UK Health Security Agency

Surveillance of surgical site infections in NHS hospitals in England

April 2023 to March 2024

Contents

Main points

The main points of the report are that:

- in the financial year 2023 to 2024, 189 NHS hospitals (124 NHS trusts) and 8 Independent Sector (IS) NHS treatment centres submitted surveillance data for 135,619 surgical operations to the UK Health Security Agency (UKHSA, previously Public Health England) Surgical Site Infection (SSI) Surveillance Service
- across 17 surgical categories, surveillance data was submitted on 109,491 operations in mandatory categories and 26,128 operations in voluntary categories 1,276 inpatient and readmission-detected SSIs were reported in 2023 to 2024
- one NHS trust did not meet the mandatory surveillance participation requirements in 2023 to 2024
- coronary artery bypass graft (CABG) and spinal surgery had the highest degree of continuous surveillance (participation in all 4 surveillance quarters) among participating hospitals (CABG: 85% and spinal: 75%)
- 2 trusts were identified as high outliers for the mandatory orthopaedic surveillance categories (both in repair of neck of femur)
- 10-year trends in inpatient and readmission SSI risk showed a decrease for 8 of 10 categories assessed, the exception being small bowel and cardiac (non-CABG) surgery
- the SSI risk increased marginally for 9 out of 10 categories (with at least 5 participating hospitals) except for hip replacement, between 2022 to 2023 and 2023 to 2024
- median time to infection across all categories was 16 days ranging from 7 days for small bowel surgery to 25 days for knee replacement
- among SSIs with accompanying microbiological confirmation, Enterobacterales continued to make up the highest proportion of causative organisms across all surgical categories in financial year 2023 to 2024 for both superficial (29.9%) and deep or organ and space (30.1%) SSIs
- compared to the previous financial year, the proportion of SSIs caused by meticillin-resistant *Staphylococcus aureus* (MRSA) showed marginal increases for superficial (2.1% and 2.3%) infections and decreases for deep or organ and space infections (2.5% and 2.4%), while the proportion caused by meticillin-sensitive *Staphylococcus aureus* (MSSA) decreased for both superficial (17.3% and 15.9%) and deep or organ and space infections (18.4% and 17.2%)
- in the financial year 2023 to 2024, the proportion of patients given post discharge questionnaire (PDQ) and those completing PDQ (of given) increased to 48% and 83%, respectively

Hospital participation and surgical volumes

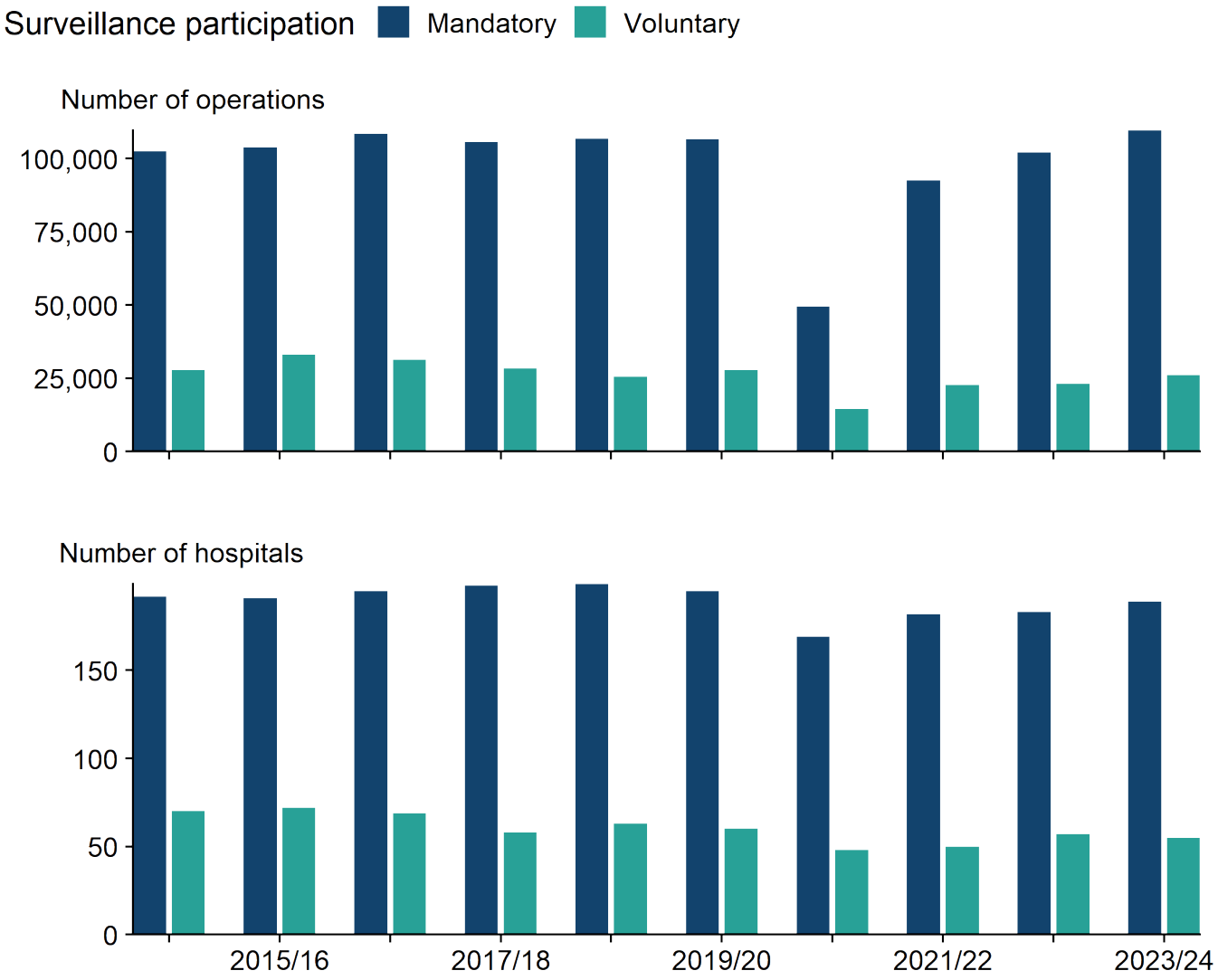
Through partnership working with NHS and independent sector healthcare providers, the UKHSA SSI Surveillance Service (SSISS) has accumulated surveillance data for almost 3 million operations and 58,000 SSIs since its inception in 1997.

