



HCAI



ROYAL COLLEGE OF
PHYSICIANS OF IRELAND



Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Quality and Patient Safety Division

Prevention of Intravascular Catheter-related Infection in Ireland

Partial update of 2009 National Guidelinesⁱ

Summary of Recommendations

September 2014

This summary document reflects a partial update to the 2009 National Guidelines that were produced by the SARI Prevention of Intravascular Catheter-related Infection Sub-Committee, in December 2009.ⁱ

The full document including the rationale for the updated recommendations is available at <http://www.hpsc.ie>

Disclaimer

The clinical advisory group's expectation is that healthcare staff will use clinical judgment, medical nursing and clinical knowledge in applying the general principles and recommendations contained in this document. Recommendations may not be appropriate in all circumstances and the decision to adopt specific recommendations should be made by the practitioner taking into account the individual circumstances presented by each patient and available resources. Therapeutic options for the treatment of intravascular catheter-related infection should be discussed with a clinical microbiologist or infectious disease physician on a case-by-case basis as necessary.

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1. Updated National Guidelines for the Prevention of Intravascular Catheter-related Infection in Ireland

1.1 Rationale

The use of vascular catheters plays an essential role in patient care. However, vascular catheter-related bloodstream infections (CRBSIs) are a leading cause of health-care-associated bloodstream infections and are associated with substantial morbidity and mortality. A focus on infection prevention is therefore essential to ensure appropriate practice during the insertion and subsequent optimal care of these devices.

In December 2009, the Strategy for the Control of Antimicrobial Resistance in Ireland (SARI) Prevention of Intravascular Catheter-related Infection Sub-Committee published National Guidelines for the Prevention of Intravascular Catheter-related Infection in Ireland.ⁱ These guidelines, incorporated a number of supporting tools such as patient information leaflets, checklists and care bundles.ⁱⁱ

In January 2014, the Clinical Advisory Group of the National Clinical Programme for the Prevention of Healthcare-Associated Infection (HCAI) and Antimicrobial Resistance (AMR) identified that certain recommendations of the 2009 guidelines required updating as did the corresponding national care bundles – specifically the peripheral line care bundle. To ensure the rapid assessment and implementation of emerging evidence in this important area, a partial review of the 2009 Irish guidelines was undertaken. Membership of the clinical advisory group is outlined in Appendix 1.

1.2 Methodology

This review was lead by Dr. Joanne O Gorman, Consultant Microbiologist in conjunction with the members of the multidisciplinary clinical advisory group. The updated summary document and full guideline document was drafted after the consultation process (Section 1.3) by Dr. O’Gorman, Dr. Fidelma Fitzpatrick, National Clinical Lead and Ms. Sheila Donlon, Infection Control Nurse Manager, Health Protection Surveillance Centre. The updated care bundles were drafted by Dr. Fidelma Fitzpatrick and Ms. Sheila Donlon.

As other international groups had recently reviewed the evidence base, the clinical advisory group agreed not to repeat this process, rather review the 2009 National Guidelines in relation to these recent publications. The review focused on the prevention of IV catheter infection and incorporated aspects of the following publications that are acknowledged as the most authoritative reference guidelines currently available;

- epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS hospitals in England. 2014.ⁱⁱⁱ
- Infection prevention and control of healthcare-associated infections in primary and community care (NICE Clinical Guideline) 2012.^{iv}
- Guidelines for Prevention of Intravascular Catheter-Related Infection (CDC/HICPAC) 2011.^v
- IBTS - National Blood Users Group. Guidelines for the Administration of Blood and Blood Components. 2004.^{vi}

1.3 Consultation Process

The updated recommendations were widely circulated for consultation. (Appendix 2) Feedback from the consultation exercise was discussed by the clinical advisory group and the updated guidelines approved in September 2014.

This summary version includes the 2014 updated recommendations. The updated care bundles and the updated full version guideline provides more detail, including references, bibliography and appendices and is available at www.hpsc.ie

1.4 Limitations

A review of published literature beyond that cited in the aforementioned documents was not undertaken and as with the 2009 guidelines, evidence grading was not applied.

The update does not include a review of the 2009 guidelines in relation to the following sections;

- Management of intravascular catheter related infection (Section B3 and 3.3)
- Diagnosis of infection (Section D and 5.0)
- Implementation of the guidelines (Section F).

A partial review of section B2 was performed. Since publication of the 2009 guidelines, European case definitions for catheter-related infection were agreed by the European Centre for Disease Prevention and Control (ECDC).^{vii} The clinical advisory group recommend that these definitions are used for surveillance of catheter-related infection. A partial review of section E: prevention of CRBSI in specific settings (Emergency Department and Haemodialysis) was performed to ensure content was updated where applicable however no new settings were included.

1.5 Aim of this Guideline

The purpose of the guideline is to enhance the safety and quality of patient care by reducing healthcare-associated infection, specifically those caused by intravascular catheter-related infection, through a series of recommendations that reflect best international practice. Comprehensive implementation of this guideline in all Irish healthcare settings as part of an integrated infection prevention and control and patient safety strategy will ensure that patients with intravascular catheter-related infection are detected in a timely fashion and managed optimally and that patients with intravascular catheters receive high quality care to minimise infection.

The *National Standards for Safer Better Healthcare HIQA 2012* provide a strategic approach to improving safety, quality and reliability in our health services.^{viii} The following are the elements of a programme to ensure that patient care is reliable, designed to keep patients/residents safe and of high quality in line with the National Standards.

Patient-centered care

- Prevention and control of intravascular catheter-related infection is a key priority for all healthcare providers
- Patient information on intravascular catheters and infection prevention

- Governance and reporting systems to provide assurance
- Implementation of *National Standards in Infection Prevention and Control (IPC) HIQA 2009*.

Effective care

Systems and controls in place to:

- Monitor intravascular catheter-related infection
- Monitor compliance with National IPC standards and other national standards relevant to this area
- Analyse and learn from intravascular catheter-related infection incidents when they occur – dissemination of learning and institution of controls to prevent recurrence.

Safe care

- Implementation of national guidelines including intravascular catheter-related infection, antimicrobial stewardship and hand hygiene guidelines
- Audit and assessment of guideline compliance.

Better health and well being

- Healthcare provider education regarding the prevention of HCAI and AMR including patient/resident education regarding the prevention of intravascular catheter-related infection.

