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## Brief report

# Adding innovative practices and technology to central line bundle reduces bloodstream infection rate in challenging pediatric population



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Disinfection cap  
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Chlorhexidine gluconate

A specialized pediatric hospital serves many patients with short bowel syndrome. The patients' fecal residue plus frequent access of intravenous lines increases bloodstream infection (BSI) risk. To reduce BSIs, the hospital first implemented an alcohol-dispensing disinfection cap and then added 3 more interventions, with both the cap-only phase and the multipronged phase successfully lowering the hospital's BSI rate.

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A vulnerable patient population can cause a hospital's central line–associated bloodstream infection (CLABSI) rate to stay stubbornly above national benchmarks. Such a situation existed at an urban pediatric postacute care hospital (97 beds) where many patients have short bowel syndrome (SBS).

Patients with SBS cannot properly digest food or absorb nutrients and water, leading to diarrhea, other explosive bowel movements, malabsorption, and steatorrhea (oily or sticky stool).<sup>1</sup> These patients often require parenteral nutrition, delivered via central intravenous (IV) lines, to receive nourishment.

The diarrhea or explosive stool pattern increases the risk of enteric bacteria (*Enterobacteriaceae* family) colonizing the patient's skin or contaminating their environment. This then increases risk of a patient's IV line becoming contaminated, leading to a bloodstream infection.<sup>2,3</sup> SBS patients also require frequent IV line accesses, raising the risk.<sup>1</sup> In addition, patients' IV lines have extended dwell times, which amplify CLABSI risk as well.<sup>4</sup>

These factors kept the hospital's CLABSI rates alarmingly high. As a result, the hospital began an initiative to identify targeted interventions for enteric pathogens.

## METHODS

Because of patients' frequent line accesses, the hospital focused on its protocol for disinfecting IV needleless connector hubs.

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Hospitals normally require nurses to manually disinfect the hubs by wiping the hub with an isopropyl alcohol (IPA)–impregnated swab before accessing IV lines. This manual technique is notoriously prone to variance and noncompliance,<sup>5</sup> however, making it a logical suspect when hospitals have high CLABSI rates.

To rule out this cause, the hospital conducted a 7-month observational study that surprisingly showed neither noncompliance nor variance with hub disinfection. This suggested that the manual method might not adequately disinfect even when performed perfectly, especially given the SBS patients' elevated contamination risk.

To reduce CLABSIs, the hospital devised a multipronged preventive scheme that decreased potential contaminants and increased disinfection. It also hoped to identify both the most effective preventive measures and the unnecessary ones. The scheme began by trialing a disinfection cap (SwabCap; Excelsior Medical, Neptune, NJ) that supplements manual hub disinfection. The device addresses the primary reasons for variance and noncompliance with the manual method, while offering additional protection that manual disinfection cannot provide.

The device works by dispensing IPA over the hub and its external threads when it is twisted onto the threads. The cap provides 2 safeguards that scrubbing cannot: (1) it bathes the hub in IPA the whole time it is in place, which greatly increases disinfection compared with scrubbing; and (2) if kept in place between line accesses, it protects the hub from external contamination sources, including contamination, such as droplets from explosive bowel movements.

The cap was trialed in the third quarter of 2010. The hospital then added the following interventions to complete its