Overall, 189 NHS hospitals representing 124 NHS trusts (of 135 acute NHS trusts in England) and an additional 8 IS NHS treatment centres participated in the SSISS data collection in the financial year 2023 to 2024. The number of hospitals contributing data increased (189) in comparison to 2022 to 2023 (183) and trusts remained the same. Surveillance data was submitted for 135,619 operations from which 1,276 SSIs were identified. Of these operations, 109,491 were orthopaedic operations submitted as part of mandatory surveillance and 26,128 operations submitted as part of voluntary surveillance spanning 13 other surgical categories. Compared to the financial year 2022 to 2023, the number of operations submitted for mandatory orthopaedic surveillance increased by 7.3% (from 102,027 operations), while voluntary surveillance showed an increase of 13.3% (from 23,070 operations, Figure 1), an overall increase of 8.4% across all categories.

During the COVID-19 pandemic, hospitals saw a decrease in the number of surgical operations due to a combination of deferral of non-urgent surgery, cancellations, staff sickness, and reduced operating theatre capacity (1 to 3). There has been a year-on-year increase in the number of submitted operations for both mandatory and voluntary surgical categories since financial year 2021 to 2022. The number of submitted operations in 2023 to 2024 was 2.7% higher than pre-pandemic (financial year 2019 to 2020) for mandatory categories (109,491 compared to 106,630 operations, respectively) and lower for voluntary categories (6.3% lower than 27,873 operations).

Mandatory surveillance requirements (requirement to report surgical volumes and inpatient and readmission infections for at least one quarter per financial year per trust in at least one orthopaedic category, see Background information section for further details) means that hip and knee replacement, repair of neck of femur, and reduction of long bone fracture surveillance had the highest number of participating hospitals in financial year 2023 to 2024 (152,148, 77 and 25 hospitals, respectively). Participation in voluntary surgical categories in financial year 2023 to 2024 was the highest for large bowel surgery (18 hospitals), followed by breast surgery and CABG surgery (15 and 13 hospitals, respectively).

Figure 1. Annual participation in SSISS voluntary and mandatory surveillance, NHS hospitals England, April 2014 to March 2024



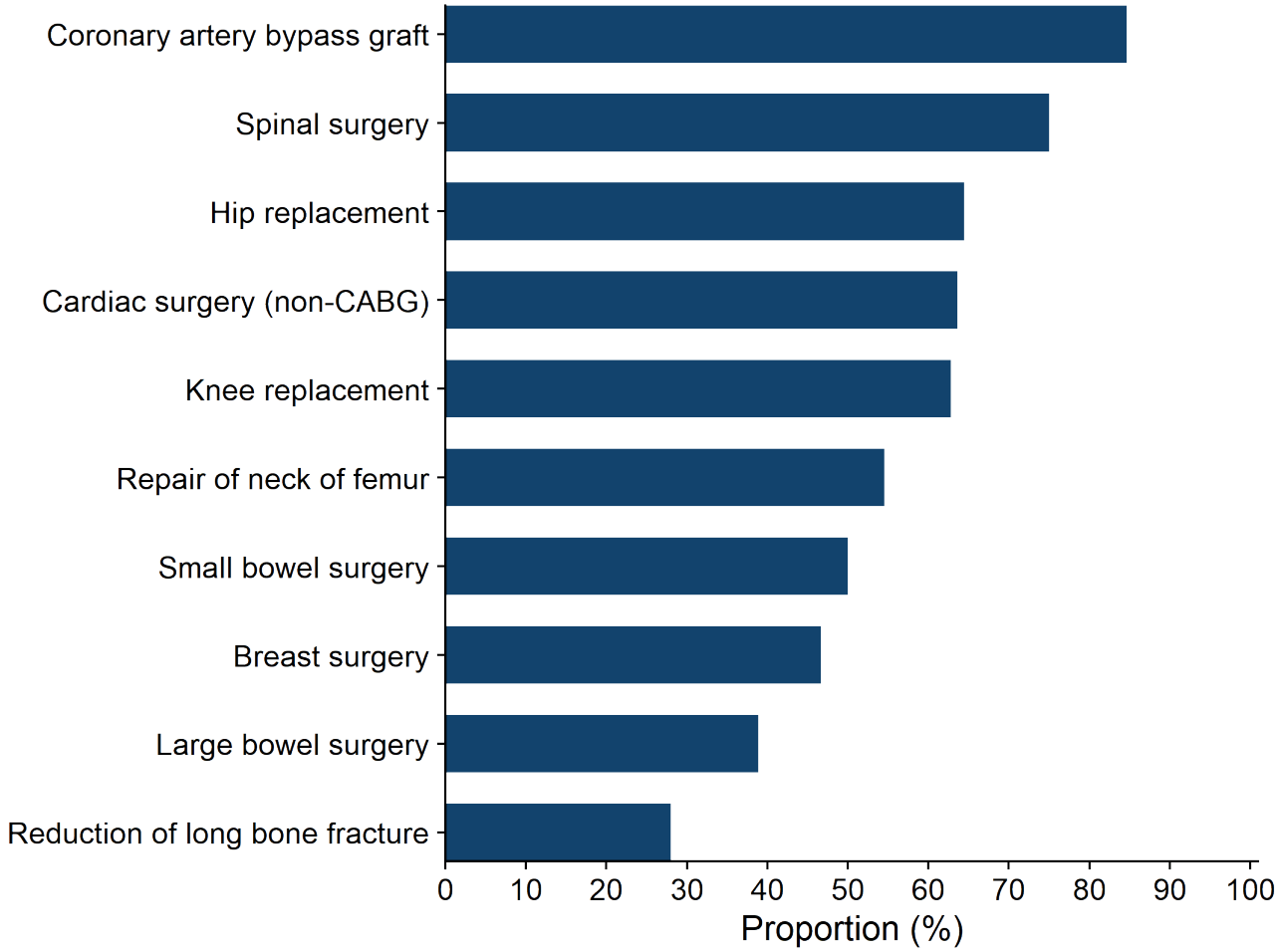
See data table 1 in accompanying data tables spreadsheet.

