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The Swiss SSI surveillance program

Surgical site infections (SSI) correspond to one of the most frequent complications of surgery, contributing to patient morbidity and mortality, extended hospitalization periods, and substantial healthcare expenditures.

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According to international guidelines, surveillance, consisting in the standardized follow-up of patients who underwent surgical procedures for establishing SSI rates and feeding them back to stake holders, constitutes an important measure for preventing SSI and its implementation is highly recommended.[3,4]

History and legal basis

SSI surveillance was the first healthcare-associated infections (HAI) incidence surveillance module introduced on a large scale in Switzerland. Developed in Valais in 1998, it was implemented in agreement with the local surgeons first in the hospitals of Romandie, Tessin and Emmental before being transferred to Swissnoso, the National center for infection prevention (www.swissnoso.ch), in 2010 and becoming mandatory and nationwide in 2011 as part of the outcome indicators of the ANQ, the Center of excellence for quality measurement in hospitals and clinics (www.anq.ch).

Until 2011, hospitals participated on a voluntary basis. Since then, the implementation and the funding of the surveillance program are governed by the national contract for quality of the ANQ (www.anq.ch/de/nationaler-qualitaetsvertrag-anq/) signed by by H+ (National Association of Swiss Hospitals and Clinics), the health insurances and the cantons under the federal law (Bundesgesetz über die Krankenversicherung – KVG, Loi fédérale sur l'assurance-maladie – LAMal).

Methodology

The surveillance methods are available on the Swissnoso website (http://www.swissnoso.ch/module/ssi-surveillance/material/handbuch-formulare) and have been described in details in former publications.[5,6] They are similar to those of the US Centers for disease control and prevention (CDC) with particular efforts put on post-discharge follow-up and periodic onsite validation audits. Briefly, each hospital has to choose every year from a pool of 13 operations (see Table 1) and to monitor at least three of them, including colon surgery in addition to pediatric appendectomies, which are mandatory for hospitals performing these operations.

Intervention type	*Elective/required*	*Participating hospitals in 2024/25**	*Number cases in 2024/25*
Appendectomy in adults (≥ 16 years old)	Elective		
Appendectomy in children (< 16 years old)	Required in addition to 3 other types of intervention	85	6786
Cholecystectomy	Elective	44	6230
Colon surgery	Required	95	8637
Rectum surgery	Elective	14	603
Gastric bypass	Elective	10	1221
C-section	Elective	27	7375
Hysterectomy (abdominal and vaginal)	Elective	25	2864
Heart surgery (stratified in CABG, valve replacement and other)	Elective	9	5041
Elective total hip prosthesis	Elective	91	21396
Elective knee prosthesis	Elective	71	20977
Laminectomy	Elective	33	5363
Arterial surgery of the lower limbs)	Elective	0	0

Table 1: List of interventions for SSI Surveillance and freedom of choice

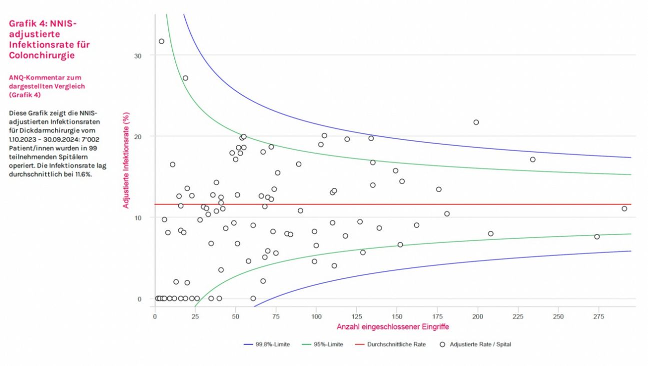
Patients are followed-up for one month (12 months, 3 months since 2021, for operations with implantation of foreign bodies) by specifically trained infection control nurses and infectious diseases physicians using chart reviews and phone or online interviews with the patients and attending physicians. SSIs are diagnosed using the CDC SSI definitions.[7] Data are entered manually using online case report forms by most hospitals but a direct transfer through a web service is possible for hospitals ready for it. SSI rates are calculated by operation for each hospital (plus each surgeon until 2009) globally and for superficial incisional infections (until 2025), deep incisional infections, and organ/space infections. Comparisons are performed between hospitals for each operation using statistical methods (e.g. logistic regression models) allowing the estimation of risks adjusted for the contamination class, the American society of anesthesiologists (ASA) score, and the duration of the operation.