1.6 Implementation

It is essential that *all* healthcare staff understand and appreciate that they are responsible for the prevention and control of HCAI which includes intravascular catheter-related infection in all areas of their responsibility. This must be supported by clear lines of accountability which include systems that can detect and correct lapses in infection prevention and control practice on a timely basis and increases in intravascular catheter-related infection incidence. Patients can also play a role, expecting the highest standards of healthcare quality and safety and ensuring that healthcare facilities assure them that there is an effective intravascular catheter-related infection control programme in place.

1.6.1 Roles and Responsibilities

Each healthcare staff member has a role to play in the prevention and control of healthcare-associated infection, which includes intravascular catheter-related infection by adhering to best practice as outlined in these guidelines. This guideline should be reviewed by the healthcare facilities senior management teams in conjunction with the relevant specialists to plan implementation of the recommendations. This will enable the facility to ensure that the prevention and control of intravascular catheter-related infection is a key patient/resident safety issue for the facility.

Organisational responsibility: Within each healthcare facility the CEO/General Manager has corporate and clinical responsibility for implementation of the National Clinical Guideline.

All healthcare staff:

- Comply with this guideline and related policies, procedures and protocols.
- Adhere to their code of conduct and scope of practice guidelines as appropriate to their role and responsibilities
- Maintain competency in the prevention and control of intravascular catheter-related infection
- In using this guideline be aware of the role of appropriate delegation.

1.7 Audit Criteria

To ensure that this guideline positively impacts on patient care, it is important that it is audited. Audit is recommended to support continuous quality improvement. The following are examples of audit criteria which are consistent with HIQA *National Standards for the Prevention and Control of Healthcare Associated Infections* (2009):

Outcome Measures:

- Intravascular catheter-related infection rates
- Bloodstream infection associated with intravascular catheters (central and peripheral)

Process Measures:

- CVC Insertion checklist compliance
- Maintenance Care Bundle compliance
- Hand hygiene compliance score (%)

2. Updated Recommendations' 2014

This update to the 2009 National Guidelines for the Prevention of Intravascular (IV) Catheter Related Infection in Irelandⁱ is integrated with the original recommendations and evidence from the 2009 Guidelines. The recommendations made in this update are clearly marked as 'Update 2014' and highlighted in the text.

Recommendations are divided into six sections as follows:

Section	Subsection	Recommendation Number
General Infection Prevention and Control Principles	• General Principles	1
	• Hand Hygiene	2
	• Aseptic technique	3
	• Educations of healthcare workers & patients	4
Central Intravascular Catheters	• Skin asepsis	5
	• Maximal Barrier Precautions	6
	• CVC Insertion Protocols	7
	• Selection of CVC type & insertion site	8
	• Prophylaxis: Antimicrobial Ointments, Antiseptic & Antimicrobial Locks	9
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	• Daily Review of CVCs	11
	• CVC replacement	12
	• CRBSI surveillance	13
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Peripheral Intravascular Catheters		17
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Prevention of CRBSI in specific settings	• The Emergency Department	19
	• Haemodialysis	20
Implementation of these guidelines	• Responsibility for implementation of these guidelines	21

Summary of Recommendations that were changed as part of the 2014 update

SECTION B: CENTRAL INTRAVASCULAR CATHETERS (CVC)

Recommendation 5: Skin Asepsis

- Updated recommendation on chlorhexidine allergy

Recommendation 8: Selection of CVC Type and Insertion Site

- Updated recommendation for patients requiring regular or continuous IV access
- Updated recommendation on antiseptic/antimicrobial impregnated CVCs

Recommendation 10: CVC Care and Maintenance

- New recommendation on chlorhexidine sponge dressings
- Updated recommendation on daily skin cleansing with chlorhexidine in adult patients with CVCs
- Updated recommendation on administration sets (IV giving sets)

SECTION C: PERIPHERAL INTRAVASCULAR CATHETERS

- Updated recommendations on replacement of peripheral intravascular catheters

SECTION E: PREVENTION OF CRBSI IN SPECIFIC SETTINGS

Recommendation 19: The Emergency Department

- Updated recommendation on replacement of IV catheters

APPENDIX 16 (FULL VERSION OF GUIDELINES): UPDATED PVC CARE BUNDLE

2.1 General Infection Prevention and Control Principles

Recommendation 1:

- Intravascular catheters should only be inserted when there is a clear clinical indication for their use. When the clinical indication is no longer present, the catheter must be removed.

Recommendation 2: Hand Hygiene

- Hand hygiene is the single most important procedure in the prevention of intravascular catheter-associated or related infections. Hands must be decontaminated before and after accessing or dressing an intravascular catheter.
- Hands can be decontaminated by washing with an antimicrobial liquid soap and water, or if hands are physically clean, by an alcohol based hand rub. Hands that are visibly soiled or contaminated with dirt or organic material must be washed with liquid soap and water before using an alcohol hand rub.

Recommendation 3: Aseptic Technique

- Aseptic technique should be used by all healthcare workers during insertion and maintenance of intravascular catheters. Aseptic (no touch) technique is a term used to describe a technique that maintains asepsis and is non-touch in nature – the susceptible site should not come into contact with any item that is not sterile. (Appendix 6 – full guideline document)
- Following hand hygiene, clean gloves and an aseptic (no touch) technique should be used when accessing an intravascular catheter when the luer* lock is not disconnected from the catheter (e.g., intravenous drug administration, blood sampling or connecting or disconnecting intravenous fluids).
- Sterile gloves in addition to aseptic (no touch) technique should be used when a luer needleless connector is disconnected (e.g., manipulation of a catheter, haemodialysis).
- Sterile gloves and aseptic (no touch) technique must be used for changing total parenteral nutrition (TPN) and central venous catheter (CVC) insertion site dressing change.
- Each facility should develop and implement a standardised protocol for aseptic (no touch) technique.

*Luer connection systems are the standard way of attaching syringes, catheters, hubbed needles, IV tubes, and so on to each other. They consist of round male and female interlocking tubes, they can either be 'luer slip', or can have an additional outer rim of threading called a 'luer lock', allowing them to be more secure.

Recommendation 4: Education of Healthcare Workers and Patients

- Infection prevention and control, including the principles of prevention of catheter-related bloodstream infection (CRBSI), must be an essential component of the core curriculum of training programmes of medical and nursing students at both undergraduate and postgraduate level.
- Following training, HCWs must be assessed and documented as competent in using and consistently adhering to appropriate infection prevention and control practices when inserting or maintaining intravascular catheters. Ideally a national competency document would ensure standardisation of training and allow for interchange between

healthcare facilities (due to staff movement); however, this would need an appropriate infrastructure in terms of project management, IT and education.

