Guideline Title: Multi-resistant organisms (MROs): Prevention, surveillance and control.

Summary:
Patients admitted to the Intensive Care Unit will be screened for the presence of multi-resistant organisms so as appropriate isolation/segregation practices can be enabled. Ongoing surveillance and prevention and control of the spread of multi-resistant organisms will occur to protect patients, staff and visitors.

Approved by: ICU Medical director
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Replaces Existing Policy: Multi-resistant organisms (MROs): Prevention, surveillance and control.

Background Information:
Measures to control the emergence and transmission of multi-resistant organisms (MROs) are necessary and beneficial to patients and healthcare facilities (HCF). Public Health Organisations (PHO) must ensure that appropriate infection prevention and management strategies are implemented, evaluated for effectiveness and modified to ensure that there is a consistent decrease in the incidence of all MROs, particularly methicillin-resistant *Staphylococcus aureus* (MRSA). The principles and practices can also be applied to the prevention and management of other MROs such as vancomycin resistant enterococci (VRE) and multi-resistant *Acinetobacter baumannii* (MRAB). ¹

The NSW Policy PD2007_084 Infection Control Policy: Prevention & Management of Multi-Resistant Organisms (MRO) is a comprehensive document that outlines all care required for screening, prevention, management and therapies for patients infected with organisms causing illness/organ failure. This ICU guideline aims to inform staff of the major issues to consider and current strategies employed to prevent, identify and manage the spread of micro-organisms and in particular those that are resistant to antibiotics for patients when they are admitted to ICU.

1. **Introduction contains:**

   **The risk addressed by this policy:**

   Patient Safety

   **The Aims / Expected Outcome of this policy:**

   Surveillance measures will be utilised to identify resistant organisms and nosocomial infections will be minimised

   Where a resistant organism(s) colonises or infects a patient, control measures will be employed to reduce the spread of the organism and maintain patient safety, staff and visitor safety and enable appropriate clinical care.
2. Policy Statement

- All care provided within the Liverpool Hospital ICU will be in accordance with infection prevention/control, manual handling and minimisation and management of aggression guidelines.
- All patients are to be screened as follows for the presence of Multi-Resistant Organisms (MROs):
  - Within 24 hours of admission
  - Followed by weekly on each Tuesday
  - At discharge
- Screening will include respiratory specimen (throat swab or sputum specimen), groin swab (one premoistened swab used to swab both the left and right groin), and a rectal swab. These are referred to as surveillance swabs.
- Patients must be informed of the need to perform the surveillance swabs and verbal consent obtained. If a patient refuses to have a swab attended, this must be documented in the health care record.
- On admission, if there are wounds present, a swab should be taken to assess for the presence of MROs. Swab sticks are to be moistened with a small amount of sterile 0.9% sodium chloride before taking a swab.
- Cotton gowns must not be worn by staff in patient care areas.
- When entering the Unit, you must perform hand hygiene.
- Staff must comply with the 5 moments for hand hygiene.
- If you enter any ICU/HDU bed area, you must wear a plastic apron, to avoid contact of clothing with the equipment / bed / patient. Staff wearing long-sleeved clothing or a tie/scarf must ensure the sleeves are rolled above the elbow (maintain bare below the elbow) to avoid contamination and the tie/scarf is secured within the shirt. Cotton gowns must not be worn by staff.
- If you are attending a patient that has a large wound with exudate / shedding or where contact will occur with your clothing despite the plastic apron; a fluid impermeable, long sleeved gown must be worn.
- When leaving the bed area, dispose of the personal protective equipment and wash hands/use hand gel prior to writing in the notes and leaving the Unit.
- The clinical health record must not be placed on the bed or within the bed area zone.

3. Guidelines

Patient information and consent

- Patients are informed of the necessity to obtain admission, weekly and discharge swabs to both protect the patient and others from the threat of nosocomial and other micro-organism transmission. Their verbal consent is obtained.
- If a patient refuses to have a swab attended, this must be documented in the health care record.