Reporting and results

SSI rates and benchmarking

Each hospital (and each surgeon until 2009) gets a yearly report that describes in detail its own SSI rates stratified by operations, and different risk factors as well as its temporal trends and its statistically adjusted risk for SSI as compared to the other participating hospitals (and previously other surgeons).

In addition, yearly general reports and SSI adjusted rates of each hospital are openly published on the ANQ website since 2011 together with various information as shown in figure 1 with the example of colon surgery (www.anq.ch/de/fachbereiche/akutsomatik/messergebnisse-akutsomatik).



The general results of SSI surveillance constitute also a part of the annual report on healthcare-associated infections published by Swissnoso on mandate of the Federal Office of Public Health (www.swissnoso.ch/guidelines-publikationen/annual-reports-hai).

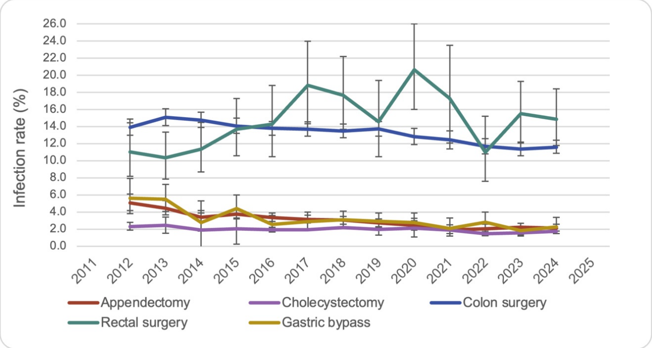


Figure 2: Temporal trend of SSI rates for visceral surgery

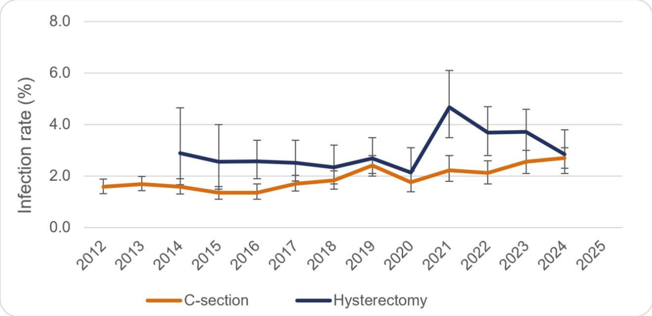


Figure 3: Temporal trend of SSI rates for C-section and hysterectomy

Figures 2 to 5 show the aggregated temporal trends of SSI rates for various operations in Switzerland since 2011. SSI rates have decreased significantly over time for 10 operations, i.e. appendectomies, cholecystectomies, colon surgery, gastric bypasses, cardiac surgery including coronary bypasses and valve procedures, hip replacements, knee replacements, and laminectomies with implants. In contrast, temporal trends show a significant increase for rectal surgery, hysterectomies, and C-sections. These trends occurred while the number of patients with an ASA score >=3 increased in a significant statistical manner for most interventions as did their age for appendectomy, cholecystectomy, colon surgery, C-section, laminectomy without implant, hip, and knee arthroplasty.