- Only competent, trained staff (or training staff supervised by competent staff) should insert and maintain intravascular catheters.
- Before discharge from a healthcare facility, patients with an intravascular catheter and their carers must be educated by a member(s) of the patient's clinical multidisciplinary team with respect to the procedures necessary to safely manage their catheter and to prevent infection. This should include education on the signs of infection and a relevant information leaflet.^{ix}
- Ongoing quality assurance/improvement, risk management and surveillance programmes should be in place to monitor the incidence of infection associated with intravascular catheters, to evaluate the response to patient and staff education, and to identify future educational needs. Monitoring compliance with care bundles are important process measures for evaluation of a CRBSI preventative programme.^x These results should be reviewed and fed back to relevant ward areas and senior management at regular intervals.

2.2 Central Intravascular Catheters (CVC)

2.2.1 Prevention of Infection Associated with CVCs

Recommendation 5: Skin Asepsis

- Individual single use sachets of antiseptic solution or individual packages of single use antiseptic-impregnated swabs or wipes should be used to disinfect the CVC insertion site. Skin must be allowed to air dry prior to further manipulation. If the skin is visibly dirty, it should be washed with soap and water prior to skin asepsis.
- In adults and children ≥ 2 months (assuming normal gestation at birth), a single patient use application of alcoholic chlorhexidine gluconate solution (preferably 2% chlorhexidine gluconate in 70% isopropyl alcohol if compatible with the CVC) should be used and must be allowed to air dry;
 - For skin disinfectant prior to the insertion of a CVC.
 - To disinfect the CVC insertion site during dressing changes.
 - Prior to accessing the CVC hub or injection port.
- 0.5-1% chlorhexidine is the optimal range for neonatal (< 2 months) skin asepsis; however randomised controlled trials are required to clarify this range.
- An aqueous solution of 2% chlorhexidine gluconate should be used if the CVCs manufacturer's recommendations prohibit the use of alcohol with their product.

Update 2014.

- **Healthcare providers should be aware of the risk of chlorhexidine allergy including anaphylaxis. Single patient use application of alcoholic povidone-iodine solution should be used for patients with a history of chlorhexidine sensitivity if available. Alternatives include tincture of iodine, an iodophor (such as 10% aqueous povidone iodine or povidone iodine alcoholic tincture) or 70% alcohol.**

- HCW should ensure that CVC site care is compatible with CVC materials (e.g., tubing, hubs, injection ports, luer needleless connectors and extensions) and carefully check compatibility with the manufacturer's recommendations. This assessment must be performed in advance of purchasing the CVC/materials. If the CVC/materials are incompatible with 2% chlorhexidine gluconate in 70% isopropyl alcohol, there should be a clear clinical benefit to purchasing the CVC/materials. If not, an alternative CVC/materials should be sought.

Recommendation 6: Maximal Barrier Precautions

- Maximal barrier precautions are recommended for insertion of all CVCs and when exchanging a CVC over a guide wire and must be used by the operator and any person who enters the sterile field to assist in the procedure.
- These precautions include:
 - Strict compliance with hand hygiene must be practiced by the operator placing the CVC and staff assisting in the procedure.
 - Covering the patient with sterile drape(s) from head to toe with an appropriate opening for the site of insertion.
 - The operator and staff assisting in the procedure wearing the following: cap, (should cover all hair), mask (should cover the nose and mouth tightly), protective eyewear, sterile gown and sterile gloves.

Recommendation 7: CVC Insertion Protocols

- It is recommended that each healthcare facility has a written CVC insertion procedure guideline that is updated regularly. (Appendix 8 full guideline document)
- CVC insertion packs containing all the necessary items for CVC insertion are recommended. (Appendix 9 full guideline document)
- It is recommended that a CVC checklist is used to ensure adherence to infection prevention and control practices at the time of CVC insertion. (Appendix 10 full guideline document) This checklist is used to ensure and document compliance with aseptic technique. CVC insertion should be observed by a HCW who has received appropriate education to ensure that aseptic technique is maintained. The observer will assist in identifying breaches in aseptic technique, which if observed should result in the procedure being aborted and restarted.

Recommendation 8: Selection of CVC Type and Insertion Site

- Patients should be assessed prior to CVC insertion as to the appropriate number of lumens that are likely to be required. If a multi-lumen CVC is used, one port should be identified and designated exclusively for TPN (if required).
- In selecting an appropriate insertion site, the risks for infection should be assessed against the risks of mechanical complications.
- For patients likely to require long term renal replacement, early consideration of the future vascular access plan is essential prior to CVC insertion (including future arteriovenous (AV) fistula site). In these patients the subclavian site should be avoided because of the frequent development of subclavian stenosis which interferes with long term provision of vascular access.

- Portable ultrasound imaging may be considered for selected patients at high risk of complications (e.g., known vascular anomaly) or where vascular access is likely to be difficult (e.g., children).
- The use of implantable ports is recommended for patients who require long term, intermittent vascular access.

Update 2014.

- **In units or patient populations that have a high CRBSI rate despite compliance with basic CRBSI prevention practices, antiseptic/ antimicrobial impregnated CVCs should be used in adults whose catheter is expected to remain in place >5 days.**

Recommendation 9: Prophylaxis: Antimicrobial Ointments, Antiseptic and Antimicrobial Locks

- The application of antimicrobial ointment to the CVC placement site prior to insertion is not recommended.
- Antimicrobial lock solutions may be used for the prevention of CRBSI in certain subgroups of patients, notably those who require long term vascular access (e.g., haemodialysis, short bowel syndrome) and who have had multiple episodes of CRBSI and have developed these infections despite strict adherence to all other preventative measures. Ongoing surveillance for the emergence of resistant organisms should be performed where antimicrobial lock therapy is used.
- The decision to use antimicrobial lock prophylaxis and the choice of antimicrobial agent to be used will need to be decided on a individual patient basis, based on the previous positive microbiology and in conjunction with the medical microbiologist / infectious diseases physician.
- The administration of prophylactic antimicrobials prior to CVC insertion is not recommended.

