This Guideline provides recommendations regarding best practice for infection prevention and control in the Dialysis Setting.

**Recommendations**

**Infection Control Precautions for Dialysis Services**

Standard Precautions are the system of infection control practices that apply to all patients, regardless of their suspected or confirmed infection (or colonisation) status, in any setting where healthcare is delivered. They are based on the principle that all blood, body fluids, secretions, excretions (except sweat), non-intact skin, and mucous membranes may contain transmissible infectious agents. They are designed to protect both patients and healthcare workers (HCW’s). They include:

- hand hygiene
- use of appropriate personal protective equipment (PPE) to provide a barrier to contact with blood, body fluids, non-intact skin or mucous membranes
- immunisation of healthcare workers
- use of aseptic technique to reduce patient/client exposure to microorganisms
- management of sharps, blood spills, linen, and waste to maintain a safe environment
- routine environmental cleaning.

**Infection Control Precautions for Dialysis Services** are more stringent than Standard Precautions and are designed to prevent transmission of blood borne virus’s (BBVs) and bacterial pathogens including Multi-Resistant Organisms (MROs), in dialysis settings.

- routine serological testing
- hepatitis B vaccination
- surveillance for infections
- additional cleaning procedures
- the management of equipment, medications and consumables.

**Hand Hygiene**

- The major route of transmission of microorganisms in healthcare settings has been determined as the unwashed hands of HCW’s (direct contact transmission).
- Hand hygiene is a general term used to describe any type of hand cleansing. This includes hand washing with soap and water, or applying an alcohol-based hand hygiene product (QH staff should refer to Queensland Health Hand Hygiene Guideline: [http://www.health.qld.gov.au/qhpolicy/docs/gdl/qh-gdl-321-1-1.pdf](http://www.health.qld.gov.au/qhpolicy/docs/gdl/qh-gdl-321-1-1.pdf)).
- All staff should cover cuts and abrasions with waterproof dressings. Staff who come into direct contact with patients or dialysis machines, who have extensive untreated cuts or chronic skin disease, such as eczema, should not work in dialysis units when their skin lesions are active, or if there is extensive breaks in the skin surface.3
• Staff who provide direct hands-on care to patients should not wear artificial fingernails or extenders.

• Hand hygiene facilities should be located as close as possible to the point of contact with patients and dialysis equipment:
  - one Type A clinical hand wash basin should be provided for every three dialysis stations in the main dialysis area and a minimum of one Type A clinical hand wash basin in an isolation room.\(^3\)\(^9\)

• Appropriate hand hygiene supplies (including dispensers and brackets) should be available at all hand wash basins, including:
  - non-antimicrobial soap solution
  - antimicrobial soap solution:
    - an antimicrobial soap is recommended (1) prior to clinical and surgical procedures where it is important to reduce bacterial counts as low as possible, and/or (2) to reduce cross transmission of multi resistant organisms.
  - hand moisturising agent (lotion or cream) to minimise irritant contact dermatitis
  - paper towel (preferably interleaved) for hand drying.

• The soap solution should be provided in dispensers with disposable cartridges or single-use bottles, to prevent bacterial contamination of the product.

• Hand moisturising agents should be compatible with other hand hygiene products e.g. Chlorhexidine gluconate, and gloves being used in the facility.

• Alcohol-based hand hygiene products should be placed at the point of patient contact (unless contraindicated), for example:
  - next to each patient’s bed or dialysis chair
  - attached to the frame of patient’s beds
  - near the door to each patient room/bay
  - staff stations or chart and medication trolleys.

• To avoid any confusion between soap and alcohol-based hand hygiene products, alcohol dispensers should not be placed adjacent to sinks.

• It is important to reinforce that hands should be rubbed together after application of the alcohol-based hand hygiene product until all the alcohol has evaporated before engaging in other activities.

**Personal Protective Equipment (PPE)**

There should be adequate supplies of PPE available at the point of use.

**Gloves**

Non-sterile, disposable gloves made of a variety of materials (e.g. latex, vinyl, nitrile, neoprene) are available for routine patient care.

• Gloves should be stocked in several sizes and located in dispensers at the point of patient contact.
• Heavier, reusable utility gloves can be used for handling and cleaning contaminated equipment or surfaces.

• Clean, single use non-sterile gloves are required when contact with blood or body fluids is anticipated; this includes contact with patients and dialysis equipment.
  - gloves should be changed and hand hygiene performed between patients and/or stations
  - gloves must also be changed and hand hygiene performed between different activities on the same patient (e.g. moving from a contaminated to a clean body site)
  - gloves should not be washed or alcohol based hand hygiene product applied for subsequent reuse
  - gloves should be worn for any cleaning activities.

**Eye/Face Protection**

• Face protection (eyewear/goggles, masks, face shields) is required when performing procedures that may generate splashes or sprays of blood or body fluids. Personal eyeglasses and contact lenses are **not** considered adequate eye protection.

• Appropriate face protection should be selected based on the anticipated level of exposure.

• Masks come in various shapes, sizes, filtration efficiency, and method of attachment (e.g. ties, elastic, ear loops). Different types of masks may need to be supplied based on individual HCW needs.

• Eye protection (goggles) should allow for sufficient peripheral vision, be adjustable to ensure a secure fit, and incorporate indirect air flow properties to reduce fogging.
  - disposable or non-disposable face shields may be used as an alternative to goggles.

**Aprons/Gowns**

• Plastic aprons are indicated to prevent contamination of the HCW’s clothing with blood, body fluids, MRO’s and other potentially infectious material.

• Aprons and/or gowns should be provided in several sizes and at the point of patient contact.

• A long-sleeved, fluid-barrier (impervious) gown should be worn if exposed areas of the body e.g. arms, body front, are likely to be contaminated by blood, body fluids or MRO’s.

• All PPE (with the exception of eyewear/goggles unless soiled) should be changed and hand hygiene performed between attending different patients.

• PPE should be changed at the earliest opportunity if it becomes contaminated with blood or body fluids.

• PPE should be removed immediately on leaving the work area in a manner that prevents contamination of the wearer’s clothing or skin.
Environmental Issues including Equipment and Consumables

- Minimise storage of equipment close to dialysis machines and patients.
- Equipment labelled for ‘single patient use’ or ‘single use’ should not be reprocessed.
- Any item taken to a patient’s dialysis station should be disposed of, dedicated for use by that patient only, or reprocessed prior to return to a clean (storage) area or used on another patient.
  - where possible, designate regularly used equipment to each patient, including tourniquets, blood pressure cuffs and clamps
  - reusable items that cannot be reprocessed (e.g. cloth-covered blood pressure cuffs) should be dedicated for use only on a single patient and discarded when soiled.
- Dialysis machines should be internally disinfected, externally cleaned (and disinfected if indicated), and allowed to dry after each patient treatment.
  - the exterior of the machine should be effectively cleaned using procedures that follow manufacturer’s instructions
  - special attention should be given to cleaning control panels on the dialysis machines and other surfaces that are frequently touched and potentially contaminated with patients’ blood.
- Cleaning of non-critical surfaces (e.g. dialysis bed or chair, countertops, external surfaces of dialysis machines and equipment) should be done with neutral detergent and water after each patient treatment.
- If the surface/item is visibly contaminated with blood or after each BBV-infected patient’s dialysis session:
  - remove organic matter (e.g. use disposable paper towels to soak up) and discard into Clinical Waste
  - small blood spills (e.g.<10mls)
    - use sodium hypochlorite 1:100 dilution (e.g. 1:100 dilution of a 5.25-6.15% sodium hypochlorite provides 525-615ppm available chlorine).
    - large blood spills (e.g. >10mLs)
      - decontaminate using 1:10 dilution of sodium hypochlorite.
- Communal equipment including weigh scales should be cleaned after use with detergent and water (or detergent-impregnated wipes), if there is any prolonged, direct contact between the patient’s skin and equipment surfaces OR if visibly soiled AND at least daily.
- Soiled linen and clinical waste should be managed in accordance with existing hospital procedure.
- Volunteers and visiting personal appearance service persons (e.g. hair dressers, nail technicians, massage therapists) that have direct patient contact should be assessed in relation to the risk of infection transmission associated with their service, particularly where common equipment is used e.g. scissors and nail files. For more detailed information refer to Part 2, Guideline 3 – Non-higher Risk Services, Queensland Health Guidelines for Infection Control for Personal Appearance Services, January 2007
Medications

- Medications (including multiple dose vials containing diluents) or supplies (syringes, alcohol impregnated swabs, etc.) taken to the patient’s station should be used only for that patient and should not be returned to a common clean area or used on other patients.

- Multiple dose vials should be used for individual patients.
  - when multiple dose medication vials are used (including vials containing diluents), prepare individual patient doses in a clean, centralised area away from dialysis stations and deliver separately to each patient
  - do not carry multiple dose medication vials from station to station.

- Medication carts/trolleys should not be used to deliver medications to patients.

- All parenteral medications should be prepared in a clean area separate from potentially contaminated items and surfaces.

- Do not carry medication vials, syringes, alcohol impregnated swabs or supplies in pockets.

- If trays are used to deliver medications to individual patients, they must be cleaned between patients.

- Clean areas should be clearly designated for the preparation, handling and storage of medications and unused supplies and equipment.

- Do not handle and store medications or clean supplies in the same or an adjacent area to that where used equipment or blood samples are handled.
  - all medications shall be labelled in accordance with the National Recommendations for user applied labelling of Injectable medicines, fluids and lines. Refer to National Labelling Recommendations.2 http://www.safetyandquality.gov.au/our-work/medication-safety/user-applied-labelling/

Asepsis

- Aseptic technique refers to practices designed to render and maintain objects and areas as free from microorganisms as possible.


- An aseptic technique shall be used by all HCWs undertaking invasive medical procedures including insertion and access of vascular devices (haemodialysis catheters) and peritoneal dialysis catheters.

Sharps Management

- Where possible the use of needles and other sharps should be eliminated or reduced. Examples include introduction of devices with an integrated sharps injury
Staff Training

- Staff in dialysis units should receive training and education on infection prevention and control practices. This should include:
  - appropriate hand hygiene technique
  - appropriate use of PPE
  - modes of transmission for BBV, pathogenic bacteria, and other microorganisms
  - Infection Control Precautions for Dialysis Units
  - rationale for segregating BBV-positive patients
  - aseptic non touch technique
  - correct techniques for initiation, care, and maintenance of dialysis access sites.

- New and inexperienced staff should be supervised until they are considered competent to practice safely on their own.

Surveillance

- A method should be developed by units to monitor, review and evaluate all serological testing for BBV and microbiological screening for MROs.

- Dialysis units should regularly review adherence to infection control practices e.g. develop self-assessment audit.

Blood Borne Virus (BBV) Screening and Management

- Dialysis patients are at risk for acquiring BBV infections including HBV, HCV and HIV. Of these viruses, hepatitis B has most commonly been transmitted during haemodialysis treatment. Investigations of dialysis-associated outbreaks of hepatitis B and hepatitis C, indicate that transmission most likely occurs because of inadequate infection control practices.\(^1\) Transmission of BBV’s is preventable.

- The following recommendations for serology testing may not be adequate for patients on the active transplant waiting list as they may require more frequent BBV testing.
Pathology

- Units should develop pre-printed forms in consultation with local Pathology Laboratory to ensure standardisation of pathology testing requests (QH staff should refer to the Pathology Queensland Handbook: [http://qheps.health.qld.gov.au/pathology/tests/home.htm](http://qheps.health.qld.gov.au/pathology/tests/home.htm)).

- Develop a unit-specific process for renal dialysis nurses to request pathology tests.
  - the process must include the following details:
    - specific test(s) to be requested
    - indications for request
    - frequency of request (if applicable)
    - collection instructions
    - categories of staff authorised to initiate
    - documentation required in clinical record
    - follow-up required
    - medical staff responsible for reviewing and action on results
    - clinical unit(s) or areas authorised.

- the process must be authorised by the director (medically qualified) or senior medical officer of the clinical unit in which it is implemented. All processes must be reviewed and endorsed by the appropriate Discipline Working Party (DWP) of Pathology Queensland.

- new processes for endorsement should be submitted to Pathology Queensland through the local Director of Pathology or Coordinating Pathologist who will forward them to the appropriate DWP for endorsement.

- A register of request processes will be maintained by the local Pathology Queensland laboratory manager.

- A copy of the Pathology Queensland Standard Operating Procedure for Pathology Test Requests for Non-medical Staff is available from [http://qhss:8031/qhpss/plsql/psdoc_view$main.actionquery](http://qhss:8031/qhpss/plsql/psdoc_view$main.actionquery); click on the Document link No. 10018 to view the document.

- It is preferable that pre dialysis initial serological testing be undertaken by Pathology Queensland (formerly Queensland Health Pathology Service {QHPS}), so that results are readily accessible.

- Units should:
  - develop a checklist for both patients and staff to ensure serological testing (and vaccination) is undertaken at recommended intervals
  - establish a register (paper-based or electronic) to record results of serological testing
  - the development of management (‘shared-care’) plans with the patient’s usual GP, particularly in the pre-dialysis period, may be more convenient for some patients. This should incorporate reminders about management strategies including serological testing and vaccination schedules.
Serological Screening

Patients

- Informed consent should be obtained prior to testing.
  - those who withhold consent should be managed in accordance with practices for patients infected with a BBV
  - develop generic patient information sheets/brochures to assist with educating patients regarding the need for serological testing.

- All patients must be tested for HBsAg, HBsAb (or anti-HBs), anti-HBc, HCV and HIV before admission or transfer to/or from the dialysis service. Patients need to have been tested within the previous month before admission and copies of results available.
  - this should also include patients transferring from another unit (including those dialysed outside Australia). Dialysis centres outside Australia can pose an increased risk of infection with BBV (especially HBV and HCV)
  - if a patient’s BBV serological status is not known at the time of admission, testing should be completed within 7 days
  - patients should be managed in accordance with practices for patients infected with a BBV until results are known.

- Patients should then be tested at six-monthly intervals depending on their serological status and the prevalence of BBV infection in the unit (refer Table 1).

