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## **Surgeons' perspectives on surgical wound infection rate data in Queensland, Australia**

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### **Background**

The results of the Study on the Efficacy of Nosocomial Infection Control (SENIC) project demonstrated that hospitals with active infection control programs had lower rates of nosocomial infection than those without such programs. A key component of these programs was the inclusion of a systematic method for monitoring nosocomial infection and reporting these infections to clinicians.

### **Objectives**

To identify the perspectives of surgeons in Queensland, Australia, regarding infection rate data in terms of its accuracy and usefulness as well as their perceptions regarding acceptable infection rates for surgical procedures classified as "clean" or "contaminated."

### **Methods**

A postal survey was conducted, with a convenience sample of 510 surgeons.

### **Results**

More than 40% (n = 88) of respondents believed that the acceptable infection rate associated with clean surgical procedures should be less than 1%, a rate much lower than the threshold of 1.4% to 4.1% set by the Australian Council on Healthcare Standards (ACHS). Almost 30%

(n = 55) of respondents reported that they would accept infection rates of 10% or higher for contaminated surgical procedures, which is higher than the ACHS threshold of 1.4% to 7.9%. Respondents identified failure to include postdischarge infections in the data and difficulties standardizing criteria for diagnosis of infection as the major impediments to the accuracy and usefulness of data provided.

## Conclusion

The results of this study have significant implications in relation to the preparation of surgical site infection reports, especially in relation to the inclusion of postdischarge surveillance data and information regarding pathogens, antibiotic sensitivities, and comorbidities of patients developing surgical site infection. Surgeons also identified the need to include information regarding the use of standardized definitions in the diagnosis of wound infection and parameters that allow comparison of infection rates to improve their perceptions regarding data accuracy and usefulness.

Through the Study on the Efficacy of Nosocomial Infection Control (SENIC) project, Haley et al<sup>1</sup> identified that hospitals with an established, effective infection control program demonstrated lower infection rates overall than those hospitals without such programs. An influential finding in this study was that hospital administrators and clinicians did not comprehend the seriousness of a hospital's infection problems or the need for implementation of preventive strategies until they were provided with aggregate surveillance data. Thus, as a result of these findings, surveillance of nosocomial infection became, and remains, the cornerstone of infection control programs around the world today.

In 1998, the Society for Healthcare Epidemiology of America (SHEA) underscored the central role of surveillance in a position paper on the requirements for infrastructure and essential activities of infection control and epidemiology in hospitals. This paper identified that, “the most important data-management activity of infection control programs is the surveillance of nosocomial infections and other adverse events.”<sup>2</sup> Furthermore, Condon et al<sup>3</sup> identified that a key factor in reducing surgical wound infection rates was feedback to the clinicians. Implicit in this assertion is the premise that clinicians, armed with this information, will take any necessary action to improve outcomes. Gaynes et al<sup>4</sup> supported this view, arguing that, although “demonstrating the value of surveillance data to both the hospital's patient-care personnel and administration is essential,” the real issue is whether “patient-care personnel perceive value in the data.” The authors argued that, if they do perceive the data to be valuable, they would use these data to influence their practice to reduce the incidence of nosocomial infections, and further asserted that surveillance of nosocomial infections can “influence clinical behaviour and improve the quality of patient care.” Various studies have demonstrated a relationship between surgical site surveillance programs that include dissemination of infection rates to surgeons and a reduction in surgical site infection rates.<sup>5, 6, 7, 8 and 9</sup>

However, there is no indication in the literature that research has been conducted to examine the perspective of surgeons in relation to the value and efficacy of reporting surgical site surveillance data. This research project was designed to identify the perceptions of the surgeons receiving infection rate data in relation to the value, accuracy, and usefulness of these data.

