

Introduction

- Central venous catheters (CVCs) are often required during the course of treatment of patients in the intensive care unit (ICU), constituting approximately 15 million CVC days per year among ICU patients.^{1,2}
- CVC use in the hospital is associated with complications, including bloodstream infections (BSI). Estimates suggest >250,000 episodes of CVC-related BSI occur annually in the US.³
- BSI puts patients at increased risk of:^{3,4}
 - Death
 - Extended ICU or hospital stays
 - Rehospitalization, emergency room, or follow-up outpatient visits to healthcare professionals

Objective

To assess the clinical and economic impact of BSI among patients of a managed care provider group who had a CVC placed during an ICU stay.

Results

- The study design with inclusion and exclusion criteria is depicted in Figure 1.
 - There were 522 case episodes and 1441 control episodes identified from 184,904 hospital admissions during the study period.
- Patient demographics and characteristics are presented in Table 1. Relative to control episode patients, case episode patients were:
 - More likely to have a medical ICU admission and less likely to have a surgical ICU admission.
 - More likely to have a diagnosis of diabetes or end-stage renal disease (ESRD).

Figure 1. Study Design

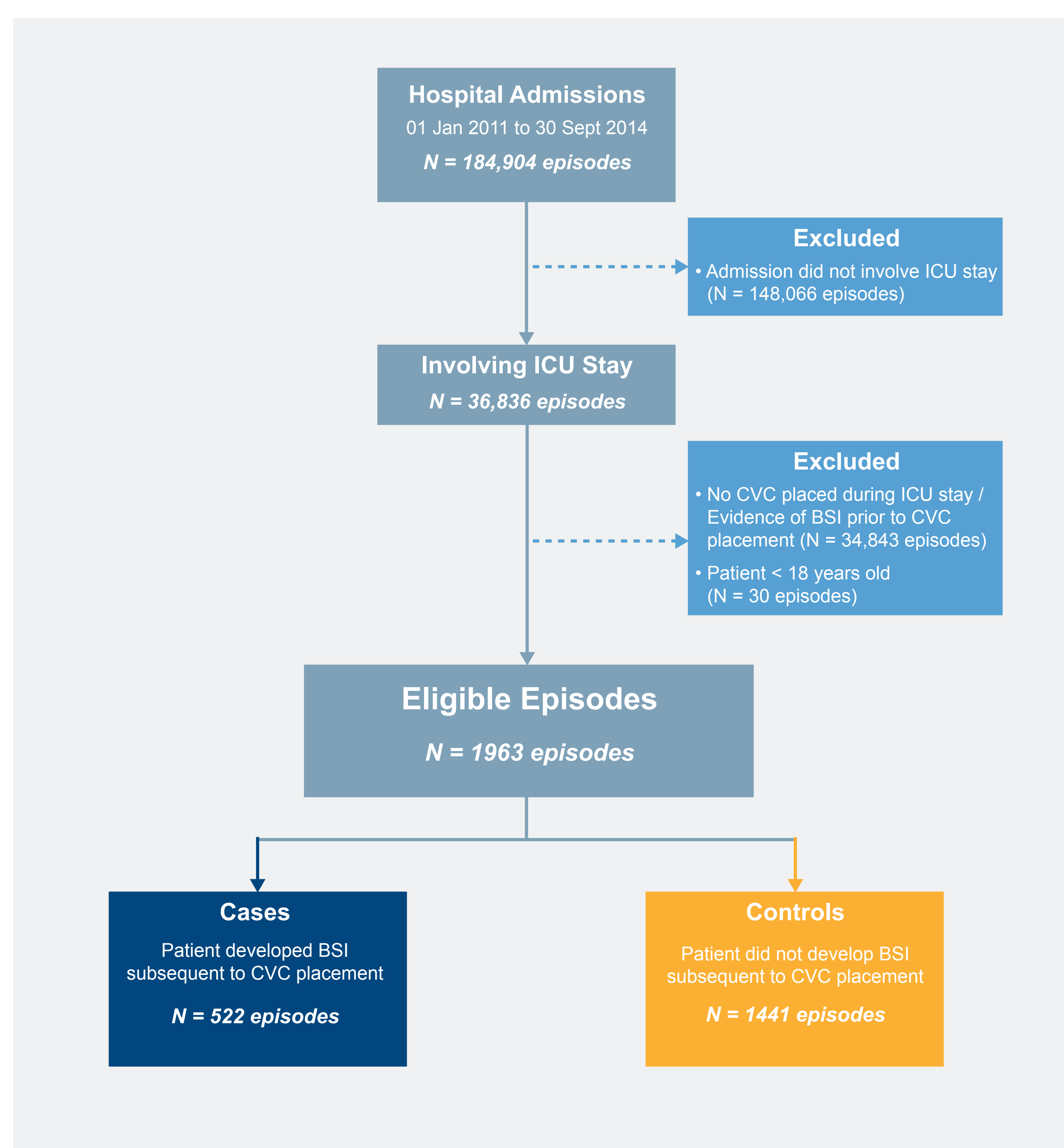


Table 1. Patient Demographics and Characteristics

	Case Episodes (CVC placed in ICU w/ subsequent BSI) N = 522 episodes	Control Episodes (CVC placed in ICU w/o subsequent BSI) N = 1441 episodes	P-value
Age, years	mean ± SD 70.0 ± 13.3	70.7 ± 13.0	0.26
	median [p25, p75] 71 [65, 79]	72 [65, 79]	