- All HBsAg-negative patients should be vaccinated against HBV; non-responders should be referred to an Infectious Diseases Physician or Infection Control Practitioner for:
  - patients whose only HBV serological marker is anti-HBc in the absence of acute HBV infection (i.e. isolated anti-HBc), it is important to rule out ongoing chronic HBV infection in order to treat patients appropriately and protect their household contacts
  - assessment for intradermal vaccination (refer Section titled Hepatitis B Vaccination).

- Anti-HBc-reactive patient’s results should be discussed with the pathology laboratory to determine appropriate further testing and management.

Staff

- HCWs infected with a BBV, like all HCWs must strictly adhere to standard infection control precautions. HCWs who are HBV/HCV/HIV positive (QH staff should refer to the Queensland Health Guideline for Management of Infected Health Care Workers: http://www.health.qld.gov.au/qhpolicy/docs/gdl/qh-gdl-321-3.pdf for definitions and further information) must advise their supervisor of their status if they are, or have been, performing exposure prone procedures (EPPs), or if it is likely
they will be called upon to perform exposure prone procedures in their current position (if none of these situations apply there is no requirement to advise their supervisor).

- Please refer to the Queensland Health Guideline for the Management of Infected Health Care Workers for further information and descriptions of EPPs.

**Carers and Close Contacts**

- Carers (relatives and friends) who assist a patient with dialysis, or close contacts (including family members, household contacts and sexual partners) are potentially at risk of acquiring a BBV.
  - carers and close contacts should be referred to their GP for HBsAg and HBsAb testing and if necessary, vaccination
  - those who are HBsAb negative should be vaccinated against HBV.
    - non-responders should still be allowed to continue to help with dialysis.
  - subsequent testing of carers and close contacts for BBV is only recommended following a needlestick/sharps injury or body fluid exposure (refer section titled Post-exposure Management).
  - a carer or close contact who is infected with BBV should be advised of the risk of transmission and of the precautions necessary to prevent it, for example:
    - personal hygiene including not sharing items that may have blood on them such as razors and toothbrushes
    - immediately cleaning and covering wounds with a waterproof dressing
    - promptly cleaning up blood spills.

**Management of Patients Infected with Hepatitis B Virus (HBV)**

- To prevent the transmission of HBV, dialysis services should institute a comprehensive blood borne virus prevention plan including:
  - a high level of compliance with BBV serological testing and HBV vaccination
  - application of the same criteria for separating HBsAg reactive patients undergoing peritoneal dialysis as those undergoing Haemodialysis as peritoneal fluid can contain high levels of HBV and should be managed in the same manner as the patient’s blood.

- The following approach to management of patients infected with HBV is recommended. The measures are ranked from the most to least preferred method for managing HBV-positive patients and should be adopted based on the number of adequately trained staff, the availability of isolation facilities, and the ability to ensure patient and staff safety:

1. dialyse HBV-positive patients in a separate room/area designated only for HBV-positive patients. This should include the use of separate dialysis equipment including machines
   - patients with HBV should be managed separately from other patients
   - patients who are HBsAg, HBeAg and HBV DNA reactive, should preferably be dialysed in a separate room due to their high level of infectivity.
2. where there are no isolation facilities, HBV-positive patients should be separated from susceptible patients (non reactive for HBsAg, HBsAb or anti-HBs, anti-HBc), and undergo dialysis on dedicated machines

3. patients with HBsAb $\geq 10$ IU/L may undergo dialysis in the same area as HBsAg-reactive patients, or they may serve as a geographic buffer between HBsAg-reactive and susceptible patients (non reactive for HBsAg, HBsAb or anti-HBs, anti-HBc)

4. when HBV-positive patients are not being dialysed, the room/area may be used for uninfected patients after cleaning and disinfection

5. machines, equipment and consumables should be managed as per the Section titled Infection Control Precautions for Dialysis Patients
   - ideally, the same dialysis equipment should not be used for both HBV-positive patients and seronegative patients; however, where this is not possible, the machine should be disinfected using conventional processes, and the external surfaces cleaned and disinfected thoroughly prior to use on another patient
   - when a machine is no longer required for HBV-positive patient(s), it can be returned to general use after standard cleaning and disinfection procedures have been carried out (refer Section titled Environmental Issues and Cleaning Including Disinfection of Haemodialysis Machines).

6. dialysis staff members caring for HBV-positive patients should not care for susceptible patients at the same time (e.g. during the same shift or during patient change-over)
   - staff members can care for HBsAg-reactive and patients with HBsAb $\geq 10$ IU/L during the same shift.

7. if dialysis staff members must care for both HBV-positive patients and susceptible patients during the same shift, they must meticulously adhere to Standard Precautions i.e. change their apron/gown and gloves, and perform hand hygiene between patients

8. the use of practices outlined in the section titled Infection Control Precautions for Dialysis Patients (i.e. no isolation or segregation), to manage HBV-positive patients should only be considered when such practices are carried out routinely and rigorously.

### Management of Patients Infected with Hepatitis C Virus (HCV)

- Isolation of anti-HCV positive patients in a separate room is strongly recommended for units with a high prevalence of HCV infection ($\geq 30\%^{10,11}$) and/or evidence of new seroconversion(s) associated with dialysis.
- There is currently no vaccination available for HCV, which reinforces the importance of infection control strategies to prevent transmission of HCV in dialysis settings.
- To prevent the transmission of HCV, dialysis services should institute a comprehensive blood borne virus prevention plan, including a high level of compliance with HCV serological testing.
- The following approach to management of patients infected with HCV is recommended. The measures are ranked from the most to least preferred method for managing HCV-positive patients and should be adopted based on the number of
adequately trained staff, the availability of isolation facilities, and the ability to ensure patient and staff safety:

1. dialyse HCV-positive patients in a separate room/area designated only for HCV-positive patients. This should include use of separate equipment

2. where there are no isolation facilities, HCV-positive patients should be separated from susceptible patients

3. when HCV-positive patients are not being dialysed, the room/area may be used for uninfected patients after cleaning and disinfection

4. machines, equipment and consumables should be managed as per the Section titled Infection Control Precautions for Dialysis Patients

   - ideally, the same dialysis equipment should not be used for both HCV-positive patients and seronegative patients; however, where this is not possible, the equipment should be disinfected using conventional processes, and the external surfaces cleaned and disinfected thoroughly prior to use on another patient.

5. staff members caring for both HCV-positive patients and susceptible patients during the same shift, must meticulously adhere to Standard Precautions i.e. change their apron/gown and gloves, and perform hand hygiene between patients

6. the use of practises outlined in the section titled Infection Control Precautions for Dialysis Patients of this document (i.e. no isolation or segregation), to manage HCV-positive patients should only be considered when such practices are carried out routinely and rigorously.

Management of Patients Infected with Human Immunodeficiency Virus (HIV)

- There is currently no vaccination available for HIV, which reinforces the importance of infection control strategies to prevent transmission of BBV in dialysis settings.

- To prevent the transmission of HIV, dialysis services should institute a comprehensive blood borne virus prevention plan, including a high level of compliance with serological testing.

- The following approach to management of patients infected with HIV is recommended. The measures are ranked from the most to least preferred method for managing HIV-positive patients and should be adopted based on the number of adequately trained staff, the availability of isolation facilities, and the ability to ensure patient and staff safety:

  1. dialyse HIV-positive patients in a separate room/area designated only for HIV-positive patients. This should include use of separate equipment

  2. where there are no isolation facilities, HIV-positive patients should be separated from susceptible patients

  3. when HIV-positive patients are not being dialysed, the room/area may be used for uninfected patients after standard cleaning and disinfection

  4. machines, equipment and consumables should be managed as per the Section titled Infection Control Precautions for Dialysis Patients
- ideally, the same dialysis equipment should not be used for both HIV-positive patients and seronegative patients; however, where this is not possible, the equipment should be disinfected using conventional processes, and the external surfaces cleaned and disinfected thoroughly prior to use on another patient.

5. staff members caring for both HIV-positive patients and susceptible patients during the same shift must meticulously adhere to Standard Precautions i.e. change their apron/gown and gloves and perform hand hygiene between patients.

**Post-exposure Management**

- All BBV exposures (patients, staff and carers) should be managed according to the Queensland Health Guideline for Management of Exposure to Blood and Body Fluids.
- All exposures should be reported to the infection control, occupational health or other designated department.
- Reports of such incidents should be monitored by the designated department and dialysis service for indications that procedures or equipment need to be modified (also refer, Event Analysis: Investigation of Occupational Exposures to Blood or Body Fluid: [http://www.health.qld.gov.au/chrisp/signal_infection/assess_analysis.pdf](http://www.health.qld.gov.au/chrisp/signal_infection/assess_analysis.pdf)).

**BBV Transmission in a Unit**

- When a previously unidentified case of a BBV infection is found, the dialysis service should contact their local Infection Control Unit and the Queensland Health Population Health Unit.

**Holiday Dialysis**

- A number of other factors may need to be considered before accepting patients for holiday dialysis which are outside the scope of this document.

**Patients Requesting Holiday Dialysis from Another Unit**

- The current BBV status (HBsAg, HBsAb, anti-HCV, anti-HIV) of patients should be ascertained prior to accepting them for dialysis to ensure adequate clinical as well as infection prevention and control measures can be implemented as required.
- Patients who refuse to provide evidence of their BBV status should be managed in accordance with practices for patients infected with a BBV.
- ‘Criteria for admission’ to a holiday dialysis program should be provided to the patient in writing, prior to acceptance on the program.
  - the form should include any requirements for serological testing and/or microbiological screening (also refer Section titled *Multi-Resistant Organism (MRO) Screening and Management*).
  - the form should be signed by the patient to indicate they understand and accept the admission criteria.
Patients Travelling from their Unit

- There is an increased risk of acquisition of BBV infection associated with dialysis units abroad.

- Before travel, patients should be tested for HBsAg, HBsAb, anti-HCV and anti-HIV, as recent results may be required by some renal units before they will accept patients for holiday dialysis.

- Patients should be advised that some overseas dialysis units participate in dialyser re-use programs. Generally dialysers are reprocessed for use on the same patient.
  - outbreaks of blood borne bacterial infections have been associated with poor dialyser reprocessing techniques
  - the risks associated with dialyser re-use programs and the option of providing single-use dialysers to patients travelling overseas (including costs), should be discussed.

- Re-admitted patients who have been dialysed outside their unit should be tested as per Table 1 before being dialysed in the main unit.

- A risk assessment of potential BBV exposure overseas should also be carried out, and if exposure is considered likely, enhanced surveillance for one or more BBV should be instituted.³
### Table 1: Recommended Schedule for BBV Testing of Dialysis Patients

<table>
<thead>
<tr>
<th>Vaccination/Serological Status and Frequency of Screening</th>
<th>Hepatitis B Virus (HBV)</th>
<th>Hepatitis C Virus (HCV)</th>
<th>Human Immunodeficiency Virus (HIV)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screening Test</strong></td>
<td><strong>Admission or transfer to or from the dialysis service (all patients)</strong></td>
<td><strong>HBV susceptible including vaccine non-responder (HBsAb &lt;10 IU/L)</strong></td>
<td><strong>anti-HCV negative</strong></td>
</tr>
<tr>
<td>HBsAg</td>
<td>On admission*</td>
<td>Every 6 months</td>
<td>None</td>
</tr>
<tr>
<td>HBsAb</td>
<td>On admission*</td>
<td>Every 6 months</td>
<td>Every 6 months</td>
</tr>
<tr>
<td>anti-HBc</td>
<td>On admission*</td>
<td>Every 6 months</td>
<td>None</td>
</tr>
<tr>
<td>HBeAg &amp; HBV DNA</td>
<td>None</td>
<td>Every 6 months</td>
<td>None</td>
</tr>
</tbody>
</table>

*Results of BBV testing should be known before the patient begins dialysis*
Hepatitis B Vaccination

Patients with progressive chronic kidney disease are potentially at increased risk of HBV infection once they commence dialysis (particularly haemodialysis). Investigations of outbreaks of HBV infection among haemodialysis patients have indicated that transmission resulted from failure to use recommended infection control practices. This included failure to routinely screen patients for HBsAg and routinely review results of testing to identify infected (and susceptible) patients. In addition, few patients had received hepatitis B vaccine.1

United States (US) national surveillance data (1994), “have demonstrated that independent risk factors among chronic haemodialysis patients for acquiring HBV infection include the presence of ≥1 HBV-infected patient in the haemodialysis centre who is not isolated, as well as a <50% hepatitis B vaccination rate among patients.”1-12

Hepatitis B vaccination is recommended for both (susceptible) chronic dialysis patients and staff members. Optimal use of the hepatitis B vaccine reduces the reservoir of infected patients, thereby decreasing opportunities for cross transmission and the infection of others.12

The major determinants of vaccine response are age (>40 years), obesity, smoking and immune depression.1 Current hepatitis B vaccines are prepared using recombinant technology and have a significant protective effect against acquiring HBV infection in chronic dialysis patients.13 Vaccination early in the course of kidney disease (or before dialysis) appears to increase the rate of response. Dialysis patients should be given a double dose or dialysis formulation13.

Although no data exist on the response of paediatric haemodialysis patients to vaccination with standard paediatric doses (5 - 10 µg), high response rates were reported after a three dose (20 µg) schedule in both predialysis and dialysis-dependent patients.1

Among persons with normal immune status who respond to the primary series of hepatitis B vaccine, protection against hepatitis B persists even when antibody titres become undetectable. However, among haemodialysis patients who respond to the vaccine, protection against hepatitis B is not maintained when antibody titres fall below protective levels.1

Because of the low response to vaccination, the shorter duration of immunity and potential loss of antibodies, regular HBsAb testing of dialysis patients is recommended (also refer Section titled Blood Borne Virus (BBV) Screening and Management).