Routine Screening to detect the presence of organisms: surveillance swabs

- Surveillance swabs are collected upon admission to the ICU (within 24 hours of the admission), every Tuesday, and before transfer from the Unit to a ward/other facility.
- Transfer (discharge) swabs should be attended once a bed on the ward is confirmed and when the patient is about to depart the Unit for actual transfer to the ward.
The following table identifies what surveillance swabs are taken (and for what organism) and which must be repeated each week and upon transfer (discharge) from the ICU:

<table>
<thead>
<tr>
<th>Swab/Specimen to be taken</th>
<th>To detect a MRO:</th>
<th>When to test</th>
<th>Repeat testing when Patients are positive for a MRO?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>Throat swab (preferred), or sputum sample</td>
<td>MRSA and Multi-Resistant Gram Negatives (MRGNs)</td>
<td>On admission Weekly On Discharge</td>
</tr>
<tr>
<td>Groin</td>
<td>One swab for both right and left groin</td>
<td>VRE</td>
<td>On admission Weekly On Discharge</td>
</tr>
<tr>
<td>Rectal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Response to a Notification of Resistant Organism(s)
- When a patient has been identified as having been colonised/infected with a MRO, he/she will be cohorted into a single room for isolation – as available.
- If a single room is unavailable, patients will be cohorted into an area of the ICU and this area will be identified as a ‘resistant-organism’ zone.

Bedside Equipment – within the bed area zone (considered contaminated)
- Disposable equipment (syringes, gauze squares etc) should be kept to a minimum at the bedside.
- Non-disposable items required for immediate patient care are to remain within the bed area zone, and are not to be used for other patients during this care episode.
- Alcoholic-based hand rub (hand rub/hand gel) and skin lotion are available in the bed area zone.
- Triclosan wash lotion for use when bathing patients (bed bath / shower / bath).
- Linen skip
  → The entire bed area zone is considered contaminated - bed, bedside trolley and any other equipment used in the area
  → To reduce the likelihood of contamination: each shift – wipe-over the bed, trolley and area with neutral detergent wipes (Tuffy wipes). If a 70% Isopropyl Alcohol wipe is required, the Infection Control CNC will advise.

Bedside Equipment – outside the bed area zone (considered clean)
- The trolley used for documentation is "clean", place health care records/documentation here – the trolley is to remain outside the bed area zone.
- Patient notes/files must not be placed on the bed or within the bed area zone.
- Stock of plastic aprons and impermeable gowns are to be readily available outside of the bed area zone.
- Personal protective equipment (gowns, gloves, eye-shields/goggles, masks) to be available.

Hand Hygiene (5 moments)
Hand hygiene remains the mainstay for preventing cross infection and applies to ALL staff and visitors. The 5 moments include:
1. Before touching the patient
2. Before a procedure
3. After a procedure or body fluid exposure risk
4. After touching a patient
5. After touching a patient’s surroundings, and also in the following circumstances:
  → Before and after wearing gloves
→ Between touching different wound sites/moist areas (e.g. axilla or groin) – thus preventing localised spread of an organism.

Hand washing with ‘soap’ and water occurs when hands are visibly soiled/contaminated with proteinaceous material/blood/body fluids, or if exposure to potential spore forming organisms is suspected/proven e.g. *Clostridium difficile*.

- Hand washing is performed when attending aseptic procedures.
- Hand washing involves washing all surfaces of the hands vigorously, followed by adequate drying.
- See **Appendix 2** for the ‘5 moments hand hygiene’ and hand-wash/rub technique.

**Gloves**
- Hands must be decontaminated prior to putting on gloves.
- Gloves must be changed and 5 moments of hand hygiene attended with particular attention to performing differing procedures with the same patient.

**Bedside curtains**
- Antimicrobial disposable curtains are currently used for all bed areas in ICU. These curtains are changed after 12 months of the date they were initially put up and/or when visibly soiled.

**Aprons/Gowns**
- Cotton gowns must not be worn by staff in patient care areas (they are permeable and allow clothing to become contaminated with organisms).
- Long sleeved impermeable gowns are for single-use and are worn by **all staff** (and carers) when performing direct patient care or with prolonged contact of the bed/bedside equipment/environment.
- Plastic aprons are for single-use and are worn when there is the potential to make contact with the bed and equipment within the isolated area.
- Gowns and plastic aprons must not be worn beyond the immediate bed area zone.
- See **Appendix 3** for Putting on / Removing Personal protective Equipment (PPE).

