ORIGINAL ARTICLE

The Impact of Depth of Infection and Postdischarge Surveillance on Rate of Surgical-Site Infections in a Network of Community Hospitals

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OBJECTIVE. To describe the epidemiology of surgical-site infections (SSIs) in community hospitals and to explore the impact of depth of SSI, healthcare location at the time of diagnosis, and variations in surveillance practices on the overall rate of SSI.

DESIGN. Retrospective cohort study.

SETTING. Thirty-seven community hospitals in the southeastern United States.

PATIENTS. Consecutive sample of patients undergoing surgical procedures between July 1, 2007, and December 31, 2008.

METHODS. ANOVA was used to compare rates of SSIs, and the F test was used to compare the distribution of rates of SSIs. Wilcoxon rank-sum was used to test for differences in performance rankings of hospitals.

RESULTS. Following 177,706 surgical procedures, 1,919 SSIs were identified (incidence, 1.08 per 100 procedures). Sixty-four percent (1,223 of 1,919) of these were identified as complex SSIs; 87% of the complex SSIs were diagnosed in inpatient settings. The median proportion of superficial-incisional SSIs was 37% (interquartile range, 29.6%–49.5%). Postdischarge SSI surveillance was variable, with 58% of responding hospitals using surgeon letters. As reporting focus was narrowed from all SSIs to complex SSIs (incidence, 0.69 per 100 procedures) and, finally, to complex SSIs diagnosed in the inpatient setting (incidence, 0.51 per 100 procedures), variance in rates changed significantly ($P = .02$). Performance ranking of individual hospitals, based on rates of SSIs, differed significantly, depending on the reporting method utilized ($P = .0006$).

CONCLUSIONS. Inconsistent reporting methods focused on variable depths of infection and healthcare location at time of diagnosis significantly impact rates of SSI, distribution of rates of SSI, and hospital comparative-performance rankings. We believe that public reporting of SSI rates should be limited to complex SSIs diagnosed in the inpatient setting.

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Surgical-site infections (SSIs) are an important category of healthcare-associated infection (HAI) because they cause substantial morbidity, mortality, and prolonged length of hospital stay and result in high cumulative healthcare costs.[1-3] Indeed, SSIs are estimated to cost the US healthcare system upward of $10 billion annually.[4]

Hospitals and ambulatory surgical centers now face increasing external pressures to publicly report their rates of SSIs and to improve outcomes for surgical patients.[5] This pressure comes from many sources, including national directives, the general public, and pay for performance tied to specific process measures. As of July 2011, 36 states have enacted laws related to the reporting of HAIs.[6] The recently approved healthcare reform law underscores the importance of this issue with a provision calling for mandatory public reporting of all HAIs nationwide.[7]

The ability to properly inform the public of SSI rates is dependent on a reporting method focused on those categories of SSIs that are most accurately diagnosed and a clinical setting where surveillance is standardized. Currently, however, SSI surveillance methods vary from hospital to hospital, and no standardized method exists for public reporting of SSI rates. Thus, we undertook this study (1) to describe the epidemiology of SSIs in community hospitals, stratified by depth of infection and healthcare setting at the time of diagnosis (inpatient vs outpatient), (2) to describe variations in the surveillance practices for superficial-incisional SSIs and SSIs diagnosed in the outpatient setting among hospitals in an

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TABLE 1. Epidemiological Features of 177,706 Surgical Procedures in 2007–2008: Patient, Procedure, and Size Characteristics for 37 Community Hospitals

Characteristic	Value
Patient characteristics	
Mean age, years (SD)	52 (19)
NHSN risk index, *n* (%)	
0–1	160,415 (90.2)
2–3	17,387 (9.8)
Procedure characteristics	
Surgical procedure, *n* (%)	
General surgery	78,046 (44)
Orthopedics	43,897 (25)
Obstetrics-gynecology	26,530 (15)
Cardiothoracic[a]	6,139 (3)
Neurosurgery	10,924 (6)
Subspecialty[b]	12,266 (7)
Total	177,706 (100)
Hospital characteristics	
Hospital bed size, median (IQR)	232 (142–349)
Annual surgical volume, median (IQR)	3,931 (2,143–5,965)

NOTE. IQR, interquartile range; NHSN, National Healthcare Safety Network.

[a] Includes cardiac (2,809) and thoracic (3,330) surgeries.

