CONCISE COMMUNICATION

The Effect of Participating in a Surgical Site Infection (SSI) Surveillance Network on the Time Trend of SSI Rates: A Systematic Review

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This systematic literature review reveals that participating in a surgical site infection (SSI) surveillance network is associated with short-term reductions in SSI rates: relative risk [RR] for year 2, 0.80 (95% confidence interval [CI], 0.79–0.82); year 3 RR, 0.92 (95% CI, 0.90–0.94); year 4 RR, 0.98 (95% CI, 0.96–1.00).

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Surveillance of healthcare-associated infections (HAIs) is recommended as a core component of effective infection control programs by the World Health Organization.[1] The specific effect of surveillance on surgical site infection (SSI) prevention, however, remains controversial because of conflicting evidence that conducting surveillance as part of a network has a positive impact on SSI rates. Some studies report a successful reduction of SSI rates after participation in a surveillance network, while others report no effect or even increased rates.[2–7]

To the best of our knowledge, there has been no systematic review questioning the effect of participation in a network on time trends of SSI rates. We performed a systematic review to determine the time trend of SSI rates in hospitals that are members of regional, national, or international SSI surveillance networks, using data stratified by year of hospital participation.

METHODS

We searched electronic databases (Medline, EMBASE, Cochrane Library) and reference lists of relevant papers to identify studies published between 1980 and June 2016. A broad search strategy used the keywords or medical subject headings (MeSH) terms "surgical wound infection," "surveillance," and "population surveillance" (see Appendix for full search strategy). Retrieved citations were imported into reference manager software (DistillerSR, Evidence Partners, Ottawa, Canada) and were screened independently by 2 authors (M.A. and E.T.) in 2 stages: (1) title and abstract and (2) full-text screening. The reviewers resolved disagreement by discussion. Interrater reliability was assessed using Cohen's κ statistic.

Studies from hospitals reporting participation in a surveillance network for ≥ 3 years and presenting annual SSI rates were included. The data had to be stratified by hospital year of participation in the network or presented from a subset of hospitals that participated from the beginning of the network. Randomized controlled trials, single-center studies, and those studies exclusively concerned with ambulatory surgery only or procedures for which there is no National Healthcare Safety Network (NHSN) recommendation for surveillance were excluded. No language restrictions were applied during the search, but during the screening process, publications in languages other than English, French, German, Spanish, Italian, Portuguese, Arabic, or Chinese were excluded. We also conducted a grey literature search via Google and GoogleScholar by visiting websites of identified networks and searching for data. Data that were potentially duplicates were not used for the data synthesis. If necessary, SSI rates from publications were calculated from raw data. Results were summarized by pooling numerator data (SSIs) and denominator data (number of procedures) and by calculating annual rate ratios (RR) with 95% confidence intervals (CI), using year 1 as the reference. Whenever possible, results were also summarized for procedure-specific data.

Initially, an assessment of the quality of the studies was planned. However, none of the available tools were suited for the evaluation of these studies for several reasons, including the absence of a comparator group and absence of interventions. Therefore, no assessment of the quality of the studies was performed.

RESULTS

The literature search yielded 1,079 articles after duplicates were removed. After screening, 1,073 articles were excluded, leaving 7 studies[4,5,8–12] for quantitative synthesis. Agreement between the reviewers before conflict resolution was moderate for title and abstract screening ($\kappa = 0.56$) and very good for full-text screening ($\kappa = 0.83$). The study selection process is illustrated in Figure 1.

The included studies represented 4 networks from Germany (Krankenhaus-Infektions-Surveillance-System),[4,8,10,12] Netherlands (Preventie van Ziekenhuisinfecties door Surveillance),[11] Switzerland (southwestern Swiss regional network),[5] and the United States (American College of Surgeons National Surgical Quality Improvement Program).[9] In total, these networks reported nonduplicate data in publications on 3,085,448 surgical procedures and 115,604 SSIs, giving an overall pooled cumulative SSI rate of 3.75% (95% CI, 3.73–3.77). After searching the websites of other networks, no relevant data were obtained, mainly because no data were available on the website

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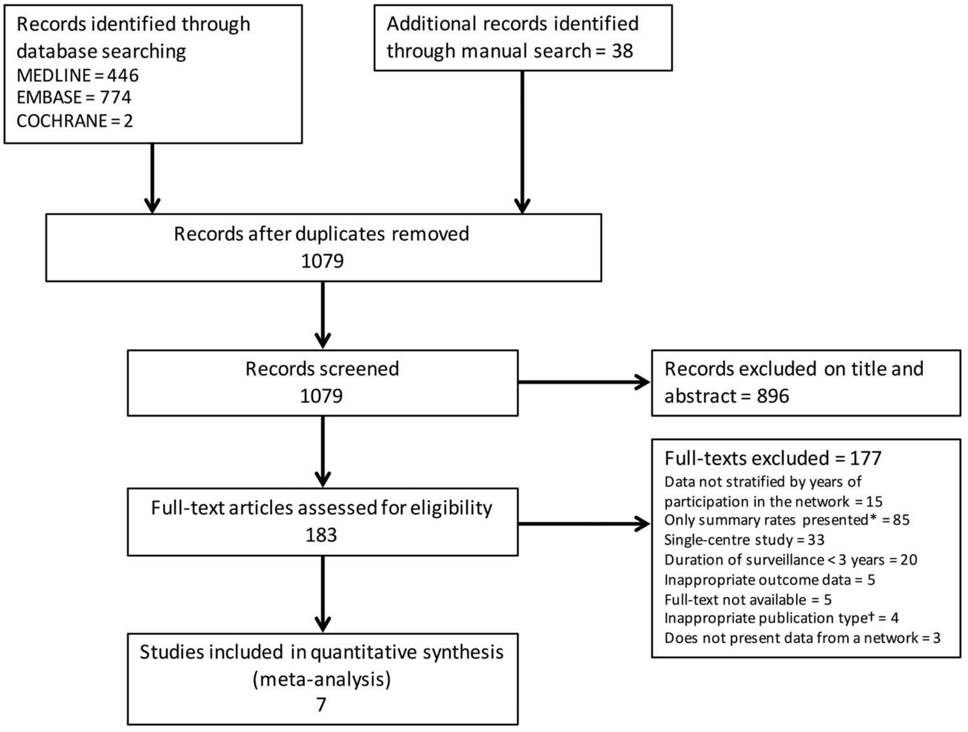