General

- All dialysis units should have access to the current edition of The Australian Immunisation Handbook either electronically at: http://www.immunise.health.gov.au/ or in hard copy.
- A registered nurse may administer a vaccine under:
  - a doctor’s written medical order.
- Vaccines may be prescribed and administered by:
- a registered nurse previously endorsed by the Queensland Nursing Council (QNC) or a registered nurse who has obtained a qualification approved by the chief executive to practice in an approved immunisation program in accordance with the Health (Drugs and Poisons) Regulation 1996, ‘Drug Therapy Protocol Immunisation Program’: http://www.health.qld.gov.au/ph/documents/ehu/dtp-immunisation.pdf; or

- a nurse practitioner endorsed to practice in accordance with the provisions of the Drug Therapy Protocol (DTP), prescribe, give a written or oral instruction, supply, and administer those drugs listed in the Queensland Health (QH) List of Approved Medications (LAM) for which a Health Management Protocol (HMP) has been developed and approved (also refer Nurse Practitioner – Drug Therapy Protocol: http://www.health.qld.gov.au/ph/documents/ehu/30472.pdf).

- Units administering vaccines should develop a procedure for the management of anaphylaxis (including availability of equipment and drugs) and promptly report any significant adverse event following vaccination to the Communicable Diseases Branch, Queensland Health: http://www.health.qld.gov.au/ph/cdb/default.asp.

- Units should develop a standardised pre-vaccination checklist to determine the vaccinee’s medical fitness for vaccination; refer Pre-Vaccination Checklist contained in The Australian Immunisation Handbook: http://www.immunise.health.gov.au/.

- Units should develop a standardised method for recording vaccinations (e.g. in patient’s medical record or dialysis chart). This should include:
  - that valid consent was given
  - details of the vaccine given, including dose, brand name, batch number, route and site of administration
  - the name of the person providing the vaccination
  - the date of vaccination
  - the date the next vaccination is due (if applicable).

- Provide a written record of vaccinations to the patient, including the date of the next scheduled vaccination (if necessary).

**Consent**

- Valid consent should be obtained before each vaccination, after it has been established there are no medical conditions that contraindicate vaccination.

- Compile an information package for patients regarding vaccinations including the risks and benefits of vaccination and common adverse events that may occur following vaccination to allow vaccinee to make an informed decision.

- As with any medical intervention, the provider should document in the vaccinee’s clinical record that such a discussion has taken place prior to the person giving consent. A stamp or sticker, signed by the provider, is acceptable.

Australian Vaccination Policy

- Universal childhood vaccination against hepatitis B for infants and adolescents began in 2000 (adolescent programs commenced in some States and Territories in 1997). In time, many persons who develop end-stage renal failure will have a history of vaccination against hepatitis B. These persons should have responded to the vaccine when their immune status was normal, but if their HBsAb levels are <10 IU/L when they begin dialysis, they should be revaccinated with a complete series.

Primary Vaccination in Dialysis patients

- For adults over 20 years of age a full course of hepatitis B vaccine consists of 3 doses of 1 mL dialysis formulation (40 µg).
- For children and young adults up to their twentieth birthday a total of three doses of 1 mL adult formulation (20 µg) are recommended.
- There should be an interval of 1 month between the first and second doses with a third dose 5 months after the second dose.
  - it is not necessary to restart the primary series if there have been prolonged intervals between doses.
- Administer the vaccine by deep IM injection into the deltoïd muscle in adults and older children, and into the anterolateral thigh in neonates and infants under 12 months of age.
- If an adult patient begins the vaccine series with a standard dose (20 µg) before beginning dialysis treatment, then moves to dialysis treatment before completing the series, complete the series using the higher dose recommended for dialysis patients (40 µg).
- The vaccinee should remain under observation in a designated place for a minimum of 15 minutes after the vaccination.

Post-vaccination Serological Testing

- Post-vaccination serological testing (HBsAb) is recommended 4 to 8 weeks after the third dose of hepatitis B vaccine.

Vaccine Responder

- If vaccine responder after primary course (i.e. HBsAb ≥10 IU/L), consider immune.
  - monitor HBsAb at 6-monthly intervals (refer Section titled Blood Borne Virus (BBV) Screening and Management)
  - a booster dose (40 µg) is recommended if HBsAb <10 IU/L
  - retesting after the booster dose is not necessary.¹

Non-responder

- If non-responder after primary course (i.e. HBsAb <10 IU/L):
  - investigate the possibility of HBsAg carriage
  - if HBsAg negative, administer a further 3 doses one month apart
  - check HBsAb 4 weeks after last dose
- if HBsAb ≥10 IU/L, consider immune and monitor HBsAb at 6-monthly intervals (refer Section titled Blood Borne Virus (BBV) Screening and Management).

**Persistent Non-responder**
- If persistent non-responder after 6 doses of vaccine:
  - no data exists to indicate that additional (IM) doses would induce an antibody response
  - persistent non-responders should be informed about the need for hepatitis B immunoglobulin (HBIG) within 72 hours following a significant exposure to HBV.

**Refusal to be Vaccinated**
- If a patient refuses to be vaccinated due to a personal, philosophical, religious or medical belief:
  - monitor HBsAg and HBsAb at 6-monthly intervals
  - inform them of the need for HBIG within 72 hours following a significant exposure to HBV (also refer Table 2)
  - continue to offer the patient the opportunity to be vaccinated
  - document in patient’s medical notes.

**Vaccination of Staff**
- Hepatitis B vaccination or proof that an individual is not susceptible to hepatitis B is a condition of employment in Queensland Health facilities for all workers who have direct contact with patients or who in the course of their work may be exposed to blood/body fluids or contaminated sharps.
- Obtain evidence of hepatitis B vaccination or that an individual is not susceptible to hepatitis B from a new employee, prior to employment. Proof of vaccination or that an individual is not susceptible to hepatitis B can be provided via a letter from a general practitioner, infection control or occupational health department.

**Primary Vaccination**
- For adults over 20 years of age a full course of hepatitis B vaccine consists of 3 doses of 1 mL adult formulation (20 µg). There should be an interval of 1 month between the first and second doses with a third dose 5 months after the second dose.
  - it is not necessary to restart the primary series if there have been prolonged intervals between doses.
- Administer the vaccine by deep IM injection into the deltoid muscle.
Post-vaccination Serological Testing

- Post-vaccination serological testing (HBsAb) is recommended 4-8 weeks after the third dose of hepatitis B vaccine.

Vaccine Responder

- If vaccine responder after primary course (i.e. HBsAb ≥10 IU/L), consider immune.
  - booster doses are not recommended in immunocompetent individuals after a primary course; this applies to staff of healthcare facilities \(^{13}\)
  - periodic serological testing to monitor antibody levels is not recommended. \(^{1}\)

Non-responder

- If non-responder after primary course (i.e. HBsAb <10 IU/L):
  - investigate the possibility of HBsAg carriage.
  - Knowledge of hepatitis B carriage in healthcare workers may have significant implications for future employment and these tests should not be undertaken without:
    - advice from an Infectious Diseases Physician or Medical Microbiologist
    - the fully informed consent of the healthcare worker.
  - If HBsAg negative, administer a 4\(^{th}\) dose and retest HBsAb 4 weeks after the 4\(^{th}\) dose. Staff who are non-responders after being given the 4\(^{th}\) dose should have a further 2 doses of hepatitis B vaccine at monthly intervals \(^{13}\):
    - check HBsAb 4-8 weeks after the 4\(^{th}\) or last dose \(^{13}\)
    - if HBsAb ≥10 IU/L, consider immune; no further booster doses or serological testing are required \(^{13}\)
    - For HBsAg-negative healthcare workers who are non-responders to a primary course of vaccination and to subsequent additional IM doses (≥5 doses in total), some small observational studies report that some individuals may respond to the vaccine administered intradermally \(^{13}\)

Persistent Non-responder

- If persistent non-responder after 6 doses of vaccine refer: Vaccination of Patients – Persistent Non-responder.

Vaccination of Carers and Close Contacts

- Hepatitis B vaccination is recommended for carers and close contacts of HBsAg-reactive patients.
  - carers and close contacts should be referred for assessment for serological testing and vaccination
  - testing (HBsAg and HBsAb) before planned vaccination is recommended, particularly those who are from high prevalence populations (e.g. Australian Aboriginal, Central African, and South-East Asian populations). \(^{13}\)
Vaccine Transport, Storage and Handling

- The ‘cold-chain’ is the system of transporting and storing vaccines within the temperature range of 2°C to 8°C from the place of manufacture to the point of administration.
  - this temperature range is recommended because outside this range vaccines may (very quickly) lose their potency.13

Other Vaccinations

Patients

- Pneumococcal vaccination is recommended for persons aged over 5 years at increased risk of complications from invasive pneumococcal disease (IPD) because of chronic illness, including adults with chronic renal failure, or relapsing or persistent nephrotic syndrome.13
  - A single dose of 13vPCV is recommended.
    - For those with a newly diagnosed (or newly recognised for the purposes of requiring vaccination) condition, the dose of 13vPCV should be given at the time of diagnosis and followed by 23vPPV doses. The 1st 23vPPV dose should be given a minimum of 2 months after 13vPCV.
    - For adults who have received 1 or more doses of 23vPPV, the dose of 13vPCV should be given at least 12 months after the most recent dose of 23vPPV.
  - All adults with conditions associated with an increased risk of IPD are recommended to receive additional doses of 23vPPV (compared with those who do not have an increased risk).
    - In adults with a pre-existing condition, the 1st adult dose of 23vPPV is recommended at approximately 18 years of age, or a minimum of 5 years after the most recent dose of 23vPPV, and is to be followed by up to 2 additional doses.
    - For those newly diagnosed, or who have never received pneumococcal vaccination, they should receive a single dose of 13vPCV at time of diagnosis, followed by a 1st dose of 23vPPV a minimum of 2 months later. A 2nd dose of 23vPPV is recommended at approximately 5-10 years (minimum 5 years) after the 1st dose of 23vPPV. A 3rd dose of 23vPPV is recommended at the age of 50 years for Indigenous adults and 65 years for non-Indigenous adults, or a minimum of 5 years after the 2nd dose, whichever is later.
    - For older adults newly diagnosed who have already received an age-based 1st dose of 23vPPV at 65 years (non-Indigenous) or 50 years (Indigenous), a 2nd dose of 23vPPV is recommended a minimum of 5 years after the previous dose. A 3rd dose of 23vPPV is recommended, a minimum of 5 years after the 2nd dose or at age 65 years, whichever is later.
- In general, no more than three 23vPPV doses are recommended during a person’s adult life.


- Influenza vaccine is recommended annually before the beginning of the influenza season (March/April) for dialysis patients.

- Patients on dialysis should receive the pertussis diphtheria tetanus toxoids as recommended for healthy people.

- Varicella zoster virus (VZV) vaccine should be administered for future transplant patients if non-immune (i.e. VZV IgG negative).

**Staff**

- Dialysis staff may be exposed to, and transmit, vaccine-preventable diseases such as influenza, chickenpox (VZV), measles, rubella and pertussis

<table>
<thead>
<tr>
<th>Group</th>
<th>Dose</th>
<th>Schedule</th>
<th>Serological Testing</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Patients &gt;20 years: Pre-dialysis</td>
<td>40 µg*</td>
<td>Give at 0, 1 &amp; 6 months (total of 3 doses)</td>
<td>Check HBsAb 4-8 weeks after the third dose</td>
<td>Adequate response is defined as HBsAb ≥10 IU/L</td>
</tr>
<tr>
<td>Patients &gt;20 years: Dialysis-dependent</td>
<td>40 µg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients &lt;20 years</td>
<td>20 µg</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Vaccine responder</td>
<td>40 µg</td>
<td>Administer booster dose if HBsAb becomes undetectable (&lt;10 IU/L)</td>
<td>Check HBsAb every 6 months</td>
<td>Retesting after a booster dose is not necessary</td>
</tr>
<tr>
<td>HBsAb ≥10 IU/L</td>
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<tr>
<td>Non-responder</td>
<td></td>
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</tr>
<tr>
<td>HBsAb &lt;10 IU/L (and HBsAg negative)</td>
<td>40 µg</td>
<td>Further 3 doses at monthly intervals</td>
<td>Check HBsAb 4-8 weeks after the last dose</td>
<td>The possibility of HBsAg carriage should be investigated. For persons found to be non-responders after six doses of vaccine, no data exist to indicate that additional (IM) doses would induce an antibody response</td>
</tr>
<tr>
<td>Persistent non-responder</td>
<td>Nil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBsAb &lt;10 IU/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refusal to be vaccinated</td>
<td>Nil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovery from natural infection</td>
<td>Nil</td>
<td></td>
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</tr>
</tbody>
</table>
### Table 2: Recommended Hepatitis B Vaccination Schedule for Patients and Staff of Dialysis Services

<table>
<thead>
<tr>
<th>Group</th>
<th>Dose</th>
<th>Schedule</th>
<th>Serological Testing</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>(HBsAb and anti-HBc reactive)</td>
<td></td>
<td></td>
<td></td>
<td>from natural HBV infection</td>
</tr>
<tr>
<td><strong>Staff</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td>20 µg**</td>
<td>Give at 0, 1 &amp; 6 months (total of 3 doses)</td>
<td>Check HBsAb 4 weeks after the last dose</td>
<td></td>
</tr>
<tr>
<td>Vaccine responder HBsAb ≥10 IU/L</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-responder HBsAb &lt;10 IU/L (and HBsAg negative)</td>
<td>20 µg</td>
<td>4th dose or a further 3 doses at monthly intervals</td>
<td>Check HBsAb 4-8 weeks after the 4th or last dose</td>
<td>The possibility of HBsAg carriage should be investigated in consultation with Infectious Diseases Physician or Medical Microbiologist</td>
</tr>
<tr>
<td>Persistent non-responder HBsAb &lt;10 IU/L</td>
<td>Nil</td>
<td>Refer to Infectious Diseases Physician or Infection Control Practitioner for consideration for intradermal vaccination</td>
<td>Nil</td>
<td>Follow needlestick injury/body fluid exposure procedure should an occupational exposure occur Administer Hepatitis B immunoglobulin within 72 hours following a significant exposure to hepatitis B</td>
</tr>
<tr>
<td>Recovery from natural infection (HBsAb and anti-HBc reactive)</td>
<td>Nil</td>
<td>Nil</td>
<td>No additional HBV testing required</td>
<td>The presence of HBsAb and anti-HBc indicates immunity from natural HBV infection</td>
</tr>
</tbody>
</table>