# Methods

## Setting and design

For more than a decade, the Australian Council on Healthcare Standards (ACHS) has facilitated a standardized approach to surgical site infection surveillance in Australian health care facilities.<sup>10</sup> ACHS has a function similar to that of the Joint Committee on Accreditation of Healthcare Organizations (JCAHO) in the United States. It is an independent body that undertakes periodic review of health care facilities to determine whether the facility meets specific health care standards. Participation in the ACHS accreditation process in Australia is undertaken on a voluntary basis.<sup>10</sup> In 1989, the ACHS Care Evaluation Program (CEP) was established, and clinical indicators were developed. The first set of clinical indicators included hospital-acquired infections associated with clean and contaminated surgical procedures. Clean procedures were defined as operations “performed in a sterile field (that is, uncontaminated by bacteria).”<sup>11</sup> Contaminated surgical procedures were defined as operations including “those which breach the gastrointestinal, respiratory or genito-urinary tracts, traumatic wounds, and those in which a break in aseptic technique occurs”<sup>11</sup> Using these definitions, participating health care facilities submitted their infection rate data to the Care Evaluation Program. On the basis of these data, ACHS established infection rate thresholds for clean and contaminated categories of surgery. Over time, the infection rate thresholds were revised and stratified on the basis of facility size, defined by bed numbers.<sup>11</sup>

In 2002, the ACHS published new definitions for surgical site surveillance.<sup>12</sup> These definitions were developed by the Australian Infection Control Association (AICA) National Advisory Board and were essentially based on the definitions developed for and used in the National Nosocomial Infection Surveillance (NNIS) project in the United States.<sup>13 and 14</sup> Development and use of these definitions reflect the move toward targeted surveillance and risk stratification and will allow comparison of Australian infection rate data with international infection rates.

It is within the context of this state of flux that this research project was undertaken to obtain information regarding surgeons' perspectives regarding specific aspects of surgical wound infection rate data. The project was confined to Queensland in the first instance to limit variations associated with specific data collection and reporting requirements imposed by some State Health Departments.

Queensland is Australia's second largest and third most populous state, with more than 3.75 million residents.<sup>15</sup> The Queensland Health Department delivers government-funded health services through a network of 38 Health Service Districts.<sup>16</sup> Queensland Health recognized 111 public and 103 private and freestanding day hospitals in 2003.<sup>16</sup> The Australian Council on Healthcare Standards (ACHS) is the accrediting body for most of these facilities, and fulfilment of the accreditation criteria requires evidence that nosocomial infections are monitored and reported to administrators and clinicians.<sup>11</sup> Infection control personnel are usually responsible for conducting such monitoring programs and report the results via the facility's infection control committee.

## Design

Data collection for this project was via a postal survey of Queensland surgeons.

## **Participants**

The Royal Australasian College of Surgeons (RACS) has approximately 700 members in Queensland. Following an unsuccessful request for support from the Queensland branch of RACS, a sampling frame for the study was drawn from those members of the Queensland branch of the Australian Medical Association (AMAQ), identifying themselves as surgeons. The AMAQ membership directory 2002<sup>17</sup> lists 510 members identifying themselves as practicing surgeons. In total, 510 questionnaires were posted. Twenty forms were returned to sender unopened, leaving a sample size of 490.

## **Instrument**

A 2-page questionnaire was developed to elicit surgeons' opinions and attitudes regarding specific aspects of surgical wound infection rate data. Three experienced and qualified infection control practitioners checked the initial survey instrument for face and content validity through review. The instrument was then pilot tested with a sample of 12 surgeons at a major metropolitan hospital in another Australian state. Minor adjustments were made to the language of some items in response to surgeons' feedback.

The instrument consisted of 5 sections. Section 1 related to demographic information. These items related to the surgeon's practice context, the capacity in which he/she was employed, years of experience performing in their current surgical specialty, and whether the respondent currently received infection rate data.

Section 2 consisted of 2 questions and focused on the surgeons' perspective of the accuracy of infection rate data. Section 3 focused on the usefulness of the infection rate data provided to the surgeons by their organizations. Section 4 asked the surgeons to identify the infection rates that they found acceptable for surgical procedures classified as "clean" and "contaminated," according to the ACHS published definitions.<sup>10</sup> Finally, the surgeons were asked to suggest ways in which improvements could be made to the accuracy and usefulness of the infection rate data with which they are provided. Sections 2 to 5 elicited responses in a variety of formats, including multiple-choice answers, visual analogue scale (VAS), and open-ended comment.

## **Procedures**

In August 2002, the questionnaire and project information letter were mailed to the business address listed for each of the surgeons, along with an addressed reply-paid envelope. A follow-up letter was mailed 4 weeks after the original mail out to optimize the response rate. The total survey period lasted 6 weeks. Participants were assured of confidentiality and data security, and ethics approval for the study was obtained from the university human research ethics committee.