Recommendation 10: CVC Care and Maintenance

- It is recommended that each healthcare facility has a written CVC care and maintenance guideline that is updated regularly/as new evidence becomes available.
- Hand hygiene, aseptic technique and decontamination of the CVC hub/injection port should be performed as in Recommendations 2, 3 and 5.
- Manipulations of the CVC, including replacement of dressings should be documented.
- A sterile, transparent semi permeable dressing should be used to cover the CVC insertion site and should be changed every seven days or sooner if it is no longer intact or if moisture collects under the dressing. If a sterile gauze dressing is used (e.g., if a patient has profuse perspiration or if the insertion site is bleeding or oozing) it should be replaced by a transparent semi permeable dressing as soon as possible.

Update 2014.

- **The use of chlorhexidine impregnated sponge dressing should be considered in adult patients with temporary short term CVCs.**

- Dressings used on tunnelled or implanted CVC insertion sites should be replaced every seven days until the insertion site has healed, unless there is an indication to change them sooner.

Update 2014.

Consider the use of daily skin cleansing with chlorhexidine in adult patients with a CVC.

- A sterile 0.9% sodium chloride solution should be used to flush and lock CVC lumens. When recommended by the manufacturer, implanted ports or opened-ended CVC lumens should be flushed and locked with heparin sodium flush solutions. Routine use of systemic anticoagulants is not recommended to prevent CRBSI. The committee have omitted heparin dosage information in these guidelines. This is because policy may differ between healthcare facilities and patient groups. It is suggested that on adoption of these guidelines, the use of heparin is supported with in-house guidelines which take into account dosage and product formulation. In addition, special provision should be made for patients with a history of heparin induced thrombocytopenia, as heparin should not be used in such a scenario.

Update 2014.

- **Administration sets (IV giving sets) in continuous use do not need to be replaced more frequently than every 96 hours unless they become disconnected, or the intravascular access device is replaced.**
- **Blood administration sets should be changed after a maximum of 6 hours.**
- **Administration sets in continuous use for lipid containing parenteral nutrition should be changed 24 hours after initiating the infusion**
- **Replace tubing used to administer propofol infusions every 6 or 12 hours, when the vial is changed, per the manufacturer's recommendation.**

Recommendation 11: Daily Review of CVCs

- All CVCs should be reviewed daily, documented as reviewed and those that are no longer clinically indicated promptly removed.
- The insertion site should be examined daily for drainage, tenderness, pain, redness, swelling, suture integrity and CVC position and all findings documented. Site appearance should not be used as the only indicator of infection. The patient should also be examined for fever or other signs of sepsis (e.g., tachycardia, tachypnoea, hypotension).
- Patients should be encouraged (where possible) to report any changes in their CVC site or any new discomfort.
- Patients transferring from other healthcare facilities with a CVC *in situ* must have the device reviewed upon arrival for evidence of any infectious or mechanical complications.

Recommendation 12: CVC Replacement

- Management of CVC replacement in the context of CVC infection is outlined in Recommendation 16.

- If the CVC is fractured, it should be replaced and a new CVC inserted ideally at a different site.
- Because breaches in sterile technique are more likely during emergency procedures, CVCs inserted during a medical emergency must be replaced as soon as possible.
- Routine replacement of CVCs that are functioning and have no evidence of causing local or systemic complications (including scheduled guidewire exchanges of CVCs) as a method to reduce CRBSI is not recommended.
- Guidewire techniques should not be used to replace CVCs in patients suspected of having CVC infection. Guidewire assisted CVC exchange to replace a malfunctioning CVC or to exchange an existing CVC should be used only if there is no infection at the CVC site or no suspicion of CRBSI. If after a guidewire exchange, investigations reveal CRBSI, the newly inserted CVC should be removed and if still required reinserted at a different site. In selected patients with tunnelled haemodialysis CVCs and bacteraemia, CVC exchange over a guidewire, in combination with antibiotic therapy, might be an alternative as a salvage strategy in patients with limited venous access.
- For guidewire exchanges, the same meticulous aseptic technique and use of full sterile barriers are mandatory as outlined in Recommendations 2-3 and 5-9.

2.2.2 Surveillance of Infection associated with CVCs

Recommendation 13: CRBSI Surveillance

- Healthcare managers must support surveillance activities, including surveillance of CRBSI.
- Surveillance must start and end with the patient in order to improve patient care. A CRBSI surveillance programme should be introduced in a healthcare facility as dictated by the specialities and requirements of that healthcare facility and the resources available for surveillance, to determine healthcare associated (HCA) CRBSI rates, monitor trends in rates, and assist in identifying lapses in infection prevention and control practices. Areas that may be involved might include ICU/HDU, dialysis units, haematology/oncology units, TPN services and interventional radiology units. The committee have provided sample forms for CRBSI surveillance.^{xi} These forms represent a template and can be used to guide healthcare facilities in the design of their own forms. Each healthcare facility may wish to include additional questions in the template form so that local needs can be met.
- A local multidisciplinary steering committee should be established with representatives from the relevant area(s) in which surveillance is to commence (e.g., ICU, haemodialysis, medical microbiology, infectious diseases, infection prevention and control and senior management) to help drive the surveillance project, encourage compliance and advise the relevant area(s) and healthcare facility management based on surveillance results.
- CRBSI rates must be fed back to the relevant area(s) and healthcare facility management on a regular basis, ideally monthly, but at least quarterly.
- All clusters of HCA CRBSI and all episodes of HCA CRBSI due to *S. aureus* must be investigated.
- The introduction of new intravascular catheters should be monitored for an increase in the occurrence of infection.

Recommendation 14: Case Definitions for CRBSI Surveillance

- CRBSI protocols must be standardised and adhere to other international frameworks (e.g., HELICS) for comparative analysis of CRBSI incidence rates.^{xii}

Update 2014.

- **The HELICS case definitions for catheter-related infection as outlined by the European Centre for Disease Prevention and Control (ECDC) are the recommended case definitions for intravascular catheter-related infection surveillance.**

Recommendation 15: Denominators for Surveillance

- The CRBSI rate should be expressed as the number of CRBSIs per 1000 CVC days.