Figure 2 shows the proportion of hospitals carrying out continuous surveillance during financial year 2023 to 2024 by surgical category. Seven surgical categories with fewer than 5 participating hospitals (abdominal hysterectomy, bile duct, liver or pancreatic surgery, cholecystectomy, cranial, gastric, limb amputation, and vascular surgery), were excluded from this analysis.

Of the voluntary categories, CABG and spinal surgery had the highest proportion of hospitals carrying out continuous surveillance in financial year 2023 to 2024 (84.6% and 75.0%, respectively). For hip and knee replacement, which are a part of the mandatory surveillance for at least one orthopaedic category for a minimum of one 3-month surveillance period per financial year (along with reduction of long bone fracture and repair of neck of femur), almost two-thirds of participating hospitals carried out continuous surveillance in financial year 2023

to 2024 (64.5% and 62.8%, respectively). This was comparable to the previous financial year where 64.0% and 65.9% of hospitals undertook continuous surveillance for hip and knee replacement surgery, respectively.

Figure 2. Proportion of hospitals undertaking continuous surveillance, by surgical category, NHS hospitals England, April 2023 to March 2024



See data table 2 in accompanying data tables spreadsheet.

Patient and surgical characteristics

Data completeness for key patient and surgical characteristics was high (equal to or greater than 90%), with most being mandated for collection (see Appendix 1 and Appendix 2). Data completeness was similar to the previous financial year. The average data completeness varied across all surgical categories and patient and surgical-related fields; it ranged from 84.9% to 97.7% in financial year 2023 to 2024, compared with 82.5% to 99.1% in financial year 2022 to 2023.

Some variability in the completion of American Society of Anesthesiologists' (ASA) score was seen between categories, ranging from 88.8% for cardiac (non-CABG) and 100% for cholecystectomy, as hospitals may use an alternative assessment score for certain categories

(for example cardiac and CABG). Height and weight fields are optional for collection, which means the completeness of body mass index (BMI) information was low compared to mandatory fields and varied by category (between 0.0% for bile duct, liver and pancreatic surgery and cholecystectomy and 96% for hysterectomy). In financial year 2023 to 2024, BMI was available for 63.7% of operations (7.8% higher than financial year 2022 to 2023 (58.9%)). Twelve of 17 surgical categories had BMI data available for 50% or more of those submitted, the same as the previous year. Abdominal hysterectomy and vascular surgery had the most complete BMI information in financial year 2023 to 2024 (96.0% and 91.4%, respectively).

Table 1a and Table 1b show the distribution of key patient and surgical characteristics. Collection of these characteristics is important to help hospitals better understand their results by identifying factors which might be contributing to an increased SSI risk in their patients. Data for surgical categories with less than 5 participating hospitals (abdominal hysterectomy, bile duct, liver or pancreatic surgery, cholecystectomy, cranial surgery, gastric surgery, limb amputation and vascular surgery) should be interpreted with caution. Data for financial year 2023 to 2024 was similar to the previous financial year with small decrease in proportion of male patients undergoing cardiac (non-CABG) and CABG operations (63.3% and 80.4% versus 67.2% and 83.9%, respectively) and an increase in proportion of patients undergoing breast surgery receiving antimicrobial prophylaxis (82.1% versus 74.2%)

In the annual report for financial year 2020 to 2021, we discussed the increase in surgical complexity in financial year 2020 to 2021 compared to financial year 2019 to 2020.

Compared to the previous financial year (2022 to 2023), of the 10 categories assessed, none had consistent increases or decreases in all 4 fields indicating complexity (ASA score, increased surgery duration, patients undergoing multiple operations through the same incision, increased length of stay); proportional changes were relatively small. The percentage of patients undergoing operations for multiple surgical categories decreased for 7 of the 10 categories with the greatest change for small bowel surgery and cardiac (non-CABG) (31.4% and 22.6% and 42.7% and 34.7% in 2022 to 2023 and 2023 to 2024, respectively). Cardiac (non-CABG) surgery also showed the largest decrease in median operation duration of surgery between financial years 2022 to 2023 and 2023 to 2024 (250 minutes and 240 minutes, respectively) (Table 1b).

