Annual Epidemiological Report for 2018–2020

Healthcare-associated infections: surgical site infections

Key facts

- Surgical site infections (SSIs) are among the most common healthcare-associated infections (HAIs). They are associated with longer post-operative hospital stays, additional surgical procedures, treatment in intensive care units and higher mortality.
- In 2018-2020, 12 EU Member States and one EEA country reported 19 680 SSIs from a total of 1 255 958 surgical procedures for nine types of surgical procedures.
- The percentage of SSIs varied from 0.6% in knee prosthesis surgery to 9.5% in open colon surgery, depending on the type of surgical procedure.
- The incidence density of in-hospital SSIs per 1 000 post-operative patient-days varied from 0.1 to 5.0, depending on the type of surgical procedure.
- Comparing the year 2020 to 2018-2019, there was a decrease in the yearly number of surgical procedures reported and countries providing data to ECDC.

Methods

This report is based on data for 2018-2020 retrieved on 13 February 2023 from The European Surveillance System (TESSy) and ECDC's decentralised data storage for antimicrobial resistance and healthcare-associated infections (ARHAI). TESSy is a system for the collection, analysis and dissemination of data on communicable diseases. EU/EEA countries contribute to the system by uploading their infectious disease surveillance data at regular intervals. The ARHAI decentralised data storage is a system allowing EU/EEA countries to store their surveillance data on their national servers in TESSy data format.

For a detailed description of methods used to produce this report, please refer to the *Methods* chapter [1].

Additional data on this topic are accessible from ECDC's online *Surveillance atlas of infectious diseases* [2].

SSI surveillance data for 2018-2020 were reported to ECDC by 13 countries (12 EU Member States and one EEA country).

Data on SSIs following surgical procedures that took place in 2018-2020 were collected in hospitals participating in national or regional surveillance of SSIs across Europe. The surveillance protocol allowed these hospitals to opt for patient-based or unit-based reporting, but in 2018-2020 all countries provided patient-based data [3,4]. SSI cases were classified according to the modified 2012 EU case definitions [5,6].

The SSI surveillance protocol includes nine types of surgical procedures: coronary artery bypass graft (CABG), open and laparoscopic cholecystectomy (CHOL), open and laparoscopic colon surgery (COLO), caesarean section (CSEC), hip prosthesis (HPRO), knee prosthesis (KPRO) and laminectomy (LAM). SSIs detected within a defined follow-up period were included in the analysis. The standardised follow-up period was 31 days. For deep or organ/space infections following orthopaedic operations with an implant in place (HPRO/KPRO), the follow-up period was extended to 91 days [4]. Laparoscopic/open procedures for CHOL and COLO only include the data for which the variable 'endoscopic procedure (yes/no)' was reported.

For all patients with an SSI, basic demographics, infection characteristics and outcome at hospital discharge were collected. In the patient-based surveillance option, these data were collected from all surgical patients. Furthermore, information on each surgical procedure was collected, including whether the operation was urgent (i.e. not planned at least 24 hours in advance). The US National Healthcare Safety Network (NHSN) risk index, which is based on the presence of three major risk factors (duration of the operation, wound contamination class and the American Society of Anesthesiologists physical status classification), was used to assign all surgical patients to one of four categories from low to high risk (0, 1, 2 and 3) [8,9]. In this analysis, categories 2 and 3 were combined because of the low number of operations in these categories. For the duration of the operation, instead of set cut-offs used in the SSI surveillance protocol v2.2, the 75th percentile was calculated from the surveillance data 2018-2020 to classify procedures with long duration [4].

For each type of surgical procedure under surveillance, two main indicators were calculated:

- The percentage of SSIs per 100 operations: an indicator which includes both SSIs diagnosed during hospital stay and after discharge from the hospital (detected at hospital readmission or by post-discharge surveillance).
- The incidence density of in-hospital SSIs per 1 000 post-operative patient-days: an indicator which only includes SSIs diagnosed during hospital stay in patients with a known date of discharge from the hospital.

Both indicators were also stratified by NHSN risk index categories (shown by type of surgical procedure in the annexed Tables A2.2-A10.2).

Since the 2017 protocol update, the ECDC SSI surveillance has included structure and process indicators for SSI prevention, aggregated by type of surgical procedure. These indicators include: 1) Administration of perioperative antibiotic prophylaxis (PAP) within 60 minutes before incision, 2) Discontinuation of PAP within 24 hours after initiation of surgery, 3) Use of alcohol- and chlorhexidine gluconate (CHG)-based antiseptic solutions for surgical site skin preparation, 4) No hair removal, 5) Ensuring normothermia in the perioperative period for the patient, and 6) Use of a protocol for intensive perioperative blood glucose control and monitoring of blood glucose levels.

Compliance with these indicators was measured by calculating the ratio of compliant observations to all observations and stratifying them by type of procedure. Graphical assessments of mean and interquartile range were used to identify differences between participating hospitals.

Epidemiology

All 13 EU/EEA countries that participated in surveillance of SSIs in 2018-2020 reported patient-based data (Figure 1). The number of participating hospitals as well as country representativeness varied between countries, with noticeable differences in the national coverage of the surveillance systems (Table 1). Seven of the 13 EU/EEA countries reported performing post-discharge surveillance, using different methods varying from SSIs being reported by the patient to SSIs being reported by the surgeon or general practitioner.

Figure 1. **Participation in the surveillance of surgical site infections (SSIs), EU/EEA, 2018–2020**
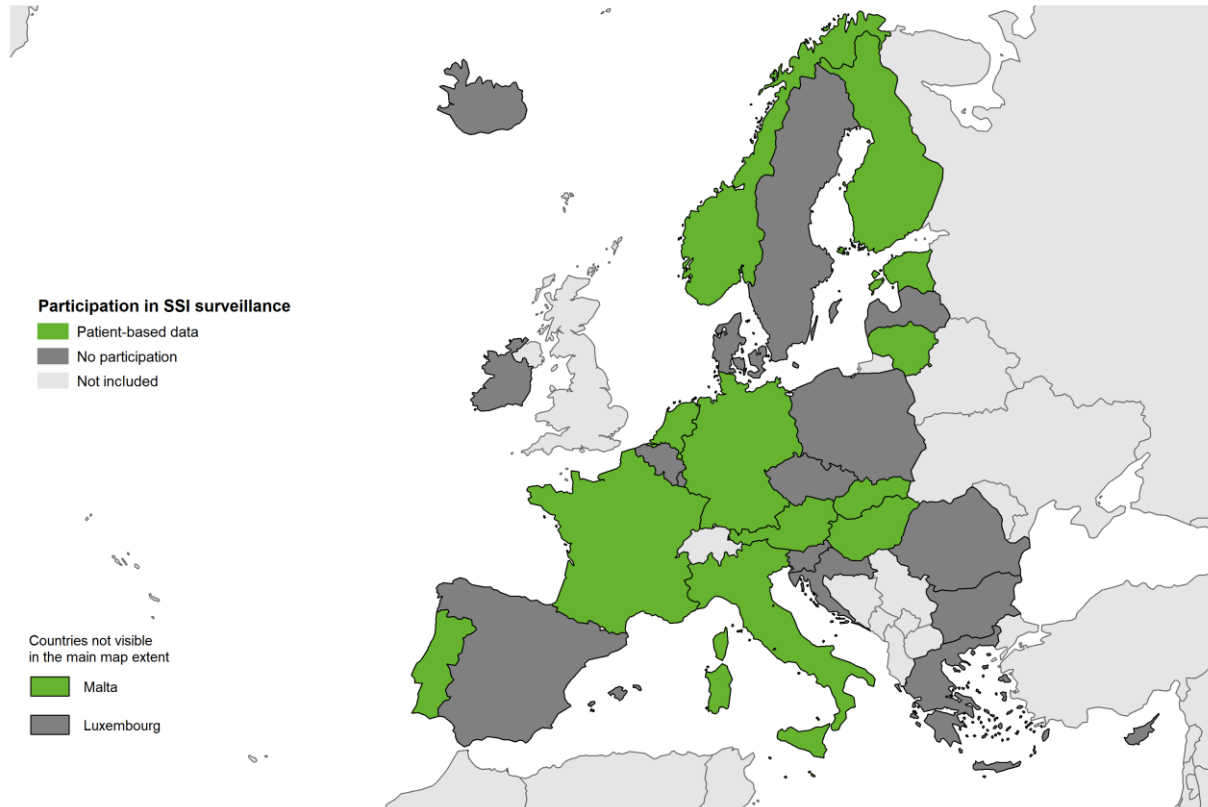
Source: ECDC TESSy SSI surveillance data
The boundaries and names shown on this map do not imply official endorsement or acceptance by the European Union. ECDC. Map produced on 16 February 2023

Source: ECDC, HAI-Net, 2018-2020

Overall, 1 255 958 surgical procedures from 2 537 hospitals were reported in 2018-2020 (Table 1). The most frequently reported types of surgical procedure were HPRO, followed by KPRO and CSEC.