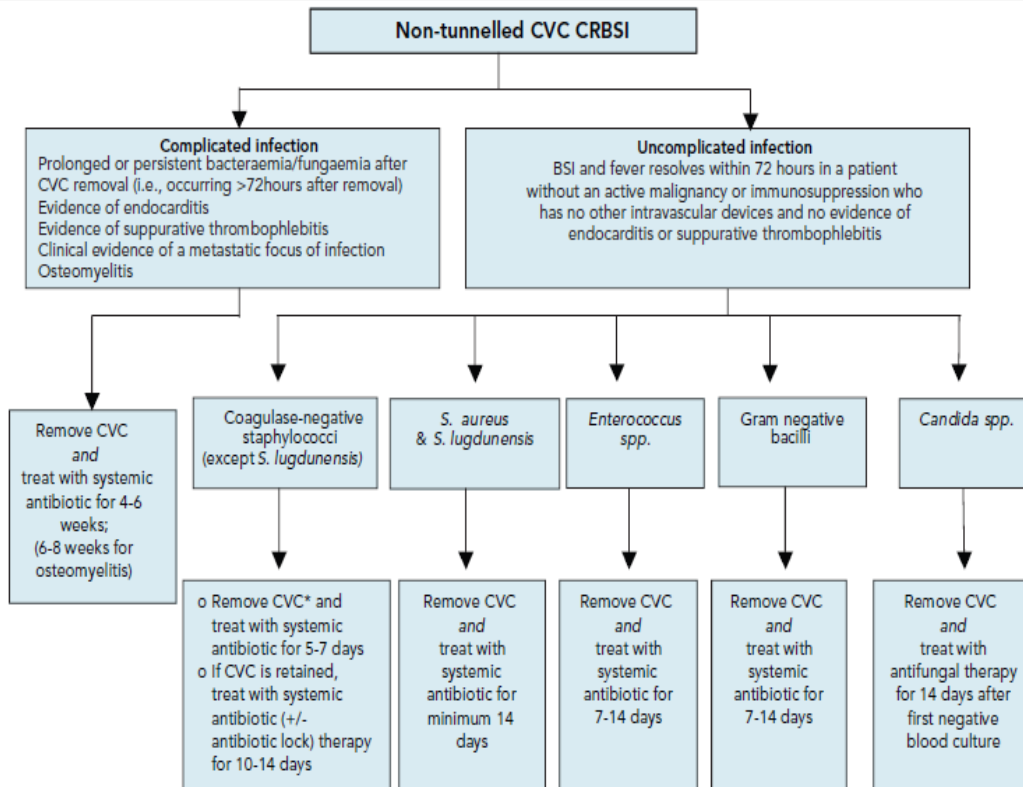
2.2.3 Management of CVC-related Infection

Recommendation 16:

- Management of CVC-related infection depends on the type of CVC involved, the infecting organism, and the associated complications.
- When a CVC-related infection is documented and a specific pathogen is identified, systemic antimicrobial therapy should be adjusted according to antimicrobial susceptibility.
- Duration of treatment will depend on the organism identified, presence of bacteraemia, presence of complications and whether the line has been removed.
- When denoting duration of antibiotic therapy for treatment of BSI, day one is the first day on which negative blood cultures are obtained.
- Exit site infection: Empiric therapy with an appropriate antibiotic should be commenced after blood cultures are taken and involvement of the tunnel/port pocket ruled out (if a tunnelled CVC is present). CVC removal is recommended if antibiotic treatment fails. Exchange of the CVC over a guidewire in the presence of an exit site infection is not recommended. If blood cultures are positive, then treatment for CRBSI is indicated.
- Tunnel infection: Successful therapy of tunnel infections without CVC removal is very unlikely. In the absence of bacteraemia 7-10 days of antibiotics may suffice. If associated with bacteraemia, the patient should be considered to have complicated CRBSI.
- CRBSI:
 - In patients with BSI and an indwelling CVC, it is important to rule out other sources of infection to avoid unnecessary CVC removal. Where a patient has a single blood culture for coagulase-negative *Staphylococcus spp.* additional blood cultures (peripheral and through the CVC) should be obtained.
 - Empiric intravenous antimicrobial therapy should be considered, after cultures are obtained. In general a glycopeptide antibiotic is recommended for empirical therapy in health care settings in which MRSA is prevalent. Additional gram-negative coverage is indicated in patients who are neutropenic or severely ill with sepsis or for suspected infections involving femoral catheters. Antifungal agents (choice depending on local susceptibility patterns) should be considered for empirical treatment when fungaemia is suspected.

- Patients with complicated CRBSI will require 4-6 weeks of IV antibiotics. This includes patients with suppurative thrombophlebitis, endocarditis, metastatic seeding, or persistent bacteraemia (> 72 hours despite appropriate antibiotics) after removal of the catheter.
- Management of CRBSI when the infecting organism is known is outlined in Figures 1 and 2.
- Repeat blood cultures to document clearance of bacteraemia are recommended.
- In uncomplicated CRBSI due to organisms other than *S. aureus*, *P. aeruginosa*, fungi, mycobacteria, *Micrococcus spp.*, *Propionobacterium* or *Bacillus spp.*, CVC salvage may be attempted in situations where there is limited vascular access. If bacteraemia is persistent (>72 hours) this should prompt reassessment of the ability to salvage the CVC. Antibiotic lock therapy should be used when CVC salvage is being attempted, however this should always be administered with systemic antibiotic therapy.