## **Analysis**

Data obtained from the responses were analyzed using the Statistical Package for the Social Sciences (SPSS) software (version 10; SPSS Inc., Chicago, IL). Open-ended responses were coded according to themes. Descriptive statistics were applied to the data to determine frequencies, means, and standard deviations. Spearman rank correlations were calculated to

determine whether there was any association between respondents' ratings of the accuracy and usefulness of the infection rate data.

## Results

In total, 490 surgeons were surveyed, with 218 responding to the survey, representing a response rate of 44.5%. Some questions were left unanswered by individuals; therefore, some of the data presented relate to different sample sizes. The respondents were asked to describe themselves in terms of staff designation, years of experience, and practice context and whether they received infection rate data. Their responses are listed in [Table 1](#). Responses indicated that the majority of respondents were visiting medical officers (n = 166, 76.5%) with more than 16 years experience in their respective specialty (n = 125, 57.6%). Respondents tended to practice in both the public and private health care sectors (n = 145, 66.8%), and most received reports regarding surgical site infection data (n = 160, 73.7%).

Table 1.

Profile of respondents

Variable (n = 217)	Subgroups	N (%)
Staff designation	Visiting medical officer	166 (76.5)
	Private specialist	36 (16.6)
	Staff specialist	15 (6.9)
Experience (in years)	1-5	25 (11.5)
	6-10	30 (13.8)
	11-15	37 (17.0)
	16-20	37 (17.0)
	>20	88 (40.6)
Practice context	Practices in both contexts	145 (66.8)
	Exclusively private	62 (28.6)
	Exclusively public	10 (4.6)
Data received	Yes	160 (73.7)
	No	57 (26.3)

Respondents were asked to nominate a value representing acceptable infection rates for procedures classified into either clean or contaminated categories of surgery. These categories were based on the Australian Council on Healthcare Standards (ACHS) definitions,<sup>11</sup> used throughout Queensland at the time of the survey. The responses are listed in [Table 2](#). All

respondents indicated that infection rates associated with clean surgical procedures should be 10% or less, with more than half of the respondents (n = 115, 54.2%) identifying that the clean surgery infection rate should be between 1% and 5%.

Table 2.

Frequencies and percentages of responses related to acceptable rates of infection

Acceptable infection rates (%)	Clean surgery (n = 212) N (%)	Contaminated surgery (n = 184) N (%)
0	23 (10.9)	3 (1.6)
<1	65 (30.7)	0 (0)
1-5	115 (54.2)	60 (32.6)
6-10	9 (4.2)	66 (35.9)
11-15	0 (0)	20 (10.9)
16-20	0 (0)	22 (12.0)
21-25	0 (0)	4 (2.2)
26-30	0 (0)	8 (4.3)
100	0 (0)	1 (0.5)

Although a small proportion of respondents (n = 3, 1.6%) believed that 0% infection rates should be associated with contaminated surgical procedures, most (n = 181, 98.4%) believed that some infections resulting from contaminated surgery are acceptable. More than half (n = 126, 68.5%) believed that the rate would range from 1% to 10%.

Using the visual analogue scale (VAS), with a possible range of 0 to 10, respondents were asked to rate the accuracy and usefulness of the infection rate data they receive. [Table 3](#) presents these results. The association between surgeons' perceptions regarding the accuracy of infection rate data and their perceptions regarding usefulness of the data reached statistical significance ( $r = 0.489$ ;  $P < .0001$ ).

Table 3.

Mean, standard deviation, and range of visual analogue scale ratings

Variable	N	Minimum	Maximum	Mean	Standard deviation
Accuracy rating	179	2	10	6.68	2.309
Usefulness rating	193	2	10	6.97	2.533

The respondents were asked to identify how the accuracy and usefulness of the data could be improved. A small proportion of respondents (n = 4, 3.6%) believed the data to be accurate, and 5.4% (n = 6) of respondents felt that increasing the frequency of reports would improve the accuracy of the data. However, the major issues affecting accuracy according to the respondents, related to postdischarge surveillance and definitions of infection. The coded responses and their frequencies are listed in [Table 4](#).

Table 4.