Table 1. Number of reporting hospitals and reported surgical procedures by country/network and type of surgical procedure, EU/EEA, 2018–2020

| Country/network | Number of reporting hospitals | Number of procedures | | | | | | | | | Total |
		CABG	Laparoscopic CHOL	Open CHOL	Laparoscopic COLO	Open COLO	CSEC	HPRO	KPRO	LAM	
Austria	35	1 196	5 545	2 282	106	1 057	9 395	18 372	12 621		50 574
Estonia	2	119					441				560
Finland	18							28 530	25 198		53 728
France	330	1 055	6 666		1 283		12 624	15 605	11 486	1 227	49 946
Germany	1 711	28 985	62 190	3 961	14 642	22 361	82 206	221 138	139 245	23 384	598 112
Hungary	41	308	2 904	699	245	978	5 470	1 092	982	686	13 364
Italy	126	4 022	12 140	3 421	4 538	6 224	15 834	26 435	18 341	7 331	98 286
Lithuania	51	479	1 879	102	91	246	1 580	1 480	1 159		7 016
Malta	2				40	213		371	663		1 287
Netherlands	82	1 107	24 246	123	9 380	3 890	25 124	97 012	83 383	5 354	249 619
Norway	61	3 624	17 725	579	5 539	3 917	23 810	38 405			93 599
Portugal	73	79	9 806	88	4 343	530	8 720	7 235	6 732	1 825	39 358
Slovakia	5		381	128							509
EU/EEA	**2 537**	**40 974**	**143 482**	**11 383**	**40 207**	**39 416**	**185 204**	**455 675**	**299 810**	**39 807**	**1 255 958**

Source: Country reports from Austria, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway, Portugal and Slovakia.
CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis, KPRO: knee prosthesis, LAM: laminectomy.

The ratio of male to female patients was the highest in CABG operations (4.3:1) and the lowest in HPRO, KPRO and laparoscopic CHOL operations (0.6:1); this ratio was not reported for CSEC operations (Table 2). The median age of patients varied from 32 years in CSEC operations to 72 years in HPRO operations. Post-operative in-hospital case fatality (7.4%) and the proportion of contaminated or dirty operations (35.7%) were the highest among open COLO operations. The median duration of operation was the longest in CABG operations (206 minutes), and the median length of post-operative stay was the longest in open COLO operations (11 days). The proportion of urgent operations varied from 11.9% in KPRO operations to 48.5% in CSEC operations. For most types of surgical procedures, over 80% and up to 99% patients received antibiotic prophylaxis, with the exception of CHOL operations, for which 47% patients with a laparoscopic procedure and 71% patients with an open procedure received antibiotic prophylaxis.

Table 2. Characteristics of patients by type of surgical procedure, patient-based data, EU/EEA, 2018–2020

Characteristics	CABG (n=40 974)	Laparoscopic CHOL (n=143 482)	Open CHOL (n=11 383)	Laparoscopic COLO (n=40 207)	Open COLO (n=39 416)	CSEC (n=185 204)	HPRO (n=455 675)	KPRO (n=299 810)	LAM (n=39 807)
Sex ratio (male:female)	4.3	0.6	0.9	1.0	1.0	0	0.6	0.6	1.2
Median age (years)	69	56	65	68	71	32	72	70	57
Post-operative in-hospital case fatality (%)	1.8	0.3	1.9	2.9	7.4	0	2.1	0.1	0.1
Contaminated or dirty operations (%)	3	17.3	26.7	24.2	35.7	7.8	0.7	0.6	0.8
Median duration of operation (minutes)	206	57	85	144	138	37	68	74	63
75th percentile of the duration of operation (minutes)	250*	79	129	190	185	47	86	92	96
Median length of post-operative stay (days)	9	3	6	7	11	4	7	7	4
Urgent operations (%)	32.9	26.7	28.5	11.6	33.9	48.5	30.4	11.9	18.5
Antibiotic prophylaxis (%)	99.6	46.8	70.6	86.3	83.2	83.8	96.1	97.9	84.9

*CABG with both chest and donor site incisions: 248 minutes; CABG with only chest incision: 260 minutes.
Source: Country reports from Austria, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway, Portugal and Slovakia.
See Table 1 for reporting hospitals and reported surgical procedures in EU/EEA countries.
CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis surgery, KPRO: knee prosthesis surgery, LAM: laminectomy.

In 2018-2020, 19 680 SSIs were reported. Of these, 8 560 (42%) were superficial, 6 042 (30%) deep and 5 720 (28%) organ/space SSIs. The Netherlands reported all combined deep and organ/space SSIs as deep SSIs. In 55

(0.3%) SSIs, the type of SSI was unknown. The proportion of deep or organ/space SSIs was 27% in CSEC operations, 42% in laparoscopic CHOL operations, 44% in open CHOL operations, 44% in LAM operations, 50% in open COLO operations, 50% in CABG operations, 57% in laparoscopic COLO, 74% in KPRO operations and 81% in HPRO operations (Figure 2). Thirty per cent of all SSIs were diagnosed in hospitals, whereas 50% were detected after discharge and for 20% the discharge date was unknown. The proportion of SSIs diagnosed in-hospital varied from 59% in open COLO operations to only 9% in KPRO operations.

Figure 2. Types of SSI by type of surgical procedure, EU/EEA, 2018-2020

CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis surgery, KPRO: knee prosthesis surgery, LAM: laminectomy
Source: Country reports from Austria, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway, Portugal and Slovakia.
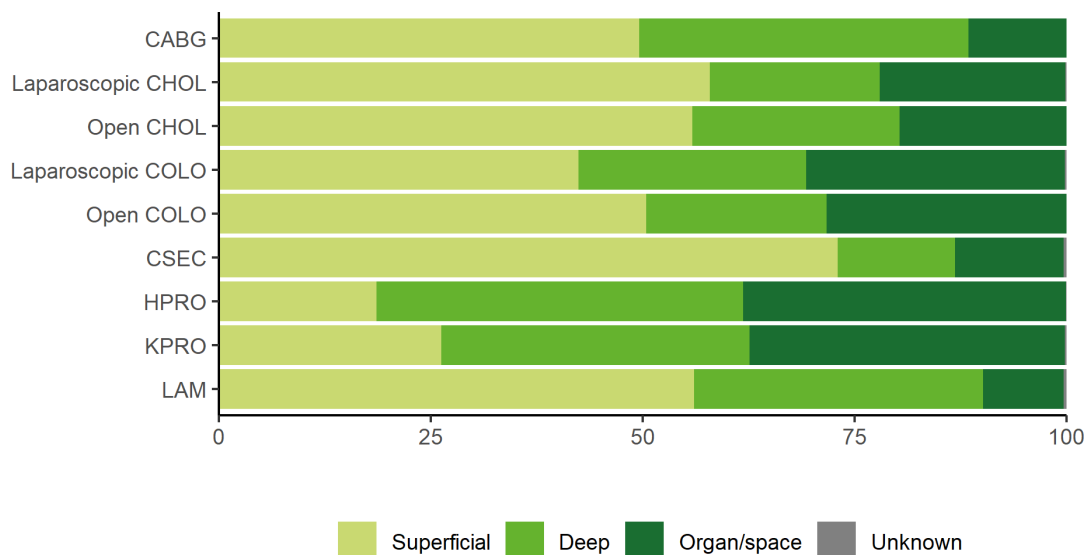*Note: The Netherlands reported all combined deep and organ/space SSIs as deep SSIs.*
See Table 1 for reporting hospitals and reported surgical procedures in EU/EEA countries.

The percentage of SSIs varied greatly by type of surgical procedure, from 0.6% in KPRO operations to 9.5% in open COLO operations. Similarly, there were notable differences in the incidence density of in-hospital SSIs between different types of surgical procedure (Table 3). Laparoscopic procedures in both CHOL and COLO operations had lower percentages of SSIs and incidence density than open procedures.

Table 3. Percentage of SSIs and incidence density of in-hospital SSIs by year and type of surgical procedure, EU/EEA, 2018–2020

Type of surgical procedure	Percentage of SSIs per 100 operations [intercountry range]	Incidence density of in-hospital SSIs per 1 000 post-operative patient-days [intercountry range]
CABG	1.9 [0.0-5.0]	0.7 [0.0-3.3]
Laparoscopic CHOL	1.5 [0.4-2.9]	0.9 [0.4-3.1]
Open CHOL	3.8 [0.9-12.4]	3.1 [1.3-7.8]
Laparoscopic COLO	6.7 [3.5-16.4]	4.4 [2.1-12.9]
Open COLO	9.5 [3.6-26.8]	5.0 [3.3-12.2]
CSEC	1.3 [0.5-3.6]	0.5 [0.2-1.4]
HPRO	1.2 [0.0-3.0]	0.3 [0.0-1.2]
KPRO	0.6 [0.2-4.2]	0.1 [0.1-0.9]
LAM	0.7 [0.4-2.6]	0.3 [0.1-2.9]

CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis surgery, KPRO: knee prosthesis surgery, LAM: laminectomy
Source: Country reports from Austria, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway, Portugal and Slovakia.
See Table 1 for reporting hospitals and reported surgical procedures in EU/EEA countries.