An elevated BMI has been shown to increase the likelihood of developing an SSI (4, 5). Overall, there was only a marginal difference in median BMI amongst patients undergoing any of the 17 surgical categories between 2023 to 2024 and 2022 to 2023. In financial year 2023 to 2024, knee replacement had the highest proportion of patients with BMI greater than or equal to 30 kilogram per square meter (kg/m^2) among the 17 categories (56.8%), similar to the previous financial year (57.0%). Gastric surgery was the second highest (49.4%) and abdominal hysterectomy third highest (41.7%) (Appendix 3).

The median patient BMI for hip replacement was 28.5 kg/m^2 (IQR=25.1 to 32.5 kg/m^2) and for knee replacement, 30.9 kg/m^2 (IQR=27.3 to 35.0 kg/m^2), similar to the previous financial year.

The median BMI decreased marginally in 5 out of 17 surgical categories. In patients undergoing hip replacement, knee replacement, repair of reduction of long bone fracture and cardiac surgery (non-CABG), the median BMI remained the same or increased in patients having elective surgery and decreased in emergency operations. However, completion of BMI data is variable by surgical category (Appendix 2) and by hospital and should be interpreted with caution.

Completion of BMI has improved slightly between financial years 2022 to 2023 (59%) and 2023 to 2024 (63.7%). BMI is important to consider when assessing high hospital outliers, especially where BMI thresholds are applied by Integrated Care Boards commissioning surgery (6).

The highest proportion of paediatric (under 18 years) data submitted in 2023 to 2024 was for spinal surgery (11.5% of operations) followed by cardiac surgery (non-CABG) (4.7%), and reduction of long bone fracture (4.0%), which was similar to financial year 2022 to 2023 when the surgical categories with the highest proportion of paediatric patients were spinal, small bowel and cardiac (non-CABG) surgery (11.0%, 7.4% and 5.6%, respectively) (Appendix 3).

Table 1a. Patient-related characteristics by surgical category, NHS hospitals England, April 2023 to March 2024

Surgical category	Median age, IQR (years)	Male (%)	BMI ≥ 30 kg/m^2 (%)	ASA ≥ 3 (%)
Abdominal hysterectomy	55 (47 to 64)	not applicable	41.7	27.4
Bile duct, liver or pancreatic surgery	64 (55 to 73)	52.1	no data	49.7
Breast surgery	61 (51 to 69)	0.9	35.5	17.9
Cardiac surgery (non-CABG)	66 (56 to 73)	63.3	30.5	98.1
Cholecystectomy	58 (42 to 69)	43.9	no data	28.9
CABG	66 (59 to 73)	80.4	34.1	99.2
Cranial surgery	57 (45 to 69)	52.7	29.5	40.8
Gastric surgery	60 (46 to 70)	45.8	49.4	50.0
Hip replacement	70 (62 to 77)	40.1	39.6	32.0

Surgical category	Median age, IQR (years)	Male (%)	BMI ≥ 30 kg/m^2 (%)	ASA ≥ 3 (%)
Knee replacement	70 (63 to 76)	44.1	56.8	30.5
Large bowel surgery	67 (56 to 76)	52.3	27.7	49.7
Limb amputation	68 (60 to 75)	75.3	30.8	93.9
Reduction of long bone fracture	68 (46 to 82)	39.7	25.5	49.4
Repair of neck of femur	84 (77 to 89)	32.0	10.3	81.7
Small bowel surgery	61 (51 to 74)	54.6	28.9	51.9
Spinal surgery	57 (37 to 70)	46.8	39.4	30.2
Vascular surgery	71.5 (64 to 78)	72.6	27.0	89.1

Abbreviations

IQR = interquartile range
BMI = body mass index
ASA = American Society of Anesthesiologists

Table 1b. Surgery-related characteristics by surgical category, NHS hospitals England, April 2023 to March 2024

Surgical category	Wound contaminated or dirty (%)	Median surgery duration, IQR (minutes)	Median length of stay, IQR (days)	Pre-op stay more than one day (%)	Emergency surgery (%)	Multiple surgical categories (%)	Antibiotic prophylaxis not given (%)	Implant present (%)
Abdominal hysterectomy	2.8	145.5 (103 to 202)	2 (1 to 5)	3.1	0.0	43.8	3.6	0.0
Bile duct, liver or pancreatic surgery	0.0	287.5 (162.5 to 423)	7 (4 to 11)	7.4	0.0	44.7	1.6	1.1
Breast surgery	0.0	72 (49 to 103)	0 (0 to 1)	0.2	0.1	5.8	17.9	10.3
Cardiac surgery (non-CABG)	0.0	240 (195 to 310)	10 (7 to 17)	29.5	2.8	34.7	0.3	96.2
Cholecystectomy	0.4	85.5 (55 to 202)	1 (0 to 6)	9.3	1.6	32.9	0.4	0.4
CABG	0.0	240 (204 to 282)	9 (7 to 16)	48.3	1.5	20.4	0.4	83.1
Cranial surgery	2.8	121.5 (70 to 192)	6 (3 to 12)	22.0	4.9	0.2	5.2	61.1
Gastric surgery	4.8	179.5 (125 to 339)	3.5 (2 to 9.5)	8.4	1.2	10.2	9.5	4.8
Hip replacement	0.1	82 (64 to 104)	2 (1 to 4)	4.2	0.1	0.8	0.7	100.0
Knee replacement	0.1	79 (61 to 99)	2 (1 to 4)	0.6	0.0	0.4	0.5	100.0
Large bowel surgery	18.5	192 (139 to 269)	7 (4 to 13)	14.6	6.3	14.2	3.3	10.0
Limb amputation	5.7	84.5 (55 to 118)	27.5 (15 to 38)	67.2	3.4	5.7	2.3	1.1
Reduction of long bone fracture	5.5	93 (67 to 130)	8 (2 to 19)	35.1	0.2	9.0	3.8	95.9
Repair of neck of femur	0.0	70 (56 to 89)	13 (9 to 21)	31.9	0.5	0.4	1.7	100.0
Small bowel surgery	48.0	125 (89 to 187)	8.5 (5 to 18)	27.6	2.1	22.6	6.6	1.8
Spinal surgery	0.1	129 (89 to 198)	3 (1 to 7)	9.8	2.6	1.4	1.1	44.8

