

The Quality of Denominator Data in Surgical Site Infection Surveillance (NOIS) versus Administrative Data (NPR)

Løwer HL, Eriksen HM, Aavitsland P, Skjeldestad FE

Rationale

High quality of surveillance systems for surgical site infections (SSIs) is the key to their usefulness. The Norwegian Surveillance System for Antibiotic Consumption and Healthcare-Associated Infections (NOIS) was introduced by regulation in 2005, and is based largely on automated extraction of data from underlying systems in the hospitals.

Methods

During the period of this study, NOIS-SSI had a 3-month surveillance period and a flexible implementation strategy where hospitals could choose procedures according to a list. The following NCSP surgical procedures are included in this study (in order of priority in NOIS-SSI): coronary artery bypass graft (CABG), cesarean section (CSEC), hip arthroplasty (HPRO) and cholecystectomy (CHOL). NOIS-SSI includes data on the following variables of interest for this study; dates of admission, discharge and surgery, NCSP codes, age, sex, and hospital identifier.

We evaluated the data quality of NOIS-SSI with regard to the completeness, representativeness and accuracy of the denominator data compared with de-identified data from the Norwegian Patient register (NPR). Frequencies were calculated for each of the surgical categories for each year, the whole period, and for each included variable. NOIS-SSI was evaluated against NPR in terms of percentages and chi-squared analysis.

Results

After data cleaning 162,509 procedures remained from NPR for 2005-2010, whereof 45,347 (27.9%) from September - November. From NOIS-SSI, 26,250 procedures were included from September-November of 2005-2010.

Completeness

Completeness as the number of procedures submitted to NOIS-SSI divided by the total number of procedures in NPR for the 3-month surveillance period in 2005-2010 is shown in table 1. NOIS-SSI encompassed 57.9% of the total number of surgical procedures in NPR. The overall completeness improved from 29.2% in 2005 to 79.8% in 2010.

	2005	2006	2007	2008	2009	2010	Total
CABG							
NOIS	167	599	680	718	746	612	3 522
NPR	1 067	1 006	1 046	928	817	796	5 660
Completeness	15,7 %	59,5 %	65,0 %	77,4 %	91,3 %	76,9 %	62,2 %
CSEC							
NOIS	883	1 322	1 634	1 948	2 171	2 484	10 442
NPR	2 210	2 304	2 443	2 513	2 509	2 586	14 565
Completeness	40,0 %	57,4 %	66,9 %	77,5 %	86,5 %	96,1 %	71,7 %
HPRO							
NOIS	903	1 052	1 338	1 853	2 522	2 565	10 233
NPR	2 621	2 628	2 870	2 776	3 106	3 141	17 142
Completeness	34,5 %	40,0 %	46,6 %	66,8 %	81,2 %	81,7 %	59,7 %
CHOL							
NOIS	166	234	339	342	409	563	2 053
NPR	1 356	1 308	1 394	1 362	1 285	1 275	7 980
Completeness	12,2 %	17,9 %	24,3 %	25,1 %	31,8 %	44,2 %	25,7 %
TOTAL completeness	29,2 %	44,3 %	51,5 %	64,1 %	75,8 %	79,8 %	57,9 %

NOIS: Norwegian Surveillance System for Antibiotic Consumption and Healthcare-Associated Infections
NPR: Norwegian Patient Register

Table 1. Completeness: The number of procedures by type of surgical procedure and year and proportion of the procedures in NOIS versus NPR, September-November 2005-2010.