For all types of surgical procedure, the number of reporting countries and the total number of reported procedures decreased in 2020 compared to 2018 or 2019 (Figure 3). With the exception of CABG and open CHOL procedures, the highest numbers of procedures were nevertheless reported in 2019, whilst for the reporting countries, participation was the highest in 2018.

Figure 3. Number of (A) participating countries and (B) reported procedures by year and type of surgical procedure, EU/EEA, 2018–2020
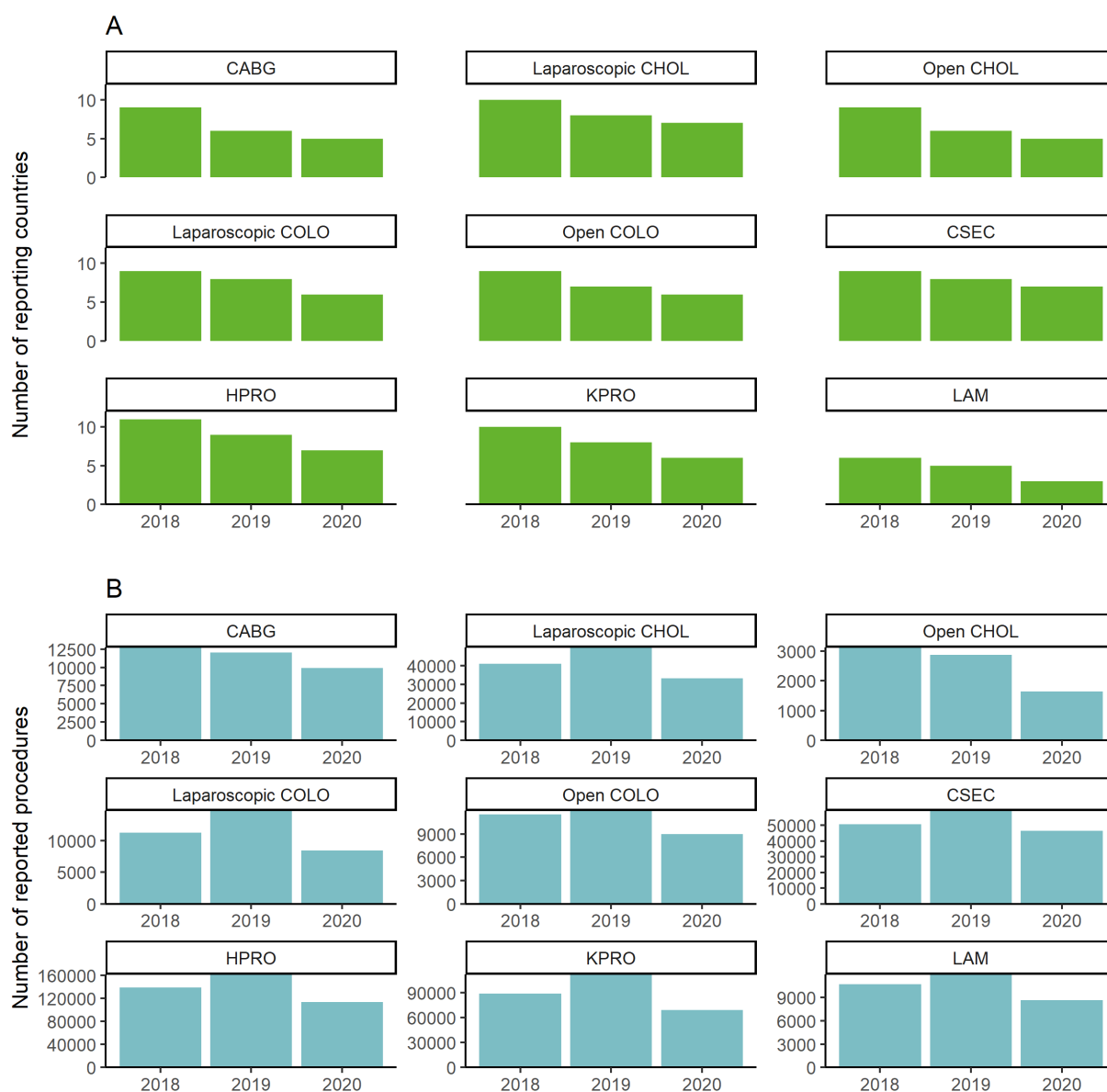
CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis surgery, KPRO: knee prosthesis surgery, LAM: laminectomy
Source: Country reports from Austria, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway, Portugal and Slovakia.
See Table 1 for reporting hospitals and reported surgical procedures in EU/EEA countries.

Including only the types of surgical procedures that were consistently reported by participating countries (data reported for all three years), the percentage of SSIs was the lowest in 2020 or in 2019-2020 for most types of surgical procedures except for open CHOL procedures (Figure 4). For the incidence density of in-hospital SSIs, HPRO procedures showed a higher incidence density in 2020 than in preceding years.

Figure 4. Trends of (A) percentage of SSIs and (B) incidence density of in-hospital SSIs by year and type of surgical procedure, EU/EEA, 2018–2020
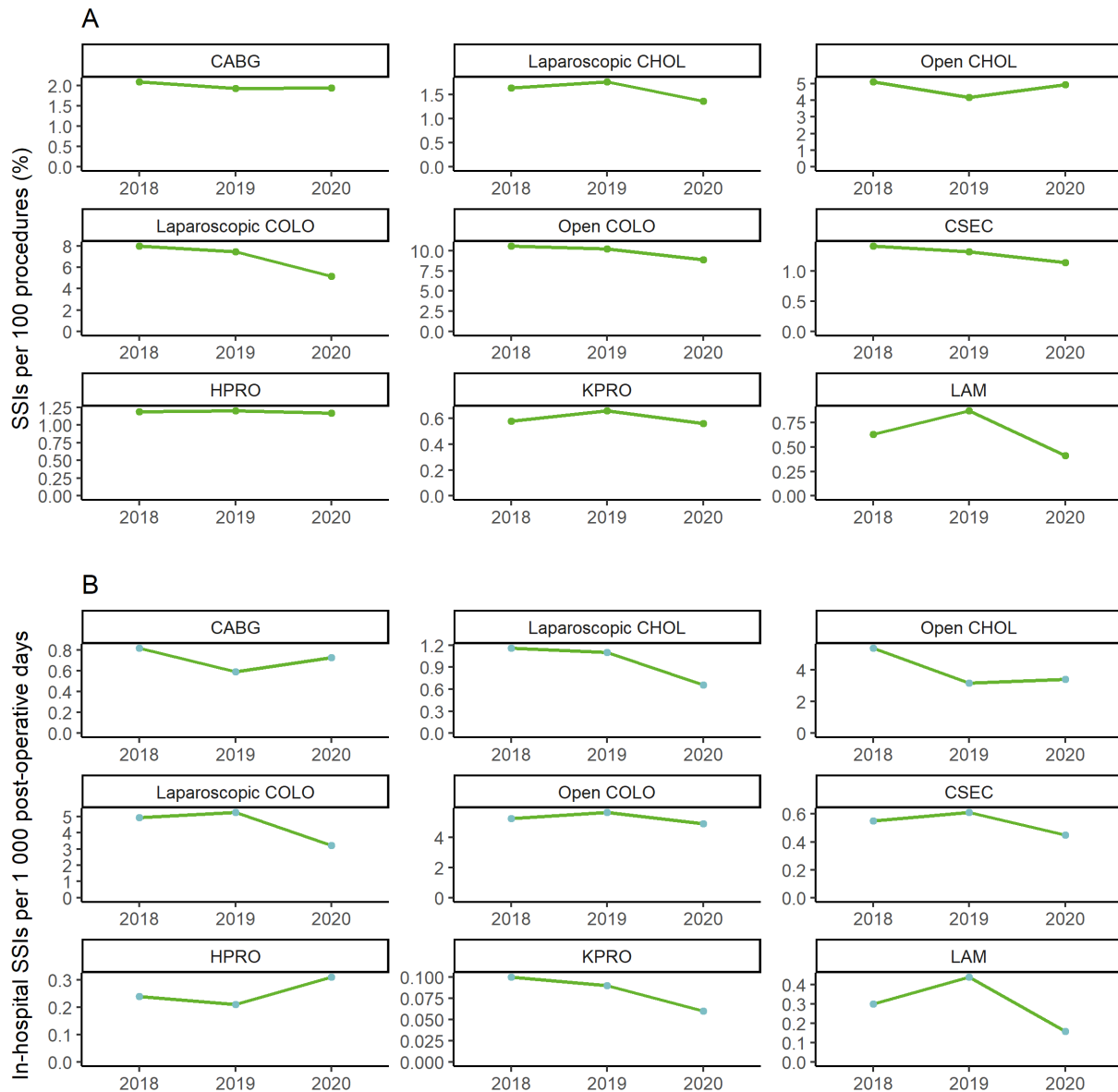

CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis surgery, KPRO: knee prosthesis surgery, LAM: laminectomy
Data included only for countries reporting data on types of surgical procedure for all three years continuously: Austria, Finland, Germany, Hungary, Lithuania, the Netherlands, Norway and Portugal.