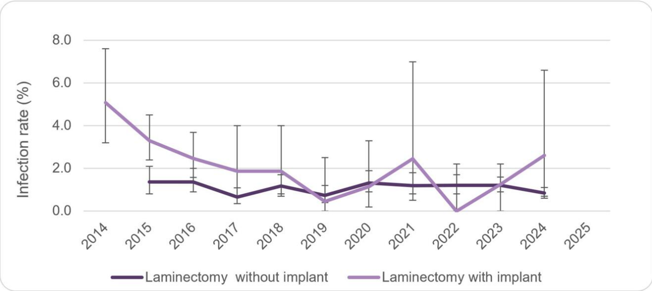


Figure 4: Temporal trend of SSI rates for laminectomy

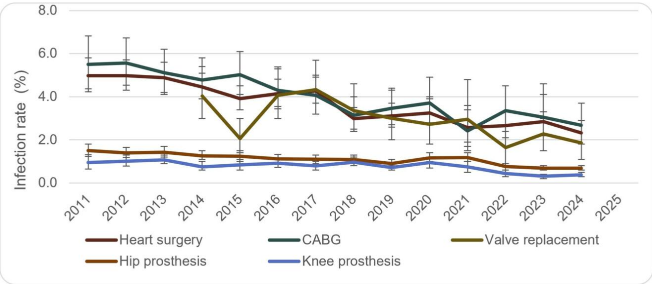


Figure 5: Temporal trend of SSI rates for heart surgery and hip and knee prosthesis

These results are shown and discussed in details in the 2 above-mentioned reports. Of note, in 2023-2024, 36% of SSI necessitated a new admission and 51.5% a new intervention.

Quality control

Periodic onsite visits by trained Swissnoso personnel are organized to test the homogeneity of the surveillance procedures and diagnosis criteria between hospitals. Using a standardized scoring system, each hospital gets a mark varying from 0 to 50, visible on the ANQ website together with SSI rates and other information. This allows quality monitoring, comparisons to other hospitals and corrective measures when necessary. As shown in Figure 6, the evolution of the distribution of scores through successive visits corresponds to an improvement of quality over time.

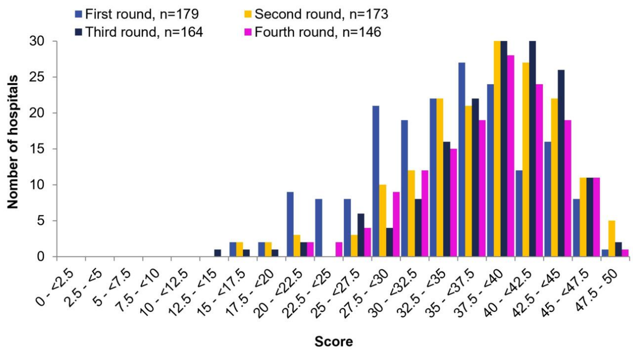


Figure 6: Distribution of the scores that hospitals and clinics received during the various audit visits

Research and peer-reviewed publications

The Swiss SSI surveillance program gave rise to various scientific hypotheses that were tested using its anonymized database (currently about 800,000 operations included) for observational studies. A number of resulting research papers were published in peer-reviewed journals.[5,6,8-27]

Analyses were performed to determine the independent association between specific parameters and SSI such as laparoscope use in digestive surgery (associated with a lower risk of SSI),[8] daytime for cardiac surgery (no influence found on SSI and mortality),[9] environmental temperature and heatwaves in hip and knee arthroplasties (higher SSI rates in the summertime)[10], and air quality in the operating room (better ventilation properties as assessed by a newly developed index associated with lower rates of superficial and deep incisional SSI in orthopedic and cardiac surgery).[11] Of note, surgeons were confirmed as playing an important role for the prevention of SSI in colon surgery without correlation found between their individual adjusted risk and their self-reported adherence to guidelines or time since their board certification.[12]