Suggestions for improving data accuracy

<b>Suggestion (Respondents: n = 111 )</b>	<b>N (%)</b>
Standardize infection definition	63 (56.8)
Collect and include postdischarge data	52 (46.9)
Increase reporting frequency	6 (5.4)
Improve liaison between surgeon and infection control	4 (3.6)
Current data are accurate	4 (3.6)
Centralized infection recording accessible to all hospitals	1 (0.9)
Establish and document infection status on and during admission	1 (0.9)

Some respondents made more than 1 suggestion.

When asked for suggestions for improving the usefulness of infection rate data, some respondents (n = 11, 12.1%) identified that the data they currently receive are useful. Other respondents (n = 6, 6.6%) suggested that inclusion of postdischarge surveillance data would increase usefulness, and 14.3% (n = 13) of respondents suggested that the usefulness of the data would be increased if the accuracy improved. The majority of respondents suggested that increased usefulness could be achieved by standardizing definitions (n = 24, 26.4%) or by providing additional information in the reports such as identifying the causative organism and its antibiotic sensitivities or classifying the infection (n = 32, 35.2%). The coded responses are listed in [Table 5](#).

Table 5.

Suggestions for improving data usefulness

<b>Suggestion (Respondents: n = 91 )</b>	<b>N (%)</b>
Provide more information on reports, eg, organisms and sensitivities, type of infection	32 (35.2)
Standardize definitions	24 (26.4)

<b>Suggestion (Respondents: n = 91 )</b>	<b>N (%)</b>
Improve accuracy	13 (14.3)
Increase reporting frequency	12 (13.2)
Current data useful	11 (12.1)
Include postdischarge data	6 (6.6)
Ophthalmology infections are so rare that data are not useful	3 (3.3)

Some respondents made more than 1 suggestion.

Respondents were also asked for suggestions regarding changes to data collection, and their coded responses are listed in [Table 6](#). Generally, suggestions echoed those made in relation to previous questions; however, 11.5% (n = 10) of respondents identified the need for allocation of additional resources for data collection, and 8.0% of respondents (n = 7) stated that they would like to receive infection rate data. These 7 respondents composed a proportion of the 26.3% of respondents who had previously indicated that they did not receive infection rate data.

Table 6.

Suggested changes to data collection

<b>Suggestion (Respondents: n = 87 )</b>	<b>N (%)</b>
Standardize definition	33 (37.9)
Increase information collected, eg, organisms, antibiotics, comorbidities	16 (18.4)
Increase frequency of feedback to clinicians	12 (13.8)
Include postdischarge data	12 (13.8)
Increase data collection resources	10 (11.5)
I would like to receive data	7 (8.0)
Increase audit/surveillance activities, eg, check surgeons scrub technique, routine nasal screening of staff	7 (8.0)
Link infection rates to specific operating theatres	1 (1.2)

Some respondents made more than 1 suggestion.

Respondents were then given the opportunity to make a further brief comment on surgical wound infection rate data. Few responded (n = 30), and some of the comments repeated points that had been made earlier, such as the need to include postdischarge data in reports (n = 2, 6.7%) and the need for standardized definitions (n = 6, 20.0%). Nine respondents (30.0%) stated that they doubted the usefulness of infection rate data associated with specific surgical procedures, including ear, nose and throat, and ophthalmology. In addition, 16.7% (n = 5) stated that there was no obvious benefit associated with surveillance, and 13.3% (n = 4) thought that individual clinicians need to be vigilant in relation to asepsis. A further 13.3% of respondents (n = 4) expressed individual comments that were categorized as “other.”

## Discussion

According to Cummings et al,<sup>18</sup> there is no “gold standard” for an acceptable response rate to surveys mailed to medical officers. Their analysis of response rates associated with mailed physician questionnaires over a 10-year period (1986-1995) identified minimum response rates ranging from 11% to 39% and maximum response rates ranging from 86% to 100%.<sup>18</sup> The authors found that the average response rate associated with mailed physician questionnaires was 61.2% over that 10-year period. Therefore, the 44.5% response rate associated with this postal survey is consistent with response rate range identified by Cummings et al.<sup>18</sup>