Gender	n (%)		0.29
Male	272 (52.1)	790 (54.8)	
Female	250 (47.9)	651 (45.2)	
Race	n (%)		0.65
White	162 (31.0)	460 (31.9)	
Black	32 (6.1)	85 (5.9)	
Asian	22 (4.2)	47 (3.3)	
Other	2 (0.4)	13 (0.9)	
Unknown/missing	304 (58.2)	836 (58.0)	
Ethnicity	n (%)		0.61
Hispanic or Latino	82 (15.7)	213 (14.8)	
Other/unknown	440 (84.3)	1228 (85.2)	
ICU admission type	n (%)		< 0.001
Medical	474 (90.8)	1017 (70.6)	
Surgical	41 (7.9)	380 (26.4)	
Oncologic	7 (1.3)	44 (3.1)	
Diabetes	n (%)		< 0.001
	235 (45.0)	511 (35.5)	
ESRD	n (%)		< 0.001
	76 (14.6)	128 (8.9)	
Malignancy	n (%)		0.49
	198 (37.9)	522 (36.2)	

Abbreviations: BSI, bloodstream infection; CVC, central venous catheter; ESRD, end-stage renal disease; ICU, intensive care unit; p25, 25th percentile; p75, 75th percentile; SD, standard deviation.

References

1. Mermel LA. Prevention of intravascular catheter-related infections. *Ann Intern Med.* 2000;132(5):391–402.
2. O'Grady NP et al. Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis.* 2011;52(9):e162–93.
3. Blot SI et al. Clinical and economic outcomes in critically ill patients with nosocomial catheter-related bloodstream infections. *Clin Infect Dis.* 2005;41(11):1591–98.
4. Dudeck MA et al. National Healthcare Safety Network report, data summary for 2013, Device-associated Module. *Am J Infect Control.* 2015;43(3):206–21.

Methods

Data Source

- This study was a retrospective observational analysis of data on patients of a managed care provider group administering health care services in the US. The group covers approximately 750,000 enrolled members at any time across a variety of care settings in Southern California and Nevada.