Data on microorganisms were reported for 11 170 microorganisms in 7 816 SSIs from 11 countries. Overall, *Enterococcus* species (17.6%), *Escherichia coli* (17.2%) and *Staphylococcus aureus* (15.2%) were the most frequently reported microorganisms (Table 4). The distribution of microorganisms varied by type of surgical procedure. For open CHOL, laparoscopic COLO, KPRO and LAM operations, the most frequently reported microorganisms were Enterobacterales; for other types of surgical procedure, gram-positive cocci remained the most frequently reported microorganisms.

Table 4. **Percentages of microorganisms identified in SSIs by type of surgical procedure, pooled data from 11 EU/EEA countries, 2018–2020 (n=11 170)**

Microorganisms	CABG (n=619)	Laparoscopic CHOL (n=747)	Open CHOL (n=251)	Laparoscopic COLO (n=1 640)	Open COLO (n=2 950)	CSEC (n=666)	HPRO (n=3 224)	KPRO (n=926)	LAM (n=147)	Total (n=11 170)
Gram-positive cocci	65.9	52.9	39	34.8	70.4	78.8	74.8	43.4	36	52.8
Staphylococcus aureus	19.1	23.9	7.6	4.3	25	38.4	42.2	7.2	1.9	15.2
Coagulase-negative staphylococci	37.2	9.2	6.2	2.2	27	22.6	24.5	6	2.2	14
Enterococcus species	7.6	11.1	18.9	24.5	9.3	5.6	4.8	27.9	29.6	17.6
Streptococcus species	0.8	4.8	1.9	2.3	3.7	5.7	0.7	0.8	0.9	2.6
Other gram-positive cocci	1.3	3.9	4.4	1.4	5.4	6.5	2.7	1.6	1.4	3.3
Gram-positive bacilli	1	1.5	0.8	0.1	2	2.7	0	0.8	0.2	1.1
Gram-negative bacilli, Enterobacterales	24.1	27.5	44.4	48.7	18.3	10.6	15.6	45.8	46.6	32.8
Escherichia coli	5.2	13.2	21.7	30.4	6.2	3.5	8.8	24.7	28.1	17.2
Citrobacter species	0.6	0.5	2.4	1.1	0.7	0.4	0.7	0.4	2.2	1.2
Enterobacter species	6.8	2.3	5.6	5.5	3.3	2.8	2	7.6	4	4.1
Klebsiella species	4.5	5	9.8	6.2	2.1	1.4	1.4	11.6	6.1	4.7
Proteus species	4	3.5	2.1	2.1	3.8	1.3	1.4	0.4	2.9	2.9
Serratia species	1.8	1.1	0.3	0.9	1	0.8	0.7	0.8	0.8	0.9
Other Enterobacteriaceae	1.1	2.1	2.5	2.5	1.1	0.4	0.7	0.4	2.6	1.8
Gram-negative non-fermentative bacilli	4.2	4.2	2.1	6	3.8	3.3	4.8	1.6	7.8	5
Acinetobacter species	0.3	0.5	0.3	0.4	0.6	0.6	0.7	0.4	0.3	0.4
Haemophilus species	0	0.2	0.1	0	0	0.1	0	0	0	0
Pseudomonas aeruginosa	3.6	2.1	0.9	5.3	2.9	1.6	3.4	0.4	6.9	4
Pseudomonadaceae family, other	0	0.2	0	0	0.2	0.6	0	0	0	0.1
Stenotrophomonas maltophilia	0.2	0	0.3	0.1	0.1	0.3	0	0	0.3	0.2
Other gram-negative non-fermentative bacilli	0.2	1.4	0.5	0.2	0.1	0	0.7	0.8	0.2	0.3
Anaerobes	3.1	12	8.7	6.3	4.8	3.8	3.4	5.2	4.5	5.5
Bacteroides species	0	1.8	1.2	4.4	0.2	0.1	0	3.2	3.3	1.8
Other anaerobes	3.1	10.2	7.5	2	4.6	3.7	3.4	2	1.3	3.6
Other bacteria	0.2	1.8	3.5	1	0.4	0.6	0	0	1.3	1
Fungi, parasites	1.6	0.2	1.5	3.2	0.3	0.1	1.4	3.2	3.5	1.8
Candida species	1.6	0.2	1.5	3.2	0.3	0.1	1.4	3.2	3.5	1.8
Other fungi or parasites	0	0	0	0	0	0	0	0	0	0

CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis surgery, KPRO: knee prosthesis surgery, LAM: laminectomy
See Table 1 for reporting hospitals and reported surgical procedures in EU/EEA countries.
Source: Country reports from Austria, Estonia, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Portugal and Slovakia.

Data on structure and process indicators were provided by five countries (Austria, Italy, Lithuania, Malta and the Netherlands), with the Netherlands only reporting data for 2018 and not reporting any data for the discontinuation of PAP within 24 hours after surgery initiation or for the use of a protocol for intensive perioperative blood glucose control and monitoring of blood glucose levels. All five countries reported indicators for HPRO procedures, with 27 564 procedures assessed for compliance with alcohol- and CHG-based antiseptic solutions for surgical site skin preparation. For KPRO and CHOL, data were reported by four countries.

Compliance with each indicator is shown in Figure 5, with variability observed both between indicators and types of surgical procedure. The indicator for discontinuation of PAP within 24 hours after initiation of surgery was reported for 5 948 surgical procedures of different types (for further details on reporting and overall compliance, see Annex, Table A11).

Figure 5. Compliance (%) with each structure and process indicator by type of surgical procedure, EU/EEA, 2018–2020

CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis surgery, KPRO: knee prosthesis surgery, LAM: laminectomy
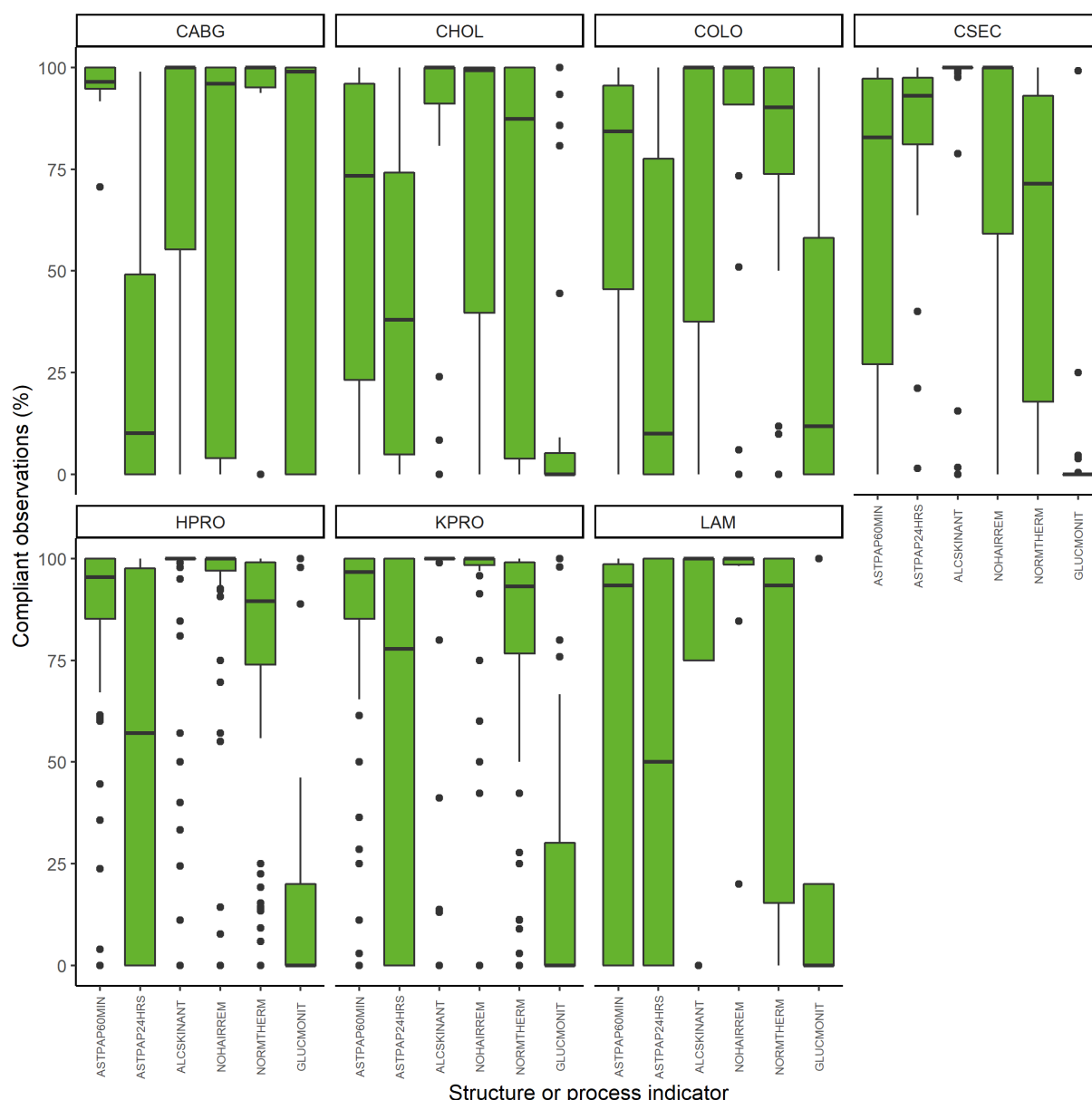ASTPAP60MIN: administration of peri-operative antibiotic prophylaxis (PAP) within 60 minutes before incision,
ASTPAP24HRS: discontinuation of PAP within 24 hours after initiation of surgery,
ALCSKINANT: use of alcohol- and CHG-based antiseptic solutions for surgical site skin preparation,
NOHAIRREM: No hair removal,
NORMOTHERM: ensuring the patient's normothermia in the perioperative period,
GLUCMONIT: using a protocol for intensive perioperative blood glucose control and blood glucose levels monitored.
Source: Country reports from Austria, Italy, Lithuania, Malta and the Netherlands.
The illustration shows the hospital compliance medians, 25th and 75th percentiles, 1.5*interquartile range distance from each percentile, and the points show the outliers.