[b] Includes ear/nose/throat (ENT), ophthalmology, plastic surgery, vascular surgery, urology, podiatry, anesthesiology, and oral surgery.

infection control network, and (3) to determine the impact of excluding superficial-incisional SSIs and/or SSIs diagnosed in outpatient settings on the overall rate of SSI. We hypothesized that narrowing our focus to deeper-seated SSIs and the inpatient setting would highlight the most clinically significant SSIs and minimize the variability in overall SSI rates due to differences in surveillance methods.

METHODS

We performed a retrospective analysis of prospectively collected data on 14 categories of surgical procedures performed from July 1, 2007, through December 31, 2008, at 37 community hospitals affiliated with the Duke Infection Control Outreach Network (DICON), an infection surveillance network in the southeastern United States.[8] We collected the following data on all patients who underwent surgical procedures at the study hospitals: type of surgery, date of surgery, patient demographics, National Healthcare Safety Network (NHSN) risk index score, healthcare location at time of diagnosis of SSI (index inpatient admission, readmission, or outpatient/postdischarge), and microbiological data.[2,9] All data were collected by trained infection preventionists. Deep-incisional and organ/space SSIs were collectively defined as complex SSIs.[2] SSIs diagnosed in the inpatient setting were defined as SSIs diagnosed in either the index hospitalization or during readmission. SSI incidence was calculated per 100 procedures.[10] Data were maintained in Access (Microsoft) and analyzed with Stata (v11) and SAS (v9.1) software.

All hospitals performed outpatient surveillance for SSIs. Hospitals were polled to provide additional data regarding the methods each used for surveillance of SSIs in the outpatient setting and, in particular, whether letters to surgeons were part of their surveillance programs. For hospitals that sent letters to surgeons, we requested an estimate of the proportion of these letters that were returned during the calendar year.[11]

SSI and patient characteristics were described as counts, incidence, and proportions. Descriptive statistics were calculated to determine mean and standard deviation for normally distributed data; median and ranges were determined for nonparametric data. ANOVA was used to compare rates of SSIs at study hospitals; the *F* test was used to compare the distribution of rates of SSIs. The Wilcoxon rank-sum was used to test for differences in performance rankings of hospitals sorted by rates of complex SSIs alone, complex SSIs diagnosed in the inpatient setting, and all reported SSIs. A two-tailed *P* value of .05 or less was considered significant.

Some groups have advocated for reporting of major surgical procedures that are currently the focus of the Surgical Care Improvement Project (SCIP).[12] Thus, we performed a subanalysis of the following 7 surgical procedures: coronary artery bypass grafting (CASX), colorectal surgery (COLO), hip arthroplasty (HPRO), knee arthroplasty (KPRO), abdominal hysterectomy (HYST, VHYS), and vascular surgery (VASX).[13]

RESULTS

The median hospital bed size was 232 beds (interquartile range [IQR], 142–349); 177,706 surgical procedures were performed during the 18-month study period. The median an-

TABLE 2. All Surgical-Site Infections, Stratified by Healthcare Location at Time of Diagnosis

		Complex		
Location	Superficial-incisional	Deep-incisional	Organ/space	Total
Current admission	116	116	127	359 (19)
Readmission	318	467	349	1,134 (59)
Outpatient	262	115	49	426 (22)
Total	696 (36)	698 (37)	525 (27)	1,919 (100)[a]

NOTE. Data are number (%) of surgical-site infections.

[a] 96 patients (4.7%) were excluded because of missing data.

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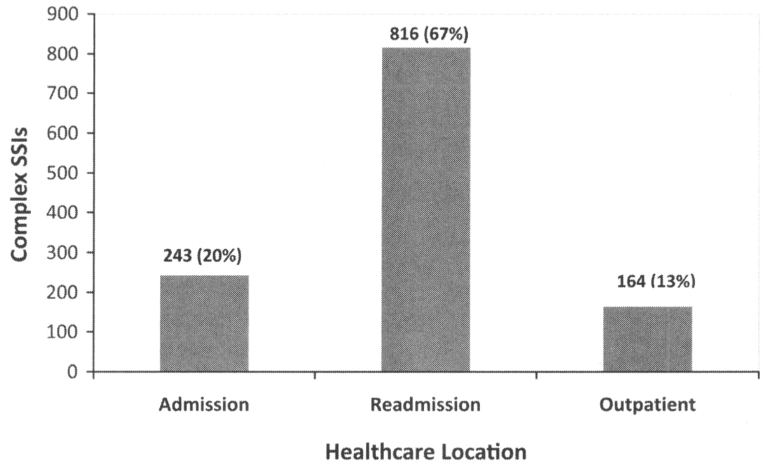

FIGURE 1. Complex surgical-site infections (SSIs), stratified by healthcare location at time of diagnosis.

nual surgical volume per hospital was 3,931 procedures (IQR, 2,143–5,965; Table 1). General surgery (n = 78,046; 44%), orthopedics (n = 43,897; 25%), and obstetrics-gynecology (n = 26,530; 15%) constituted the vast majority (84%) of surgical procedures during the study period. Patient age was evenly distributed (mean ± SD, 52 ± 19 years), and for most of the procedures patients had low baseline NHSN risk scores of 0 or 1 (90%; 160,415 of 177,706).