FIGURE 1. Flow chart of literature search for study identification on the effect of surveillance on the time trend of surgical site infection (SSI) rate.
* None of these citations reported performing an analysis that was stratified by years of participation in the network.
† Narrative reviews, editorials/commentaries, guidelines, case reports, protocols, clinical trials.

or the data were not stratified by years of participation in the network. Characteristics of the included studies are available in the Appendix.

From the German network, 4 studies[4,8,10,12] provided potentially overlapping data on knee prosthesis and caesarean section, and all operations. To avoid potential duplicate counting of procedures and/or SSIs, we used data from the publication with the largest number of operations; we did not use data on all procedures from 1 publication.[12] A Swiss study[5] only presented data in graphs, but one of its authors provided the raw data.

Pooled data from the publications showed significant decreases in the RR for SSI for year 2 (RR, 0.80; 95% CI, 0.79–0.82), year 3 (RR, 0.92; 95% CI, 0.90–0.94), year 4 (RR, 0.98; 95% CI 0.96–1.00), and year 5 (RR, 0.95; 95% CI, 0.93–0.97) (Figure 2). This effect was not present in year 6 (RR, 1.02; 95% CI, 0.99–1.04), year 7 (RR, 0.99; 95% CI, 0.97–1.02), or year 8 (RR, 1.02; CI, 1.00–1.05).

Pooled procedure-specific data from the German and Swiss networks showed decreased SSI rate ratios for year 3 for hip prosthesis (RR, 0.61; CI 0.45–0.83) and knee prosthesis (RR, 0.54; 95% CI, 0.37–0.78) but not for cholecystectomy (Appendix 3).

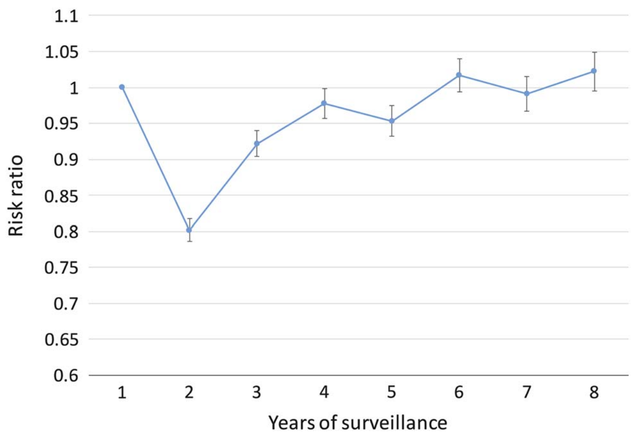

FIGURE 2. Time trend of surgical site infection (SSI) risk ratios by year of participation.

DISCUSSION

The results of this study suggest that SSI rates decrease during the first 5 years of participation in a surveillance network. These results are important because they suggest that participating in a surveillance network can lead to positive patient outcomes. The scope of this review was limited, and SSI surveillance by hospitals not participating in a network may also lead to decreased SSI rates. The reasons for this decrease in SSI rates may be due to a "surveillance effect," like the Hawthorne effect, or may be due to the implementation of evidence-based practices to prevent SSI after obtaining baseline rates during the first year of surveillance.

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The apparent increase in SSI rates after the year 6 of surveillance may be due to enhanced case finding with the increasing experience of infection control practitioners[13] or to a lack of sustainability of SSI prevention interventions (eg, education and training). Also, it is possible that tertiary-care hospitals participate in the network longer and that this apparent "rebound effect" simply represents the absence of smaller community hospitals with a lower case mix and lower SSI rates. This finding may also be counterintuitive; there may be a case for lower intensity case finding, ie, "fatigue" that leads to underestimation of SSI rates over time.

One limitation of this study is the limited amount of data available for synthesis, which limited procedure-specific analyses. Most surveillance networks present data in calendar years, not stratified by year of hospital participation. This reporting method may introduce a bias because large hospitals usually join the networks first, followed by smaller and/or private hospitals later. This effect may alter the case mix and may artificially decrease SSI rates. In addition, it was not possible to differentiate the specific effect of surveillance from other interventions. Also, the extent to which these findings are generalizable to all hospitals is unknown; few to no data are available regarding the characteristics of participating hospitals. Finally, it was not possible to perform a quality assessment of the included studies.

In summary, there seems to be a case for the surveillance effect, yet this needs to be confirmed by performing further studies by obtaining data from surveillance networks worldwide.

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SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2017.186.

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