Surgical category	Wound contaminated or dirty (%)	Median surgery duration, IQR (minutes)	Median length of stay, IQR (days)	Pre-op stay more than one day (%)	Emergency surgery (%)	Multiple surgical categories (%)	Antibiotic prophylaxis not given (%)	Implant present (%)
Vascular surgery	0.0	193 (145 to 288)	4 (2 to 9)	18.4	3.3	3.8	2.0	78.4

Abbreviations
IQR = interquartile range
BMI = body mass index
ASA = American Society of Anesthesiologists

The primary indication for patients undergoing hip and knee replacement is shown in Table 2. Osteoarthritis continues to be the main reason why patients undergo joint replacement surgery (84.0% for hip; 92.7% for knee). The proportion of replacement surgeries carried out as a result of trauma or fracture decreased slightly for hip (5.2% versus 5.4%) and remained the same for knee (0.3%) in comparison to last year. The proportion of operations due to revision decreased for both hip (from 8.1% to 5.0%) and knee (from 5.6% to 5.0%) between financial year 2022 to 2023 and 2023 to 2024.

Table 2. Primary indication for hip replacement (N=40,407 [note 1]) and knee replacement (N=42,678 [note 1]) surgery, NHS hospitals England, April 2023 to March 2024

	Indication for surgery	Hip replacement: number of operations	Hip replacement: proportion (%)	Knee replacement: number of operations	Knee replacement: proportion (%)
	Osteoarthritis	33,923	84.0	39,575	92.7
	Inflammatory joint disease	232	0.6	276	0.6
Primary	Avascular necrosis	389	1.0	25	0.1
	Trauma or fracture	2,105	5.2	140	0.3
	Other	648	1.6	549	1.3
	Total	**37,297**	**92.3**	**40,565**	**95.0**
	Infection	332	0.8	269	0.6
Revision	Fracture	566	1.4	113	0.3
	Other	2,043	5.1	1557	3.6
	Unknown	169	0.4	174	0.4
	Total	**3,110**	**7.7**	**2,113**	**5.0**

Note 1: total does not include patients who had missing data for primary indication (hip: n=991, knee: n=1,368).

Assessing SSI risk

Inpatient and readmission SSI risk

Table 3 presents the cumulative SSI incidence (risk) and incidence density by surgical category. Five years of data (April 2019 to March 2024) were used to produce national benchmarks. Inpatient and readmission SSI risk varied greatly depending on the type of surgical procedure.

The highest risk was observed in bile duct, liver or pancreatic surgery at 19.9% (95% CI: 17.24 to 22.68) in 2023 to 2024; however, only 3 hospitals participated in this category and a low number of operations were reported, therefore the results should be interpreted with some caution. The surgical categories with the next highest risk of infection were large bowel surgery at 8.5% (7.94 to 9.01), and small bowel at 8.5% (7.27 to 9.81). These are operations carried out at body sites with high levels of bacterial contamination, contributing to a higher risk of SSI. Hip and knee replacement surgery carried the lowest SSI risk (0.5%; (0.43 to 0.49), and 0.4%; (0.35 to 0.41), respectively).

In the current financial year, there were 2 categories with fewer than 5 participating hospitals included in the benchmark. This is the same as in financial year 2022 to 2023.

Large bowel surgery has historically been the category of surgery with the highest risk. The risk associated with large bowel surgery remained steady at 8.5% (7.94 to 9.01) in the financial year 2023 to 2024.

Overall, there was a small year-on-year fluctuation in the risk of SSI across multiple categories of surgery. The degree of change in the estimates of SSI risk mean that there is little statistical evidence to suggest that these differences did not occur due to random variation in the risk. Ten-year trends in SSI risk presented later in the report provide indicators of long-term changes in the SSI risk over time.

For operations associated with short post-operative stays (0 to 3 days), such as hip or knee replacement, abdominal hysterectomy, breast, spinal and vascular, a large proportion of SSIs were captured through readmission surveillance (ranging from 45.5% to 98.9%) in financial year 2023 to 2024, emphasising the importance of post-discharge surveillance.

SSI incidence density accounts for the differences in length of hospital stay in capturing inpatient SSIs. The incidence density of in-hospital detected SSIs per 1,000 post-operative patient-days varied from 0.1 (0.00 to 0.67 and 0.08 to 0.14) per 1,000 inpatient days for breast surgery and knee replacement, to 15.7 (13.27 to 18.47) per 1,000 inpatient days for bile duct, liver or pancreatic surgery, albeit the latter was based on a small number of participating hospitals. Large bowel surgery had the second highest risk by incidence density (7.1; 6.61 to 7.63, per 1,000 inpatient days) followed by cholecystectomy (6.1; 5.13 to 7.15, per 1,000 inpatient days).