**Visitors**
- Plastic aprons and alcohol based hand rub are available and to be used prior to entering the Intensive Care Unit clinical areas. Trolleys are available at the entrance to each unit with signage, plastic aprons and alcohol based hand rub for use by visitors.
- Explain to visitors upon arrival in the Unit the importance of:
  ⇒ Hand hygiene before and after entering the patient bed-area zone
  ⇒ A plastic apron is worn within the bed area zone; and when providing/assisting with personal care of the patient.
  ⇒ The need to remove both gown and gloves when exiting the area, then decontaminating hands prior to answering a phone/greet other relatives, etc.
  ⇒ Visitors with babies may need advice re: limiting contact near the site where a MRO has been isolated.

**Patient Transport**
- Patient notes / files are to be placed into a clear plastic bag and then placed on the bed or are to be carried by the nurse during the patient transport.
- A plastic apron (or impermeable gown; as required) and gloves are to be worn, and goggles/mask are to be available.

**Transfer to the Ward**
- The bed area zone is wiped over, bed stripped and all linen within the bed zone to be laundered. Used suction canisters and other disposable items/ single patient use equipment appropriately discarded. Medications sent with patient upon transfer or removed (containers wiped over or medications discarded).
- Disposable equipment/stock is dusted or transferred with the patient; re-useable equipment is cleaned with neutral detergent (Tuffy wipe).
• Page the Isolation Cleaner on 25327 (0600 - 2300 hours) for terminal cleaning of bed area (After Hours if urgent, phone Supervisor on 2778), ensure all equipment is thoroughly cleaned and that curtains have been replaced if visibly soiled.
• Ventilator internals are cleaned as normal.

Avoidance of Cross Contamination
• When caring for more than one patient diagnosed with a resistant organism, all individual patient precautions must be maintained to avoid cross contamination, as there are varying strains of individual organisms.

Clinical Issues
See Appendix 1 and 2 for outline of organisms, appropriate management and hand hygiene outline.

4. Performance Measures
All colonisation and infection reports of resistant organisms are reviewed by the CNCs for Infection Prevention and by the Microbiology lab, as required. Reports are sent to the and NUM – ICU and reviewed for infection prevention strategies. All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.

5. Definitions and Abbreviations
• Clinical swabs: a specific request and specimen is sent to detect/identify an organism causing clinical signs of infection.
• Surveillance swabs: include admission swabs, routine Tuesday swabs for ongoing surveillance and transfer to the ward (discharge) swabs. These swabs are used to detect resistant organisms only.
• Colonise: the organism is present but the patient is not displaying signs of infection (hard to spot, easy to spread).
• MRAB: Multi-resistant Acinetobacter baumannii
• MRGN: Multi-resistant gram negative
• MRSA: Methicillin resistant Staphylococcus aureus
• MRO: Multi-resistant organism
• VRE: Vancomycin resistant enterococcus
• MDR: Multi-drug resistant
• PDR: Pan-drug resistant (virtually all antibiotics are rendered inactive)
• CVAD: Central venous access device

6. References / Links:

Authors: CNC – ICU (S. Shunker)
Reviewers: ICU Medical Director, ICU Staff specialists, NM, NUM, CNC, CNE – ICU, CNC – Infection Prevention and Control
Endorsed by: Prof Michael Parr
Appendix 1: Outline of organisms of concern to the ICU environment

Background Information

Multi-resistant organisms can cause serious illness and avoidable deaths in patients. Multi-resistant organisms (MROs) are bacteria that are resistant to a number of different antibiotics. Some are better known than others, and are often called by their initials. Examples are MRSA (methicillin-resistant *Staphylococcus aureus*), VRE (vancomycin-resistant *Enterococcus*), ESBL (extended spectrum beta lactamase producing organisms) and MRAB (multi resistant *Acinetobacter baumannii*).

Multi-resistant organisms arise naturally, by spontaneous mutation or when the genes for resistance are passed on from other bacteria. Their presence is encouraged by the frequent use of ‘broad spectrum’ antibiotics. The bacteria, however, can be spread from person to person, usually on hands. Some multi-resistant organisms, such as MRSA, are found mainly in people’s noses or on their skin. Others, such as VRE and ESBL, are found mainly in the gut (intestine).

Antibiotic Resistance

The overuse of broad spectrum antibiotics, including the third generation cephalosporins, has been linked to the emergence of MRO and an increase in the incidence of opportunistic pathogens eg. *Clostridium difficile*.

Antibiotic resistance may be intrinsic or occur when there is a mutation of existing genetic material or there is acquisition of new genetic material. International surveillance networks report that there is a growing prevalence of Gram positive and Gram negative bacteria that is multidrug resistant - MDR (resistant to three or more classes of antimicrobials), extensively drug resistant – XDR (resistant to all but one or two classes) and pandrug resistant – PDR (resistant to all available classes).