Discussion

The results presented in this report constitute an updated source for information on the incidence of SSIs in the EU/EEA. The number of reporting EU/EEA countries remained the same in 2018-2019 as in 2017, but for 2020 the number of reporting countries as well as number of reported procedures decreased substantially. Furthermore, the observed intercountry variation, and the fact that not all EU/EEA countries participate, does limit the extent to which the results can be considered representative of the overall EU/EEA situation, especially for 2020 where the COVID-19 pandemic affected both surveillance of SSI, and in general public health surveillance activities, in all EU/EEA countries.

Due to a decrease in reported data, an assessment of trends for 2018-2020 was not included in this report. Nevertheless, a visual examination of the data suggests that there were year-to-year differences in both the percentage of SSIs and the incidence density of in-hospital SSIs between types of surgical procedure. These two metrics reflect slightly different aspects of SSI epidemiology, which were particularly relevant during the COVID-19 pandemic, during which hospitalisation, access to surgical procedures and discharge practices may have considerably differed from previous years. However, year-to-year comparisons are complicated by the changing reporting practices and availability of the data, as shown by the number of participating countries by year and the overall number of reported procedures.

In addition, national representativeness, surgical practices and surveillance methods vary considerably from country to country, which makes it very difficult to compare SSI rates across countries. Length of stay in the hospital after surgery as well as differences in post-discharge surveillance methods affect the rate of superficial SSIs that are mostly diagnosed in-hospital and can often be missed, and therefore not reported, after hospital discharge. For this reason, intercountry comparisons, when performed, should focus on the incidence density of in-hospital SSIs; even though comparisons of incidence densities still have caveats because countries having different post-operative discharge policies, they are less affected by the varying post-discharge surveillance methods.

Similarly, as reported for the 2017 data [10], the percentage of SSIs and incidence density of in-hospital SSIs varied by type of surgical procedure. This is because of the different population groups that undergo these operations and because of the different proportions of clean and contaminated operations for each type of surgical procedure, and depending on whether the procedure was open or laparoscopic. Therefore, comparisons of SSI rates across countries and between years should only be made for a specific type of surgical procedure.

For the newly included structure and process indicator data, one of the main findings of the data on perioperative prophylaxis (PAP) was the common pattern of prolonged PAP beyond 24 hours, in line with the observation reported in the ECDC point prevalence surveys of healthcare-associated infections and antimicrobial use in European acute care hospitals, in 2012-2013 and in 2016-2017 [7, 8, 9]. Whilst the number of observations was small in comparison with other indicators, the overall compliance with discontinuation of PAP within 24 hours after initiation of surgery remained low. In addition, compliance with many of the other indicators showed large variation between hospitals, from 98% compliance for the skin antisepsis indicator to relatively low values for ensuring the patient's normothermia in the perioperative period or administration of PAP within 60 minutes before incision in certain type of procedures. Low compliance for using a protocol for intensive perioperative blood glucose control and blood glucose levels monitored is expected in other types of procedures than CABG.

Public health implications

Surveillance is a key component in the prevention of healthcare-associated infections and an important tool for monitoring the effectiveness of prevention and control measures [11]. The increasing trend in reported SSIs after laparoscopic CHOL operations, noted in the data up to 2017, did not seem to continue in 2018-2020 [10]. Further analysis on trends may be possible when SSI surveillance data becomes available for 2021 onwards.

To further strengthen surveillance of SSIs in the EU/EEA, ECDC started collecting data on structure and process indicators of SSI prevention, with a 2017 protocol update that was implemented in several national surveillance systems in 2018. Data on these structure and process indicators and information on compliance with measures to prevent SSIs, were presented for the first time in this report for surveillance years 2018-2020. Continued monitoring of these indicators with ECDC SSI surveillance can help healthcare providers to monitor and improve their SSI prevention practices, and identify areas where additional interventions may be needed to further reduce the incidence of SSIs. By implementing evidence-based infection prevention practices and tracking these indicators over time, healthcare providers can work towards improving patient outcomes and reducing the burden of SSIs on patients and healthcare systems [9, 12].

Finally, SSI surveillance data will be important reference data when analysing and exploring future ECDC point prevalence survey data, or when possibly looking into new methods for surveillance of SSIs. A minor update of the SSI surveillance protocol is planned for 2023-2024 to address changes related to ICD-10-CM coding, which remain important for keeping SSI surveillance up to date with the evolution of healthcare information systems [13].

References

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Annex

Table A1. Percentage of unknown or missing values by TESSy variable and year, patient-based data, 2018–2020

Variable	Name of TESSy variable	Unknown or missing values (%)*
Gender	Gender	0.003
In-hospital outcome	OutcomeHospital	72.1
Date of operation	DateOfOperation	0
Date of hospital admission	DateOfHospitalAdmission	51.9
Date of hospital discharge	DateOfHospitalDischarge	16.6
Operation code	OPCode	0
ICD-9-CM code	ICD9CMCode	51.7
Wound class	WoundClass	0.7
Duration of operation	OperationDur	0.3
ASA score	ASAClassification	1.8
Urgent operation	UrgentOperation	57.4
Prophylaxis	Prophylaxis	70.1
Type of infection	SSIType	0.1

Source: Country reports from Austria, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway, Portugal and Slovakia
* n= 1 255 958 surgical procedures and n= 19 680 SSIs

Table A2.1. Coronary artery bypass graft (CABG): percentage of SSIs and incidence density of in-hospital SSIs by country, EU/EEA, 2018–2020

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1000 post-operative patient-days [95% CI] (5)
Austria	1 196	24	2.0 [1.3-3.0]	833	11 574	14 (58.3)	1.2 [0.7-2.0]
Estonia	119	1	0.8 [0.0-4.7]	119	1 495	1 (100)	0.7 [0.0-3.7]
France	1 055	42	4.0 [2.9-5.4]	1 055	10 841	12 (28.6)	1.1 [0.6-1.9]
Germany	28 985	516	1.8 [1.6-1.9]	18 807	246 133	146 (28.3)	0.6 [0.5-0.7]
Hungary	308	15	4.9 [2.7-8.0]	308	2 592	7 (46.7)	2.7 [1.1-5.6]
Italy	4 022	37	0.9 [0.6-1.3]	4 017	46 937	19 (51.4)	0.4 [0.2-0.6]
Lithuania	479	24	5.0 [3.2-7.5]	479	7 324	24 (100)	3.3 [2.1-4.9]
Netherlands	1 107	18	1.6 [1.0-2.6]	1 107	7 991	5 (27.8)	0.6 [0.2-1.5]
Norway	3 624	115	3.2 [2.6-3.8]	3 624	24 374	18 (15.7)	0.7 [0.4-1.2]
Portugal	79	0	0.0 [0.0-4.7]	79	835	0 (-)	0.0 [0.0-4.4]
EU/EEA	**40 974**	**792**	**1.9 [1.8-2.1]**	**30 428**	**360 096**	**246 (31.1)**	**0.7 [0.6-0.8]**

Source: Country reports from: Austria, Estonia, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway and Portugal
(1) Only SSIs diagnosed within 30 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge – date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.
Incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Table A2.2. Coronary artery bypass graft (CABG): mean and percentile distributions of percentage of SSIs and incidence density of in-hospital SSIs in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020

NHSN risk index	No. of operations (1)	No. of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90			Mean	P10	P25	P50	P75	P90
0	755	19	1.3	0	0	0	0	3.1	4 940	2	0.1	0	0	0	0	0
1	28 960	508	2.1	0	0.3	1.4	2.8	4.6	243 250	141	0.7	0	0	0.4	1.0	2.1
2 and 3	9 532	229	3.8	0	0	1.4	3.8	8.6	98 144	93	1.7	0	0	0	1.5	4.0
Unknown	1 727	36	6.7	0	0	0	2.9	7.1	13 762	10	0.5	0	0	0	0.4	1.4
Overall	**40 974**	**792**	**2.2**	**0**	**0.7**	**1.7**	**3.0**	**5.0**	**360 096**	**246**	**0.9**	**0**	**0.1**	**0.6**	**1.2**	**2.0**

