RESEARCH BRIEFS

Assessing the Relative Burden of Hospital-Acquired Infections in a Network of Community Hospitals

Hospital-acquired infections (HAIs) occur commonly, cause significant harm to patients, and result in excess healthcare expenditures.[1] The urinary tract is frequently cited as the most common site of HAI, but these estimates were extrapolated from National Nosocomial Infection Surveillance (NNIS) data from the 1990s.[1] Updated information regarding the relative burden of specific types of HAIs would help governmental agencies and other stakeholders within the field of infection prevention to prioritize areas for research and innovation. The objective of our study was to assess the relative proportion of HAIs attributed to each of the following 5 types of infection in a network of community hospitals: catheter-associated urinary tract infection (CAUTI), surgical site infection (SSI), ventilator-associated pneumonia (VAP), central line–associated bloodstream infection (CLABSI), and *Clostridium difficile* infection (CDI).

We performed a retrospective cohort study using prospectively collected HAI surveillance data from hospitals participating in the Duke Infection Control Outreach Network (DICON). DICON hospital epidemiologists and liaison infection preventionists work directly with local hospital infection preventionists to provide surveillance data validation, benchmarking, and infection prevention consultation services to participating hospitals.[2]

Fifteen DICON-affiliated community hospitals (median size, 186 beds; range, 50–457 beds) that had continuously collected hospital-wide and surgical surveillance data from January 1, 2010, through June 30, 2012, were included in the study. Infection preventionists at each hospital prospectively identified all HAIs occurring in intensive care unit (ICU) and non-ICU locations using standardized National Healthcare Safety Network (NHSN) surveillance definitions.[3,4] All adult and pediatric cases of CLABSI, CAUTI, VAP, and hospital-onset healthcare facility–associated (HO-HCFA) CDI identified during the study period were included in the analysis. SSIs identified after 37 procedure types performed during the study period were included in this analysis if they met the following criteria: (1) surgery did not involve implanted material, and SSI occurred within 30 days; or (2) surgery involved implanted material, and SSI occurred within 90 days.

The 30-month healthcare exposure period included 100,449 surgical procedures, 135,716 ICU inpatient-days, 1,596,277 non-ICU inpatient-days, 244,105 central line-days, 393,948 urinary catheter–days, and 53,352 ventilator-days. A total of 2,345 HAIs were identified. SSIs were the most common HAI (n = 882; 38%). The second most common HAI was CAUTI (n = 611; 26%), followed by HO-HCFA CDI (n = 514; 22%), CLABSI (n = 280; 12%), and VAP (n = 58; 2%).

The median percentage of HAIs due to SSIs at each hospital was 43% (range, 16%–63%). SSIs were the most frequent HAI for 12 hospitals (80%). The proportion of HAIs due to SSIs was not related to surgical volume or the ratio between surgical and inpatient volume at individual hospitals (data not shown).

The overall prevalence rate of SSI in our cohort was 0.82 infections per 100 operations. The most common surgical procedures to result in infections are shown in Table 1 and include colon surgery (90 SSIs; 2.6 SSIs per 100 operations), open herniorrhaphy (69 SSIs; 0.7 SSIs per 100 operations), knee replacement surgery (63 SSIs; 0.8 SSIs per 100 operations), and Cesarean delivery (63 SSIs; 0.9 SSIs per 100 operations). One-third of all identified SSIs (n = 316) were superficial-incisional. A total of 600 SSIs (68%) were identified at the time of hospital readmission. Only 169 SSIs (19%) were identified in the outpatient setting. The incidence rates of other HAIs were comparable to or lower than rates published by the NHSN[5] and included 1.6 CAUTIs per 1,000 urinary catheter-days, 1.1 CLABSIs per 1,000 central line-days, 1.1 VAPs per 1,000 ventilator-days, and 3.0 cases of HO-HCFA per 10,000 inpatient-days.

SSIs were the most frequently observed HAI in this large cohort of community hospitals in the southeastern United States. This finding is remarkable, because the overall rate of SSI in this cohort was low. However, because the surgical volume in these hospitals was relatively high, the total burden of HAIs due to SSI exceeded that of other HAIs. Our large, multicenter study validates the results of other recent investigations. For example, SSIs were the most common HAI and accounted for 39% of all HAIs reported to the NHSN at a single academic medical center.[6] In another study, SSIs accounted for 31% of the 58 HAIs identified during a point prevalence survey of 9 acute care hospitals in a single city.[7]

Our study has important limitations. First, our cohort included only community hospitals in one region of the United States. Thus, even though the majority of hospitals in the United States are similar in size to the hospitals in our cohort, our results may not be generalizable to all settings. Second, we suspect that our data underestimate the true frequency with which SSIs actually occur. SSIs occurring in outpatients are underrecognized by current SSI surveillance mechanisms. This is particularly important because more than 50% of all SSIs occur after hospital discharge.[8] Additionally, because non-ventilator-associated pneumonias, non-catheter-associated UTIs, and SSIs after procedure types not reported to the NHSN were not included in this data analysis, we may have undercounted the actual burden of SSIs and other types of HAIs in this cohort of hospitals.[6] We believe, however, that

https://doi.org/10.1086/673443 Published online by Cambridge University Press

TABLE 1. Prevalence Rates of Surgical Site Infection (SSI) for Select Surgical Procedures, Duke Infection Control Outreach Network, January 1, 2010–June 30, 2012

Procedure type	Total no. of procedures	No. of SSI identified within 90 days	Prevalence of infection by procedure type[a]
Colon surgery	3,473	90	2.6
Open hernia repair	9,554	69	0.7
Cesarean delivery	7,385	63	0.9
Knee arthroplasty	7,453	63	0.8
Breast surgery[b]	6,481	56	0.9
Hip arthroplasty	4,830	55	1.1
Abdominal hysterectomy	5,026	47	0.9
Small bowel surgery	1,005	43	4.3
Spinal fusion	3,912	38	1.0
Peripheral vascular bypass surgery	766	26	3.4
Coronary artery bypass grafting	1,495	25	1.7
Vaginal hysterectomy	3,129	18	0.6

[a] SSIs per 100 operations.
[b] Without implants.

it is unlikely that any one specific HAI not included in our analysis occurs frequently enough to supplant SSIs as the most common HAI.

SSIs are now the most common HAI in our community hospital network. We believe that our findings highlight the need for improved and expanded evidence-based interventions to effectively reduce the rate of SSIs in real-world settings. Collectively, the infection prevention community has already made substantial and important progress in reducing HAIs due to CLABSI and CAUTI in the past decade. It is time to shift our focus to finding better and new ways to prevent SSI.

ACKNOWLEDGMENTS

Financial support. This work was supported by the National Institute of Allergy and Infectious Diseases at the National Institutes of Health (K23 AI095457 to D.J.A.).

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

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Received March 28, 2013; accepted May 19, 2013; electronically published November 1, 2013.
Infect Control Hosp Epidemiol 2013;34(11):1229-1230
 0899-823X/2013/3411-0019$15.00. DOI: 10.1086/673443

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