**Multi-Resistant Organism (MRO) Screening and Management**

In general, multi-resistant organisms (MRO) are defined as microorganisms – predominantly bacteria – that are resistant to one or more classes of antimicrobial agents. Although the names of certain MROs suggest resistance to one agent (e.g. methicillin resistant *Staphylococcus aureus* (MRSA), vancomycin resistant enterococci (VRE)), these pathogens are usually resistant to all but a few commercially available antimicrobial
agents. This latter feature defines MROs that are considered to be epidemiologically important and deserve special attention in healthcare facilities.\textsuperscript{16}

The prevalence of MROs in various healthcare settings, including outpatient dialysis facilities, has increased considerably in the last decade. Antimicrobial use and direct contact transmission of resistant strains are the two main factors that have contributed to this significant increase.\textsuperscript{17}

- Preventing transmission of MROs in a dialysis setting requires a comprehensive approach to limit the spread of these resistant organisms, including:
  - administrative support (e.g. fiscal and human resources to maintain infection control programs, nurse staffing, communication systems)
  - clinical microbiology laboratory support to ensure prompt detection and reporting of MROs including antimicrobial susceptibility, and access to molecular typing and rapid diagnostic tests
  - appropriate antimicrobial stewardship programs should be developed that includes optimal selection, dose, and duration of treatment, as well as control of antibiotic use
  - active surveillance cultures (screening) to identify patients colonised or infected with MROs
  - application of principles outlined in the Section titled Infection Control Precautions for Dialysis Services during patient care
  - education and training of HCWs, patients and families on the principles and practices for preventing transmission of infectious agents
  - decolonisation therapy where appropriate
  - environmental measures (cleaning of the patient care environment and equipment, dedicated single-patient-use of non-critical equipment).\textsuperscript{18}

**General Principles**

These recommendations should be adopted when there is agreement between nephrology, infection control, infectious diseases and/or microbiology staff regarding the dialysis service’s MRO screening program. The program should be based on facility demographics including predominant microorganisms and antimicrobial resistance patterns (antibiograms), as well as human and physical resources to effectively and safely isolate patients where indicated.

**Pathology**

- Establish a multidisciplinary forum of key stakeholders (nephrology, infection control, infectious diseases and microbiology staff) to determine the MRO screening program (i.e. target MROs) for the dialysis service.

- A point-prevalence study could be undertaken to determine the prevalence of MROs within the dialysis service.

- The MRO screening program should be reviewed at least annually and include:
  - an analysis of results from the previous year’s specimens
  - the facility’s overall MRO rates (infections and colonisations)
  - local antimicrobial resistance patterns (particularly mupirocin-resistance in MRSA isolates) and antibiotic use.
• It is preferable that initial microbiological screening be undertaken by Pathology Queensland, so that results are readily accessible.


• Develop a unit-specific protocol for renal dialysis nurses to request pathology tests that includes the following details:
  - specific test(s) to be requested
  - indications for request
  - frequency of request (if applicable)
  - collection instructions
  - categories of staff authorised to initiate
  - documentation required in clinical record
  - follow-up required
  - medical staff responsible for reviewing and action on results
  - clinical unit(s) or areas authorised.

• Develop generic patient information sheets/brochures to assist with educating patients regarding the need for microbiological screening.

• Dialysis services should:
  - develop a patient checklist to ensure MRO screening is undertaken at recommended intervals
  - establish a register (paper-based or electronic) to record results of MRO screening.

**Screening**

**General Principles:**

• Active surveillance cultures do not replace the need to obtain microbiological specimens as part of clinical management of the patient.

• Consent should be obtained prior to testing, especially when there are implications for therapy and management of a colonised or infected patient (e.g. instigation of infection control precautions including isolation).

• It is preferable that patients *do not* collect the swabs themselves.

• Use commercially-prepared, sterile fibre-tipped swabs.

• Swabs can be used dry or pre-moistened with sterile normal saline.

• Pathology request form(s) must include specimen site/type and test requirements e.g. nose and groin swabs for MRSA.

• The specimen container(s) must be labelled with patient’s full name, date of birth, UR number, site and date of collection and should be transported to the laboratory as soon as possible.

• Also refer to Table 3 for MRO Screening Recommendations for Dialysis Patients.
Patients

- The decision to screen patients for MROs is generally based on the need to guide patient management including treatment and infection control practices. It is important to note that some patients may be colonised and/or infected with more than one MRO.

- The recommended screening intervals contained in this document are arbitrary; more or less frequent screening may be indicated depending on local circumstances. Some services may opt to only screen patients with high-risk characteristics associated with MRO colonisation and infection e.g. - elderly patient (age >60 years)
  - previous history of infection or colonisation with MRO(s)
  - recent antimicrobial therapy
  - previous hospitalisation
  - interhospital or nursing home transfer
  - co-morbidities/underlying conditions (renal insufficiency, diabetes mellitus)
  - long-term haemodialysis
  - receipt of immunosuppressive therapy
  - presence of skin lesions (wounds, ulcers, dermatitis)
  - long-term indwelling devices.19,20

- Decisions regarding screening should be made in consultation with infection control.

Staff

- It is not necessary to routinely screen staff for MROs. The exception may be ongoing transmission of a MRO within a unit, for which no other source is identified.

- HCWs may be transiently colonised with a MRO, particularly those staff with underlying medical conditions such as diabetes, exfoliative skin conditions, and paronychia. For this reason, staff screening should only be undertaken in consultation with Infection Control and/or Infectious Diseases/Microbiology staff.

Carers and Close Contacts

- Whilst there have been reports in the literature of transmission of MRSA to close family contacts, it is not necessary to routinely screen carers or close contacts of dialysis patients, for MROs.

Management of Patients Infected or Colonised with a MRO

Ideally, Contact Precautions should be implemented for all patients infected or colonised with a MRO. However, given the practical limitations in instituting these measures in a dialysis setting, the following tiered approach to management of MRO-positive patients is recommended:

- The principles outlined in the section titled Infection Control Precautions for Dialysis Services are adequate to prevent transmission for most patients infected or colonised with a MRO.21

- Contact Precautions should be considered for the management of:
- patients who might be at increased risk of transmitting a MRO. This includes patients with:
  · an infected/colonised wound that cannot be contained by a dressing
  · urinary incontinence
  · faecal incontinence or diarrhoea uncontrolled with personal hygiene measures
  · enterostomies
  · exfoliative skin conditions (e.g. dermatitis, psoriasis).

**OR**

- all patients with a MRO when:
  · the incidence of a MRO is increasing despite implementation of, and correct adherence to *Infection Control Precautions for Dialysis Services*; or
  · the first case or outbreak of an epidemiologically important MRO is identified within the healthcare facility or unit.

- The following recommendations are ranked from the most to least preferred method for managing MRO-positive patients (whether infected or colonised), and should be adopted based on the number of adequately trained staff, the availability of isolation facilities, and the ability to ensure patient and staff safety.
  - Dialyse MRO-positive patients in:
    1. a separate (isolation) room designated only for MRO-positive patient(s), using Contact Precautions
    2. the main unit but in a separate/designated area, using Contact Precautions
    3. the main unit using Contact Precautions.

- Other points to consider are:
  · ≥1 metre spatial separation between beds/chairs is advised to reduce the opportunities for inadvertent sharing of items between the infected/colonised patient and other patients
  · patients with the same MRO may be managed together (cohorted)
  · patients with different MROs should be managed separately
  · when MRO-positive patients are not being dialysed, the room may be used for MRO-negative patients after cleaning and the area is dry
  · the use of separate machines or dedicated staff is not necessary.

- Environmental measures (also refer Section titled *Infection Control Precautions for Dialysis Services*):
  - dedicate non-critical medical equipment (e.g. blood pressure cuff, tourniquet, stethoscope) to MRO-positive patient(s)
  - when this is not possible, cleaning (and if necessary, disinfection) after use is recommended
  - limit the amount of reusable equipment and consumables in the patient’s immediate environment
- general routine cleaning and disinfection of environmental surfaces including patient-care equipment should be adequate for inactivation of MROs \(^2\)
- routine environmental cultures are not necessary.

- The use of common areas of the unit by patients infected or colonised with a MRO, should be based on their risk to other patients and their ability to comply with appropriate hand hygiene practices.

- Transport of patients within the facility (e.g. for diagnostic or therapeutic purposes):
  - transport staff should wear an apron and non-sterile single use disposable gloves if direct contact with the patient is anticipated
  - notify staff in the receiving area of the impending arrival of the patient and of the precautions necessary to prevent transmission.

- Transport of patients outside the facility (e.g. ambulance transfer):
  - standard precautions are sufficient.

- Transport equipment (e.g. wheelchairs, trolleys) should be cleaned with detergent and water or detergent-impregnated wipes or alcohol-impregnated wipes after use.

- A system should be implemented to identify patients known to be positive for a MRO e.g. HBCIS and/or Patient Record/Chart Infection Control Alert.

Contact Precautions

- Contact Precautions are intended to prevent transmission of infectious agents, including MROs, which are spread by direct or indirect contact with the patient or patient’s environment:
  - signage may be used to indicate the patient requires transmission based precautions (QH staff should refer to Transmission Based Precaution Signage: [http://www.health.qld.gov.au/chrisp/resources/transmission_prec.asp](http://www.health.qld.gov.au/chrisp/resources/transmission_prec.asp))
  - HCWs caring for patients on Contact Precautions must wear an apron or gown and clean non-sterile single use gloves for all interactions that may involve contact with a colonised or infected patient or potentially contaminated areas in the patient's environment
  - face protection should be worn in accordance with section titled Infection Control Precautions for Dialysis Services
  - the apron/gown and gloves (and face protection if worn) should be removed before leaving the patient care area
  - hand hygiene is to be performed following glove removal.

- Containers including linen skips and waste receptacles for used disposable or reusable PPE should be placed in a location that is convenient to the site of removal to facilitate disposal and containment of contaminated materials.

- The use of PPE in healthcare settings by visitors has not been addressed specifically in the scientific literature:
  - family members or visitors who are providing care or having very close patient contact may have contact with other patients and could contribute to transmission if PPE are not used correctly. Specific recommendations should be determined based on the level of interaction. \(^2\)
Evidence of Ongoing Transmission

- When transmission continues despite adherence to Infection Control Precautions for Dialysis Services and Contact Precautions, enhanced infection control precautions should be considered in consultation with an Infection Control Practitioner. For example:
  - placement of MRO-positive patient(s) in single rooms, or cohort patients with the same MRO in a designated area
  - assign designated staff to the care of MRO patient(s) only
  - stop new admissions to the unit
  - implement patient-dedicated or single-use disposable non-critical equipment, instruments and devices
  - limit transport of patients within the facility to essential purposes only
  - intensify (and monitor) environmental cleaning of patient care areas, particularly surfaces and items in close proximity to the patient and those likely to be frequently touched by the patient and HCWs.

Empiric Application of Contact Precautions

- Laboratory tests, particularly those that depend on culture techniques, often require two or more days for completion. Contact Precautions should be implemented while test results are pending based on the patient’s clinical presentation, high-risk characteristics and likely pathogens.

MRO Clearance and Discontinuation of Contact Precautions

- Depending on the organism, colonisation may persist for months or even years.
- Shedding of the organism may be intermittent and surveillance cultures may fail to detect their presence.\(^{16,20}\)
- Known risk factors for MRO acquisition such as older age, prior hospitalisation, antibiotic therapy, presence of skin lesions, and use of indwelling devices, are associated with long-term carriage.

MRSA, ESBL-producing gram-negative bacteria and Carbapenem-resistant Acinetobacter baumannii (CRAB):

- A patient should be considered clear of MRSA, ESBL producing gram-negative bacteria and/or CRAB and Contact Precautions discontinued, if they meet the clearance criteria in the Queensland Health Guideline for screening and clearance of Multi-resistant Organisms: [http://www.health.qld.gov.au/chrisp/policy_framework/guideline_4_MRO.pdf](http://www.health.qld.gov.au/chrisp/policy_framework/guideline_4_MRO.pdf)
- All of the following criteria should be met:
  - more than six months elapsed time from the last positive specimen
  - the patient has not had exposure to antibiotic or antiseptic body wash for at least two weeks prior to screening
  - in the case of MRSA, no exposure to specific anti-MRSA antibiotic therapy in the past three months
  - all wounds have healed
- no invasive (indwelling) medical devices are present; and
- consecutive negative screens from screening sites (refer to Queensland Health Guideline for the Screening and Clearance of Multi-Resistant Organisms for required screening sites) on three separate occasions. The screening swabs are to be separated by a minimum period of one week. This period should not be less than three weeks but is typically months.

**Vancomycin Resistant Enterococci (VRE)**

Clearance of patients with VRE shall be in accordance with the Queensland Health Protocol: Management of patients with VRE:


In addition to an assessment of the risk, the following criteria shall be fulfilled prior to commencing the process of VRE clearance:

- at least 6 months since the last positive VRE specimen
- a period (at least 6 months) free from the following:
  - hospitalisation (acute episode)
  - antimicrobial therapy active against VRE (e.g. linezolid, teicoplanin).

Clearance screening shall be undertaken according to the following:

- three consecutive negative stool, rectal or perianal swabs separated by a minimum period of one week per negative specimen. This period should not be less than three weeks but is typically months
- facilities will need to decide on local level processes for patients who meet the above criterion and are cleared, particularly in relation to rescreening of these patients when antibiotics are administered.