### Acceptable infection rates

Nichols<sup>19</sup> identified that the incidence of surgical site infection “varies from surgeon to surgeon, from hospital to hospital, from one surgical procedure to another, and—most importantly—from one patient to another.” Through the SENIC project, Haley et al<sup>1</sup> demonstrated a relationship between an established infection control program, which included nosocomial infection surveillance, and a 32% reduction in infection rates overall. However, whereas the SENIC project established that at least a proportion of nosocomial infection is preventable, defining “acceptable” rates of infection associated with specific surgical procedures has proven difficult, and most health care facilities rely on benchmarking processes to contextualize their performance. A number of authors<sup>20, 21, 22, 23 and 24</sup> have documented the problems associated with benchmarking infection rates, identifying the need for aggregated infection data to achieve a reasonable sample size and risk stratification to facilitate comparison of rates among facilities servicing different patient populations. This is usually achieved through participation in programs such as the NNIS program in the United States or the ACHS Clinical Indicator program in Australia.

The ACHS infection rate thresholds were based on aggregate data submitted by participating hospitals and were stratified according to hospital size determined by the number of beds. From 1998 until 2002, the ACHS infection rate threshold for “clean” surgical procedures was 1.4% to 4.1%, and the infection rate threshold for “contaminated” surgical procedures was 1.4% to 7.9%.<sup>8 and 11</sup>

When asked to identify acceptable rates of infection for each of the categories of surgery, the majority of respondents 54.2% (n = 115) considered a range of 1% to 5% an acceptable infection rate for clean surgical procedures, which is fairly consistent with the thresholds set by the ACHS. However, a number of respondents, more than 30% (n = 65), expected that the infection rate associated with clean surgery should be less than 1%, and a further 10.8% (n = 23) thought that there should be no infections associated with this category of surgery. These rates are lower than the threshold set by the ACHS. The reason for this deviation from the ACHS threshold is unclear.

Interestingly, the range considered acceptable for infection rates associated with contaminated surgical procedures was broader. Three respondents (1.6%) believed 0% to be an acceptable rate of infection for contaminated surgery, whereas 1 respondent (0.5%) thought that contaminated surgical procedures would result in infection 100% of the time. The range favored by the highest number of respondents (35.9%, n = 66) was 6% to 10%. This reflects and extends the upper limits of the threshold set by the ACHS. A number of respondents (29.9%, n = 55) believed the acceptable infection rate for contaminated surgery to be higher than 10%, and, of these respondents, most (23.9%, n = 44) believed that it would range between 11% and 20%. It is unclear why these respondents would accept an infection rate in a range higher than that set by the ACHS. The implications of these findings are that this group of surgeons would not necessarily identify a need to take any action to reduce surgical wound infection rates associated with contaminated surgery until rates exceeded 11% to 20%, which is more than twice the threshold set by the ACHS.<sup>11</sup>

These results have implications both for infection control practitioners and for surgeons. Infection control practitioners, when preparing infection rate reports, need to include information that will contextualize the rates reported. Inclusion of information, such as the ACHS thresholds or the infection rates reported for the same period and procedure in previous years, will alert surgeons to the need for increased infection awareness and prevention activities when infection rates are higher than accepted benchmarks. It may also positively reinforce current practices when the rates are lower than current benchmarks. In reality, there is no acceptable infection rate for any category of surgery.

## **Data accuracy and usefulness**

The results of this study indicated a statistically significant association between the surgeons' perceptions of the accuracy and usefulness of the data provided. However, only 24.0% of the variance in one variable is explained by the other variable ( $r = 0.48$ ), and, thus, there may be multiple factors that effect surgeons' perceptions/opinions. In relation to improving data accuracy, many respondents (46.8%, n = 52) suggested that the infection rate data were inaccurate because wound infections diagnosed after the patient had been discharged from the hospital are not included. Therefore, they argued that the data set was incomplete. These respondents believed that inclusion of postdischarge wound infections would improve accuracy.

The other major issue affecting data accuracy according to the respondents was the issue of definition of infection. Just over half the respondents (56.8%, n = 63) were concerned about the ability of others to identify wound infection on a consistent basis. Of these, 23.4% (n = 26) deemed standardized definitions necessary, thus implying that standard definitions were either not currently available or not currently used. A small proportion of these respondents (7.2%, n = 8) stated that the surgeon should review all wounds because he/she is

the only person capable of diagnosing infection, and others (26.1%, n = 29) reported that other personnel would need to be specially trained to identify the presence of infection.