In total, 1,919 SSIs were diagnosed during the 18-month study period (overall rate of SSI, 1.08 per 100 procedures). The majority of SSIs were diagnosed in the inpatient setting (78%; 1,493 of 1,919), and a majority of all SSIs were complex in depth (64%; 1,223 of 1,919; Table 2). Of the complex SSIs, 87% (1,059 of 1,223) were diagnosed in the inpatient setting, and 67% (816 of 1,223) required hospital readmission (Figure 1). Superficial-incisional SSIs represented 36% (696 of 1,919) of all infections. Of note, most of the SSIs diagnosed in the outpatient setting were superficial-incisional (62%, 262 of 426). The median proportion of superficial-incisional SSIs at participating hospitals was 37%; however, there was wide

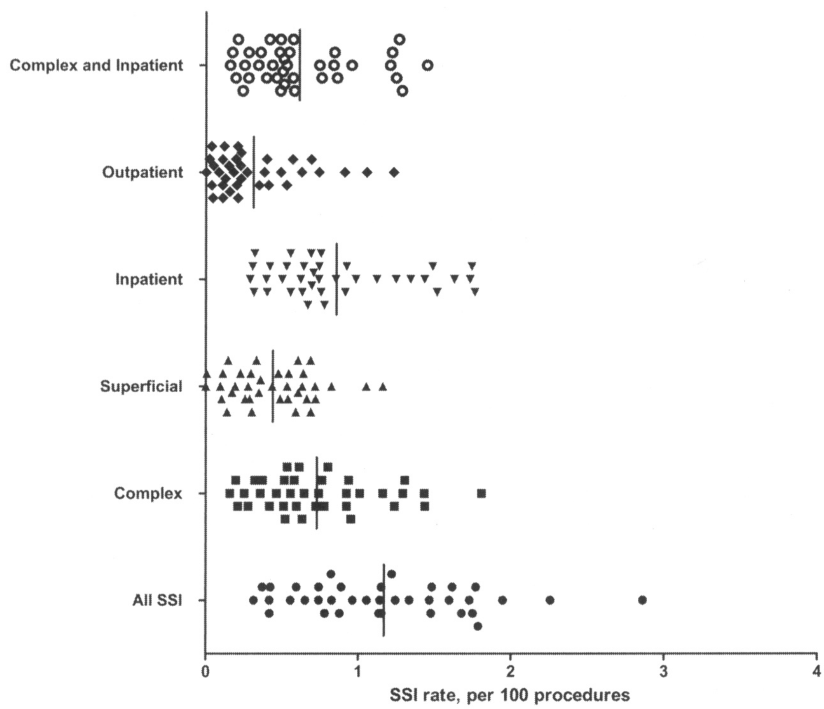

FIGURE 2. Distribution of surgical-site infection (SSI) rates at study hospitals, stratified by reporting method. The solid vertical line represents median incidence of SSIs among study hospitals.

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TABLE 3. Variance in Rates of Surgical-Site Infections (SSIs) at Study Hospitals as Focus of Reporting Narrowed

Reporting method	Incidence of SSI, per 100 procedures	P[a]
Overall SSI	1.08	
All SSIs, median (IQR)	1.14 (0.74–1.60)	Ref
Clinical setting, inpatient only, median (IQR)	0.74 (0.56–1.12)	<.05
Depth of infection, complex SSIs only, median (IQR)	0.63 (0.46–0.94)	<.05
Complex SSIs in inpatient setting, median (IQR)	0.51 (0.36–0.84)	<.05

NOTE. IQR, interquartile range.
[a] Hypothesis testing with ANOVA.

variation in this proportion between hospitals (IQR, 29.6%–49.5%).

Questionnaires were sent to all participating hospitals to quantify outpatient postdischarge surveillance practices. In total, 31 of the 37 hospitals (84%) responded; 18 of the 31 hospitals (58%) utilized surgeon letters, while 13 (42%) used other methods. Of the hospitals that did use surgeon letters, the median response rate was 57% (range, 25%–100%).

