

Table: VAE incidence rates per 1,000 ventilator days in LTCH locations, 2016-2018

Year	Location	No. Locations ¹	No. VAEs	No. vent days	Pooled mean	Percentile ²		
						10%	50%	90%
2016	Critical Care	89 (86)	252	102,144	2.467	0	0	9.56
	Ward	597 (508)	1,817	1,087,080	1.671	0	0	6.38
2017	Critical Care	89 (84)	268	102,329	2.619	0	0	9.62
	Ward	571 (484)	1,464	1,044,161	1.402	0	0	5.37
2018	Critical Care	81 (77)	206	97,643	2.110	0	0	8.48
	Ward	546 (459) ³	1,283	942,132	1.362	0	0	4.95

¹No. of locations reporting >50 ventilator days/year shown in parentheses.

²Percentile distributions shown for locations with ≥ 20 units reporting >50 ventilator days per year.

³The VAE Outcome Measure was removed from the CMS LTCH QRP on October 1, 2018.

complications (IVAC), and possible ventilator-associated pneumonia (PVAP). Furthermore, we calculated pooled mean VAE rates per 1,000 ventilator days, and we determined the rate distributions for locations with ≥ 20 units reporting >50 ventilator days per year.

Results: Overall, 493 LTCHs reported 22,359 location months of VAE data from ward and critical care locations. In total, 5,290 VAEs were reported, of which 3,871 (73%) were VAC, 961 (18%) were IVAC, and 458 (9%) were PVAP. Also, 42% (2,241) of VAEs occurred in female patients, and 1,305 (25%) occurred in patients who died during their hospitalization. The median time from LTCH admission to VAE onset was 18 days (IQR, 9–37), and from initiation of mechanical ventilation to VAE onset was 22 days (IQR, 10–43). Pathogens were identified from 454 PVAPs, with *Pseudomonas aeruginosa* (43% of PVAPs) and *Staphylococcus aureus* (26%) being the most common organisms. Annual pooled mean incidence rates in critical care locations ranged from 2.11 to 2.62 VAEs per 1,000 ventilator days, whereas rates in ward locations ranged from 1.36 to 1.67 VAEs per 1,000 ventilator days (Table 1). **Conclusions:** During a period of required reporting, pooled mean LTCH VAE rates remained low. Most VAEs in LTCHs were reported as VACs. Additional work is needed to understand the clinical events associated with LTCH VAE, including whether most VAEs truly represent non-infection-related events or reflect limited evaluation to identify infection-related complications. This distinction might influence the identification of appropriate interventions to reduce LTCH VAE rates.

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Characteristics of Pediatric Ventilator-Associated Events Reported to the National Healthcare Safety Network, 2019

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Background: Mechanical ventilation is a life-saving measure for patients with respiratory failure; however, these patients are at high risk for complications and poor outcomes. Surveillance for ventilator-associated events (VAEs) via the CDC NHSN began in 2013 in adult patient care locations in hospitals. Pediatric ventilator-associated event (PedVAE) surveillance began in January 2019. The PedVAE definition is based on increases in mean airway pressure (MAP) or fraction of inspired oxygen (FiO₂). We summarized the first 9 months of PedVAE data reported to the NHSN. **Methods:** Neonatal and pediatric locations of US acute-care hospitals, long-

term acute-care hospitals, and inpatient rehabilitation facilities were eligible to participate in PedVAE surveillance as of January 1, 2019. When submitting PedVAEs to the NHSN, facilities may also optionally report information about antimicrobials, pathogens, and clinical events associated with PedVAEs. We analyzed PedVAE data from January through September 2019 submitted by facilities participating in surveillance according to the NHSN protocol. We calculated pooled mean incidence rates (no. events per 1,000 ventilator days) for neonatal and pediatric intensive care units (NICUs and PICUs), and we describe characteristics of PedVAEs. **Results:** Overall, 205 PedVAEs were reported: 111 events from 147 NICUs in 140 facilities and 94 events from 117 PICUs in 85 facilities. The pooled mean incidence was 1.61 events per 1,000 ventilator days in level 2 and 3 NICUs, 1.09 events per 1,000 ventilator days in level III NICUs, and 1.25 events per 1,000 ventilator days in PICUs. Of 205 PedVAEs, 133 (65%) met only the MAP criterion, 65 (32%) met only the FiO₂ criterion, and 7 (3%) met both. Optional data on antimicrobials, pathogens, and clinical events were reported for 74 of 205 PedVAEs (36%). Among these 74 events, antimicrobial administration was common (50 of 74, 68%). By contrast, a minority had a pathogen reported (21 of 74, 28%). Of 74 PedVAEs, 60 were associated with a clinical event (80%), although only 15 (20%) were reported to be associated with a clinical infection. Of 74 PedVAEs, 4 (5%) were associated with mechanical ventilation weaning. **Conclusions:** PedVAE incidence rates are low in NICUs and PICUs. Most PedVAEs appear to be associated with clinical events. Although a minority of PedVAEs were associated with infections or pathogens, antimicrobial administration was reported for >60%. Further evaluation of the clinical correlates of PedVAEs can inform development of effective prevention and antimicrobial stewardship in mechanically ventilated children.