There is a tension between the need to collect data regarding wound infections that manifest after discharge from hospital and the need to validate the diagnosis of infection in these cases. This tension is reflected in the literature. Gaynes<sup>21</sup> argued that the issue of postdischarge surveillance and its accuracy is a major difficulty in relation to the ability to compare data and “may be in large part, responsible for variation in surgical site infection rates when multiple institutions aggregate their rates.” Coello et al<sup>24</sup> identified that the different approaches to postdischarge surveillance in England, Germany, and The Netherlands create a barrier in relation to the ability to compare infection rates. Studies have shown that anywhere from 14% to 71% of surgical site infections manifest after the patient is discharged from the hospital,<sup>25, 26, 27</sup> and <sup>28</sup> which means that failure to include these infections when calculating and reporting infection rates may result in a serious underestimation of the incidence of surgical site infection.

Concerns related to this issue are reflected in the surgeons' responses to this survey. Respondents who advocate inclusion of infections diagnosed postdischarge argue for completeness of the data set. However, those respondents who currently receive data including infections diagnosed postdischarge believe that postdischarge diagnosis of surgical wound infection by general medical practitioners (GPs) and other clinicians, such as nurses, is unreliable because of either the absence of standardized definitions or lack of training.

The ACHS recommends that postdischarge surveillance be undertaken using the presence of purulent exudate to define infection; however, a study by Whitby et al<sup>29</sup> identified that patients “frequently confuse serous (*wound*) discharge with pus,” thus providing credence for the argument against inclusion of infections diagnosed postdischarge. Nevertheless, Whitby et al<sup>29</sup> argue for inclusion of infections diagnosed postdischarge in the data set if the patient's GP has prescribed antibiotics within the review period.

Other suggestions related to improving the usefulness of the data collected were to incorporate into the infection rate report information related to the identification of the organism causing the infection and its antibiotic sensitivities as well as the type of infection--superficial, deep, organ space. A small number of respondents (13.2%, n = 12) suggested that the usefulness of the data would be improved by increasing the frequency of reports. Those preparing the reports should consider suggestions regarding the frequency of reports and the type of information surgeons would like to see included if the provision of data is to have the maximum effect.

## Conclusions

Haley et al<sup>1</sup> demonstrated through the SENIC project that a reduction in nosocomial infection rates including surgical site infections is achievable through the implementation of active nosocomial infection and surveillance and prevention programs. A key component of the surveillance initiatives is the feedback of infection rate data to clinicians. If surgeons are to be influenced by these data in terms of decision making and practice changes, they must have confidence in the accuracy of the data and find the data useful. Haley et al<sup>1</sup> argue that, without these data, surgeons may underestimate the seriousness of a hospital's infection problem or the need to implement prevention strategies. However, the results of this surgeon survey indicate that surgeons doubt the accuracy of the data when postdischarge surveillance is not

conducted. The literature supports this concern, identifying that the infection problem may be seriously underestimated if postdischarge surveillance of surgical site infection is not undertaken and reported.<sup>25, 26, 27 and 28</sup>

Whenever possible, inclusion of additional information such as the pathogens isolated and their antibiotic sensitivities and risk factors such as comorbidities of patients with surgical wound infection should be included in the report. Surgeons surveyed in this study indicated that inclusion of such information would be useful to them. The frequency of reports needs to be considered if surgeons are to address any increase in infection rates in a timely manner.

The study demonstrates that some surgeons may overestimate acceptable infection rates for contaminated surgery. Therefore, inclusion of acceptable and, if possible, risk-adjusted parameters such as infection rate data from previous years or the ACHS peer group comparisons should be considered by those preparing the reports. In addition, some surgeons lack confidence in the infection rate data because of their perception that standardized infection definitions are not used. Inclusion of definitions and the source of the definitions should be considered when preparing reports.

The limitations of this study are that the sample of participants was drawn from 1 Australian state, thus limiting the generalizability of the findings. The focus of the survey was confined to surgeons' attitudes to accuracy and usefulness of surveillance data, and a more in-depth study might explore additional variables and how they influence these attitudes. Nevertheless, the results of the survey have a number of practice implications, as referred to above.

The findings from this study provide useful information on the optimum structure of infection surveillance reports to enhance their usefulness in reducing health care-associated infection. The findings also indicate that the study could be usefully repeated in other settings to provide context-specific information on the efficacy of reporting infection surveillance findings to surgeons.

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