The mean overall rate of SSIs at study hospitals was significantly different from the mean rate of complex SSIs (1.08 vs 0.69 per 100 procedures; relative rate, 1.57; $P = .0003$). In addition, significant differences in the distribution of rates of SSIs were seen when reporting was limited by depth of infection and/or the healthcare location at the time of diagnosis. As we narrowed our focus from all SSIs to complex SSIs and, finally, to complex SSIs diagnosed in the inpatient setting, variance in rates changed significantly (Figure 2; Table 3; $P = .02$). Finally, the performance ranking of individual hospitals based on rates of SSIs differed significantly, depending on which of these three reporting methods was utilized (Table 4; $P = .0006$). For example, Hospital G was the seventh-best-performing hospital when all SSIs were analyzed but was the top-performing hospital when the analysis was limited to complex SSIs diagnosed in the inpatient setting.

Staphylococcus aureus species were the most common cause of SSI in our study (35.9%; 689 of 1,919), with methicillin-resistant *S. aureus* (MRSA) being the most frequent pathogen overall (21.1%; 405 of 1,919). MRSA was also the most commonly implicated pathogen in superficial-incisional (24.1%; 168 of 696) and complex SSIs (19.3%; 236 of 1,223). Of note, superficial-incisional SSIs were more likely than complex SSIs to be diagnosed without culture (14.4% vs 7.9%; $P < .0001$).

The subgroup analysis of the 7 SCIP major surgical categories included 852 SSIs diagnosed following 45,872 procedures (overall rate of SSI for SCIP procedures, 1.86 per 100 procedures). The proportion of complex SSIs (540 of 852; 63.4%) was similar to that in the overall study population, with a majority of all complex SSIs (76.3%; 412 of 540) being diagnosed in the inpatient setting. Results of additional comparisons among this group were essentially unchanged from those presented for the full cohort (data not shown).

DISCUSSION

Public disclosure of rates of SSIs is controversial but inevitable.[7] While public reporting of performance measures may yield potential benefits, including improved transparency and motivation for improved quality of care, it has had minimal effect on patient outcomes to date. In contrast, public reporting has already led to potentially harmful changes in practice and referral patterns.[14] Furthermore, appropriate, consistent, and validated reporting must be implemented, or hospitals will be unfairly and inaccurately judged.

The current method of reporting assumes all SSIs to be equal; we believe that this assumption is incorrect when clinical sequelae and patient values are considered. Our study demonstrated that reporting methods focused on variable depths of infection and healthcare location at time of diagnosis had important effects on rates of SSI, distribution of rates of SSI, and hospital comparative-performance rankings. We believe that our results support the limitation of public reporting of SSI rates to complex SSIs diagnosed in the inpatient setting.

The diagnosis of superficial-incisional SSIs is subjective, inconsistent, and prone to error.[2,15] Such inconsistencies in the reliability and accuracy of detecting superficial-incisional SSIs probably caused the wide variability in the proportion of all SSIs that are categorized as superficial-incisional among our study hospitals. The uncertainty of data related to superficial-incisional SSIs is further magnified in comparisons of surgical performance of hospitals that conduct SSI surveillance at varying levels of quality and intensity.[16-18] We believe that uncertainty related to inconsistent detection of superficial-incisional SSIs should be addressed by excluding them if data are used for interhospital comparisons—as illustrated by a recent study comparing the surveillance systems of the Netherlands and Germany, where the difference in overall SSI rates was reduced when superficial-incisional SSIs were excluded from reporting.[19] Exclusion of superficial-incisional SSIs in our study similarly resulted in significant differences in rates of SSIs and significant variance in rates of SSIs at participating hospitals. We believe that these shortcomings of superficial-incisional SSI diagnosis introduce sig-

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TABLE 4. Impact of Reporting Method on Surgical-Site Infection (SSI) Rates and Hospital Performance Rankings

Hospital ID	Performance ranking (by reporting method)[a]		
	All SSIs	Complex SSIs	Complex/inpatient only[b]
A	1	3	4
B	2	2	2
C	3	5	3
D	4	6	5
E	5	9	11
F	6	4	6
G	7	1	1
H	8	8	8
I	9	22	21
J	10	17	15
K	11	13	13
L	12	14	16
M	13	19	19
N	14	16	22
O	15	24	27
P	16	7	10
Q	17	21	24
R	18	20	23
S	19	11	17
T	20	27	26
U	21	10	12
V	22	18	20
W	23	15	7
X	24	25	18
Y	25	26	14
Z	26	28	30
AA	27	23	25
BB	28	32	32
CC	29	29	28
DD	30	12	9
EE	31	30	31
FF	32	31	29
GG	33	33	36
HH	34	36	33
II	35	34	34
JJ	36	35	35
KK	37	37	37

[a] Numerical rank directly correlates with SSI rate.
[b] Complex SSIs diagnosed in the inpatient setting.

nificant biases and limit the relevance of these SSIs in public reporting.