Strategies to improve antibiotic prescribing:

- M icrobiology guides therapy wherever possible
- I ndications should be evidence based
- N arrowest spectrum required
- D osage appropriate to the site and type of injection
- M inimise duration of therapy
- E nsure monotherapy in most situations

Strategies to reduce nosocomial infections (and thus the need for antibiotic therapy) include:

- → prevent them with the use of hand hygiene,
- → prevent and control organism spread with the use of personal protective equipment,
- → prevent and control organism spread with the use of environmental cleaning,
- → educating the patient / carer and clinician,
- → frequent review of Infection prevention, surveillance and control measures, and
- → antibiotic usage scrutiny (stewardship)

Transmission

Reservoirs of MROs include patients and occasionally health care workers (HCWs) who are colonised, and contaminated objects or surfaces in the environment. They are often inadvertently transmitted on the hands of HCWs. The factors that may contribute to a high rate of MROs include:

- Poor compliance with hand hygiene
- Ineffective infection prevention/control practices – failure to wear protective equipment for patient contact / procedures.
- A higher proportion of vulnerable patients
- An increased used of indwelling devices and medical interventions that breach a patients normal bodily defences
• Organisational factors – such as high bed occupancy, increased movement of patients across geographical areas.
• Structural issues such as access to single rooms, hand wash basins, alcohol gels, PPE (personal protective equipment).
• Environmental conditions such as variable cleaning standards and practices, availability and frequency of curtain changes.
• Excessive and inappropriate use of antibiotics.

Multi-resistant *Acinetobacter baumannii* (MRAB)
• Gram-negative coccobacilli, non-motile, aerobic; that can develop resistance rapidly to different classes of antibiotics, including beta-lactams, aminoglycosides, fluoroquinolones and tetracyclines.
• Multi-drug resistant strains are more common and some panresistant strains have emerged.
• Found in soil and water and on dry surfaces such as computer keyboards and humidifiers. It is prevalent within the hospital environment.

**Risk factors** include: long stay patients, ETT, previous isolation for MRSA, presence of a CVAD, surgery and broad-spectrum antibiotics; especially carbapenems and 3rd generation cephalosporins.

**Strategies:**
→ 5 moments of hand hygiene are critical.
→ Patients with a history of MRSA and those colonised and infected should be isolated or cohorted.
→ If cohorted, patients with MRSA still sensitive to mupirocin, rifampin, minocycline, should be kept apart from patients with MRSA strains that are resistant.
→ Patients with active pulmonary infection with MRSA must use closed suction systems and clinicians should use masks to prevent colonisation of the nares.
→ Clean environmental surfaces with neutral detergent (Tuffy wipe); or when advised – use a 70% Isopropyl Alcohol wipe.

*Methicillin resistant Staphylococcus aureus* (MRSA)
• A facultative anaerobe (it survives with and without oxygen) coagulase-positive bacterium, colonising the skin, nose and perineum.
• It is the leading cause of nosocomial pneumonia, surgical site infection and 2nd leading cause of bacteraemia.
• Risk factors for developing MRSA include the use of broad-spectrum antibiotics or multiple antibiotics, surgical wounds, pressure sores, and proximity to another patient with MRSA.
• Many strains exist, so two patients with MRSA might have two entirely different strains, cross infection does occur.
• MRSA is mainly spread via HAND contact, good hand hygiene is essential.

*Vancomycin resistant enterococcus* (VRE)
• Enterococci are gram positive cocci that form part of the normal gut flora. They can also be found in food, water, sand and soil. Exposed to antibiotics, these enterococci have developed resistance and are difficult to treat. The vancomycin resistant gene in VRE can be transmitted to other Gram positive organisms such as Staphylococcus aureus.
• Identified risk factors for environment contamination include: poor hand hygiene, diarrhoea, antibiotic use and occupancy of area by a VRE-colonised patient.
• Able to survive on environmental surfaces (including fabrics) for long periods of time.

Multi-resistant gram negatives (MRGNs) including ESBL, MBL and AmpC-producers

**ESBL**: Extended-spectrum β-lactamases are enzymes that are able to hydrolyse the majority of β-lactam antibiotics and render them inactive (these antibiotics include penicillins, cephalosporins, carbapenems, monobactams and β-lactams). Infections with
ESBL-producing organisms are associated with poor outcomes. β-lactamases open the β-lactam ring, inactivating the antibiotic.

