

## CVC Insertion Bundles

Bundles incorporate evidence-based science into practices, and bundle use is recommended in central line–associated bloodstream infection (CLABSI) guidelines.<sup>1,2,3</sup> More than a decade ago, the bundles were shown to reduce rates of central venous catheter (CVC)–related infections.<sup>4</sup> Recent studies have demonstrated that consistent application of evidence-based practices can lead to significant, sustained reductions in CLABSI rates.<sup>5–16</sup> The Institute for Healthcare Improvement (IHI) describes bundles as “groupings of best practices with respect to a disease process that individually improve care, but when applied together result in substantially greater improvement. The science supporting the bundle components is sufficiently established to be considered standard of care.”<sup>17</sup>

### Potential Insertion Bundle Components\*

- Hand hygiene
  - Hands are decontaminated immediately before and after each episode of patient contact using the correct hand hygiene technique. An organized approach such as that of the World Health Organization (WHO) “5 Moments of Hand Hygiene” or the British National Patient Safety Association (NPSA) “Clean Your Hands” campaign may be used.
- Use of full barrier precautions/personal protective equipment
  - Maximal sterile barriers and aseptic technique, including a sterile gown, sterile gloves, and a large sterile drape, are used for the insertion of a central venous access device.
  - Full facial protection is worn if there is a risk of splashed blood or other bodily fluids.
- Chlorhexidine skin antisepsis
  - A solution of 2% chlorhexidine gluconate in 70% isopropyl alcohol is used and allowed to dry for at least 30 seconds. If a patient is sensitive to this agent, a single patient use povidone-iodine application may be used.
  - Aseptic technique is maintained throughout insertion of CVCs.
  - Antisepsis for infants is consistent with local policy or current science for neonates.
- Optimal catheter type selection
  - A catheter with the minimum number of ports or lumens necessary for that patient should be selected.
    - Aseptic lumen access
  - Antimicrobial-impregnated catheter is used if the duration is estimated to be for an extended period of time and the risk of CLABSI high.
- Optimal catheter site selection
  - Selection of a central line placement site should be guided by such considerations as patient comfort, patient-specific factors (such as preexisting catheters, irregularities in hemostasis, or anatomic anomalies), risk of complications (such as bleeding risk or pneumothorax), infection risk, potential for ambulation, and operator experience. An assessment of the risk/benefit analysis in each specific clinical situation also should contribute to the final decision regarding CVC placement.<sup>23</sup>
  - Adult Patients:
    - Avoid the femoral vein for inserting CVCs (except in children); catheter is inserted into the subclavian or internal jugular unless a PICC line is used.
  - Pediatric Patients:
    - Optimal catheter type and site selection in children is more complex, with the internal jugular vein or femoral vein most commonly used.
- Dressing
  - A sterile dressing is applied (gauze, transparent dressing, gauze and transparent dressing, antimicrobial foam disc).
- Safe disposal of sharps
  - Sharps are disposed of safely at the point of care and in accordance with local policy.
- Daily review of line necessity, with prompt removal of unnecessary CVCs

- Health care personnel education about CLABSI prevention
- Availability of CVC carts that contain all necessary supplies
- Checklist to ensure adherence to proper practices
- Procedures stopped in nonemergent situations if evidence-based practices were not being followed
- Feedback provided to health care personnel regarding the number of CLABSI episodes and overall rates
- Buy-in for the CLABSI reduction initiative secured from the chief executive officers of the participating hospitals

■ Documentation

- Details of insertion are documented in the records (including date, location, catheter lot number, and signature and name of operator undertaking insertion).

\*The components are listed for adult and pediatric populations unless specified otherwise. The featured recommendations are not intended to cover emergency situations, which require clinical judgment for patient care actions. Implementation of elementary infection prevention measures, such as health care personnel education, hand hygiene, and feedback of infection rates to health care personnel, have been found to have a major impact on CLABSI rates in resource-limited countries, though the CLABSI rates have not declined to the level of those in developed countries.<sup>18-22</sup>