**Methicillin Resistant *Staphylococcus aureus* (MRSA)**

- Worldwide, MRSA is commonly isolated as a cause of haemodialysis catheter-related bloodstream infection and peritoneal dialysis-related catheter infection and peritonitis. The emergence of new epidemic strains of non-multiresistant MRSA (nm MRSA), among patients without established MRSA risk factors has led to an increase in the number of patients with MRSA infection or colonisation diagnosed at hospital admission. Furthermore, transmission within hospitals of nm MRSA strains are being reported with increasing frequency.¹⁶,¹⁸

**Non-multiresistant MRSA (nm MRSA)**

- MRSA isolates which are less resistant are reported as non-multiresistant MRSA, previously referred to as community-acquired MRSA.
- nm MRSA strains are frequently associated with minor skin and soft tissue infections (e.g. furuncles, abscesses), but can cause severe invasive disease including necrotising pneumonia.¹⁶

**Screening**

(also refer Table 3)

- Because of the relatively high prevalence of MRSA and nm MRSA within Queensland, all patients should be tested for *S. aureus* (including MRSA and nm
MRSA) before admission or readmission to the dialysis service/program or the first dialysis treatment:
- this should also include patients transferring from another unit/service (including those dialysed outside Australia).

• The subsequent screening frequency should be based on the prevalence of the pathogen and risk factors for colonisation:
  - for example, more frequent cultures would be indicated in a facility where 50% of all S. aureus isolates are MRSA than in one where less than 1% of all S. aureus isolates are MRSA.\(^{23}\)

• In general, patients should be re-tested regularly, e.g. six-monthly intervals.
  - more frequent screening may be indicated if there is evidence of cross transmission in the unit (e.g. weekly, until transmission has ceased and then decreasing frequency).\(^{16}\)

• The anterior nares (nostrils) are the most consistent site from which S. aureus can be cultured.\(^{23}\)

• Colonisation with MRSA can be prolonged (months to years).
  - studies demonstrating initial clearance of MRSA following decolonisation therapy have reported a high frequency of subsequent carriage (treatment of MRSA carriage is discussed in Section titled Management of Patients Colonised with Staphylococcus aureus).

Management of MRSA-positive Patients
(refer to Management of Patients Infected or Colonised with a MRO)

MRSA patients should be managed separately to patients with multiresistant strains of MRSA.

Vancomycin Resistant Enterococcus (VRE)

- VRE were first reported in the late 1980s, with one of the first reports being among patients with renal failure.

- Clinically important vancomycin resistance in enterococci has been found most commonly in Enterococcus faecalis and E. faecium, and primarily caused by the acquisition of vancomycin-resistance genes (vanA and vanB). The gastrointestinal (GI) tract is the major reservoir for enterococci.

- Risk factors for VRE colonisation include extended hospitalisation, intensive care unit stay, and use of vancomycin and third-generation cephalosporins. VRE colonisation in dialysis patients has been most closely associated with recent vancomycin use and hospitalisation.

- When transmission of VRE occurs, it is generally thought to be by direct contact, for example, from patient to patient on the hands of HCWs.

- Enterococci are hardy organisms that survive on the hands of HCWs and environmental surfaces, which facilitates their transmission.

- Reduction of vancomycin use is one of the most important strategies to limit the spread of vancomycin resistance.\(^{23,24}\)
Screening

- All patients shall be screened for VRE before admission or readmission to the dialysis service/program or the first dialysis treatment
  - this shall also include patients transferring from another unit/service (including those dialysed outside Australia).
- Patients shall be re-screened every three months.
- Stool specimens, rectal or perianal swabs are considered a sensitive method for detection of VRE (Pathology Queensland do not test nose swabs for VRE).

Management of VRE-positive Patients

The preferred placement for these patients is single room accommodation.

- Where single room accommodation is not available, provide patient treatment in an area with as few adjacent stations as possible (for example, at the end or corner of the unit).
- These patients shall be managed using Contact Precautions.
- VanA and vanB patients should be managed separately.

Extended Spectrum β-lactamase (ESBL)-producing gram-negative bacteria

- β-lactamase is an enzyme which causes the chemical breakdown of β-lactam antibiotics e.g. amoxycillin, penicillin, cephalothin. The extended spectrum means the β-lactamase is capable of breaking down β-lactam antibiotics with an extended spectrum of activity i.e. 3rd generation cephalosporins – cefotaxime, ceftazidime, ceftriaxone.22
- This type of β-lactamase was first recognised in Australia in 1988. The most common organism to produce the enzyme is K. pneumoniae. There are other ESBL-producing Enterobacteriaceae, however they are not all necessarily considered of significance from an infection control perspective - consult with an Infectious Diseases Physician for clarification.22
- ESBL-producing gram-negative bacteria are found in the lower gastrointestinal tract. Because these organisms are part of the bowel flora, the organisms will usually be shed onto the patient’s skin. Spread is therefore on the hands of attending staff who have not performed hand hygiene properly.22

Screening
(also refer Table 3)

- All patients should be tested for ESBL-producing gram-negative bacteria before admission or readmission to the dialysis service/program or the first dialysis treatment
- this should also include patients transferring from another unit/service (including those dialysed outside Australia).

• The screening frequency should be based on the prevalence of the pathogen and risk factors for colonisation
  - in general, patients should be re-tested regularly, e.g. six-monthly intervals
  - more frequent screening may be indicated if there is evidence of cross transmission in the unit (e.g. weekly, until transmission has ceased and then decreasing frequency).16

• Groin, perirectal or rectal swabs are generally considered a sensitive method for detection of ESBL-producing gram-negative bacteria.

• Colonisation with ESBL-producing gram-negative bacteria can be prolonged (months to years).

• There is no known way to eradicate colonisation with ESBL-producing gram-negative bacteria, so efforts must be focused on preventing its spread – specifically restriction of third-generation cephalosporins.

Management of ESBL-positive Patients
(refer: Management of Patients Infected or Colonised with a MRO).

Carbapenem-resistant Acinetobacter baumannii (CRAB)

• Acinetobacter are Gram negative bacteria that are free living, widespread, and found in almost all soils and surface water worldwide. They colonise the skin and mucous membranes in about 25% of normal healthy people. The most frequently isolated Acinetobacter, the one most likely to acquire multiple antibiotic resistance, and the commonest cause of hospital outbreaks is Acinetobacter baumannii.22,25

• Due to the ability of Acinetobacter to develop resistance to antibiotics and to survive for long periods on dry surfaces, strains resistant to most antibiotics have become a problem in hospitals throughout the world. Hospital outbreaks generally originate from contaminated environmental sources or follow hand transmission from the skin of colonised/infected patients.22,25

Screening
(also refer Table 3)

• All patients should be tested for CRAB before admission or readmission to the dialysis service/program or the first dialysis treatment
  - this should also include patients transferring from another unit/service (including those dialysed outside Australia).

• The screening frequency should be based on the prevalence of the pathogen and risk factors for colonisation
  - in general, patients should be re-tested regularly, e.g. six-monthly intervals
  - more frequent screening may be indicated if there is evidence of cross transmission in the unit (e.g. weekly, until transmission has ceased and then decreasing frequency).16

• Groin, perirectal or rectal swabs are generally considered a sensitive method for detection of CRAB.
• Length of carriage with CRAB is unknown, but can be prolonged (months to years).
• There is no known way to eradicate colonisation with CRAB.

Management of CRAB-positive Patients
(refer: Management of Patients Infected or Colonised with a MRO).

Clostridium difficile Infection (CDI)

• *C. difficile* is a spore-forming Gram positive bacterium that was first identified as the most common cause of antibiotic-associated diarrhoea and pseudomembranous colitis in 1977. Antimicrobials most commonly associated with increased risk of CDI include cephalosporins, clindamycin and ampicillin (the risk is higher if multiple antibiotics are administered). CDI may occur during antibiotic administration or several weeks after discontinuation of the antimicrobial.26

• *C. difficile* produces two major toxins: toxin A (enterotoxin) and toxin B (cytotoxin) which cause the disease symptoms including diarrhoea and mucosal damage. The incubation period for diarrhoea after acquisition of CDI is less than 1 week, with a median onset of two days following acquisition.26.

• Since 2004 there has been an increase in CDI cases, this has attributed to a new hypervirulent strain. The hypervirulence of this strain has been associated with its ability to produce a high concentration of toxins and its high transmissibility. Infection with this strain can cause more severe disease and excess mortality relative to other strains.

• The pathogen is a major cause of hospital-associated diarrhoea and factors that contribute to outbreaks include environmental contamination, persistence of spores for long periods of time, hand carriage by healthcare workers to other patients, and exposure of patients to frequent courses of antimicrobial agents.

Screening

• Routine screening is not recommended.

• CDI should be considered in patients with clinically significant diarrhoea or other gastrointestinal symptoms compatible with CDI particularly where there is a history of prior antibiotic use.

• Laboratory testing for *Clostridium difficile* toxins shall only be performed on diarrhoeal stool specimens (defined as a faecal specimen that conforms to the shape of its container)

• If testing is not possible within 2 hours of collection the specimen must be refrigerated.

Management of *C. difficile*-positive Patients
Refer to Management of Patients Infected or Colonised with a MRO.

• Patients should be managed in a single room or cohorted with other CDI patients based on microbiologic confirmation.

• Asymptomatic colonisation is common and treatment of these patients with metronidazole or vancomycin is not advised.26
Emerging Antibiotic Resistant Organisms

- Since 1996, isolates of *S. aureus* with reduced sensitivity to vancomycin and other glycopeptide antimicrobials have been reported. Including strains of *S. aureus* that are Intermediate or Resistant to Vancomycin:
  - the acronyms VRSA, VISA and GISA (glycopeptide-intermediate *S. aureus*; the glycopeptide class of antimicrobial agents include both vancomycin and teicoplanin) have all been used to indicate *S. aureus* strains with reduced susceptibility to vancomycin:
    - Vancomycin-intermediate *S. aureus* (VISA = MIC 4 - 8 μg/mL)
    - Vancomycin-resistant *S. aureus* (VRSA = MIC ≥16 μg/mL).
    - Patients infected with these strains may fail to clinically improve on vancomycin therapy, particularly when patients have an indwelling catheter or an unrecognised focus of infection.27

- New Delhi metallo-beta-lactamase (NDM) is a beta lactamase enzyme producing bacteria which can destroy antibiotics. It is often produced by gram negative bacteria such as *Escherichia coli*, *Klebsiella Pneumoniae* and *Enterobacter cloacae*. At this time the majority of patients with NDM have travelled to India or Pakistan.

- Multi-drug resistant Gram negative bacteria are an emerging threat worldwide. Of particular concern are a group of organisms called Carbapenem-Resistant Enterobacteriaceae or CRE:
  - Although still comparatively uncommon in Australia, resistance to carbapenems appears to be slowly rising
  - All patients with CRE should be managed in accordance with Management of Patients Infected or Colonised with a MRO.

Screening

- Pathology Queensland laboratories are responsible for detecting emerging vancomycin resistance in *S. aureus* isolates (particularly MRSA isolates).

- Dialysis staff should record on the pathology request form if the patient has recently been hospitalised overseas

Management of Positive Patients

- Refer Management of Patients Infected or Colonised with a MRO.

Holiday Dialysis

Patients Requesting Holiday Dialysis from Another Unit

- The current MRSA and VRE status of patients should be ascertained *prior* to accepting them for dialysis to ensure adequate clinical as well as infection control measures, can be implemented as required.

- The decision to screen for other MROs should be based on the prevalence of the MRO(s) in the patient's usual healthcare facility, consultation with Infection Control is recommended

- Patients who refuse to provide evidence of their MRO status should be managed in accordance with practices for patients infected or colonised with a MRO.
‘Criteria for admission’ to a holiday dialysis program should be provided to the patient in writing, prior to acceptance on the program.
- the form should include any requirements for microbiological screening
- the form should be signed by the patient to indicate they understand and accept the admission criteria.

Patients Travelling from their Unit

- Recent MRO screening results may be required by some renal units before they will accept patients for holiday dialysis.
- Re-admitted patients should be tested for MRSA and VRE, and Contact Precautions implemented while test results are pending based on the patient’s clinical presentation and high-risk characteristics, until found negative for MRSA or VRE.
- The decision to screen for other MROs should be based on whether the MRO is prevalent in the facility where the patient dialysed. Consultation with Infection Control is recommended.

Home Care Settings

- The incidence of infection in home care patients, other than those associated with infusion therapy e.g. central venous catheter-related bloodstream infections, is not well known.6
- Transmission risks during home care are presumed to be minimal. The main transmission risks to home care patients are from an infectious healthcare provider or contaminated equipment; providers also can be exposed to an infectious patient receiving home care including blood contact through percutaneous or mucosal exposures.6
- The following recommendations should be considered for home care settings:
  - utilise Standard Precautions particularly aprons and gloves for contact with non-intact skin (e.g. draining wounds, pressure ulcers), or if the patient is faecally incontinent or has diarrhoea
  - use Contact Precautions for patients known to be infected or colonised with an MRO
  - limit the amount of reusable patient-care equipment that is brought to the home of patients infected or colonised with a MRO. This includes clinical bags/boxes which may be left in the vehicle, and only the items used for patient care are carried into the home
  - if non-critical patient care equipment (e.g. stethoscopes) cannot remain in the home, clean and if necessary disinfect items before removing them from the home OR place reusable items in a plastic bag for transport to another site for subsequent cleaning and disinfection
  - transmission based precautions, other than good personal hygiene, do not need to be taken by the patient or their family/carers whilst at home.
Other Infectious Diseases

- Patients actively infected with or incubating transmissible infectious diseases are seen frequently in ambulatory settings and potentially expose HCWs and other patients, family members and visitors.6

- General strategies which can be implemented in ambulatory care settings to minimise the risk of transmission of infectious diseases include:
  - locate signs at entrance to facilities or at the reception or registration desk requesting that patients and individuals accompanying the patient promptly inform staff if there are any symptoms of a respiratory infection (e.g. cough, flu-like illness); gastroenteritis (e.g. presence of diarrhoea, nausea, vomiting); skin rash; or known exposure to an infectious disease (e.g. chickenpox, measles, pertussis)
  - place potentially infectious patients without delay in an examination room to limit exposure to individuals in the common waiting area
  - implement source containment measures to prevent transmission of respiratory infections, beginning at the point of initial patient encounter (e.g. ask coughing patients to wear a surgical mask or cover their cough with tissues)
  - in waiting areas, maintaining a distance between symptomatic and non-symptomatic patients (e.g. >1 metre), in addition to source containment measures, may limit exposure
  - encourage patients to perform hand hygiene as part of basic personal hygiene, including the use of alcohol-based hand rubs
  - application of the same infection control precautions may need to be extended to person(s) accompanying the patients, if they are symptomatic.