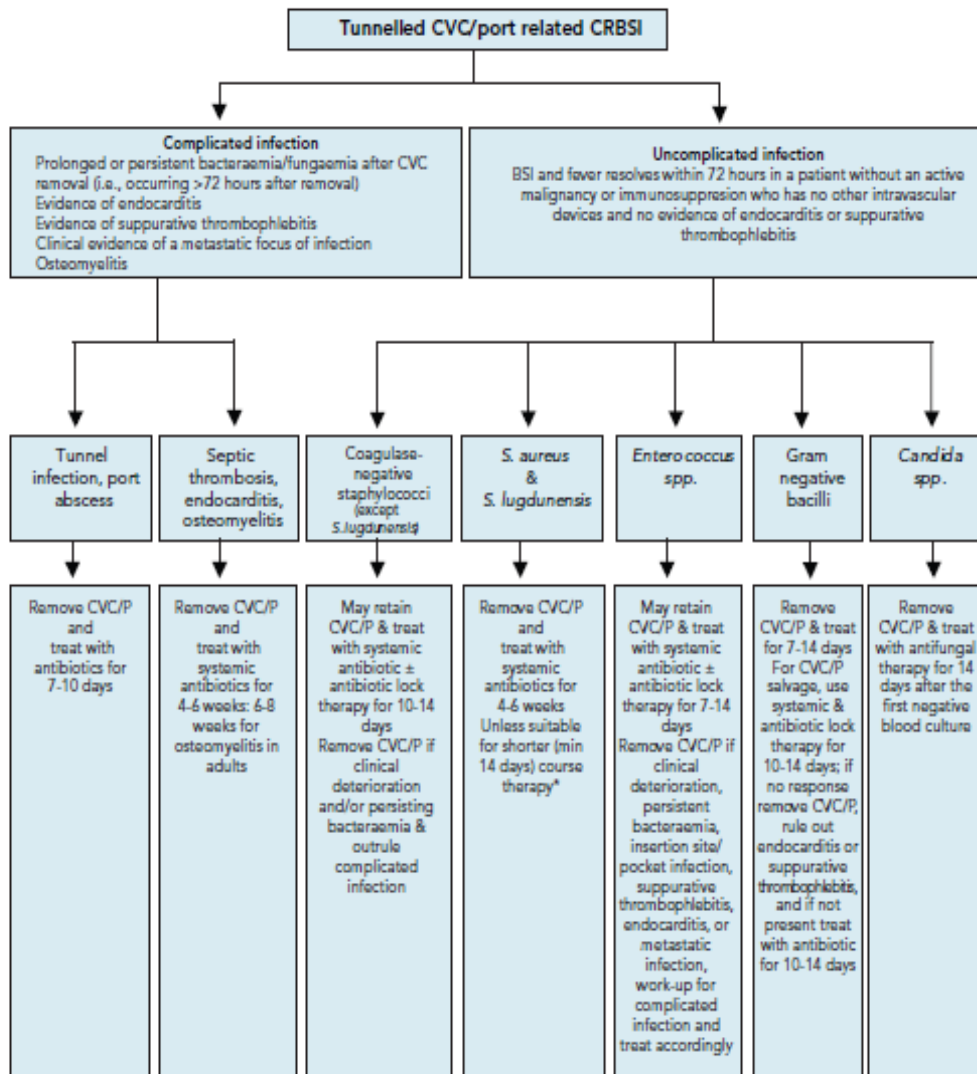
Figure 1: Management of CRBSI associated with non-tunnelled CVCs.



*Infections may resolve in patients without intravascular/orthopaedic prosthesis/devices with CVC removal alone (and no antibiotic therapy). Blood cultures should be repeated after CVC withdrawal to confirm the absence of bacteraemia.

Figure 1: Management of CRBSI associated with non-tunnelled CVCs.

Figure 2: Management of CRBSI associated with tunnelled CVCs or ports (CVC/P)



* Patients can be considered for a shorter duration of antimicrobial therapy (i.e., a minimum of 14 days therapy) if the infected tunnelled CVC / port is removed and

- Fever and bacteraemia resolve within 72 hours of initiating appropriate antimicrobial therapy.
- The patient has no prosthetic intravascular device (e.g., pacemaker, recently placed vascular graft).
- There is no evidence of endocarditis or suppurative thrombophlebitis on TOE and ultrasound, respectively.
- There is no evidence of metastatic infection on physical exam and sign/symptom-directed diagnostic tests.
- The patient is not diabetic, not immunosuppressed (i.e., not receiving systemic steroids, neutropaenia, or other immunosuppressive drugs such as those used for transplantation).

Figure 2: Management of CRBSI associated with tunnelled CVCs or ports (CVC/P)

2.3 Peripheral Intravascular Catheters

Recommendation 17:

- Only competent, trained staff (or training staff supervised by competent staff) should insert and maintain peripheral intravascular catheters.
- In order to prevent contamination of peripheral intravascular catheter sites and subsequent bloodstream infection, hand hygiene and aseptic technique as outlined in Recommendations 2 and 3 must be performed each time:
 - Before peripheral intravascular catheter insertion (both before and after palpating the catheter insertion site).
 - Before peripheral intravascular catheter access or maintenance (e.g., dressing manipulations, palpating the catheter).

Following hand hygiene, clean gloves and an aseptic technique must be employed. Hand hygiene must also be performed immediately after removing gloves and after each episode of patient care. All sharps must be disposed of carefully into an approved sharps container.

- In adults and children ≥ 2 months (assuming normal gestation at birth), a single patient use application of alcoholic chlorhexidine gluconate solution (preferably 2% chlorhexidine gluconate in 70% isopropyl alcohol if compatible with the peripheral intravascular catheter) should be used and allowed to air dry;
 - For skin disinfection prior to the insertion of a peripheral intravascular catheter.
 - To disinfect the PVC insertion site during dressing changes.
 - Prior to accessing the PVC hub.
- 0.5-1% chlorhexidine is the optimal range for neonatal (< 2 months) skin asepsis; however, randomised controlled trials are required to clarify this range. (Section 3.1.2.i full guideline document)
- The peripheral intravascular catheter site should not be re-palpated after skin asepsis.
- Select the peripheral intravascular catheter and insertion site with the lowest risk for complications for the anticipated type and duration of IV therapy.
- A sterile, transparent semi permeable dressing should be used to cover the peripheral intravascular catheter insertion site. Routine dressing change is not recommended unless the dressing is no longer intact or moisture collects under the dressing.

Update 2014.

- **Patients transferring from other healthcare facilities with a peripheral intravascular catheter *in situ* should have this device reviewed upon arrival to ensure it is still needed.**

- When adherence to aseptic technique cannot be ensured (i.e., when peripheral intravascular catheters are inserted during a medical emergency), the catheter should be replaced as soon as possible.
- All peripheral intravascular catheters should be reviewed daily, and those that are no longer needed should be promptly removed. Details of the review and the decision to remove or not should be clearly documented.
- All peripheral intravascular catheters must be removed promptly when there is clinical evidence that the peripheral intravascular catheter is infected.

Update 2014.

- **The peripheral intravascular catheter insertion site should be visually inspected at least twice daily (on every shift) for evidence of complications. The assessment should be clearly documented.**
- **Peripheral venous catheters should be re-sited when clinically indicated and not routinely.**

2.4 Diagnosis of Intravascular Catheter-related Infection

Recommendation 18:

- Clinical findings alone are unreliable for establishing a diagnosis of intravascular catheter-related infection, because of their poor specificity and sensitivity.
- Two sets of blood cultures should be taken using aseptic technique from all patients with suspected intravascular catheter-related infection. For CVCs either through the CVC and peripherally or through different lumens of the CVC if blood cultures cannot be drawn from a peripheral vein. Blood cultures should be taken prior to initiation of antimicrobial therapy. The bottles should be appropriately marked to reflect the site the cultures were drawn from.
- Routine culturing of intravascular catheter tips is not recommended. However, CVC tips should always be sent for culture if the CVC is removed and catheter-related infection is suspected. It is essential that every CVC is removed using aseptic technique.
- For suspected pulmonary artery catheter infection, the introducer tip should be cultured.
- If an implantable port is removed for suspected CRBSI, the catheter tip and the port should be sent for qualitative culture of the port reservoir contents.
- If pus is present at the catheter exit site, the site must be swabbed for culture and removal of the catheter considered. (Recommendations 16 and 17)
- Growth of >15 CFU from a segment of the catheter tip by semiquantitative (roll-plate) culture or growth of $>10^2$ CFU from a catheter by quantitative (sonication) broth culture reflects catheter colonisation. All such isolates from CVC tips are potentially significant and should be identified to genus level and to species level, if clinically indicated. Antimicrobial susceptibility should be performed on all clinically significant isolates.
- The choice of the precise microbiological method for CRBSI diagnosis may vary locally and should be made according to technical availability and after discussion between clinicians and medical microbiologists. In addition, economic considerations, such as cost-effectiveness, may also be taken into account.
- Blood culture results that are positive for *S. aureus*, coagulase-negative staphylococci, or *Candida spp.*, in the absence of any other identifiable source of infection, should increase the suspicion for CRBSI.
- For diagnosis of CRBSI the following criteria should be met: Bacteraemia or fungaemia in a patient who has an intravascular device and ≥ 1 positive blood culture obtained from the peripheral vein, clinical manifestations of infection (e.g., fever, chills, and/or hypotension), and no apparent source for BSI (with the exception of the catheter). One of the following should be present:

- A positive result of semiquantitative (>15 CFU/catheter segment) or quantitative (>10² CFU /catheter segment) catheter culture, whereby the same organism (*spp.*) is isolated from a catheter segment and a peripheral blood culture.
- Simultaneous quantitative cultures of blood with a ratio of > 3 : 1 CFU/ml of blood (catheter versus peripheral blood); differential time to positivity (Growth in a blood culture drawn through catheter hub is detected by an automated blood culture system at least 2 hours earlier than a simultaneously drawn, peripheral blood culture of equal volume).

2.5 Prevention of Intravascular Catheter-related Infection in Specific Settings

Recommendation 19: The Emergency Department

- Only appropriately trained staff (or trainee staff supervised by competent staff) should insert percutaneous CVCs in Emergency Departments. (Recommendation 4)
- There should be strict adherence to hand hygiene, skin asepsis and aseptic insertion technique. (Recommendations 2-3 and 5-9)

Update 2014.

- **When adherence to aseptic technique cannot be ensured (i.e. catheters inserted during a medical emergency), replace the intravascular catheter as soon as possible.**
- **Peripheral intravascular catheters which have been inserted using aseptic technique in the Emergency Department do not need to be removed if there is no evidence of complications.**

- Ultrasound-guided central venous access should be considered.
- Accurate documentation and record keeping is required for all instances of CVC insertion in the Emergency Department. A CVC Insertion Checklist (Appendix 10 full guideline document) may be used to ensure patient safety, auditing of clinical practice, and the tracking of infective complications.

Recommendation 20: Haemodialysis

- Haemodialysis patients should whenever possible and practical have a primary arteriovenous (AV) fistula created for vascular access. If it is not possible to achieve a functioning AV fistula a polytetrafluoroethylene (PTFE) graft is in general preferable to long term cuffed catheters.
- Renal units need to have adequate access to vascular surgeons in order to ensure the timely creation of primary vascular access.
- Patients with progressive renal failure should have a primary AV fistula created when the eGFR is between 17 and 12 aiming to start such patients with their first dialysis through a functioning fistula.
- Each unit should keep records of primary fistula prevalence, PTFE graft prevalence and cuffed catheter prevalence.
- Units should review bacteraemia rates for patients with and without catheters on a regular basis. When an episode of bacteraemia develops in a dialysis patient a root cause analysis should be undertaken to identify the source of infection and potentially modifiable risk factors.

- All patients should be screened for prevalence of MRSA colonisation regularly (e.g., three monthly) and patients managed as per national guidelines.^{xiii}
- When CVC infection is suspected in haemodialysis patients, two sets of blood cultures should be taken using aseptic technique (either through the CVC and peripherally, or through different lumens of the CVC if peripheral blood cultures cannot be taken). Peripheral blood cultures should be obtained from vessels not intended for future use in creating a dialysis fistula. When a peripheral blood culture cannot be obtained, blood cultures should be drawn during haemodialysis from bloodlines connected to the CVC.
- Empiric antibiotic therapy can be discontinued in patients with suspected CRBSI if both sets of blood cultures are negative and no other source of infection is identified. If a peripheral blood culture cannot be obtained and no clinical evidence for an alternate source of infection, then a positive catheter-drawn blood culture in a symptomatic haemodialysis patient should lead to continuation of antimicrobial therapy for possible CRBSI.
- The infected CVC should be removed in patients with haemodialysis CRBSI due to *S. aureus*, *Pseudomonas* or *Candida spp.* and a temporary (non-tunnelled catheter) inserted into another anatomical site. A long-term haemodialysis catheter can be placed once repeat blood cultures are negative. Guidewire exchange is recommended only if no alternative sites are available for CVC insertion.
- For CRBSI due to other pathogens (e.g., Gram negative bacilli other than *Pseudomonas spp.* or coagulase-negative staphylococci), a patient can be started on empiric intravenous antibiotics without immediate catheter removal (provided patient clinically stable). If symptoms persist or there evidence of a metastatic infection, the catheter should be removed.
- Surveillance blood cultures should be obtained one week after completing an antibiotic course for CRBSI if the catheter has been retained. If the blood cultures are positive, the catheter should be removed and a new, long-term dialysis catheter should be placed after a repeat blood cultures are negative.

2.6 Implementation

Recommendation 21: Responsibility for the implementation of these guidelines

- Prevention of healthcare-associated infection (HCAI) should be prioritised by the Department of Health (DoH), the Health Services Executive (HSE) and all healthcare staff in order to improve patient care and safety and to reduce all HCAI, including CRBSI.
- Implementation of the National Standards for the Prevention and Control of HCAI³ will be a key aspect of the prevention and control of intravascular catheter-related infection. Standard 8 (invasive medical device-related infection) outlines the specific key criteria that will be assessed in this regard.
- The following infrastructural requirements are recommended to institute a programme to prevent CRBSI:
 - An adequately staffed infection prevention and control programme responsible for identifying patients with CRBSI, including a surveillance coordinator with appropriate administrative support.
 - Information technology to collect and calculate catheter- days as a denominator for computing rates of CRBSI and patient-days to allow calculation of CVC

utilisation; Catheter-days from information systems should be validated against a manual method.