Source: Country reports from: Austria, Estonia, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway and Portugal
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

Table A3.1. Laparoscopic cholecystectomy (CHOL): percentage of SSIs and incidence density of in-hospital SSIs) by country, EU/EEA, 2018–2020

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1 000 post-operative patient-days [95% CI] (5)
Austria	5 545	21	0.4 [0.2-0.6]	4 062	16 468	13 (61.9)	0.8 [0.4-1.3]
France	6 666	48	0.7 [0.5-1.0]	6 664	18 295	16 (33.3)	0.9 [0.5-1.4]
Germany	62 190	585	0.9 [0.9-1.0]	51 050	239 828	138 (23.6)	0.6 [0.5-0.7]
Hungary	2 904	32	1.1 [0.8-1.6]	2 904	10 791	10 (31.3)	0.9 [0.4-1.7]
Italy	12 140	89	0.7 [0.6-0.9]	12 071	42 707	18 (20.2)	0.4 [0.2-0.7]
Lithuania	1 879	4	0.2 [0.1-0.5]	1 879	7 410	4 (100)	0.5 [0.1-1.4]
Netherlands	24 246	642	2.6 [2.4-2.9]	24 246	47 866	66 (10.3)	1.4 [1.1-1.8]
Norway	17 725	497	2.8 [2.6-3.1]	17 724	38 789	48 (9.7)	1.2 [0.9-1.6]
Portugal	9 806	230	2.3 [2.1-2.7]	9 806	39 488	122 (53.0)	3.1 [2.6-3.7]
Slovakia	381	11	2.9 [1.4-5.2]	381	1 232	3 (27.3)	2.4 [0.5-7.1]
EU/EEA	**143 482**	**2 159**	**1.5 [1.4-1.6]**	**130 787**	**462 874**	**438 (20.3)**	**0.9 [0.9-1.0]**

Source: Country reports from: Austria, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway, Portugal and Slovakia
(1) Only SSIs diagnosed within 30 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge – date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.
Incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Table A3.2. Laparoscopic cholecystectomy (CHOL): mean and percentile distributions of percentage of SSIs and incidence density of in-hospital SSIs in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020

NHSN risk index	No. of operations (1)	No. of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90			Mean	P10	P25	P50	P75	P90
0	78 899	940	0.8	0	0	0	1.1	2.6	197 263	83	0.3	0	0	0	0	0
1	43 957	727	1.4	0	0	0	2.0	4.4	157 763	170	0.9	0	0	0	0	3.2
2 and 3	17 753	434	2.2	0	0	0	2.3	7.1	98 166	169	1.4	0	0	0	0	4.1
Unknown	2873	58	2.1	0	0	0	0	3.7	9682	16	1.7	0	0	0	0	0
Overall	**143 482**	**2159**	**1.1**	**0**	**0**	**0.5**	**1.7**	**3.1**	**462 874**	**438**	**0.8**	**0**	**0**	**0**	**0.8**	**2.5**

Source: Country reports from: Austria, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway, Portugal and Slovakia
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

Table A4.1. Open cholecystectomy (CHOL): percentage of SSIs and incidence density of in-hospital SSIs by country, EU/EEA, 2018–2020

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1 000 post-operative patient-days [95% CI] (5)
Austria	2 282	20	0.9 [0.5- 1.4]	1 312	6 529	14 (70.0)	2.1 [1.2- 3.6]
Germany	3 961	223	5.6 [4.9- 6.4]	3 090	32 062	115 (51.6)	3.6 [3.0- 4.3]
Hungary	699	43	6.2 [4.5- 8.3]	699	3 788	26 (60.5)	6.9 [4.5-10.1]
Italy	3 421	56	1.6 [1.2- 2.1]	3 418	28 476	40 (71.4)	1.4 [1.0- 1.9]
Lithuania	102	3	2.9 [0.6- 8.6]	102	507	2 (66.7)	3.9 [0.5-14.2]
Netherlands	123	13	10.6 [5.6-18.1]	123	642	5 (38.5)	7.8 [2.5-18.2]
Norway	579	72	12.4 [9.7-15.7]	577	5 182	36 (50.0)	6.9 [4.9- 9.6]
Portugal	88	4	4.5 [1.2-11.6]	88	775	1 (25.0)	1.3 [0.0- 7.2]
Slovakia	128	3	2.3 [0.5- 6.8]	128	493	2 (66.7)	4.1 [0.5-14.7]
EU/EEA	**11 383**	**437**	**3.8 [3.5- 4.2]**	**9 537**	**78 454**	**241 (55.1)**	**3.1 [2.7- 3.5]**

Source: Country reports from: Austria, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway, Portugal and Slovakia.
(1) Only SSIs diagnosed within 30 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge – date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Table A4.2. Open cholecystectomy (CHOL): mean and percentile distributions of percentage of SSIs and incidence density of in-hospital SSIs in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020

NHSN risk index	No. of operations (1)	No. of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90			Mean	P10	P25	P50	P75	P90
0	3 559	40	2.9	0	0	0	0	5.9	9 937	13	0.9	0	0	0	0	0
1	3 253	144	6.4	0	0	0	8.3	20.2	21 222	76	4.3	0	0	0	5.4	13.1
2 and 3	4 281	241	6.3	0	0	1.3	10.0	15.8	45 263	147	4.1	0	0	0	7.0	11.1
Unknown	290	12	3.7	0	0	0	7.1	15.2	2 032	5	2.1	0	0	0	0	8.2
Overall	**11 383**	**437**	**5.3**	**0**	**0**	**3.1**	**9.5**	**15.0**	**78 454**	**241**	**3.3**	**0**	**0**	**1.8**	**5.5**	**9.6**

Source: Country reports from: Austria, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway, Portugal and Slovakia
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

Table A5.1. Laparoscopic colon surgery (COLO): percentage of SSIs and incidence density of in-hospital SSIs by country, EU/EEA, 2018–2020

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1 000 post-operative patient-days [95% CI] (5)
Austria	106	5	4.7 [1.5-11.0]	91	858	5 (100)	5.8 [1.9-13.6]
France	1 283	92	7.2 [5.8- 8.8]	1 283	12 338	70 (76.1)	5.7 [4.4- 7.2]
Germany	14 642	703	4.8 [4.5- 5.2]	11 621	120 182	257 (36.6)	2.1 [1.9- 2.4]
Hungary	245	16	6.5 [3.7-10.6]	245	2 236	11 (68.8)	4.9 [2.5- 8.8]
Italy	4 538	159	3.5 [3.0- 4.1]	4 537	43 340	96 (60.4)	2.2 [1.8- 2.7]
Lithuania	91	11	12.1 [6.0-21.6]	91	1 024	11 (100)	10.7 [5.4-19.2]
Malta	40	6	15.0 [5.5-32.6]	40	309	4 (66.7)	12.9 [3.5-33.1]
Netherlands	9 380	626	6.7 [6.2- 7.2]	9 380	66 063	311 (49.7)	4.7 [4.2- 5.3]
Norway	5 539	352	6.4 [5.7- 7.1]	5 538	36 927	178 (50.6)	4.8 [4.1- 5.6]
Portugal	4 343	713	16.4 [15.2-17.7]	4 343	53 612	539 (75.6)	10.1 [9.2-10.9]
EU/EEA	**40 207**	**2 683**	**6.7 [6.4- 6.9]**	**37 169**	**336 889**	**1 482 (55.2)**	**4.4 [4.2- 4.6]**

Source: Country reports from: Austria, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway and Portugal
(1) Only SSIs diagnosed within 30 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge – date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Table A5.2. Laparoscopic colon surgery (COLO): mean and percentile distributions of percentage of SSIs and incidence density of in-hospital SSIs in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020

NHSN risk index	No. of operations (1)	No. of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90			Mean	P10	P25	P50	P75	P90
0	14 573	777	5.0	0	0	0	7.1	15.4	101 642	379	2.5	0	0	0	3.4	8.8
1	17 210	1 193	6.6	0	0	5.0	10.0	15.1	146 367	653	3.8	0	0	1	6.2	10.8
2 and 3	7 560	621	8.1	0	0	1.8	11.1	21.0	78 794	381	3.9	0	0	0	6.1	12.3
Unknown	864	92	11.4	0	0	0	11.1	33.3	10 086	69	6.3	0	0	0	5.3	16.5
Overall	**40 207**	**2 683**	**6.0**	**0**	**1.7**	**5.0**	**8.7**	**13.3**	**336 889**	**1482**	**3.5**	**0**	**0**	**2.5**	**5.4**	**8.7**

Source: Country reports from: Austria, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway and Portugal
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