- ESBLs are found exclusively in Gram negative organisms, primarily Klebsiella pneumoniae and E-coli and also in Enterobacter, Morganella, Proteus, Pseudomonas, Salmonella, Serratia and Shigella.
- They are generally susceptible to β-lactamase inhibitors, such as clavulanate, sulbactam, and tazobactam.
- The only current therapeutic option for severe infections caused by ESBL-producing organisms is the carbapenem family.

**MBL**: Metallo-β-lactamases hydrolyse carbapenems and most β-lactams except aztreonam, and usually result in high-level resistance

**AmpC**: Most strains of enterobacter and citrobacter species, Morganella morganii and Serratia species are now resistant to 3rd generation cephalosporins that produce an AmpC β-lactamase. AmpCs inactivate most cephalosprins and the cephemycins and may be resistant to all the β-lactam antibiotics as well as most other antibiotic classes.

Other organisms within the ICU environment that pose an infection risk:

**Clostridium Difficile**
- Gram-positive spore that produces a toxin resulting in diarrhoea, toxic megacolon, pseudomembraneous colitis and even peritonitis.
- It has been found to colonise the colon of 2% of healthy patients and can be shed into the environment by colonised or infected patients. New colonisation is by the faeco-oral route.
- Once colonised, people are at risk of developing associated diarrhoea, especially after treatment with antibiotics.
- Send stool specimen for evidence of TOXIN A or B.
- Occurs in patients receiving antibiotics, bowel preps, and chemotherapy. (Consider using a probiotic to maintain gut flora).
- Spores can survive for weeks/months on dry surfaces and devices.
- These spores travel easily, so beware hands on bedrails, computer terminals, case notes (hence visitors must wear gloves).

**Strategies**:
- Reductions in the use of clindamycin, restriction and reduction in the use of fluoroquinolones and 3rd generation cephalosporins.
- A probiotic may be of help.
- 5 moments of hand hygiene, with alcohol-containing hand decontamination products (not just soap and water). Physical rubbing of the hands may mechanically remove spores. So hand-washing and hand gel use as an adjunct is advised to consider hands are ‘clean’.
- Toilet cleaned daily with bleach.
- Dedicated equipment.
- Terminal clean on discharge with bleach.

**Pseudomonas Aeruginosa**
- **Gram negative** aerobic rod. It is extremely opportunistic and has been found in distilled water.
- Has an odour – some describe as a sweet ‘grape’ smell and causes purulent sputum.
- Occurs in patients who are immunocompromised, have cancer, burns, tracheostomy tubes or cystic fibrosis and is a leading cause of gram negative nosocomial pneumonia. This is associated with high hospital mortality rates and prolonged lengths of stay.
- Loves soil, dry surfaces and especially water and plants (therefore, dry all nebuliser units, ensure inner cannulae from trachys are dried properly prior to re-insertion).
- Easily becomes resistant – 50% fatality in cancer, cystic fibrosis and burns.
- GIT carriage rate increases in ICU patients who have been hospitalised for longer than 72 hours.
Strategies:

→ Thorough cleaning of sinks, taps, mops, respiratory equipment.
→ Never leave containers with water within the environment – especially nebuliser units, inner cannulae and ‘dirty water’ bottles.

Appendix 2: 5 Moments of Hand Hygiene
From: [http://www.who.int](http://www.who.int), accessed 18 November 2010.

Hand Decontamination


*Based on the ‘How to Handwash’, URL: [http://www.who.int/gpsc/5may/How_To_HandWash_Poster.pdf](http://www.who.int/gpsc/5may/How_To_HandWash_Poster.pdf) © World Health Organization 2009. All rights reserved., and the ‘How to Handrub’, URL:*
How to Handrub?

Rub hands for hand hygiene: Wash hands when visibly soiled

Duration of the entire procedure: 20-30 seconds

1.  
Apply a small amount of the product in a cupped hand, covering all surfaces.

2.  
Rub hands palm to palm.

3.  
Right palm over left dorsum with interlaced fingers and vice versa.

4.  
Palm to palm with fingers interlaced.

5.  
Backs of fingers to opposing palms with fingers interlocked.

6.  
Rotational rubbing of left thumb clasped in right palm and vice versa.

7.  
Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa.

8.  
Once dry, your hands are safe.

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Clean Your Hands