Study Patients and Exposure

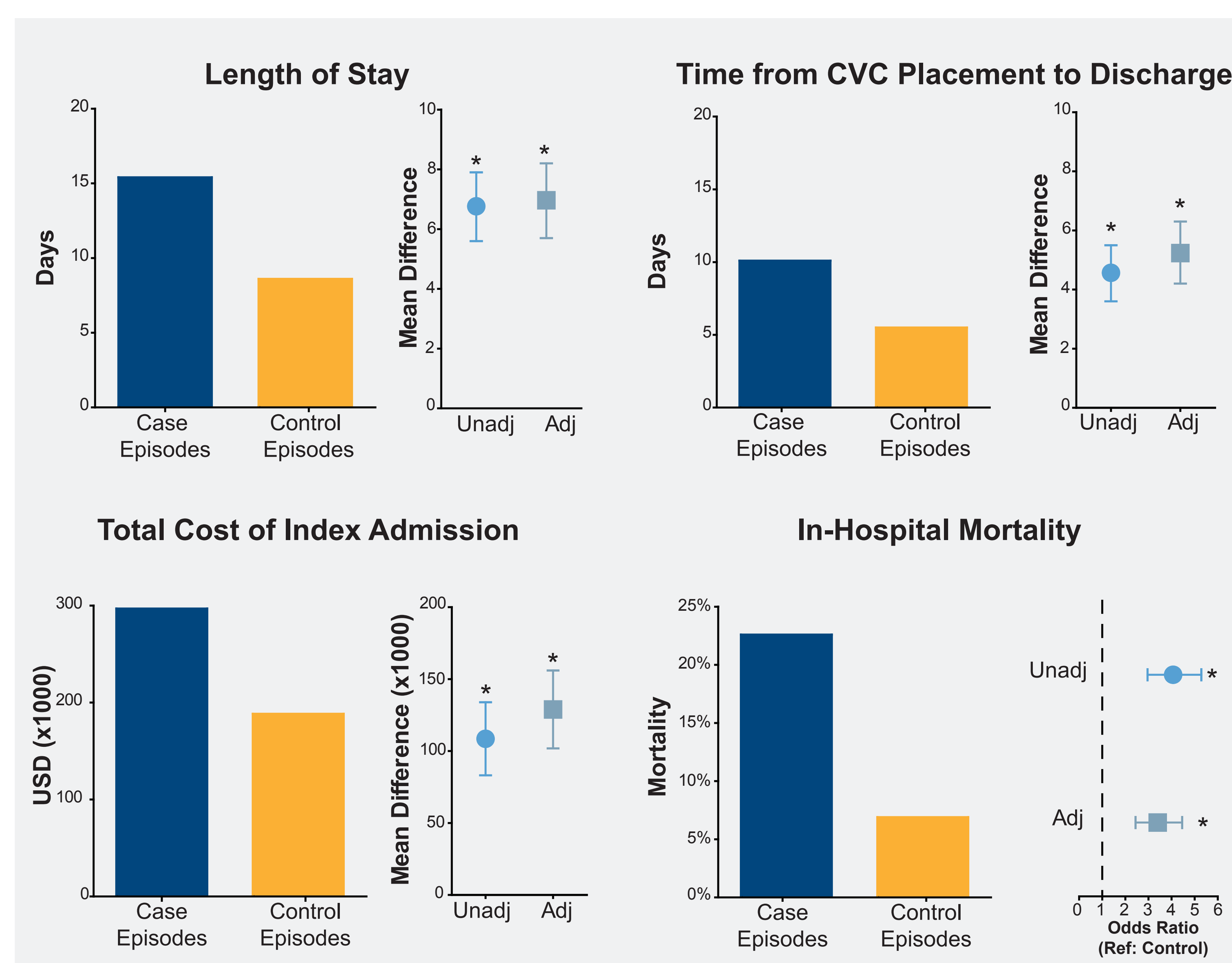
- Patient episodes eligible for inclusion in this analysis were those for which:
 - The patient was ≥ 18 years of age and was admitted to the hospital between 01 January 2011 and 30 September 2014
 - The index hospitalization included an ICU stay (medical, surgical, coronary care, mixed or intermediate care units)
 - A CVC was placed during the ICU stay; no evidence of BSI prior to CVC placement
- Patients could contribute more than one qualifying episode to the analysis:
 - Case episodes were those with infection due to catheter, bacteremia, or septicemia that occurred during the index hospitalization, on or after date of catheter placement.
 - Control episodes were those with a qualifying ICU admission and CVC placement, but no subsequent infection during index hospitalization.

Outcomes and Analysis

- Length of index hospitalization stay, hospitalization costs, and 180-day costs of care were compared using linear mixed models. In-hospital mortality and 30-day readmissions were compared using negative binomial regression models. Adjusted models included covariate terms for patient characteristics that were imbalanced across groups at baseline.