Table 3. Inpatient and readmission SSI risk by surgical category, NHS hospitals England, April 2019 to March 2024

Surgical category	Number of participating hospitals	Number of operations	Inpatient and readmission: number of SSIs	Inpatient and readmission: SSI risk (%) 95% CI	Inpatient only: number of SSIs	Inpatient only: incidence density (per 1,000 patient days) 95% CI
Abdominal hysterectomy	6	1,031	22	2.1 (1.3 to 3.2)	12	3.1 (1.6 to 5.5)
Bile duct, liver or pancreatic surgery	3	861	171	19.9 (17.2 to 22.7)	147	15.7 (13.3 to 18.5)
Breast surgery	28	13,271	87	0.7 (0.5 to 0.8)	1	0.1 (0.0 to 0.7)
Cardiac surgery (non-CABG)	13	17,139	191	1.1 (1.0 to 1.3)	131	0.7 (0.5 to 0.8)
Cholecystectomy	3	597	28	4.7 (3.1 to 6.7)	21	5.3 (3.3 to 8.2)
CABG	15	27,845	786	2.8 (2.6 to 3.0)	430	1.8 (1.6 to 1.9)
Cranial surgery	5	6,856	101	1.5 (1.2 to 1.8)	45	0.8 (0.6 to 1.1)
Gastric surgery	7	1,152	28	2.4 (1.6 to 3.5)	27	2.7 (1.8 to 3.9)
Hip replacement	184	173,326	796	0.5 (0.4 to 0.5)	160	0.2 (0.2 to 0.3)

Surgical category	Number of participating hospitals	Number of operations	Inpatient and readmission: number of SSIs	Inpatient and readmission: SSI risk (%) 95% CI	Inpatient only: number of SSIs	Inpatient only: incidence density (per 1,000 patient days) 95% CI
Knee replacement	178	172,773	652	0.4 0.3 to 0.4)	68	0.1 (0.1 to 0.1)
Large bowel surgery	36	10,717	907	8.5 (7.9 to 9.0)	749	7.1 (6.6 to 7.6)
Limb amputation	7	694	26	3.7 (2.5 to 5.4)	23	1.7 (1.1 to 2.6)
Reduction of long bone fracture	37	16,737	131	0.8 (0.7 to 0.9)	57	0.4 (0.3 to 0.5)
Repair of neck of femur	111	97,439	716	0.7 (0.7 to 0.8)	413	0.3 (0.3 to 0.3)
Small bowel surgery	13	1,924	163	8.5 (7.3 to 9.8)	144	6.1 (5.1 to 7.2)
Spinal surgery	20	29,376	328	1.1 (1.0 to 1.2)	90	0.6 (0.5 to 0.7)
Vascular surgery	7	2,890	55	1.9 (1.4 to 2.5)	28	1.3 (0.9 to 1.9)

Abbreviations

CI = confidence interval.

Risk factors for SSI

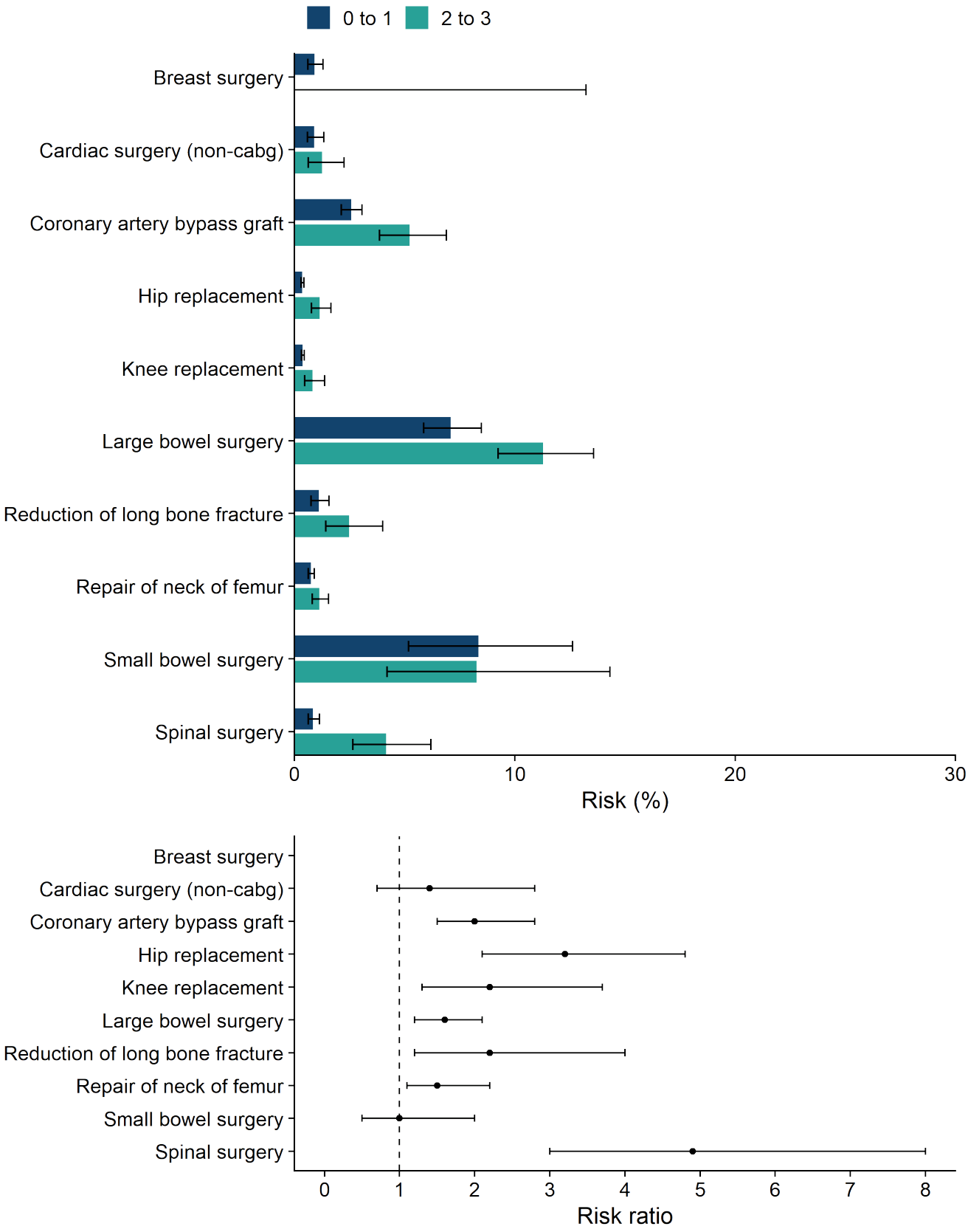
Participants are encouraged to assess their hospital's results stratified by important patient and surgery-related characteristics. The National Healthcare Safety Network (NHSN) risk index is used to account for potentially important differences in patient population. The risk index assigns a cumulative score from 0 to 3 based on the presence of the following risk factors: ASA score of 3 or higher, operation duration greater than 'T-time' (as defined by the 75th percentile for the category of surgery), and a contaminated or dirty wound.

