



## Major article

## Surgical site infection rates in 4 cities in Colombia: Findings of the International Nosocomial Infection Control Consortium (INICC)



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## Key Words:

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low income countries

**Background:** Surgical site infections (SSIs) are a threat to patient safety. However, there are no available data on SSI rates stratified by surgical procedure (SP) in Colombia.

**Methods:** From January 2008–December 2010, a prospective surveillance study on SSIs was conducted by the International Nosocomial Infection Control Consortium (INICC) in 4 hospitals in 4 cities within Colombia using the definitions of the Centers for Disease Control and Prevention–National Healthcare Safety Network (CDC–NHSN). SPs were classified into 10 types, according to ICD–9 criteria.

**Results:** We recorded 193 SSIs associated with 5,063 SPs. SSI rates per type of SP were the following, compared with INICC and CDC–NHSN rates, respectively: 9.1% for laminectomy (vs 1.7% and 1.0%), 8.3% for cardiac surgery (vs 5.6% and 1.3%), 3.9% for appendix surgery (vs 2.9% and 1.4%), 5.5% for abdominal hysterectomy (vs 2.7% and 1.6%), 4.4% for prostate surgery (vs 2.1% and 1.2%), 4.5% for spleen surgery (vs 5.6% and 2.3%), 4.3% for vaginal hysterectomy (vs 2.0% and 0.9%), and 3.0% for gallbladder surgery (vs 2.5% and 0.6%).

**Conclusions:** Compared with CDC–NHSN rates, SSIs rates in our study hospitals were higher in most types of SPs, whereas compared with INICC, they were similar in 5 of the analyzed types, and higher in 4 types. This study represents an important advance toward knowledge of epidemiology in Colombia that will allow us to introduce targeted interventions.

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VDR provided the study idea, conception, and design; software development; data assembly, data analysis, and interpretation; epidemiologic analysis; administrative, technical, and logistic support; and drafting of the article. All authors provided critical revision of the article for important intellectual content, final approval of the article, provision of study patients, and collection of data.

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The burden posed by surgical site infections (SSIs) on patients includes pain, suffering, delayed wound healing, increased use of antibiotics, revision surgery, increased length of hospital stay, and greater rates of mortality and morbidity, all of which are also reflected in excess health care costs.<sup>1</sup> However, the incidence of SSIs in Colombia has not been systematically studied. Therefore, there are neither global SSI rates nor SSI rates stratified by surgical procedure (SP) according ICD–9 criteria<sup>2–4</sup> that would enable a basis for international benchmarking.<sup>5</sup>

According to World Bank categorization,<sup>6</sup> 68% of countries are low-income and lower–middle-income economies—also referred to as lower-income countries or developing countries. Today, lower-income countries comprise >75% of the world population.

However, the incidence of SSIs in limited-resource countries has not been systematically assessed.<sup>7,8</sup>

Surveillance programs focused on health care-associated infections (HAIs)—including SSIs—are essential tools to prevent their incidence and reduce their adverse effects. As widely shown in the literature from high-income countries, particularly in the United States, the implementation of an effective surveillance approach can lead to a reduction in the incidence of HAI by as much as 30%, and by 55% in the case of SSIs.<sup>9</sup> Several reports of the International Nosocomial Infection Control Consortium (INICC) have shown that if surveillance and infection control strategies are applied in limited-resource countries, HAIs can be reduced significantly in these countries, as well.<sup>10–12</sup>

As stated in a report published by the World Health Organization in 2011,<sup>13</sup> limited-resource countries, like Colombia, only have published data on SSI rates stratified by level of wound contamination. Our multicenter study, conducted between January 2008 and December 2010 in 4 hospitals in 4 cities within Colombia, is the first to report an analysis of SSIs rates for 10 types of surgical procedures (SPs) stratified according to ICD-9 code and Centers for Disease Control and Prevention–National Healthcare Safety Network (CDC–NHSN) definitions.

## METHODS

### Background on INICC

The INICC is an open, nonprofit HAI surveillance network that applies methods based on CDC–NHSN definitions.<sup>14</sup> INICC was established to measure and control HAIs worldwide and foster the use of evidence-based prevention measures through the analysis of standardized data collected on a voluntary basis by its member hospitals. Since its inception in 2002, INICC has increasingly gained new members and now comprises nearly 1,000 hospitals in 200 cities of 50 countries in Latin America, Asia, Africa, the Middle East, and Europe, making it the only source of aggregate standardized international data on the epidemiology of HAIs.<sup>15</sup>

### Study setting and design

From January 2008–December 2010 we conducted a cohort prospective multicenter surveillance study of SSIs in patients undergoing SPs in 4 hospitals located in 4 cities within Colombia. Two of the 4 participating hospitals are private community institutions, 1 is a teaching hospital, and 1 is a public hospital. Each hospital's institutional review board agreed to the study protocol.