Table 3: Recommended Schedule for MRO Screening of Dialysis Patients

<table>
<thead>
<tr>
<th>Screening Frequency</th>
<th>Screening Site</th>
<th>Screening Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staphylococcus aureus</strong> including MRSA and NM MRSA</td>
<td>Anterior nares (nostrils)</td>
<td>Use dry swabs or moisten the swab with sterile normal saline, and insert into one nostril 1-2 cm and gently rotate swab on all surfaces of the anterior (or forward), internal part of the nasal mucosa for about 3 seconds and remove.37</td>
</tr>
<tr>
<td>Before or on admission or readmission to the dialysis service/program or the first dialysis treatment</td>
<td>The collection of specimens from other sites (e.g. groin, throat, wounds), has been shown to improve sensitivity, and should be considered in consultation with microbiology/ infectious diseases staff</td>
<td>Using the same swab, repeat the procedure in the other nostril. Be careful not to touch the external areas of the nose with the swab.</td>
</tr>
<tr>
<td>This should include patients transferring from another unit/service (including those dialysed outside Australia). Re-test regularly, e.g. six-monthly intervals</td>
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<tr>
<td><strong>Vancomycin Resistant Enterococci (VRE)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before or on admission or readmission to the dialysis service/program or the first dialysis treatment. Re-screen every three months</td>
<td>Stool specimens, rectal or perianal swabs (Pathology Queensland do not test nasal swabs for VRE)</td>
<td>To obtain a rectal swab, use dry swabs or moisten the swab with sterile normal saline, and insert into the rectum approximately 2.5cm, gently rotate against bowel wall, remove and place in transport medium. If the patient has a faecal ostomy obtain swab from the stoma. If the patient refuses a rectal swab collect a stool specimen.</td>
</tr>
</tbody>
</table>

**ESBL-producing gram-negative bacteria**

<table>
<thead>
<tr>
<th>Screening Frequency</th>
<th>Screening Site</th>
<th>Screening Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>As for MRSA</td>
<td>Groin, perirectal or rectal swab</td>
<td>To collect a groin swab, use a dry swab or moisten the swab with sterile normal saline, and roll or rub the tip over the skin in the groin area. Using the same swab, repeat the procedure on the other groin. If collecting a rectal swab, refer to VRE section. To obtain a perirectal swab, use a dry swab or moisten the swab with sterile normal saline, and swab around anus, do not insert swab.</td>
</tr>
</tbody>
</table>

**Carbapenem Resistant Acinetobacter (CRAB)**

<table>
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<th>Screening Site</th>
<th>Screening Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>As for MRSA</td>
<td>Groin, perirectal or rectal swab</td>
<td>If collecting a groin or perirectal swab, refer to ESBL-producing gram-negative bacteria section. If collecting a rectal swab, refer to VRE section.</td>
</tr>
</tbody>
</table>

**Management of Patients Colonised with Staphylococcus aureus**

The anterior nares (nostrils) are considered to be the primary colonisation or carriage site of S. aureus. Approximately 30% of the healthy population carry S. aureus in their anterior nares. The prevalence of S. aureus nasal carriage in dialysis patients is much higher than the normal population (≥50%) and appears to be related to the length of time a patient has been undergoing long-term dialysis.28,29

S. aureus infections are much more common in nasal carriers and are a major cause of morbidity and hospitalisation in dialysis patients. For example, peritoneal dialysis (PD)
patients who are *S. aureus* carriers, have a two- to six-fold higher risk of *S. aureus* peritonitis than non-carriers.\textsuperscript{29-31}

The skin, mucosal surfaces, and catheter exit sites can also be reservoirs for *S. aureus* and serve as a source for development of serious infections including bacteraemia, endocarditis, infected arteriovenous (AV) fistulas and grafts, as well as PD catheter-related peritonitis.\textsuperscript{30,31}

The type of dialysis access is a major risk factor for *S. aureus* infection. Patients with acute haemodialysis (HD) catheters are at greatest risk of *S. aureus* bacteraemia, followed by tunnelled HD catheters, and AV grafts. Patients with an AV fistula have a rate similar to that of PD patients.\textsuperscript{30}

Elimination of carriage by nasal application of topical antibiotics (e.g. mupirocin) and/or regular application to HD and PD catheter exit sites reduces the risk of *S. aureus* bacteraemia in HD patients and PD-related exit site and tunnel infections; however, increasing resistance of *S. aureus* to mupirocin has been reported.\textsuperscript{30}

**General Principles**

- These recommendations are limited to patients with proven *S. aureus* (including MRSA and nm MRSA) nasal carriage. They are not intended to be implemented in every situation.

- Each dialysis unit should examine its microbiological surveillance data (including infection rates), causative organisms (including prevalence of *S. aureus*), and antimicrobial sensitivity patterns, and adapt the recommendations as necessary for local conditions.

- Establish a multidisciplinary forum of key stakeholders (nephrology, infection control, infectious diseases and microbiology staff) to determine the *S. aureus* management program for the dialysis service.

- Develop a unit-specific process to ensure standardisation of testing and treatment programs.

- Develop generic patient information sheets/brochures to assist with educating patients regarding the need for testing and treatment of *S. aureus* carriage. This could include a treatment schedule for the patient to complete.

- Record individual patient data in relation to complications including infection(s).

- For each infection episode, an event analysis should be undertaken to determine the aetiology, and whenever possible, an intervention made to prevent another episode.

- Monitor all HD and/or PD-related infections including bacteraemias, exit-site infections, tunnel infections and peritonitis, as well as type of antibiotic administered, at a minimum, on a yearly basis.

**S. aureus Screening**

- All patients should be tested for *S. aureus* carriage (including MRSA and nm MRSA):
  - prior to placement (where possible) of HD tunnelled catheters, AV grafts, and PD catheters; and
  - before admission or readmission to the dialysis service/program or the first dialysis treatment.
• In general, patients should be re-tested regularly, e.g. six-monthly intervals (also refer Section titled Multi-Resistant Organism (MRO) Screening and Management).
  - in settings where MRSA is endemic, persons may be recolonised from external sources.27

Treatment of S. aureus Carriage

• The most commonly used antibiotic to treat S. aureus carriage is mupirocin, which is administered as an ointment or cream.
• Mupirocin therapy has been reported to reduce the risk of developing S. aureus infection by 68% among dialysis patients.19
  - in a subgroup analysis of different dialysis modalities, the reduction in risk was 80% for haemodialysis patients and 63% for peritoneal dialysis, respectively.19
• Although S. aureus is found in the body in areas other than the nose, elimination of nasal carriage can lead to loss of carriage in other sites such as skin, implying other parts are being recolonised from the nose.29
• The use of oral agents such as ciprofloxacin and rifampin to eliminate S. aureus carriage is not recommended due to the rapid development of resistance to both agents.
• The administration of systemic antimicrobials (e.g. vancomycin) is not recommended for the eradication of S. aureus colonisation, as they do not eliminate S. aureus carriage.
• The role of antiseptic washes (e.g. 2% - 4% chlorhexidine gluconate, 1% triclosan) in reducing transient skin carriage has been reported and may be useful as an adjunct for treatment of persistent S. aureus carriers.
• Any program attempting eradication of S. aureus carriage should request the microbiology laboratory to undertake susceptibility testing (including mupirocin) of S. aureus isolates because:
  - eradication is less likely when the drugs selected are inactive against the colonising strain
  - emergence of high-level mupirocin resistance has been associated with widespread and/or prolonged use in healthcare facilities.23

Mupirocin Therapy for S. aureus Carriage

• Mupirocin is a topical agent which is active mainly against Gram positive aerobes including S. aureus (and MRSA-positive strains); most Gram negative organisms are not sensitive to mupirocin.
• The optimal strategy for using topical mupirocin and minimising the emergence of resistance is unclear.
• Various bodies including the Renal Association (UK), European Renal Association-European Dialysis and Transplantation Association (ERA-EDTA), International Society of Peritoneal Dialysis (ISPD), Caring for Australians with Renal Impairment (CARI), and Infectious Diseases Society of America, have made recommendations regarding therapy for S. aureus carriage.
  - all guidelines recommend mupirocin for S. aureus nasal carriers, however there is considerable variation with treatment courses.
- since patients can become recolonised with *S. aureus* following initial treatment, periodic screening, with application of mupirocin for carriers, seems to be a reasonable strategy which would target mupirocin for use with high-risk patients and limit unnecessary use, thereby decreasing the emergence of resistance.19

- The use of mupirocin has led to the emergence of other opportunistic pathogens including *Pseudomonas aeruginosa* and fungi.

- The routine use of mupirocin in dialysis patients to prevent *S. aureus* carriage is not recommended because strains of *S. aureus* with resistance to mupirocin may develop with widespread use.

**Directions for Use**

- Mupirocin nasal ointment 2% (20mg/g) is available on the Queensland Hospitals List of Approved Medicines (LAM).

**Intranasal application**

- Mupirocin should be applied to the anterior nares two times a day as follows:
  - a small amount of the ointment, about the size of a match head, is placed on the little finger and applied to the inside of each nostril (a swab may be used for application). The nostrils are closed by pressing the side of the nose together. This will spread the ointment throughout the nares.

**Catheter Exit Site**

- A small amount of mupirocin ointment should be applied to the exit site.
- If treating both the nose and exit site, a separate swab should be used to prevent transfer of organisms between sites.

**Contraindications/Adverse Reactions**

- Contraindications include history of sensitivity reactions to any of the components. Adverse reactions to mupirocin are rare however, approximately 2% of patients may report local reactions including irritation, burning, itching, and stinging.18 Refer to MIMS Online via Clinicians Knowledge Network (CKN): https://sp.ckn.dotsec.com/.

**S. aureus Resistance to Mupirocin**

- Low and high degree resistance of *S. aureus* isolates to mupirocin has been reported and appears to be linked to long-term programs of mupirocin application (~4 years).18
- Resistance to mupirocin can be classified as low if the MIC is 8 - 256 μg/mL or high if the MIC is ≥512 μg/mL.
- It is expected that high-level resistance results in clinical failure or a high relapse rate.
- Mupirocin resistance has been identified in patients who have never been treated with mupirocin.18,33
- Mupirocin resistance emergence should be monitored by the microbiology laboratory.
- A request for ‘mupirocin sensitivity’ must be recorded in the ‘Tests Requested’ section of the pathology request form, as this is not part of the routine antibiotic sensitivity testing.

**Placement of Dialysis Access**

- A number of authors suggest elimination of *S. aureus* carriage through short-term use of decolonising agents, before placing a dialysis access (where time permits), may be beneficial in reducing infection risk.\(^{30,33,34}\)

**Recommended Practice**

**Criteria**

- **Positive *S. aureus* nasal culture (including MRSA and nm MRSA)**
- **Patients scheduled for placement of a tunnelled HD catheter, AV graft, or a PD catheter.**

**Recommended Practice**

**Criteria**

- **Positive *S. aureus* nasal culture (including MRSA and nm MRSA)**
- **Tunnelled HD catheter or AV graft**
- **Recent *S. aureus* infection including bacteraemia**
- **Home HD patient**

1. Nasal carriage of *S. aureus* should be treated with mupirocin nasal ointment twice daily (BD) for 14 consecutive days and then 3 times per week for 3 months.
   - patients should then be re-tested for *S. aureus* at regular (e.g. six-monthly) intervals
   - persistently positive patients should be re-treated.
- A request for ‘mupirocin sensitivity’ must be recorded in the ‘Tests Requested’ section of the pathology request form, for these patients.
2. The routine application of antimicrobial ointment on the catheter exit site is recommended to reduce local and systemic infection rates.\textsuperscript{36}

- options include:
  - povidone-iodine 10% ointment
  - bacterial honey
  - antiseptic (chlorhexidine)-impregnated dressings/sponges
  - mupirocin ointment (Mupirocin should only be used for patients colonised with \textit{S. aureus}).

- the antimicrobial ointment/cream should be compatible with the catheter material (refer manufacturer’s instructions). For example, ointments containing polyethylene glycol (PEG) should not be placed on long-term polyurethane dialysis catheters

- the ointment may cause the polyurethane material to become opaque, swell and crack. PEG is a common constituent of most antimicrobial ointments. The decision to use no antimicrobial ointment or cream should be based on local factors including infection rates

3. The use of antiseptic washes (e.g. 2% - 4% chlorhexidine gluconate, 1% triclosan) to reduce transient skin carriage could be considered for patients who are persistently colonised with \textit{S. aureus}.

- The catheter dressing (including polyurethane types) should not be immersed or submerged in water.

\textbf{Peritoneal Dialysis (PD)}

- The PD catheter exit site is reported to be the most important colonising site of \textit{S. aureus} strains that cause peritonitis.\textsuperscript{29}

- A systematic review in 2003, suggested topical mupirocin may reduce the risk of exit-site infection however, the clinical effectiveness of any one antibiotic, antiseptic or dressing procedure was not established for the prevention or reduction of exit-site infection rates or peritonitis.\textsuperscript{38}

- A number of studies have reported the application of mupirocin ointment intranasally and to the catheter exit site prophylactically, reduces \textit{S. aureus} exit site infection and peritonitis compared with historical controls.\textsuperscript{39} However, a recent systematic review of the effectiveness of preventing and treating \textit{S. aureus} carriage in reducing PD catheter-related infections, suggested interventions reduce exit-site infections, but not peritonitis, although this may be due to trials being too small numbers for too short periods (2007).\textsuperscript{29}

\textbf{Recommended Practice}

- The following recommended practice should be considered in the context of clinical experience of the individual dialysis service, infection rates and patient preferences.

\textbf{Criteria}

\textit{Positive \textit{S. aureus} nasal culture (including MRSA and nm MRSA)}

\textbf{PLUS}

\textit{Peritoneal dialysis catheter}
1. Nasal carriage of *S. aureus* should be treated with mupirocin nasal ointment twice daily (BD) for 5 consecutive days every 4 weeks (e.g. first 5 days of the month) for 3 months.\(^{39,40}\)

- patients should then be re-tested for *S. aureus* at regular (e.g. six-monthly) intervals
- persistently positive patients should be re-treated.
  - a request for ‘mupirocin sensitivity’ must be recorded in the ‘Tests Requested’ section of the pathology request form, for these patients.