Figure 3a shows the SSI risk for financial year 2023 to 2024 across surgical categories for patients whose operation was deemed at low risk of SSI (NHSN risk index 0 or 1) compared to patients with a higher risk of SSI after surgery (risk index 2 or 3).

Risk ratios (RR) were calculated to compare the risk between the 2 groups. A RR greater than 1 indicates an increased SSI risk among those operations with a risk index of 2 or 3 (indicating a high risk) compared to those with a risk index of 0 or 1. Where the confidence intervals do not include the measure of no difference (RR = 1), it is considered unlikely that the observed difference in SSI risk occurred by chance. In all categories of surgery except small bowel surgery and breast surgery, patients who underwent operations with a higher risk index were more likely to experience infection than those with a lower risk index. For all categories of surgery except cardiac (non-CABG) surgery and small bowel surgery, the risk ratios comparing the risk of SSI between NHSN 0 or 1 with NHSN ≥2 were greater than 1 and the corresponding 95% confidence intervals did not overlap 1, indicating statistically significant difference. However, it is important to note that these risk ratios have not been adjusted for other factors that might explain the observed increase in relative risk.

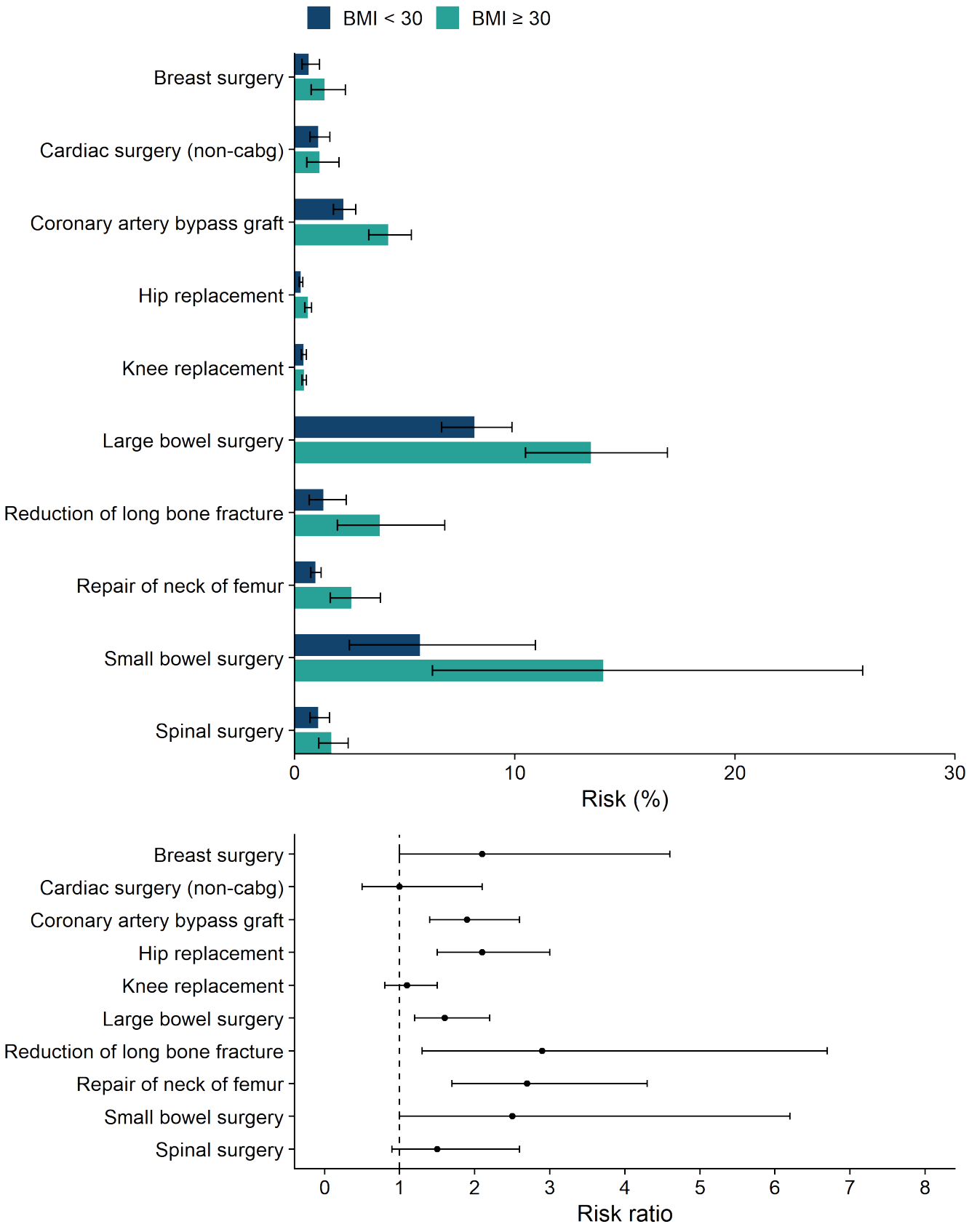
An elevated BMI has been shown to increase the risk of developing an SSI, particularly among CABG patients (4, 5). Figure 3b shows the unadjusted SSI risk for financial year 2023 to 2024 across surgical categories for patients who had BMI equal to or greater than 30 kg/m^2 compared to those with BMI less than 30 kg/m^2. In all categories, an increased risk of SSI was seen for the patient group with BMI higher than 30 kg/m^2 relative to the patients with BMI less than 30 kg/m^2.