Table A6.1. Open colon surgery (COLO): percentage of SSIs and incidence density of in-hospital SSIs by country, EU/EEA, 2018–2020

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1 000 post-operative patient-days [95% CI] (5)
Austria	1 057	38	3.6 [2.5- 4.9]	749	7 556	37 (97.4)	4.9 [3.4- 6.7]
Germany	22 361	1 984	8.9 [8.5- 9.3]	15 889	232 224	930 (46.9)	4.0 [3.8- 4.3]
Hungary	978	102	10.4 [8.5-12.7]	978	10 468	81 (79.4)	7.7 [6.1- 9.6]
Italy	6 224	367	5.9 [5.3- 6.5]	6 215	87 974	290 (79.0)	3.3 [2.9- 3.7]
Lithuania	246	26	10.6 [6.9-15.5]	246	3 142	23 (88.5)	7.3 [4.6-11.0]
Malta	213	57	26.8 [20.3-34.7]	213	2 878	35 (61.4)	12.2 [8.5-16.9]
Netherlands	3 890	627	16.1 [14.9-17.4]	3 890	46 880	471 (75.1)	10.0 [9.2-11.0]
Norway	3 917	459	11.7 [10.7-12.8]	3 916	42 101	273 (59.5)	6.5 [5.7- 7.3]
Portugal	530	77	14.5 [11.5-18.2]	530	6 749	61 (79.2)	9.0 [6.9-11.6]
EU/EEA	**39 416**	**3 737**	**9.5 [9.2- 9.8]**	**32 626**	**439 972**	**2 201 (58.9)**	**5.0 [4.8- 5.2]**

Source: Country reports from: Austria, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway and Portugal
(1) Only SSIs diagnosed within 30 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge – date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.
* Austria not included as no discharge dates provided.

Table A6.2. Open colon surgery (COLO): mean and percentile distributions of percentage of SSIs and incidence density of in-hospital SSIs in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020

NHSN risk index	No. of operations (1)	No. of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90			Mean	P10	P25	P50	P75	P90
0	8493	657	6.9	0	0	0	11.1	20.0	78 590	378	3.9	0	0	0	6.3	12.1
1	17 054	1563	9.4	0	3.2	7.7	13.6	20.1	186 903	880	4.6	0	0	3.5	7.4	10.7
2 and 3	13 073	1409	11.2	0	0	9.1	16.7	25.7	163 990	865	5.2	0	0	3.3	8.8	13.3
Unknown	796	108	6.6	0	0	0	8.3	21.8	10 489	78	4.0	0	0	0	5.3	12.9
Overall	**39 416**	**3737**	**9.5**	**1.7**	**4.4**	**8.2**	**13.7**	**18.6**	**439 972**	**2201**	**4.8**	**0**	**1.6**	**3.8**	**7.4**	**11.1**

Source: Country reports from: Austria, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway and Portugal
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

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Table A7.1. Caesarean section (CSEC): percentage of SSIs and incidence density of in-hospital SSIs by country, EU/EEA, 2018–2020

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1000 post-operative patient-days [95% CI] (5)
Austria	9 395	48	0.5 [0.4-0.7]	6 799	36 143	20 (41.7)	0.6 [0.3-0.9]
Estonia	441	9	2.0 [0.9-3.9]	441	1 966	2 (22.2)	1.0 [0.1-3.7]
France	12 624	210	1.7 [1.4-1.9]	12 624	74 773	57 (27.1)	0.8 [0.6-1.0]
Germany	82 206	526	0.6 [0.6-0.7]	67 113	324 947	85 (16.2)	0.3 [0.2-0.3]
Hungary	5 470	69	1.3 [1.0-1.6]	5 470	28 969	6 (8.7)	0.2 [0.1-0.5]
Italy	15 834	114	0.7 [0.6-0.9]	15 821	72 639	20 (17.5)	0.3 [0.2-0.4]
Lithuania	1 580	10	0.6 [0.3-1.2]	1 580	8 592	9 (90.0)	1.0 [0.5-2.0]
Netherlands	25 124	380	1.5 [1.4-1.7]	25 124	98 690	50 (13.2)	0.5 [0.4-0.7]
Norway	23 810	854	3.6 [3.4-3.8]	23 809	114 926	162 (19.0)	1.4 [1.2-1.6]
Portugal	8 720	136	1.6 [1.3-1.8]	8 720	39 768	21 (15.4)	0.5 [0.3-0.8]
EU/EEA	**185 204**	**2 356**	**1.3 [1.2-1.3]**	**167 501**	**801 413**	**432 (18.3)**	**0.5 [0.5-0.6]**

Source: Country reports from: Austria, Estonia, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway and Portugal
(1) Only SSIs diagnosed within 30 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge – date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Table A7.2. Caesarean section (CSEC): mean and percentile distributions of percentage of SSIs and incidence density of in-hospital SSIs in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020

NHSN risk index	No. of operations (1)	Number of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90			Mean	P10	P25	P50	P75	P90
0	123 415	1409	1.1	0	0	0.5	1.6	3.0	519 319	225	0.5	0	0	0	0	1.6
1	51 138	723	1.7	0	0	0	2.1	4.4	228 806	165	0.8	0	0	0	0	2.1
2 and 3	5 086	111	3.4	0	0	0	0	6.8	27 246	27	1.7	0	0	0	0	0
Unknown	5 565	113	1.8	0	0	0	0	3.2	26 042	15	0.3	0	0	0	0	0
Overall	**185 204**	**2356**	**1.3**	**0**	**0**	**0.8**	**1.9**	**3.1**	**801 413**	**432**	**0.5**	**0**	**0**	**0**	**0.6**	**1.7**

Source: Country reports from: Austria, Estonia, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway and Portugal
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

Table A8.1. Hip prosthesis (HPRO): percentage of SSIs and incidence density of in-hospital SSIs by country, EU/EEA, 2018–2020

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1 000 post-operative patient-days [95% CI] (5)
Austria	18 372	145	0.8 [0.7-0.9]	12 160	122 638	64 (44.1)	0.5 [0.4-0.7]
Finland	28 530	471	1.7 [1.5-1.8]	8 265	33 509	4 (0.8)	0.1 [0.0-0.3]
France	15 605	233	1.5 [1.3-1.7]	15 605	106 423	41 (17.6)	0.4 [0.3-0.5]
Germany	221 138	2 301	1.0 [1.0-1.1]	161 103	1 699 534	397 (17.3)	0.2 [0.2-0.3]
Hungary	1 092	10	0.9 [0.4-1.7]	1 092	9 832	8 (80.0)	0.8 [0.4-1.6]
Italy	26 435	203	0.8 [0.7-0.9]	26 386	247 218	67 (33.0)	0.3 [0.2-0.3]
Lithuania	1 480	0	0.0 [0.0-0.2]	1 480	13 280	0 (-)	0 [0-0.3]
Malta	371	11	3.0 [1.5-5.3]	371	3 428	4 (36.4)	1.2 [0.3-3.0]
Netherlands	97 012	1 205	1.2 [1.2-1.3]	97 012	322 824	58 (4.8)	0.2 [0.1-0.2]
Norway	38 405	674	1.8 [1.6-1.9]	38 405	169 335	38 (5.6)	0.2 [0.2-0.3]
Portugal	7 235	99	1.4 [1.1-1.7]	7 235	63 639	41 (41.4)	0.6 [0.5-0.9]
EU/EEA	**455 675**	**5 352**	**1.2 [1.1-1.2]**	**369 114**	**2 791 660**	**722 (13.5)**	**0.3 [0.2-0.3]**

Source: Country reports from: Austria, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway and Portugal
(1) Only superficial SSIs diagnosed within 30 days or deep or organ/space SSIs diagnosed within 90 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge – date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Table A8.2. Hip prosthesis (HPRO): mean and percentile distributions of percentage of SSIs and incidence density of in-hospital SSIs in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020

NHSN risk index	No. of operations (1)	Number of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90	days (3)	SSIs	Mean	P10	P25	P50	P75	P90
0	226 878	1 626	0.7	0	0	0	0.8	2.3	117 7621	138	0.1	0	0	0	0	0
1	176 884	2 539	1.4	0	0	0.6	2.1	3.9	1 232 600	379	0.3	0	0	0	0	1.1
2 and 3	43 806	1 072	2.8	0	0	0	3.4	7.7	344 877	194	0.6	0	0	0	0	1.0
Unknown	8 107	115	1.0	0	0	0	0	1.7	36 562	11	0.1	0	0	0	0	0
Overall	**455 675**	**5 352**	**1.2**	**0**	**0**	**0.9**	**1.9**	**3.1**	**2 791 660**	**722**	**0.3**	**0**	**0**	**0**	**0.2**	**0.9**

Source: Country reports from: Austria, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands, Norway and Portugal
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

Table A9.1. **Knee prosthesis (KPRO): percentage of SSIs and incidence density of in-hospital SSIs by country, EU/EEA, 2018–2020**