Representativeness

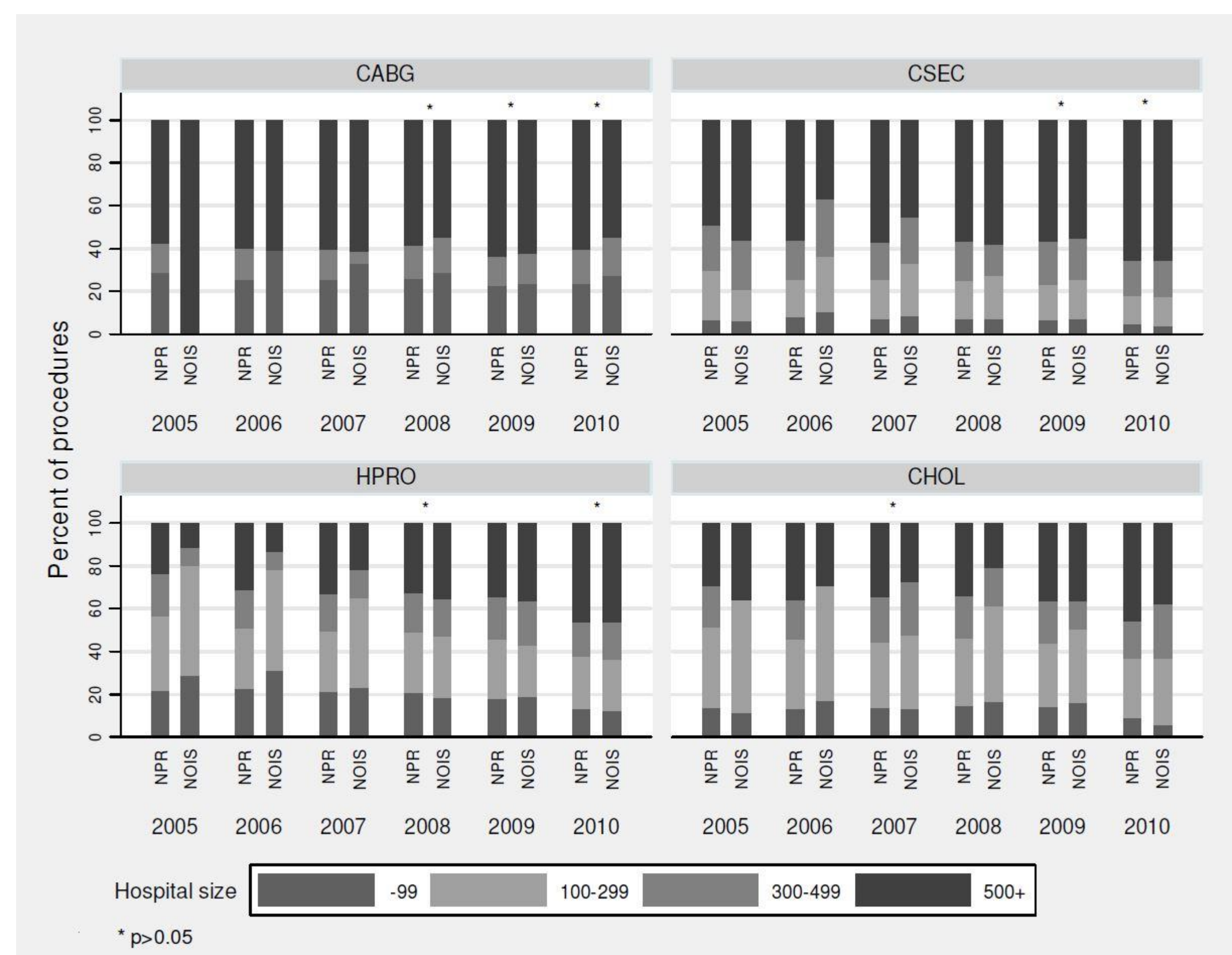


Figure 1 Representativeness: Proportion of procedures (in %) by hospital size in NOIS and NPR (2005-2010)

The representativeness of NOIS-SSI is shown by comparing the distribution of the procedures in NOIS-SSI with NPR by hospital size for each year (figure 1). NOIS-SSI differed significantly from NPR during the first years of operation. The subsequent years, as more hospitals submitted data, the distributions became more similar and thus more representative for most procedures. The median age was about 66 for CABG, 31 for CSEC, 73 for HPRO and 49 for CHOL. There were no significant differences in distribution by age and sex between NOIS-SSI and NPR.

Accuracy

The accuracy of NOIS-SSI was compared with NPR by surgical procedure and year, for hospitals and reporting months which were present in both registers (table 2). There were no significant differences in distribution by region, hospital type and size, age or sex for each year and procedure ($p>0.05$) between NOIS-SSI and NPR.

	2005	2006	2007	2008	2009	2010	Total
CABG¹							
NOIS	167	402	519	580	503	520	2 691
NPR	237	446	589	709	514	554	3 049
Accuracy	70,5 %	90,1 %	88,1 %	81,8 %	97,9 %	93,9 %	88,3 %
CSEC							
NOIS	883	1 304	1 607	1 826	2 051	2 402	10 073
NPR	904	1 346	1 660	2 014	2 065	2 431	10 420
Accuracy	97,7 %	96,9 %	96,8 %	90,7 %	99,3 %	98,8 %	96,7 %
HPRO							
NOIS	903	1 052	1 338	1 853	2 151	2 335	9 632
NPR	943	1 087	1 451	1 959	2 194	2 363	9 997
Accuracy	95,8 %	96,8 %	92,2 %	94,6 %	98,0 %	98,8 %	96,3 %
CHOL¹							
NOIS	159	234	339	341	405	524	2 002
NPR	194	274	359	395	464	582	2 268
Accuracy	82,0 %	85,4 %	94,4 %	86,3 %	87,3 %	90,0 %	88,3 %
TOTAL accuracy	92,7 %	94,9 %	93,7 %	90,6 %	97,6 %	97,5 %	94,8 %

NOIS: Norwegian Surveillance System for Antibiotic Consumption and Healthcare-Associated Infections
NPR: Norwegian Patient Register
¹ Mixed procedures excluded from NOIS for CABG in 2008 and for CHOL in 2007 and 2008

Table 2. Accuracy: The number of procedures by type of surgical procedure and year and proportion of the procedures in NOIS versus NPR for selected hospitals and reporting months, 2005-2010.