## Insertion Bundles to Reduce CLABSI Rates

Intervention/Organization/Guidelines	Bundle Components	Outcomes (if available)
<p><b>Intervention:</b> <b>Michigan Keystone Intensive Care Unit Project</b></p> <p>Scope of the initiative: State of Michigan (US)</p> <p>103 ICUs</p> <p>Developed by: Researchers at Johns Hopkins, the Michigan Health and Hospital Association, and Agency for Healthcare Research and Quality (AHRQ)</p> <p>Time frame: September 2003–September 2005</p> <p>(See Chapter 2 of monograph for additional details and Toolkit Tool CLABSI Reduction Initiatives and Campaigns.)</p>	<p>Bundle included the following interventions<sup>6</sup>:</p> <ul style="list-style-type: none"> <li>■ Hand hygiene before catheter insertion</li> <li>■ Use of full barrier precautions</li> <li>■ Chlorhexidine skin preparation</li> <li>■ Avoidance of the femoral vein for inserting CVCs (except in children)</li> <li>■ Prompt removal of CVCs</li> </ul> <p>In addition to creating the bundle, clinicians were educated about CLABSI prevention; CVC carts that contained all necessary supplies were created; a checklist was developed to ensure adherence to proper practices; procedures were stopped in nonemergent situations if evidence based practices were not being followed; feedback was provided to the clinical teams regarding the number of CLABSI episodes and overall rates; and buy-in was obtained for the initiative from the chief executive officers of the participating hospitals.<sup>6</sup></p> <p><i>Note:</i> Rosenthal (in a separate article) points out that implementation of the bundle described here could be challenging in resource-limited countries, as supplies, such as chlorhexidine or large barriers for catheter insertion, may be limited. Furthermore, the bundle alone would likely be insufficient to prevent CLABSIs in such countries, due to the use of vented (open) intravenous fluid containers rather than closed systems (see Sidebar 3-1 on page 49 of the monograph for a discussion of open versus closed intravenous systems), manual admixture of medications due to the lack of ready-to-use medications, and poor infection prevention practices, such as reusing single-use vials and withdrawing fluids from a fluid source for multiple patients.<sup>24</sup></p>	<p>This intervention resulted in a 66% reduction of CLABSIs across all participating ICUs at 16–18 months after implementation.</p>
<p><b>Intervention:</b> <b>Institute for Healthcare Improvement (IHI) 5 Million Lives Campaign</b></p> <p>Scope of the initiative: National (US)</p> <p>Developed by: Institute for Healthcare Improvement (IHI)</p> <p>Time frame: December 2006–December 2008</p> <p>(See Chapter 2 of monograph for additional details and Toolkit Tool CLABSI Reduction Initiatives and Campaigns.)</p>	<p>Bundle included the following interventions<sup>17</sup>:</p> <ul style="list-style-type: none"> <li>■ Hand hygiene</li> <li>■ Maximal barrier precautions upon insertion</li> <li>■ Chlorhexidine skin antisepsis</li> <li>■ Optimal catheter site selection, with avoidance of the femoral vein for central venous access in adult patients</li> <li>■ Daily review of line necessity with prompt removal of unnecessary lines</li> </ul> <p>Techniques and Tips are found on website for each: <a href="http://www.ihc.org/knowledge/Pages/Changes/ImplementtheCentralLineBundle.aspx">http://www.ihc.org/knowledge/Pages/Changes/ImplementtheCentralLineBundle.aspx</a></p>	<p>Rhode Island hospitals active in the campaign reported a 74% decrease in CLABSIs from 2006 to 2008, and several hospitals reported going a year or more without a CLABSI in at least one of their ICUs.<sup>25</sup></p>

Intervention/Organization/Guidelines	Bundle Components	Outcomes (if available)
<p><b>Guidelines:</b>  <b>Canadian Patient Safety Institute (CPSI) Safer Healthcare Now!</b></p> <p>Scope of the initiative:  National (Canada)</p> <p>Developed by:  Canadian Patient Safety Institute</p> <p>Time frame:  Initiative designed with a 5-year implementation period</p>	<p>Bundle included<sup>26</sup>:</p> <ul style="list-style-type: none"> <li>■ Hand hygiene</li> <li>■ Maximal barrier precautions</li> <li>■ Chlorhexidine skin antisepsis</li> <li>■ Optimal catheter type and site selection</li> <li>■ Avoiding the femoral vein in adults; subclavian preferred to minimize infection risk</li> <li>■ Site preference in children individualized, with internal jugular vein or femoral vein most commonly used</li> </ul> <p>Details on bundle elements are included in the Safer Healthcare Now! Prevent Central Line Infections Getting Started Kit available online:  <a href="http://www.saferhealthcarenow.ca/EN/Interventions/CLI/Pages/default.aspx">http://www.saferhealthcarenow.ca/EN/Interventions/CLI/Pages/default.aspx</a></p>	<p>The Canadian Collaborative to Improve Patient Care and Safety in the ICU has supported a number of successful initiatives, including the following<sup>26</sup>:</p> <p>After implementing central line insertion and care bundles using rapid cycle change methodology, Sir-Mortimer B. Davis-Jewish General Hospital over a span of 15 months reduced its CLABSI rate to zero and achieved 100% compliance with the insertion bundle and a steadily increasing compliance with the care bundle.</p> <p>A multidisciplinary team at Stollery Children's Hospital in Edmonton, also using rapid change cycle methodology, implemented central line insertion and care bundles in its pediatric ICU. Over a 10-month span, the pediatric ICU experienced a 55% drop in its CLABSI rate.</p> <p>The IWK Pediatric Intensive Care Unit in Halifax set a goal of reducing the incidence of line-related sepsis in the pediatric population by 20% within 12 months. Within 10 months, the team presented results showing a reduction in central venous line sepsis</p>