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1 000 post-operative patient-days [95% CI] (5)
Austria	12 621	57	0.5 [0.3-0.6]	8 334	71 950	9 (15.8)	0.1 [0.1-0.2]
Finland	25 198	268	1.1 [0.9-1.2]	7 465	30 022	2 (0.7)	0.1 [0.0-0.2]
France	11 486	114	1.0 [0.8-1.2]	11 486	75 500	8 (7.0)	0.1 [0.0-0.2]
Germany	139 245	560	0.4 [0.4-0.4]	100 129	948 325	58 (10.4)	0.1 [0.0-0.1]
Hungary	982	11	1.1 [0.6-2.0]	982	9 563	3 (27.3)	0.3 [0.1-0.9]
Italy	18 341	114	0.6 [0.5-0.7]	18 333	150 718	39 (34.2)	0.3 [0.2-0.4]
Malta	1 159	2	0.2 [0.0-0.6]	1 159	10 017	1 (50.0)	0.1 [0.0-0.6]
Lithuania	663	28	4.2 [2.8-6.1]	663	3 476	3 (10.7)	0.9 [0.2-2.5]
Netherlands	83 383	658	0.8 [0.7-0.9]	83 383	266 032	20 (3.0)	0.1 [0.0-0.1]
Portugal	6 732	79	1.2 [0.9-1.5]	6 732	49 932	28 (35.4)	0.6 [0.4-0.8]
EU/EEA	**299 810**	**1891**	**0.6 [0.6-0.7]**	**238 666**	**1 615 535**	**171 (9.0)**	**0.1 [0.1-0.1]**

Source: Country reports from: Austria, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands and Portugal
(1) Only superficial SSIs diagnosed within 30 days or deep or organ/space SSIs diagnosed within 90 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge − date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Table A9.2. **Knee prosthesis (KPRO): mean and percentile distributions of percentage of SSIs and incidence density of in-hospital SSIs in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020**

NHSN risk index	No. of operations (1)	No. of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90			Mean	P10	P25	P50	P75	P90
0	160 804	725	0.4	0	0	0	0	1.1	781 232	34	0.1	0	0	0	0	0
1	109 129	819	0.8	0	0	0	0.8	2.4	649 370	88	0.2	0	0	0	0	0
2 and 3	23 766	281	1.4	0	0	0	0	3.1	164 023	39	0.2	0	0	0	0	0
Unknown	6 111	66	1.5	0	0	0	0	1.1	20 910	10	1.7	0	0	0	0	0
Overall	**299 810**	**1 891**	**0.6**	**0**	**0**	**0**	**0.9**	**1.8**	**1 615 535**	**171**	**0.1**	**0**	**0**	**0**	**0**	**0.2**

Source: Country reports from: Austria, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, the Netherlands and Portugal
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

Table A10.1. **Laminectomy (LAM): percentage of SSIs and incidence density of in-hospital SSIs by country, EU/EEA, 2018–2020**

Country	No. of operations	No. of SSIs (1)	Percentage of SSIs per 100 operations [95% CI] (2)	No. of operations with a known discharge date	No. of post-operative patient-days (3)	No. of in-hospital SSIs (% of all SSIs) (4)	Incidence density of SSIs per 1 000 post-operative patient-days [95% CI] (5)
France	1 227	23	1.9 [1.2-2.8]	1 227	6 904	5 (21.7)	0.7 [0.2-1.7]
Germany	23 384	103	0.4 [0.4-0.5]	14 845	93 129	20 (19.4)	0.2 [0.1-0.3]
Hungary	686	18	2.6 [1.6-4.1]	686	3 760	11 (61.1)	2.9 [1.5-5.2]
Italy	7 331	44	0.6 [0.4-0.8]	7 331	38 315	14 (31.8)	0.4 [0.2-0.6]
Netherlands	5 354	75	1.4 [1.1-1.8]	5 354	13 827	1 (1.3)	0.1 [0.0-0.4]
Portugal	1 825	10	0.5 [0.3-1.0]	1 825	8 549	5 (50.0)	0.6 [0.2-1.4]
EU/EEA	**39 807**	**273**	**0.7 [0.6-0.8]**	**31 268**	**164 484**	**56 (20.5)**	**0.3 [0.3-0.4]**

Source: Country reports from: France, Germany, Hungary, Italy, the Netherlands and Portugal
(1) Only SSIs diagnosed within 30 days after the operation are included; (2) percentage of SSIs = (number of SSIs × 100)/number of operations; (3) post-operative patient-days = date of discharge − date of operation +1; (4) SSIs reported after discharge from hospital or with an unknown discharge date are excluded; (6) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days.

Table A10.2. Laminectomy (LAM): mean and percentile laminectomy (LAM) operations in hospitals stratified by NHSN risk index, EU/EEA, 2018–2020

NHSN risk index	No. of operations (1)	No. of SSIs	Mean and percentile distribution of percentages in hospitals (2)						No. of post-operative patient-days (3)	No. of in-hospital SSIs	Mean and percentile distribution of incidence densities in hospitals (4)					
			Mean	P10	P25	P50	P75	P90			Mean	P10	P25	P50	P75	P90
0	24 129	126	0.6	0	0	0	0	2.0	81 374	20	0.2	0	0	0	0	0
1	12 081	95	0.6	0	0	0	0	2.4	59 284	19	0.3	0	0	0	0	0
2 and 3	2 444	33	1.2	0	0	0	0	3.0	17 443	12	0.5	0	0	0	0	0
Unknown	1 153	19	1.0	0	0	0	0	1.7	6 383	5	1.0	0	0	0	0	0
Overall	**39 807**	**273**	**0.7**	**0**	**0**	**0**	**1**	**2.2**	**164 484**	**56**	**0.3**	**0**	**0**	**0**	**0**	**1.1**

Source: Country reports from: France, Germany, Hungary, Italy, the Netherlands and Portugal
(1) Operations from hospitals with less than 20 operations are excluded; (2) percentage of SSIs = (number of SSIs × 100)/number of operations, mean and percentiles in hospitals; (3) patient-days from hospitals with less than 20 operations with a known date of discharge are excluded; (4) incidence density of SSIs = (number of in-hospital SSIs × 1000)/number of post-operative patient-days, mean and percentiles in hospitals.

Table A11. Number of observations and overall compliance with the structure and process indicators of SSI prevention, by type of surgical procedure, 2018–2020

Type of procedure	Structure and process indicator	Number of observations	Overall compliance (%)
CABG	ASTPAP60MIN	977	97
	ASTPAP24HRS	551	40.8
	ALCSKINANT	1 658	93.7
	NOHAIRREM	1 410	91.1
	NORMTHERM	1 410	97.4
	GLUCMONIT	551	82.8
CHOL	ASTPAP60MIN	5 887	58.5
	ASTPAP24HRS	1 252	42.2
	ALCSKINANT	7 343	97.1
	NOHAIRREM	6 295	90.8
	NORMTHERM	5 465	70.8
	GLUCMONIT	1 138	11.7
COLO	ASTPAP60MIN	3 210	81.4
	ASTPAP24HRS	770	67.7
	ALCSKINANT	4 185	95.8
	NOHAIRREM	3 300	85.4
	NORMTHERM	3 121	79.3
	GLUCMONIT	722	38.9
CSEC	ASTPAP60MIN	6 457	67
	ASTPAP24HRS	1 297	79.8
	ALCSKINANT	8 816	94.4
	NOHAIRREM	6 503	88.1
	NORMTHERM	5 661	59.7
	GLUCMONIT	1 326	10.4
HPRO	ASTPAP60MIN	19 788	90.5
	ASTPAP24HRS	1 240	65.7
	ALCSKINANT	27 564	98.9
	NOHAIRREM	20 635	96.3
	NORMTHERM	17 986	84
	GLUCMONIT	1 215	18
KPRO	ASTPAP60MIN	15 696	92.2
	ASTPAP24HRS	791	70.5
	ALCSKINANT	21 558	98.7
	NOHAIRREM	16 321	97.2
	NORMTHERM	14 442	86
	GLUCMONIT	791	27.8
LAM	ASTPAP60MIN	499	95.2
	ASTPAP24HRS	47	12.8
	ALCSKINANT	1 326	96.8
	NOHAIRREM	694	98.6
	NORMTHERM	489	57.5
	GLUCMONIT	52	11.5

CABG: coronary artery bypass graft, CHOL: cholecystectomy, COLO: colon surgery, CSEC: caesarean section, HPRO: hip prosthesis surgery, KPRO: knee prosthesis surgery, LAM: laminectomy
ASTPAP60MIN: administration of peri-operative antibiotic prophylaxis (PAP) within 60 minutes before incision,
ASTPAP24HRS: discontinuation of PAP within 24 hours after initiation of surgery,
ALCSKINANT: use of alcohol- and CHG-based antiseptic solutions for surgical site skin preparation,
NOHAIRREM: No hair removal,
NORMOTHERM: ensuring the patient's normothermia in the perioperative period,
GLUCMONIT: using a protocol for intensive perioperative blood glucose control and blood glucose levels monitored.
Source: Country reports from Austria, Italy, Lithuania, Malta and the Netherlands.