Computer system

The development of infection control modules (ICM) from one major supplier and several manual and in-house systems in 2005, to most data from major ICM suppliers in 2010. All ICMs and other systems in the hospitals perform well, and we only find significant differences between NOIS-SSI and NPR for CSEC in 2008 ($p=0.001$). System B had the highest overall accuracy (97.5%). The three commercial systems demonstrate less variability than manual/other systems but the differences were not significant ($p>0.05$).

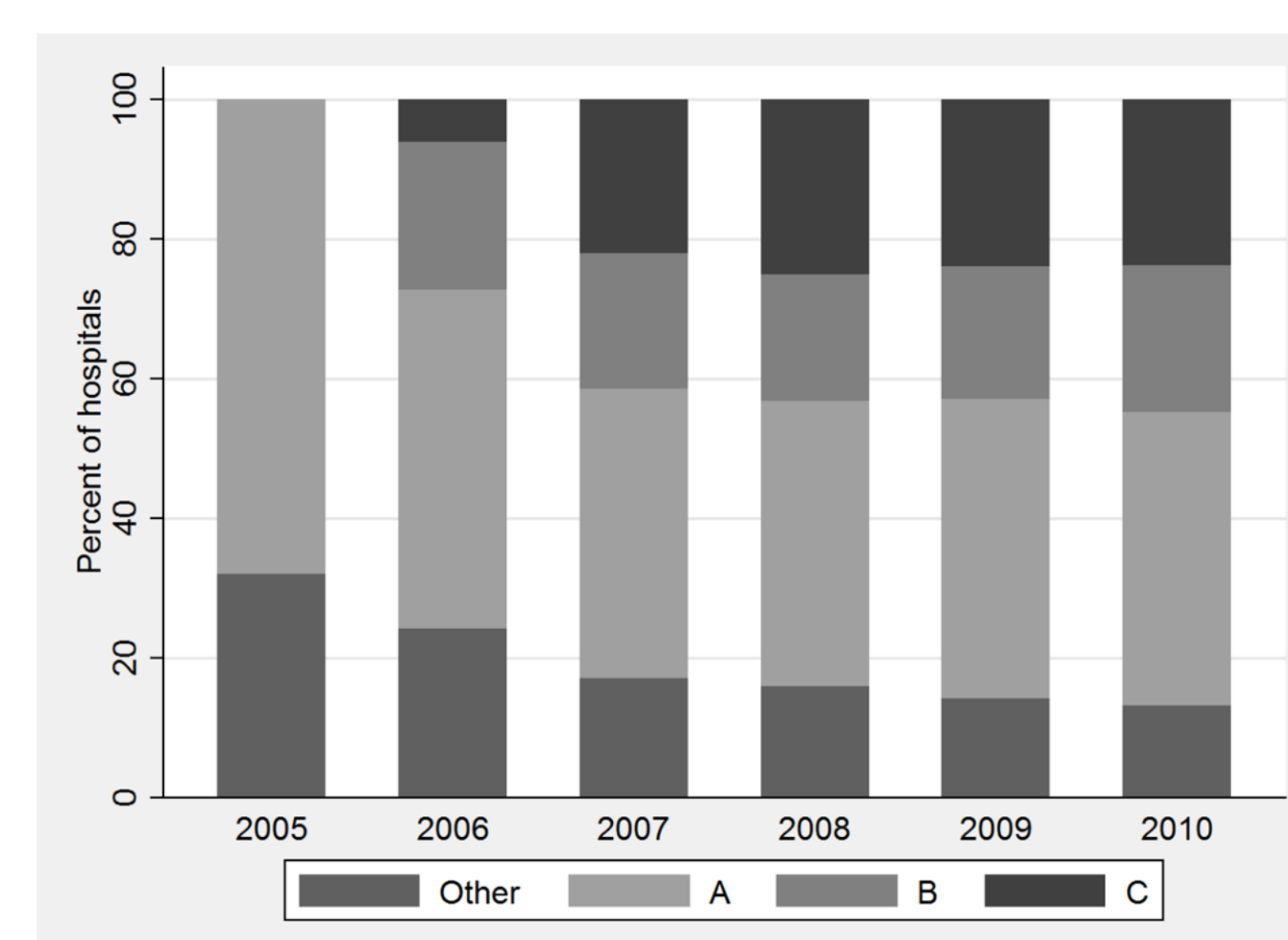


Figure 2. Proportion of hospitals submitting data to NOIS from different electronic systems (A, B and C) and other data sources, 2005-2010

Recommendations

A flexible and incremental implementation strategy has encouraged the development of computer-based surveillance systems in the hospitals which gives good accuracy, but the same strategy has adversely affected the completeness and representativeness of the denominator data. For the purpose of evaluating risk factors and implementing prevention and precautionary measures in the individual hospitals data quality seems sufficient, because hospitals generally have a consistent participation over time and good accuracy. However, for benchmarking and/or public reporting completeness and representativeness are not good enough.

References

References: Lower HL, Eriksen HM, Aavitsland P, Skjeldestad FE. The quality of denominator data in surgical site infection surveillance versus administrative data in Norway 2005-2010. BMC Infect Dis. 2015;15(1):549.