Intervention/Organization/Guidelines	Bundle Components	Outcomes (if available)
		<p>rates of more than 50%.</p> <p>Using the PDSA (plan–do–study–act) cycle approach to quality improvement, a multidisciplinary group at British Columbia Children’s Hospital improved catheter insertion and care practices resulting in a 70% decrease in CLABSIs over 10 months—far exceeding its goal of a 50% drop within 12 months. The insertion and care bundles were subsequently adapted for the operating suites and radiology department.</p>
<p><b>Guidelines:</b>  <b>United Kingdom Department of Health High Impact Intervention: Central venous catheter care bundle</b></p>	<p>Bundle included<sup>27</sup>:</p> <p>Catheter type</p> <ul style="list-style-type: none"> <li>• Single lumen catheter is used unless otherwise indicated.</li> <li>• Antimicrobial-impregnated catheter is used if the duration is estimated to be of 1–3 weeks and the risk of CR BSI high.</li> </ul> <p>Insertion site</p> <ul style="list-style-type: none"> <li>• Catheter is inserted into the subclavian or internal jugular.</li> </ul> <p>Personal protective equipment</p> <ul style="list-style-type: none"> <li>• Maximal sterile barriers and aseptic technique, including a sterile gown, sterile gloves, and a large sterile drape, are used for the insertion of a central venous access device.</li> <li>• Eye/full protection is worn if there is a risk of splashed blood or other bodily fluids.</li> </ul> <p>Skin preparation</p> <ul style="list-style-type: none"> <li>• Solution of 2% chlorhexidine gluconate in 7% isopropyl alcohol is used and not allowed to dry for at least 30 seconds. If a patient has a sensitivity, a single patient use povidone-iodine application is used.</li> <li>• Procedure is in accordance with local policy for neonates.</li> </ul> <p>Hand hygiene</p> <ul style="list-style-type: none"> <li>• Hands are decontaminated immediately before and after each episode of patient contact using the correct hand hygiene technique (use of WHO “My 5 Moments of Hand Hygiene” or the NPSA “Clean Your Hands” campaign is recommended).</li> </ul> <p>Dressing</p> <ul style="list-style-type: none"> <li>• A sterile, transparent, semipermeable dressing is used, which allows observation of insertion site.</li> </ul>	

Intervention/Organization/Guidelines	Bundle Components	Outcomes (if available)
	<p>Safe disposal of sharps</p> <ul style="list-style-type: none"> <li>• Sharps are disposed of safely at the point of care and in accordance with local policy.</li> </ul> <p>Documentation</p> <ul style="list-style-type: none"> <li>• Details of insertion are documented in the records (including date, location, catheter lot number, and signature and name of operator undertaking insertion).</li> </ul>	
<p><b>Guidelines:</b>  <b>Health Protection Scotland:</b>  <b>Preventing infections when inserting and maintaining a CVC</b></p> <p>Developed by:  National Services Scotland</p>	<p>When inserting a CVC, ensure the following<sup>28</sup>:</p> <ul style="list-style-type: none"> <li>• Surgical scrub is performed immediately before donning maximal sterile barrier precautions (gloves and gown).</li> <li>• Health care workers use maximal sterile barrier precautions; including headwear, mask, sterile gown, and sterile gloves.</li> <li>• Maximal sterile barrier precautions are used by applying a sterile body drape to the patient.</li> <li>• Aseptic technique is maintained throughout insertion of CVCs.</li> <li>• A solution of 2% chlorhexidine in 70% isopropyl alcohol is used for skin preparation of the insertion site and allowed to dry before CVC insertion.</li> <li>• The subclavian site is used, if possible, or the internal jugular vein. (Femoral site should be avoided whenever possible.)</li> <li>• A sterile transparent, semipermeable dressing is used to cover the catheter site.</li> </ul> <p>Further information regarding insertion bundles is available online:  <a href="http://www.hps.scot.nhs.uk/haic/ic/evidenceforcarebundles.aspx">http://www.hps.scot.nhs.uk/haic/ic/evidenceforcarebundles.aspx</a></p>	

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