### INICC surveillance program

As part of the first stage of the INICC program on SSI prevention, infection control professionals (ICPs) at each participating hospital were trained on conducting outcome surveillance of SSI rates<sup>16</sup> according to the standard CDC–NHSN definitions for superficial incisional infection, deep incisional infection, and organ/space infection, including laboratory and clinical criteria.<sup>14</sup>

For analytical purposes, collected data were stratified into 10 SPs according to ICD-9 code.<sup>2–4,17</sup> ICPs reviewed each SP report to find all performed procedures and identify ICD-9 codes, and then reviewed them with the surgeon in charge of the SP. Patients who underwent SPs received follow-up during the first 30 postsurgical days to detect early SSIs, or for 12 months for prosthesis SSIs. These data were sent to INICC headquarters, where data were validated and SSI rates were calculated using the number of SPs as the denominator and the number of SSI as the numerator.

**Table 1**

Surgical site infections (SSIs) of participating Colombian hospitals, by type of procedure

Code	Procedure name	No. of procedures performed	No. of SSIs identified	SSI rate*	No. of hospitals
APPY	Appendix surgery	947	37	3.9 (2.8–5.3)	2
CARD	Cardiac Surgery	363	30	8.3 (5.6–11.6)	2
CHOL	Gallbladder surgery	464	14	3.0 (1.7–5.0)	2
FUSN	Spinal fusion	152	4	2.6 (0.5–7.3)	1
FX	Open reduction of fracture	2499	75	3.0 (2.4–3.7)	1
HYST	Abdominal hysterectomy	344	19	5.5 (3.4–8.5)	2
LAM	Laminectomy	22	2	9.1 (1.1–29.2)	1
PRST	Prostate surgery	181	8	4.4 (1.9–8.5)	1
SPLE	Spleen surgery	22	1	4.5 (0.1–22.8)	1
VHYS	Vaginal hysterectomy	69	3	4.3 (0.9–12.2)	1
All		5063	193	3.8 (3.3–4.4)	4

\*Values for SSI rate are given as % (95% confidence interval).

Data on the duration of SP, level of contamination, and American Society of Anesthesiologists infection risk index classification,<sup>18</sup> according to each patient's physical condition, were not collected. Therefore, it was not possible to calculate the infection risk index of each SP; thus, we pooled the different risk categories included in the CDC–NHSN report 2006–2008<sup>19</sup> to obtain the mean rate of SSIs and compared this rate with our results.

### SPs

The 10 SPs (ICD-9 code) included in this study are: appendix surgery (APPY), cardiac surgery (CARD), gallbladder surgery (CHOL), spinal fusion (FUSN), open reduction of fracture (FX), abdominal hysterectomy (HYST), laminectomy (LAM), prostate surgery (PRST), spleen surgery (SPLE), and vaginal hysterectomy (VHYS).<sup>14</sup>

### Statistical analysis

EpiInfo version 6.04 b (CDC, Atlanta, Georgia) and SPSS 16.0 (IBM–SPSS Inc, Chicago, Illinois) were used to conduct data analysis.

Relative risk ratios, 95% confidence intervals, and *P* values were determined for all primary and secondary outcomes.

## RESULTS

Table 1 shows SSI rates, stratified by SP, including number of SPs, number of SSIs, and SSI rate. SPs with the highest SSI rates were laminectomy (9.1%) and cardiac surgery (8.3%).

Table 2 compares SSI rates in our study with SSI rates in the INICC 2005–2010<sup>15</sup> and CDC–NHSN 2007–2009.<sup>19</sup> Compared with the CDC–NHSN report,<sup>19</sup> SSI rates were significantly higher in 7 out of 10 of the analyzed types of SP (ie, appendix surgery, cardiac surgery, abdominal hysterectomy, laminectomy, prostate surgery, vaginal hysterectomy, and gallbladder surgery) and similar in 3 types of SP (ie, spinal fusion, spleen surgery, and open reduction of fracture).

Compared with the INICC 2005–2010,<sup>15</sup> SSIs rates were significantly higher in our study hospitals in 5 out of 10 of the analyzed types of SPs (ie, appendix surgery, cardiac surgery, abdominal hysterectomy, laminectomy, and prostate surgery), similar in 4 of the 10 SPs (ie, vaginal hysterectomy, gallbladder surgery, spinal fusion, and spleen surgery), and lower in 1 SP (ie, open reduction of fracture).

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