Other articles addressed questions linked to the surveillance system itself. Shortening the follow-up from 12 to 3 months for operations with implantation of foreign bodies was shown to have an acceptable impact on SSI rates.[13] Attempts were made to develop prediction models for SSI.[14,15] Importantly, a study found that a lesser quality, as measured during the onsite visits in hospitals, was associated with lower SSI rates, suggesting that the quality of surveillance is an important parameter to consider when establishing comparisons between hospitals.[16] Although a multinational study that included the Swiss program showed a general decrease in SSI rates over time when participating in a surveillance system,[17] rates were still deemed too high in Switzerland.[5,18] A complementary program was thus developed, aiming at enhancing and monitoring the adherence of hospitals to preventive measures (www.swissnoso.ch/module/ssi-intervention). Preliminary results suggested its effectiveness.[19]

Surgical antibiotic prophylaxis (SAP) is one of the most effective ways to prevent SSI.[3,4] Studies using the surveillance data addressed various still open questions. The best timing for SAP was found to be within one hour prior the incision, ideally within 10 to 25 minutes, suggesting that it could be easily done at the patient's arrival in the operating room.[20,21] A study on 55'901 C-sections found a trend, but did not confirm a statistically increased SSI risk for the mother if SAP was given after umbilical cord clamping compared to before incision.[22] Studies also found that patients undergoing low-risk cholecystectomies may benefit from routine SAP,[23] that doubling the dose of cefuroxime for patients weighting more than 80 kg is not associated with lower SSI rates,[24] that cefuroxime plus metronidazole prevents SSI better than amoxicillin/clavulanic acid in colorectal surgery and pediatric appendectomies,[25,26] and that non-beta-lactam antibiotics (e.g. clindamycin) were associated with higher odds of SSI than beta-lactam antibiotics (e.g. cefazoline or cefuroxime).[27]

Current and future developments

Surveillance programs have been shown to be useful for the prevention of SSI and are implemented in many countries.[7,17,28-30] However, they are demanding for hospitals in terms of human resources. Thus, Swissnoso and ANQ made already some changes aiming at lowering the necessary workload, i.e. shortening the follow-up from 12 to 3 months for operations with implantation of foreign bodies in 2021, and discontinuing the inclusion of superficial incisional infections and introducing more user-friendly case report forms in 2026). In addition, the merging of the Swissnoso SSI surveillance with the Swiss National Joint Registry (SIRIS) (www.siris-implant.ch) anticipated in 2027 will substantially facilitate the work of infection control teams for the follow-up of hip and knee arthroplasties.

According to a mandate of the Federal commission for quality (Eidgenössische Qualitätskommission – EQK, Commission fédérale pour la qualité – CFQ), Swissnoso will develop in the coming years a national database for healthcare-associated infections with automated transfer of standardized data from hospitals, a progress that will greatly diminish the necessary workload for surveillance. Moreover, new developments for automated or semi-automated detection of SSI through algorithms and machine learning could occur in a quite near future and contribute to further alleviate the workload of hospitals and reinforce the agreement for the diagnosis of SSI between hospitals.[31,32]

Another important future goal is to directly connect intervention procedures, such as *Staphylococcus aureus* decolonization or gut decontamination to the SSI Surveillance database and thus consider them an integral part of SSI Surveillance.

Finally, new hospital reports will include from 2027 on an online interactive access and operation-specific risk adjustment taking more confounding factors into account such as emergency, body mass index and cancer.

Conclusion

As in many countries and as recommended by international guidelines, a surgical site surveillance program was developed in Switzerland 28 years ago before becoming mandatory in 2011 for all hospitals with surgical activities. It is still evolving to facilitate its practical implementation but contributed already significantly to the fight against healthcare-associated infections and to test scientific hypotheses. It revealed a decrease in SSI rates over time for 10 of 13 included surgical procedures but also that efforts are still needed. This motivated the adjunction of an SSI-intervention module aiming at monitoring the adherence to proven prevention measures, thus adding process indicators to outcome indicators in order to better implement the PDCA (plan, do, check, act) principles of quality management in hospitals.

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