2. Exit site therapy should be considered using the following recommended process:

- apply topical mupirocin ointment daily (or alternative days) to the skin around the exit site after cleansing
  - mupirocin ointment (which contains PEG), should be avoided in patients with polyurethane catheters, as structural damage to the catheter has been reported
  - mupirocin cream is recommended for use with polyurethane catheters, but is not available on the List of Approved Medications (LAM).\(^{33}\)
- whilst gentamicin cream applied daily to the exit site has been shown to be as effective as exit-site mupirocin in reducing *S. aureus* exit-site infections, and highly effective in reducing *P. aeruginosa* exit-site infections, further clinical trials using appropriate numbers of patients and with sufficient follow-up, are required to assess different treatment strategies.\(^{33}\)
  - gentamicin cream is not available on the LAM.

3. A number of methods for cleaning exit-sites have been reported, including soap and water, povidone-iodine, chlorhexidine, hydrogen peroxide, alcohol, and combinations of topical antiseptic agents. However, evidence of the benefit of one solution over another is not available.

Additionally, the best method for dressing of exit-sites remains unclear including the type of dressing (occlusive dressings, gauze, semi-permeable dressings, or no dressing); frequency of dressings, and the technique (aseptic vs. clean).\(^{38}\)

The following recommendations could be considered but are not based on strong evidence:

- following catheter placement, the initial dressing should not be changed for several days unless there is obvious and excessive bleeding\(^{41}\)
- a sterile technique (including sterile dressing) should be used in the immediate post-operative period (~14 days)\(^{33,38,41}\)
- after 14 days, the exit-site can be cleaned daily with an antiseptic soap solution in the shower\(^{33,38,41}\)
  - the application of a cover dressing is optional once the exit-site is well healed.
- immobilisation of the catheter at all times is critical in preventing trauma by mechanical action during handling and normal body movements.
  - generally, catheters are anchored to the skin, 2.5cm to 5cm from the exit-site with either tape, a dressing, or immobiliser.\(^{41}\)
General Strategies

- All patients must be taught aseptic technique with emphasis on proper hand hygiene, to reduce the risk of contamination. This should include:
  - rigorous exit site and catheter care including daily inspection of the exit site
  - clean no-touch technique for dialysis exchanges.

Home Setting

- The patient's and/or carer's hands must be washed and dried (with a clean towel) completely before initiating the exchange.
- The location for exchanges must be clean, with avoidance of animal hair, dust-laden air, and fans.
- Personal hygiene products including towels, soap and dressing materials, should not be shared between patients and household contacts/family members.
- Tub baths are not recommended for patients with PD catheters.
- Refilling liquid soap/transferring liquid soap between containers should be avoided.
  - bar soap should not be used.
- All PD patients must be taught what contamination is and the proper response to contamination (e.g. presentation to dialysis unit for review if the tubing is contaminated).

Preventing Haemodialysis Catheter-related Bloodstream Infections

The purpose of this section is to outline recommended practices to prevent healthcare associated, haemodialysis catheter-related bloodstream infections. Whilst it was not in the scope of this project to address issues related to AV access, clarification was sought from Advisory Group members in relation to the use of clean versus sterile gloves for access cannulation.

Haemodialysis Catheters


Arteriovenous Fistulas and Grafts

Preparing the Access for Cannulation - Clean versus Sterile Gloves

Preparation of the needle site is probably the most important aspect of cannulation. The CDC states that, in patients on dialysis, infection is the second leading cause of death (15%) with vascular access infection being the number one cause.43

Recommendation43,44

1. hand hygiene should be performed prior to preparing the access for cannulation
2. wash (or ask the patient to wash) the access site with antimicrobial or plain soap and water
3. apply gloves (refer Step 6)
4. cleanse the skin by applying:
- commercially prepared 2% chlorhexidine gluconate in 70% ethyl or isopropyl alcohol swabs;
- alcoholic chlorhexidine (2% chlorhexidine gluconate in 70% ethyl or isopropyl alcohol) decanted into a sterile dressing tray
- if contraindicated 70% alcohol solution (including alcohol impregnated wipes) can be used.

5. cleanse in a circular, rubbing motion from the centre outwards, for 1 minute immediately prior to cannulation. Do not use a backward and forward movement, allow to dry

6. option 1:
   - wear clean gloves for cannulation and repeat prep if the skin is touched by the patient or staff once the skin prep has been applied, but the cannulation not completed;
   OR
   option 2:
   - wear sterile gloves for cannulation if the skin needs to be re-palpated and/or for difficult cannulations.

7. Gloves should be changed if contaminated.

**Environmental Issues and Cleaning Including Disinfection of Haemodialysis Machines**

**General**

**Environmental Issues and Cleaning**

- Most often, environmental reservoirs of pathogens during outbreaks are related to a failure to follow recommended procedures for cleaning and disinfection rather than the specific cleaning and disinfectant agents used.

- Cleaning (and disinfecting) non-critical surfaces in patient-care areas are part of Infection Control Precautions for Dialysis Services (refer Section titled Infection Control Precautions for Dialysis Services). The cleaning (and where necessary disinfection) of all patient-care areas is important for frequently touched surfaces, especially those closest to the patient, that are most likely to be contaminated (e.g. equipment in close proximity to the patient).

**Water and Dialysis Fluids**

- Every week, haemodialysis patients are exposed to ~400 L of water used for the production of dialysis fluids. Therefore, chemical and microbial contaminants must be removed from the water to minimise the risk of chemical and pyrogen reactions.

- This is generally achieved through systems that involve the pre-treatment of municipal water (or other sources e.g. surface-fed water), a final purification process (reverse osmosis {RO}), and a hydraulic circuit for the distribution of purified water.45
Bacteria and Endotoxins

- The microbial contaminants most frequently found in dialysis water are bacteria and their degradation products, such as endotoxins. The presence of bacteria, which may release endotoxins, demands vigilance in a dialysis centre water purification system and dialysate delivery systems.

- Bacteria are not expected to cross the dialysis membrane because of their size, but even moderate levels of endotoxin, have been found to do so, stimulating the production of cytokines. Pyrogenic reactions associated with endotoxin penetration across intact membranes may occur. Repetitive induction of cytokines may also contribute to some of the long-term, non-infectious complications amongst dialysis patients.45-42

Biofilms

- Gram negative water bacteria are commonly found in water supplies used for haemodialysis. Under certain circumstances these microorganisms can persist and multiply in aqueous environments associated with haemodialysis equipment. These bacteria can adhere to surfaces and form biofilms (glycocalyces), which are difficult to eradicate.46

- Once a biofilm is formed, the penetration barrier provided by the polymeric matrix, along with increased microbial resistance, reduces the efficacy of disinfectants. Moreover, the biofilm is difficult to remove because of the presence of exopolysaccharides, which help anchor the bacteria to the surface.

- In haemodialysis systems, there is the added difficulty, resulting from calcium and magnesium carbonate crystals which promote bacterial adherence.37

- Regular disinfection of the entire fluid path is necessary to prevent the formation of biofilm. Control strategies are designed not to eradicate bacteria and biofilm, but to reduce their concentration to relatively low levels and to prevent their regrowth.46,42,32

Water Quality

The following recommendations outline basic principles related to water management; for more detailed information, dialysis staff should refer to the resources developed by the Queensland Health Southern Area Health Service Water Standardisation for Haemodialysis Units Project.

Queensland Health Southern Area Health Service Water Standardisation for Haemodialysis Units Project

- A number of resources including workplace instructions, water sampling hand book and competencies, have been developed as part of the Queensland Health Southern Area Health Service Water Standardisation for Haemodialysis Units Project.15

- The documents have been developed for use by haemodialysis staff to assist them in haemodialysis water treatment validation, water sampling, and water result analysis.

Water Treatment Systems

- The water produced by RO has an optimal chemical and microbial quality however, a problem can be maintaining this level of quality. This is less difficult in the case of
chemical contamination (chemical contaminants do not develop after they have been removed) than in the case of microbial contamination.

- The only way to keep bacterial growth under control is to undertake preventative disinfection so often that it prevents microorganisms growing. Consequently RO membranes must undergo periodic disinfection and cleaning in order to avoid the risk of contamination on their clean side. Furthermore, disinfection must involve all pipes in the distribution system, including the inlet lines to the dialysis machines (the most common source of contamination in a fluid system is growth in the distribution pipes).

- Additionally, in order to guarantee the quality of the feeding water and dialysate, a final filtration system made of microfilters remove bacteria and endotoxins by sieving and absorption processes.

### Water Samples for Microbiological and Endotoxin Analysis

- Because water constitutes 95% of dialysis fluid, the quality of water used for dialysis has the main impact on final fluid quality.

- Endotoxin levels should always be measured in addition to bacterial counts because they give a different and complimentary picture of the microbiological quality of dialysis fluids.

- The most widely accepted standards for water purity are those recommended by the Association for the Advancement of Medical Instrumentation (AAMI) and European Pharmacopea, which respectively allow bacterial growth of <200 and <100 colony forming units (CFU)/mL, and an endotoxin concentration of <2 and <0.25 IU/mL.

- Microbiological testing should occur at least once per month, testing both RO water and dialysate for in-centre units. Specimens should be assayed within 30 minutes or refrigerated at 4°C and assayed within 24 hours of collection. For further information on sampling, refer to the Statewide Renal Network-Haemodialysis Water Standardisation Project Workplace Instructions.

### Haemodialysis Machines

- Manufacturers producing dialysis machines each recommend a different procedure for decontamination. However, the efficacy of a decontamination procedure used in haemodialysis machines, must be determined by both the level of biofilm and endotoxin removal, not just by the efficacy of bacterial kill as endotoxins are not necessarily destroyed by conditions that kill bacteria.

- Dialysis units must follow the manufacturer’s recommendations in relation to management of haemodialysis machines.

- Most currently used disinfectants for dialysis machines have a good bactericidal efficacy on biofilm but leave dead cells on the surface. This contributes to the regrowth of biofilm and the release of pyrogens.

- The development of bacterial biofilms in the hydraulic circuit of haemodialysis machines is routinely prevented by frequent use of a variety of chemical and heat disinfection strategies.

- The majority of Queensland Health units are using:
- internal heat disinfection between patients (80°C to 90°C depending on the type of machine)
- internal citric acid and heat disinfection daily
- monthly bleaching (5% chlorine solution).

A study comparing the effectiveness of several chemical disinfectants, commonly used alone or in combination with a treatment regimen that involved cleaning plus heat disinfection using an in vitro Pseudomonas biofilm model, identified:
- the chemical disinfection procedures were only partially successful in removing all biofilm components
- heat disinfection alone killed viable biofilm bacteria, but did not remove all the biomass components, including endotoxin
- the combination of cleaning with citric acid followed by heat disinfection was the most effective in eliminating all biofilm components from the hydraulic circuit of the in vitro model
- high levels of chlorine can result in total removal of biofilm; however such a level cannot be used regularly because of possible damage to the machine. Therefore chlorine treatment should be reserved for occasional use
- citric acid and chlorine (sodium hypochlorite), when used according to the manufacturer’s instructions at recommended concentrations, are bactericidal, fungicidal and virucidal (including HBV, HCV and HIV).

Dialysates

- Haemodialysis dialysates are regulated by the Therapeutic Goods Administration (TGA) as medical devices. Concentrated haemodialysis solutions are not provided as sterile products. They are prepared and stored using materials and methods designed to produce solutions having as low a degree of microbial contamination as possible. Because of the large volumes used, haemodialysis solutions are usually prepared by diluting a concentrated solution with water.
- The European Pharmacopoeia/British Pharmacopoeia (Ph Eur/BP) requires that the water used for the dilution of haemodialysis solutions contains <100 CFU/mL. Peritoneal dialysis solutions should be sterile.

Liquid Bicarbonate Dialysate

- Fluids containing bicarbonate, in concentrated as well as diluted form, are excellent growth media for bacteria. Liquid bicarbonate dialysate concentrate can support rapid bacterial proliferation (i.e. 2 - 4 logs growth within 72 hours after opening).
- The only microbiologically safe way to store bicarbonate is a dry powder (i.e. dry concentrate systems that prepare bicarbonate concentrate on-line). Liquid bicarbonate dialysate concentrate should not be used more than 24 hours after opening.

Haemodialysis Dialysate Bottles

- Varying procedures are used throughout Queensland to manage dialysate bottles including:
  - allocating unused portions to subsequent patients and discarding after 24 hours; with the exception of haemodiafiltration (HDF), where only new bottles are used.
- as above but discarding the liquid bicarbonate dialysate concentrate bottle if less than half-full but reusing if greater than half-full
- utilising universal bottles to top bottles on the machine if the patient only has a short period of dialysis remaining e.g. 15-20 minutes
- cutting short the dialysis period if the bottles run out
- no reuse.

- There are no published guidelines in relation to management of haemodialysis dialysate bottles. No information is provided by manufacturers on bottle labelling other than storage temperature.

- Units should consider appropriate storage of dialysate fluid.

- In December 2007, a review of haemodialysis dialysate bottle management was undertaken by CHRISP and a Queensland Pathology Medical Microbiologist:
  - dialysate bottles are accessed via suction wands attached to the haemodialysis machine – red: acid/acetate, blue: bicarbonate. The wands are stored in separate rinse ports on the machine until they are required. The wands are decontaminated as part of the routine cleaning and disinfection of the machine after use
  - suction wands do not fit snugly into the dialysate bottles and are usually inserted wholly into the bottle in use. The wands are not touched during use so the risk of them becoming contaminated with skin and/or environmental flora is low. This means that contamination of the dialysis fluid with these organisms is also minimal and that provided the fluid is used within 24 hours there will be a low risk of bacterial colonisation
  - ‘topping up’ of bottles requires that the wand be removed from the empty container and the ‘top up’ fluid introduced and the wand replaced. There are multiple opportunities for contamination to occur during this event, so ‘topping up’ is not recommended
  - reuse within 24 hours, of a partially used bottle which has been labelled and stored at the recommended ambient temperatures, should provide a minimal bacterial contamination risk
  - the ideal situation would be to open a new bottle of dialysate each time one is required
  - from a microbiological perspective the risk of bacterial contamination of the opened bottles is low. Also, the dialysate is not provided as a sterile fluid so any risk to the patient of using a bottle of fluid which has already been opened and handled appropriately remains very low provided the procedure listed below is followed.