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CHG Skin Application in Non-ICU Patients with Central Venous Catheters: Impact on CLABSI, MRSA Bacteremia, and LabID Rates

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Background: Prevention of central-line-associated bloodstream infections (CLABSIs) and methicillin-resistant *Staphylococcus aureus* (MRSA) infections requires a multifaceted approach including

strategies to decrease cutaneous bacterial colonization. Prior studies have shown benefit from chlorhexidine-gluconate (CHG) skin application on CLABSI and MRSA infection rates in intensive care units (ICUs); however, the use of CHG in the non-ICU population has not been well studied. **Methods:** We performed a quasi-experimental before-and-after study to evaluate the use of daily 2% CHG wipes in non-ICU patients at a 1,000 bed acute-care teaching hospital beginning in November 2017. The study population included adult and pediatric patients with central venous catheters on non-ICU units, excluding patients on the following units: stem cell transplant and hematologic malignancy (these units had already established use of CHG skin application as a standard prior to the intervention), labor and delivery, and psychiatry. CHG was applied according to the manufacturer's instruction by nurses or nurse aides and random monthly auditing of compliance was performed. NHSN CLABSI, hospital-onset MRSA bacteremia, and hospital-onset MRSA LabID rates were compared for the period 24 months before the intervention (November 1, 2015, through October 31, 2017) to the 24-month period after the intervention (November 1, 2017, through October 31, 2019) using a paired *t* test. Notably, the health system also discontinued the use of contact precautions for patients with MRSA (excluding MRSA from open, draining wounds) 11 months prior to onset of this intervention. **Results:** The CLABSI rate decreased by 26% from 0.594 events per 1,000 central-line days (*n* = 50) before the intervention to 0.438 events per 1,000 central-line days (*n* = 38) after the intervention (*P* = 0.19). The number of CLABSIs with gram-positive organisms also decreased by 29%. MRSA LabID rates decreased by 37% from 0.301 events per 1,000 patient days (*n* = 119) to 0.189 events per 1,000 patient days (*n* = 75) (*P* = 0.01). MRSA bacteremia rates decreased by 79% from 0.058 events per 1,000 patient days (*n* = 23) to 0.012 events per 1,000 patient days (*n* = 5) (*P* < 0.01). Compliance with the intervention was 83% (*n* = 225). **Conclusions:** Daily CHG skin application in non-ICU patients with central venous catheters is an effective strategy to prevent CLABSIs and MRSA infections. We observed a decrease in MRSA LabID and bacteremia rates despite discontinuation of contact precautions. These findings suggest that a horizontal prevention approach of daily CHG skin application may be an effective alternative to contact isolation to interrupt transmission of MRSA in hospitalized patients outside the ICU setting.

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Chlorhexidine Dressings to Prevent Catheter-Related Bloodstream Infections: A Systematic Literature Review and Meta-analysis

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Background: Catheter-related bloodstream infections (CRBSIs) are associated with significant morbidity and mortality. We aimed to determine the effectiveness of chlorhexidine (CHG) dressings in preventing incident CRBSI in different settings and types of catheters. **Methods:** We searched PubMed, Cochrane Library, CINAHL, Embase, and ClinicalTrials.gov through March 2019 for studies with the following inclusion criteria: (1) population consisted of patients requiring short or long-term catheters; (2) CHG dressing was used in the intervention group and a nonantimicrobial impregnated dressing was used in the control group; (3) CRBSI was reported as an outcome. Randomized controlled trials (RCTs) and quasi-experimental studies were included. We used a random-effect models to obtain pooled OR estimates. Heterogeneity was evaluated with I² test and the Cochran Q statistic. **Results:** The review included 21 studies (17 RCTs). The use of CHG dressings was associated with a lower incidence of CRBSI (pooled RR, 0.63; 95% CI, 0.53–0.76). There was no evidence of publication bias. In stratified analyses, CHG dressing reduced CRBSI in ICU adult patients (9 studies, pRR, 0.52; 95% CI, 0.38–0.72) and adults with oncohematological disease (3 studies, pRR, 0.53; 95% CI, 0.35–0.81) but not in neonates and pediatric populations (6 studies, pRR, 0.90; 95% CI, 0.57–1.40). When stratified by type of catheter, CHG dressing remained protective against CRBSI in short-term venous catheters (11 studies, pRR, 0.65; 95% CI, 0.48–0.88) but not in long-term catheters (3 studies, pRR, 0.76; 95% CI, 0.19–3.06). Other subgroup analyses are shown in Table 1. **Conclusions:** CHG dressings reduce the incidence of CRBSI, particularly in adult ICU patients and adults with an onco-

Table 1. Subgroup Analyses

Subgroups	No. of Studies	No. of CHG Catheters/ Control Groups	Pooled RR (95% CI)	I ² Test (%)
All studies	21	7,806/7,761	0.63 (0.53–0.76)	0
Transparent CHG dressing (Tegaderm®)	8	2,654/5,506	0.58 (0.40–0.84)	0
CHG-impregnated disc (Biopatch®)	10	5,009/5,113	0.67 (0.49–0.92)	22
RCTs	17	6,393/6,235	0.58 (0.45–0.76)	1
Non-RCT or unclear design	4	1,413/1,523	0.69 (0.53–0.89)	1
Femoral insertion (≥44% study population)	3	389/368	0.65 (0.23–1.85)	7
Antimicrobial-impregnated catheters	2	607/607	0.55 (0.36–0.84)	0
Same frequency of dressing change in both groups	12	5,137/4,910	0.55 (0.40–0.75)	0
Different frequency of dressing change between intervention and control groups (7 vs ≤ 3 d)	5	1,010/1,058	0.62 (0.38–1.00)	14