204

\*\* Ferguson, J, Doherty P. Unpublished analysis 2007.

# Sustaining Change

## **Crucial active Intensive Care partnerships include:**

- Infection Prevention and Control Service (consultancy, strategy, monitoring)
- Microbiology and Infectious Diseases (antibiotic liaison rounds and antibiotic usage/resistance reviews)
- Engineering (environment and air-conditioning maintenance)
- Patient support services (cleaning)

## **Partnership and Quality Improvement Process facilitated by:**

- leadership by ICU Executive and the infection control liaison person supported strongly by Nursing Management
- understanding of Unit staff that protection of patients from infection is their business
- monthly quality improvement meetings to review surveillance data, audit results (antibiotic use, hand hygiene, environment, central line insertion, compliance with MRO screening), staff training and other issues
- regular feedback to staff with the good news!

# Lessons Learned

- Sustained interaction is required with all stakeholders to achieve sustainable change.
- Practice change of a large multidisciplinary group is a significant challenge.
- ICU is a challenging environment to clean with the flow of staff, patients and equipment. Type of equipment and design of the facility is important
- Antibiotic usage can be effectively controlled and maintained with no demonstrable adverse effect on patient outcomes

# Future Scope

- MRAB infection/colonisation is endemic in many intensive care units across Australia.
- The success of John Hunter Hospital ICU in controlling MRAB transmission provides a model for other units to follow.
- Across the other ICUs within Hunter New England Health Service, appropriate systems of infection prevention, surveillance and antibiotic stewardship are being developed. Those units do not have identified multi-resistant organism cross-infection problems to date.

# Future Scope

- **Multi-resistant Organism (MRO) Surveillance**
  - NSW Infection Control Quality Monitoring Policy Directive PD2005/414 require ICUs to report surveillance data on MRSA and MRAB acquisition and morbidity 6-monthly (implemented 2003).
  - Planned 2007 ICU Surveillance changes: routine ICU MRO screening mandated with reporting of ICU acquisition rates for MRSA and MRAB
- **Routine Intensive care clinician support from Clinical Microbiologist and/or Infectious Disease physician required across NSW**
  - Regular (weekly or more frequent) patient review rounds to optimise antibiotic usage, especially focus on reducing unnecessary use of broad spectrum agents
- **Intensive Care Facility Design**
  - NSW ICUs should meet current Australian facility design requirements, including careful consideration of infection control.
  - Specifically negative pressure rooms to allow effective isolation