**Recommended Procedure:**

- Bottles containing unused portions of dialysate should be immediately capped after use and the exterior of the bottle wiped over with detergent and water as part of the overall procedure of cleaning the haemodialysis machine
  - bottle caps should be stored to avoid contamination after removal and before reuse, a clean, dry plastic container e.g. urine specimen container labelled with the lid source, would be suitable.
• If the bottle and/or cap becomes contaminated e.g. blood splash, they should be discarded.

• The following should be followed:
  - the date and time of opening should be recorded on the bottle using an indelible pen
  - opened bottles containing unused fluid should be discarded after 24 hours
  - used bottles should be stored in a central location away from contaminated items (including waste and dust) and hand wash basins, and off the floor e.g. on a dedicated trolley
  - bottles containing unused portions of dialysate must not be used for HDF
  - unfinished bottles used for patients infected with a BBV or colonised/infected with a MRO must be discarded immediately after the dialysis session is completed.

**Dialysis Unit Design**

• The design of a dialysis unit should take into account the need to ensure a high level of infection control in all aspects of practice.
  - class S isolation rooms should be provided at the rate of one isolation room to every five (5) treatment bays (in hospital-based and satellite units) giving a cluster of six (6) treatment spaces
    - a Class S isolation room is a single room with a shower/toilet en suite that is not shared. 9
  - there is no special requirement for the air-conditioning system but a hand wash basin and a self-closing door is recommended
  - a PPE Bay should be provided immediately outside the room to hold gloves, goggles, face shields, masks, gowns and a waterless alcohol-based hand rub dispenser.

• A PPE Bay can be shared between two isolation rooms. 9

• The design should support high levels of handwashing by staff and other persons by the convenient and adequate placement of suitable hand wash basins at a rate of one per three (3) treatment bays as well as in all separate treatment areas, utility areas, toilets and showers. 9

• Alcohol based hand-rub dispensers should be at the entrance of each treatment room and within each treatment bay for easy access by staff. 9

• Treatment bays:
  - bay size needs to be 9 square metres with a clear width of 3 metres along the back of the bay to ensure appropriate service placement, machine accommodation and curtain track placement
  - spaces of 12m² will need to be considered where more than 50% of patients are receiving dialysis in the unit inpatient beds rather than chairs or trolleys. 9
### Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>AIDS</td>
<td>Acquired Immunodeficiency Syndrome</td>
</tr>
<tr>
<td>ALT</td>
<td>Alanine aminotransferase</td>
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<tr>
<td>anti-HBc</td>
<td>Antibody to hepatitis B core antigen</td>
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<tr>
<td>anti-HBe</td>
<td>Antibody to hepatitis B e antigen</td>
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<tr>
<td>anti-HBs</td>
<td>Antibody to hepatitis B surface antigen</td>
</tr>
<tr>
<td>anti-HCV</td>
<td>Antibody to hepatitis C virus</td>
</tr>
<tr>
<td>AUSLAB</td>
<td>AUSLAB is a reporting and laboratory management software system developed by PJA Computer Consultants. The system integrates all 32 Queensland Health hospital based Pathology Laboratories and the Scientific Services (Public Health) laboratories at Coopers Plains into a single system. Staff at more than 200 health care facilities on the Queensland Health wide area network are able to access results in the AUSLAB system.</td>
</tr>
<tr>
<td>AV</td>
<td>Arteriovenous (fistula or graft)</td>
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<tr>
<td>BBV</td>
<td>Blood borne virus</td>
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<tr>
<td>BD</td>
<td>Twice daily</td>
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<tr>
<td>BSI</td>
<td>Bloodstream infection (or bacteraemia)</td>
</tr>
<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention (United States)</td>
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<tr>
<td>C</td>
<td>Celsius</td>
</tr>
<tr>
<td>CHRIISP</td>
<td>Centre for Healthcare Related Infection Prevention and Surveillance</td>
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<tr>
<td>CKN</td>
<td>Clinicians Knowledge Network - a website that provides Queensland Health clinicians with access to clinical information resources at the point of care.</td>
</tr>
<tr>
<td>Cohorting</td>
<td>In the context of this document, this term applies to the practice of grouping patients infected or colonised with the same infectious agent together to confine their care to one area and prevent contact with susceptible patients.</td>
</tr>
<tr>
<td>Colonisation</td>
<td>Proliferation of microorganisms on or within body sites without detectable host immune response, cellular damage, or clinical expression. The presence of a microorganism within a host may occur with varying duration, but may become a source of potential transmission. In many instances, colonisation and carriage are synonymous. Colonisation means that microorganisms have become resident in or in the body (e.g. the nares or stool); a culture from the site is positive, but no symptoms of infection exist.</td>
</tr>
<tr>
<td>Contact transmission</td>
<td>Direct contact transmission involves skin-to-skin contact and physical transfer of microorganisms to a susceptible host from an infected or colonised person, such as when HCWs perform patient care activities that require physical contact. Direct contact transmission also can occur between two patients (e.g. by hand contact), with one serving as the source of infectious microorganisms and the other as the susceptible host. Indirect contact transmission involves contact of a susceptible host with a contaminated intermediate object, usually inanimate, in the patient’s environment.</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>CRAB</td>
<td>Carbapenem resistant Acinetobacter (most frequently <em>Acinetobacter baumannii</em>)</td>
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<tr>
<td>CVC</td>
<td>Central venous catheter</td>
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<tr>
<td>DWP</td>
<td>Discipline Working Party of Pathology Queensland</td>
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<tr>
<td>ELFT</td>
<td>Electrolytes and liver function test</td>
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<tr>
<td>ESBL</td>
<td>Extended spectrum beta-lactamase (producing organism)</td>
</tr>
<tr>
<td>GISA</td>
<td>Glycopeptide-intermediate <em>Staphylococcus aureus</em> (the glycopeptide class of antimicrobial agents include both vancomycin and teicoplanin)</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>Healthcare associated infection (HAI)</td>
<td>An infection that develops in a patient who is cared for in any setting where healthcare is delivered and is related to receiving healthcare (i.e. was not incubating or present at the time healthcare was provided).</td>
</tr>
<tr>
<td>Healthcare worker (HCW)</td>
<td>Persons (including students) involved in the delivery of health services in health care facilities, particularly where those persons have regular contact with patients or any contact with the blood or body substances. For the purpose of this document, a health care worker also includes those Queensland Health employees who through the course of their duties may be exposed to vaccine preventable diseases e.g. chickenpox. Examples of these employees include administration staff, gardeners etc.</td>
</tr>
<tr>
<td>HBcAg</td>
<td>Hepatitis B core antigen</td>
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<tr>
<td>HBeAg</td>
<td>Hepatitis B e antigen</td>
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<tr>
<td>HBsAb</td>
<td>Hepatitis B surface antibody</td>
</tr>
<tr>
<td>HBsAg</td>
<td>Hepatitis B surface antigen</td>
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<tr>
<td>HBIG</td>
<td>Hepatitis B Immunoglobulin</td>
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<tr>
<td>HBV</td>
<td>Hepatitis B virus</td>
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<tr>
<td>HBV DNA</td>
<td>Hepatitis B virus deoxyribonucleic acid</td>
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<tr>
<td>HCV</td>
<td>Hepatitis C virus</td>
</tr>
<tr>
<td>HCV RNA</td>
<td>Hepatitis C ribonucleic acid</td>
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<tr>
<td>HD</td>
<td>Haemodialysis</td>
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<tr>
<td>HDF</td>
<td>Haemodiafiltration</td>
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<tr>
<td>HDV</td>
<td>Hepatitis D virus</td>
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<tr>
<td>HIV</td>
<td>Human immunodeficiency virus</td>
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<tr>
<td>HMP</td>
<td>Health Management Protocol</td>
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<tr>
<td>ICEAG</td>
<td>Queensland Health Infection Control Expert Advisory Group</td>
</tr>
<tr>
<td>IgG</td>
<td>Immunoglobulin G</td>
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<tr>
<td>IM</td>
<td>Intramuscular</td>
</tr>
<tr>
<td>Infection</td>
<td>The transmission of microorganisms into a host after evading or overcoming defence mechanisms, resulting in the organism’s proliferation and invasion within host tissue(s). Host responses to infection may include clinical symptoms or maybe subclinical, with manifestations of disease mediated by direct organisms pathogenesis and/or a function of cell-mediated or antibody responses that result in the destruction of host tissues.</td>
</tr>
<tr>
<td>Informed consent</td>
<td>• Does not have to be in writing</td>
</tr>
</tbody>
</table>
• Person must be legally and clinically competent to give consent, the consent must be freely given (no undue persuasion), the consent must be explicit (that is, specific to HIV, HCV or HBV testing), and the person must be informed of any implications (legal, medical, social) of test results.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>IRM</td>
<td>Queensland Health Integrated Resource Manual</td>
</tr>
<tr>
<td>Isolated HbcAb</td>
<td>Positive HbcAb with undetectable HBsAg and HBsAb</td>
</tr>
<tr>
<td>IVD</td>
<td>Intravascular device</td>
</tr>
<tr>
<td>L</td>
<td>Litre</td>
</tr>
<tr>
<td>Log</td>
<td>The period of growth, or logarithmic increase phase, of bacterial growth</td>
</tr>
<tr>
<td>MIC</td>
<td>Minimum inhibitory concentration</td>
</tr>
<tr>
<td>MIMS</td>
<td>Australia’s most comprehensive and authoritative medicine database</td>
</tr>
<tr>
<td>mL</td>
<td>millilitre</td>
</tr>
<tr>
<td>MRAB</td>
<td>Carbapenem sensitive but multi-resistant Acinetobacter (also refer CRAB)</td>
</tr>
<tr>
<td>MRO</td>
<td>Multi-resistant organism</td>
</tr>
<tr>
<td>MRSA</td>
<td>Methicillin resistant <em>Staphylococcus aureus</em></td>
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<tr>
<td>nmMRSA</td>
<td>Non-multiresistant methicillin resistant <em>Staphylococcus aureus</em> (previously known as community-acquired MRSA)</td>
</tr>
<tr>
<td>PD</td>
<td>Peritoneal dialysis</td>
</tr>
<tr>
<td>PEG</td>
<td>Polyethylene glycol - a component of some ointments which may cause polyurethane material to become opaque, crack and swell.</td>
</tr>
<tr>
<td>PEP</td>
<td>Post exposure prophylaxis</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal protective equipment (gloves, gown/plastic apron, mask, eye protection)</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts per million</td>
</tr>
<tr>
<td>QHPS</td>
<td>Queensland Health Pathology Service - now known as Pathology Queensland</td>
</tr>
<tr>
<td>QNC</td>
<td>Queensland Nursing Council</td>
</tr>
<tr>
<td>RO</td>
<td>Reverse osmosis - a water purification process</td>
</tr>
<tr>
<td>SDL</td>
<td>Standard Drug List for Queensland Public Hospitals</td>
</tr>
<tr>
<td>Source control</td>
<td>The process of containing an infectious agent either at the portal of exit from the body or within a confined space. The term is applied most frequently to containment of infectious agents transmitted by the respiratory route but could also apply to other routes of transmission.</td>
</tr>
</tbody>
</table>

**Standard Precautions**

Standard Precautions are work practice required to achieve a basic level of infection control. Standard Precautions are based on the principle that blood, body fluids, secretions, excretions (except sweat), non-intact skin, and mucous membranes may contain transmissible pathogens.

Standard Precautions are recommended for the care and treatment of all patients, regardless of their perceived or confirmed infectious status, and in the handling of:

• blood (including dried blood);
• all other body fluids, secretions and excretions (excluding sweat), regardless of whether they contain visible blood;
• non-intact skin; and
• mucous membranes.

The use of Standard Precautions is the primary strategy for the successful minimisation of transmission of health care associated infection and are designed to protect both patients and healthcare workers.

Standard Precautions comprise the following elements:
• hand hygiene
• use of appropriate personal protective equipment (gloves, gown/plastic apron, mask, eye protection) if exposure to blood or body fluids is anticipated
• use of aseptic technique to reduce patient exposure to microorganisms
• management of sharps, blood spills, linen, and waste to maintain a safe environment.

<table>
<thead>
<tr>
<th>TGA</th>
<th>Therapeutic Goods Administration</th>
</tr>
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<tbody>
<tr>
<td>µg</td>
<td>Microgram</td>
</tr>
<tr>
<td>Virion</td>
<td>A virion is a complete, fully developed viral particle composed of nucleic acid and surrounded by a protein coat. This coat protects it from the environment and serves as a vehicle of transmission from one host cell to another. Viruses are classified by differences in the structure of these coats.</td>
</tr>
<tr>
<td>VISA</td>
<td>Vancomycin-intermediate \textit{Staphylococcus aureus} (VISA = MIC $4 - 8 \ \mu g/mL$)</td>
</tr>
<tr>
<td>VRE</td>
<td>Vancomycin resistant enterococci</td>
</tr>
<tr>
<td>VRSA</td>
<td>Vancomycin resistant \textit{Staphylococcus aureus} (VRSA = MIC $\geq 16 \ \mu g/mL$)</td>
</tr>
<tr>
<td>VZV</td>
<td>Varicella zoster virus</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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References


**Bibliography**


Guideline for the Prevention and Control of Infections in Dialysis Settings
Version 3 – May 2013


Revision History

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<th>Date of Issue</th>
<th>Date of Next Revision</th>
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<td>2.2</td>
<td>04/10/2012</td>
<td>Rescinded</td>
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<td>3</td>
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Approving Officer

Dr Jeannette Young
Chief Health Officer

Approval Date

13 May 2013