- Resources to provide appropriate education and training.
- Adequate laboratory support for timely processing of specimens and reporting of results.
- Implementation of these guidelines may require ring-fenced funding to assist healthcare facilities to meet these recommendations, specifically surveillance, laboratory, infection prevention and control infrastructure and personnel.

Appendix 1: Membership of the RCPI Clinical Advisory Group of the National Clinical Programme for HCAI & AMR Prevention, August 2014

Institution Represented	Nominee
Chair of Clinical Advisory Group	Dr. Niamh O'Sullivan
National Clinical Lead on HCAI and AMR	Dr. Fidelma Fitzpatrick
Programme Manager	Ms. Roisin Breen
RCPI Programme Administration	Ms. Anita Nicholson
Academy of Medical Laboratory Science	
- Surveillance Scientist Association	Ms. Anne-Marie Meenan Ms. Karen Logan
Hospital Pharmacist Association of Ireland	
- General Pharmacist	Ms. Deirdre Lynch
- Antimicrobial Pharmacist	Ms. Marie Philbin
Department of Agriculture, Food & Fisheries	Ms. Hazel Sheridan Dr. Caroline Garvan
Department of Health & Children	Dr. Eibhlin Connolly
Faculty of Pathology, RCPI	Dr. Deirbhile Keady Dr. Brian O'Connell
Faculty of Public Health, RCPI	Dr. Phil Jennings
Health Information & Quality Authority	Mr. Sean Egan
HSE- HPSC (Health Protection Surveillance Centre)	
- Microbiologist	Dr. Karen Burns
- Microbiologist	Dr. Robert Cunney
- Infection Control Nurse	Ms. Sheila Donlon
HSE- Patient Safety & Quality	
- Assistant National Director for Health Protection	Dr. Kevin Kelleher
- Public Health Specialist	Dr. Anne Sheehan
Irish Association of Directors of Nursing & Midwifery	
- Director of Nursing	Ms. Sarah McMickan
- Infection Prevention & Control	Ms. Mairead Holland
Irish College of GP's	Dr. Nuala O'Connor
Irish Patients Association	Mr. Stephen McMahon
Principal Dental Surgeon	To be confirmed
Royal College of Surgeons in Ireland	Dr. Gillian Paul
Royal College of Physicians of Ireland	
- ID Physician	Dr. Paddy Mallon
- Geriatric - Physician	Dr. Lorraine Kyne
UCD Faculty of Veterinary Medicine	Prof. Barbara Kirby
Irish Pharmacy Union	Ms. Pamela Logan
Community Infection Control Nurse Manager	Ms. Margaret Moran
Specialist Registrar Representative	Dr. Karina O Connell

Appendix 2: Consultation Process 2014

A draft of the updated recommendations with explanatory rationale was sent to the following groups for consultation on 13th March 2014.

A four week period was given for comments. The results of the consultation process were discussed by the clinical advisory group on 29th May 2014 and the updated guidelines (full version and summary document) and care bundles were approved in September 2014.

- Members of the Prevention of Intravascular Catheter Related infection in Ireland Guidelines Committee (2009 Composition)
- Academy of Medical Laboratory Science
- Haematology Association of Ireland
- Hospital Pharmacists Association of Ireland
- HSE Clinical Leads & Programme Managers
- HSE Directors of Nursing
- HSE Nurse Practice Development Units
- Infectious Diseases Society of Ireland
- Intensive Care Society of Ireland
- Irish Antimicrobial Pharmacists Group
- Irish Association of Critical Care Nurses
- Irish Association for Emergency Medicine
- Irish Association for Nurses in Oncology
- Irish Association for Paediatric Nursing
- Irish College of General Practitioners
- Irish Nephrology Society
- Irish Nephrology Nurses Association
- Irish Patients Association
- Infection Prevention Society
- Irish Society of Clinical Microbiologists
- Irish Society of Medical Oncology
- Public Health Medicine Communicable Disease Group
- Royal College of Physicians of Ireland (RCPI) clinical advisory group on HCAI and AMR
- RCPI Faculty of Pathology
- RCPI Faculty of Paediatrics
- Royal College of Surgeons in Ireland (RCSI)
- RCSI Faculty of Radiologists
- Surveillance Scientists Association

References

- ⁱ HSE Health Protection Surveillance Centre. Prevention of Intravascular Catheter-related Infection in Ireland. SARI Prevention of Intravascular Catheter-related Infection Sub-Committee, December 2009, Updated February 2010. ISBN 978-0-9551236-6-5
- ⁱⁱ <http://www.hpsc.ie/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/IntravascularIVlines/>
- ⁱⁱⁱ Loveday, HP, Wilson JA, Pratt M, Golsorkhi A, Tingle A. *et al* epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England. *J Hosp Infect* 2014; 86 S1-S70.
- ^{iv} National Institute for Health and Clinical Excellence. Infection control, prevention of healthcare-associated infection in primary and community care (update) (clinical guideline 139). London: NICE; 2012.
- ^v O'Grady NP, Pearson ML, Raad II, *et al*. Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis* 2011;52:e162–e193.
- ^{vi} Irish Blood Transfusion Service - National Blood Users Group. Guidelines for the Administration of Blood and Blood Components. 2004.
- ^{vii} http://www.ecdc.europa.eu/en/aboutus/calls/Procurement%20Related%20Documents/5_ECDC_HAIICU_protocol_v1_1.pdf
- ^{viii} <http://www.hiqa.ie/publications/national-standards-safer-better-healthcare>
- ^{ix} <http://www.hpsc.ie/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/IntravascularIVlines/Factsheets/>
- ^x <http://www.hpsc.ie/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/IntravascularIVlines/Carebundles/>
- ^{xi} <http://www.hpsc.ie/A-Z/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/IntravascularIVlines/Surveillance/CRBSIsurveillance/>
- ^{xii} http://www.ecdc.europa.eu/en/aboutus/calls/Procurement%20Related%20Documents/5_ECDC_HAIICU_protocol_v1_1.pdf
- ^{xiii} <http://www.hpsc.ie/A-Z/MicrobiologyAntimicrobialResistance/EuropeanAntimicrobialResistanceSurveillanceSystemEARSS/ReferenceandEducationalResourceMaterial/SaureusMRSA/Guidance/>