Important clinical and cost differences exist between superficial-incisional and complex SSIs, and these must be considered. Deeper-seated SSIs often require intravenous antibiotics, inpatient admission, and wound reexploration; therefore, they are likely to be more costly.[20] Superficial-incisional SSIs, on the other hand, are typically managed with local wound care, removal of sutures or staples, and oral antibiotics. These striking differences form a basis for advocacy of the exclusion of superficial-incisional SSIs from public reporting in favor of focusing on more costly and clinically relevant complex SSIs.[21]

In addition to the exclusion of superficial-incisional SSIs, focus on SSIs diagnosed in the inpatient setting is another critical step toward the achievement of accurate surveillance and public reporting of relevant data. Adherence to standardized surveillance methods is more easily attained in the inpatient setting, where patients are followed serially and clinical data are readily available.[11] Our study highlighted the importance of the inpatient setting by demonstrating that this was where the vast majority of all SSIs and complex SSIs were detected (78% and 87%, respectively). In addition, a reliable and valid method for the outpatient surveillance of SSIs remains elusive, leading to inconsistent methodology and the potential for unfair interhospital comparisons.[16] This variability in outpatient postdischarge SSI surveillance was demonstrated within our infection control network, with less than 60% of study hospitals utilizing surgeon letters; this variability persisted in the outpatient setting despite the network's robust design, which includes utilization of standard protocols, professionally trained infection preventionists, and regular review of infection control and surveillance practices.[8,22] Finally, our study demonstrated that exclusion of SSIs diagnosed in the outpatient setting significantly altered the distribution of rates of SSIs between hospitals. We believe that these factors support the exclusion of SSIs diagnosed in the outpatient setting from public reporting.

Our study demonstrated important potential consequences of applying benchmarking without commitment to a standardized reporting method to a large infection control network. We demonstrated significant differences in hospital performance rankings by rates of SSIs, depending on the reporting methodology. This variability in hospital rankings clearly highlights the risk of inaccurate reporting to the public. The goal of a public-reporting system should be the creation of fair interhospital comparisons based on quality of care; the lack of a standardized method for public reporting of SSIs compromises this goal by making inaccurate comparisons that are affected by surveillance methods rather than true measures of performance.

This study had several limitations. We did not routinely collect data on adherence to practices that prevent SSIs among our hospitals. We were also unable to obtain additional data regarding complex SSIs diagnosed in outpatient settings or the completeness of various outpatient surveillance methods in our hospitals. We suspect that the majority of these complex SSIs detected in the outpatient setting would ultimately require rehospitalization for inpatient management and/or invasive therapies (eg, wound reexploration), but the time frame of intervention may have been too great to be captured by our surveillance methods. Further analyses of this unusual scenario are planned.

This study had several strengths. First, the large volume of surgical cases across multiple centers provided a broad representation of procedures. Second, the community-hospital

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focus is reflective of the clinical setting where the majority of Americans receive their health care.[23] Third, we performed a subanalysis of major surgical procedures included in the SCIP, whose performance measures have been included by the Centers for Medicare and Medicaid Services for public reporting.[12] Our subanalysis of SCIP procedures showed results similar to our overall findings and underscored the importance of identification of complex SSIs following these major categories of surgical procedures. Finally, each of the included community hospitals followed standard infection surveillance methods as part of our large, multicenter infection control network.

In summary, as we enter a new era of mandatory public reporting for HAIs, careful deliberation is necessary to craft a reporting system that is accurate and fair to patients and providers. Clearly, hospitals will perform at varying levels. The removal of variance introduced by insensitive surveillance strategies will better demonstrate interhospital SSI rate differences reflective of the true quality of care rather than differences in surveillance methodology. We believe that systems for mandatory public reporting of SSIs limited to complex SSIs diagnosed in the inpatient setting will help to accomplish this important goal.