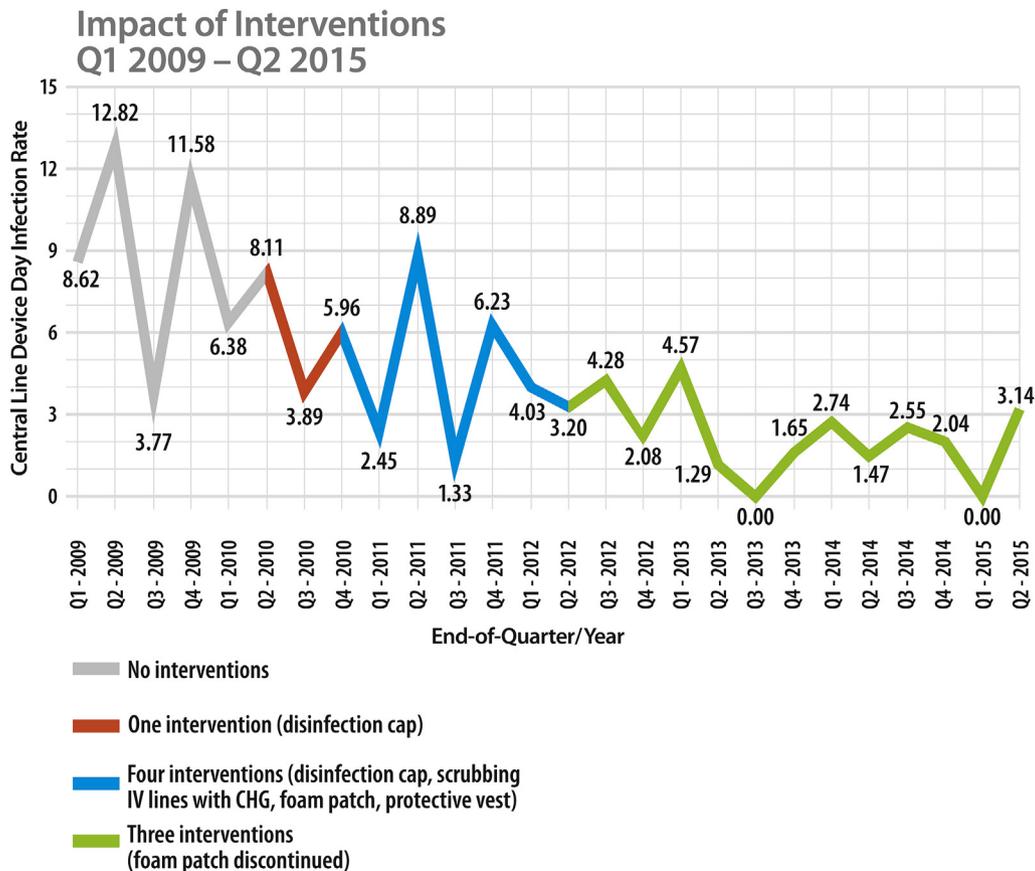


Fig 1. Impact of interventions (quarter 1 of 2009–quarter 2 of 2015). CHG, chlorhexidine gluconate; IV, intravenous.

multipronged initiative: (1) scrubbing patients' IV lines with chlorhexidine gluconate (CHG) after diaper changes to reduce line contamination from fecal bacteria; (2) using a CHG sponge dressing (Biopatch; Ethicon, Bridgewater, NJ) that secretes CHG at the catheter insertion site to protect the line from skin-based bacteria; and (3) placing a protective vest on pediatric patients so they would not handle their catheters and displace them.

Each intervention involved 20–25 patients (average age, 3 years). After implementing these interventions, staff decided that the CHG sponge dressing was problematic because it irritated some patients' skin and redundant given that IV lines were scrubbed with CHG. To test this, the hospital discontinued dressing use in May 2012 and then analyzed postdiscontinuation data.

## RESULTS

The CLABSI rate for the third quarter of 2010, when the disinfection cap alone was trialed, was 3.89 per 1,000 line days, a 54.7% drop from the rate of 8.59 per 1,000 line days from the previous 6 quarters (quarter 1 of 2009–quarter 2 of 2010).

The other 3 interventions were implemented in the fourth quarter of 2010. CLABSI rates have fluctuated erratically since then, partly because of the differences in patient acuity. Overall the trend has been clearly downward since the initiative began (Fig 1). Infection rates have dropped an aggregate 62.0% since other interventions besides the cap were added. The aggregate CLABSI rate for that period is 3.26 per 1,000 line days, a slight improvement on the drop in infections achieved with the cap alone.

Use of the CHG sponge dressing was discontinued midway through the second quarter of 2012. The CLABSI rate for that quarter was 3.20 per 1,000 line days. Since then, 6 of 8 quarters for which there is recorded data had CLABSI rates <3.20 per 1,000 line days. The aggregate CLABSI rate for the 7 quarters the CHG-impregnated dressing was used was 4.19 per 1,000 line days versus 2.35 per 1,000 line days for the 8 quarters since the dressing was discontinued.

## DISCUSSION

Because the disinfection cap was first trialed alone, these results can be evaluated separately. The cap was effective, with the CLABSI rate dropping by more than half (54.7%) during the 3-month period when the cap was the only intervention. (Note that nurses worried that restless patients might manipulate or remove the disinfection cap, but no such incidence has occurred).

CLABSIs dropped sharply after the cap supplemented strict compliance with manual disinfection. This suggests that even well-executed manual disinfection could not eliminate the contamination risk from SBS. The cap's greater disinfection ability, plus its ability to protect catheters from touch-airborne-droplet contamination, appears to have made an important contribution.

The overall initiative was also quite effective, with rates dropping 62% during the period when the 4 interventions were deployed together. The data also appear to confirm the sense that the CHG dressing provided no additional benefit in this hospital's

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