- Compared to control episodes, development of BSI (case episodes) after CVC placement in the ICU was associated with:
 - Longer hospital stay: 15.4 vs 8.6 days; adjusted mean difference, 7.0 days (95% CI: 5.7, 8.2)
 - Longer time between CVC placement and discharge: 16.2 vs 7.5 days; adjusted mean difference, 5.2 days (95% CI: 4.2, 6.3)
 - Greater cost of index hospital admission: \$296,933 vs \$188,387; adjusted mean difference, \$128,914 (95% CI: \$101,830, \$155,998)
 - More than 3-fold increase in mortality during the index hospitalization: 22.6% vs 6.9%; adjusted odds ratio, 3.30 (95% CI: 2.44, 4.46)
- No statistically significant differences were observed for 30-day readmission rates or costs of care over the 180-day period following discharge from the index admission (Figure 3).

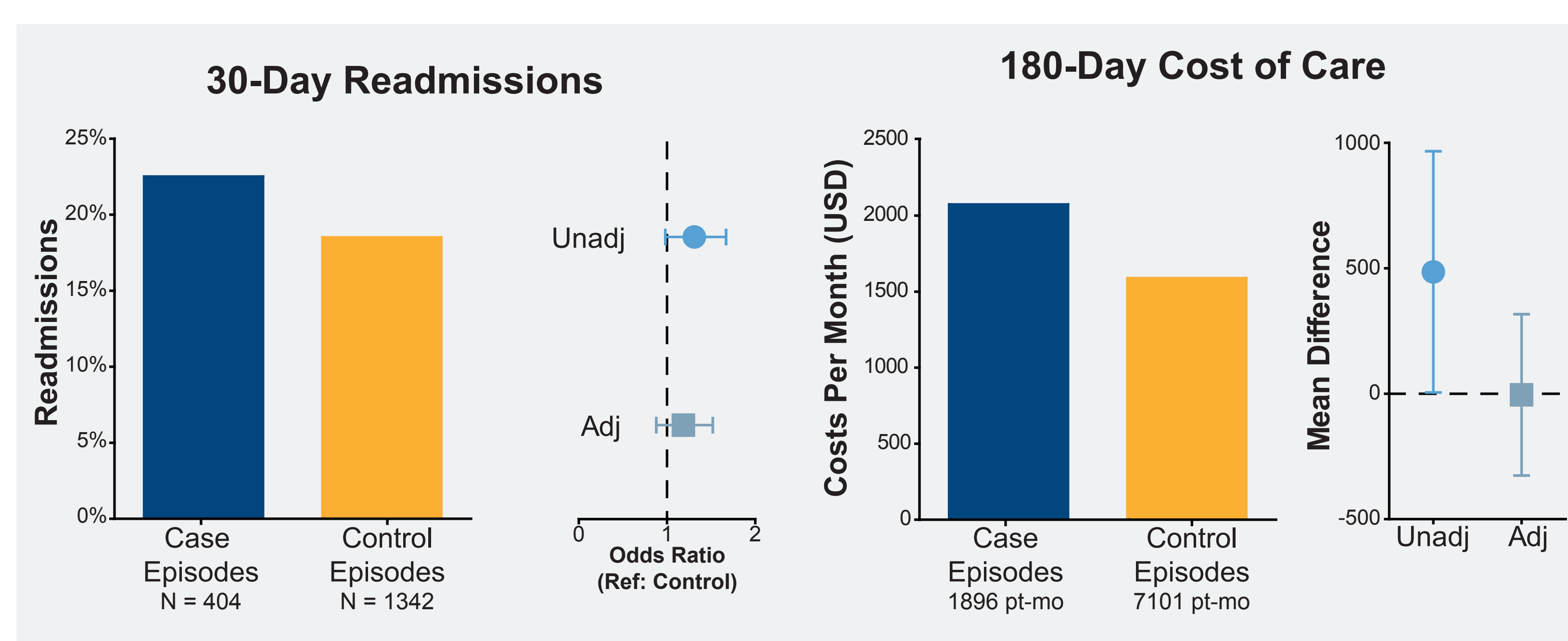
Figure 2. In-Hospital Events



* P < 0.05

Abbreviations: Adj, adjusted; CVC, central venous catheter; Unadj, unadjusted; USD, United States Dollars

Figure 3. Post-Discharge Events: Hospital Readmissions and Costs of Care



Abbreviations: Adj, adjusted; pt-mo, patient months; Ref, referent; Unadj, unadjusted; USD, United States Dollars

Conclusions

Episodes of BSI following CVC placement in ICU patients are associated with significant increases in length of hospital stay and costs of care as well as greater risk of in-hospital death.

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