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REFERENCES

1. de Lissovoy G, Fraeman K, Hutchins V, Murphy D, Song D, Vaughn BB. Surgical site infection: incidence and impact on hospital utilization and treatment costs. *Am J Infect Control* 2009; 37(5):387–397.
2. Anderson DJ, Chen LF, Sexton DJ, Kaye KS. Complex surgical site infections and the devilish details of risk adjustment: important implications for public reporting. *Infect Control Hosp Epidemiol* 2008;29(10):941–946.
3. Broex EC, van Asselt AD, Bruggeman CA, van Tiel FH. Surgical site infections: how high are the costs? *J Hosp Infect* 2009;72(3): 193–201.
4. Scott R II. *The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention.* Atlanta: Centers for Disease Control and Prevention; March 2009.
5. Schaefer MK, Jhung M, Dahl M, et al. Infection control assessment of ambulatory surgical centers. *JAMA* 2010;303(22): 2273–2279.
6. Association for Professionals in Infection Control and Epidemiology. HAI reporting laws and regulations. http://www.apic.org/downloads/legislation/HAI_map.gif. Updated July 6, 2011. Accessed August 18, 2011.
7. Patient Protection and Affordable Care Act. Pub L No 111-148, 124 Stat 388–389 (2010).
8. Anderson DJ, Miller BA, Chen LF, et al. The network approach for prevention of healthcare-associated infections: long-term effect of participation in the Duke Infection Control Outreach Network. *Infect Control Hosp Epidemiol* 2011;32(4):315–322.
9. Gaynes RP, Culver DH, Horan TC, Edwards JR, Richards C, Tolson JS. Surgical site infection (SSI) rates in the United States, 1992–1998: the National Nosocomial Infections Surveillance System basic SSI risk index. *Clin Infect Dis* 2001;33(suppl 2): S69–S77.
10. Centers for Disease Control and Prevention. Surgical site infection (SSI) event. http://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent.pdf. Published August 2011. Accessed July 29, 2009.
11. Centers for Disease Control and Prevention. National Health Safety Network (NHSN) procedure-associated (PA) module: protocols and definitions. http://www.cdc.gov/nhsn/PDFs/slides/NHSN_PAModule.pdf. Updated May 4, 2010. Accessed June 13, 2011.
12. US Department of Health and Human Services. Hospital Compare. http://www.hospitalcompare.hhs.gov. Accessed June 13, 2011.
13. Bratzler DW, Hunt DR. The surgical infection prevention and surgical care improvement projects: national initiatives to improve outcomes for patients having surgery. *Clin Infect Dis* 2006; 43(3):322–330.
14. Werner RM, Asch DA. The unintended consequences of publicly reporting quality information. *JAMA* 2005;293(10):1239–1244.
15. Kao LS, Ghaferi AA, Ko CY, Dimick JB. Reliability of superficial surgical site infections as a hospital quality measure. *J Am Coll Surg* 2011;213(2):231–235.
16. Petherick ES, Dalton JE, Moore PJ, Cullum N. Methods for identifying surgical wound infection after discharge from hospital: a systematic review. *BMC Infect Dis* 2006;6:170.
17. Niedner MF. The harder you look, the more you find: catheter-associated bloodstream infection surveillance variability. *Am J Infect Control* 2010;38(8):585–595.
18. Haut ER, Pronovost PJ. Surveillance bias in outcomes reporting. *JAMA* 2011;305(23):2462–2463.
19. Manniën J, van den Hof S, Brandt C, Behnke M, Wille JC, Gastmeier P. Comparison of the National Surgical Site Infection surveillance data between the Netherlands and Germany: PREZIES versus KISS. *J Hosp Infect* 2007;66(3):224–231.
20. Urban JA. Cost analysis of surgical site infections. *Surg Infect* 2006;7(suppl 1):S19–S22.
21. National Quality Forum. *National Voluntary Consensus Standards for the Reporting of Healthcare-Associated Infection Data.*

http://www.qualityforum.org/Publications/2008/03/National_Voluntary_Consensus_Standards_for_the_Reporting_of_Healthcare-Associated_Infection_Data.aspx. Published March 2008. Accessed August 18, 2011.

22. Kaye KS, Engemann JJ, Fulmer EM, Clark CC, Noga EM, Sexton DJ. Favorable impact of an infection control network on nosocomial infection rates in community hospitals. *Infect Control Hosp Epidemiol* 2006;27(3):228–232.

23. Centers for Disease Control. *Health—United States 2010.* Atlanta, GA: National Center for Health Statistics; 2010.