Figure 3a. Inpatient and readmission SSI risk by NHSN risk index, NHS hospitals England, April 2023 to March 2024 [note 1]



Note 1: categories with less than 5 participating hospitals were excluded.
See data table 3a in accompanying data tables spreadsheet.

Figure 3b. Inpatient and readmission SSI risk by patient body mass index, NHS hospitals England, April 2023 to March 2024 [note 1]



Note 1: categories with less than 5 participating hospitals were excluded.

See data table 3b in accompanying data tables spreadsheet.

Table 4 shows SSI risk by primary indication for hip replacement and knee replacement surgery. For both joint surgeries, revision operations carried a higher SSI risk than primary operations (hip: 1.3% versus 0.3%, knee: 1.1% versus 0.4%, respectively). The SSI risk for patients undergoing revision of hip replacement and knee replacement due to an infection increased from 1.2% (95% CI 0.3 to 3.1) to 2.1% (0.9 to 4.3) and 0.7% (0.1 to 2.3) to 2.6% (1.1 to 5.3) between financial years 2022 to 2023 and 2023 to 2024, respectively. Between 2022 to 2023 and 2023 to 2024, there were increases in SSI risk among patients undergoing revisions due to fracture in both categories (hip: 0.7% (0.2 to 1.8) to 2.3% (1.2 to 3.9); knee: 0.0% (0.0 to 3.4) to 2.7% (0.6 to 7.6)). The risk of infection in knee replacements due to trauma or fracture decreased from 3.6% (1.0 to 8.9) in 2022 to 2023 to 0.0% (0.0% to 2.6) in 2023 to 2024, albeit there were only 140 operations with this indication for surgery.

These year-on-year changes should be interpreted with caution due to overlapping confidence intervals signifying the potential role of random variation in the observed differences.

Table 4. Inpatient and readmission SSI risk by primary indication for joint replacement surgeries, NHS hospitals England, April 2023 to March 2024 [note 1]

	Indication for surgery	Hip replacement: number of operations	Hip replacement: number of SSI	Hip replacement: SSI risk (%), 95% CI	Knee replacement: number of operations	Knee replacement: number of SSI	Knee replacement: SSI risk (%), 95% CI
	Osteoarthritis	33,923	114	0.3 (0.3 to 0.3)	39,574	146	0.4 (0.3 to 0.4)
	Inflammatory joint disease	232	0	0.0 (0.0 to 1.6)	276	1	0.4 (0.0 to 2.0)
Primary	Avascular necrosis	388	3	0.8 (0.2 to 2.2)	25	0	0.0 (0.0 to 13.7)
	Trauma or fracture	2,105	4	0.2 (0.1 to 0.5)	140	0	0.0 (0.0 to 2.6)
	Other	647	5	0.8 (0.3 to 1.8)	549	5	0.9 (0.3 to 2.1)
	Total	**37,295**	**126**	**0.3 (0.3 to 0.4)**	**40,564**	**152**	**0.4 (0.3 to 0.4)**
	Infection	332	7	2.1 (0.9 to 4.3)	269	7	2.6 (1.1 to 5.3)
	Fracture	566	13	2.3 (1.2 to 3.9)	113	3	2.7 (0.6 to 7.6)

	Indication for surgery	Hip replacement: number of operations	Hip replacement: number of SSI	Hip replacement: SSI risk (%), 95% CI	Knee replacement: number of operations	Knee replacement: number of SSI	Knee replacement: SSI risk (%), 95% CI
Revision	Other	2,043	17	0.8 (0.5 to 1.3)	1,557	12	0.8 (0.4 to 1.3)
	Unknown	169	2	1.2 (0.1 to 4.2)	174	1	0.6 (0.0 to 3.2)
	Total	**3,110**	**39**	**1.3 (0.9 to 1.7)**	**2,113**	**23**	**1.1 (0.7 to 1.6)**

Note 1: totals do not include patients who had missing data for primary indication (hip: 991, knee:1,368).

Abbreviations

CI = confidence interval.

Social determinants of health

Ethnicity

There is a compelling body of evidence that health patterns and access to health vary between social groups, and highlighting some of these differences can be helpful in addressing wider health inequalities. However, discerning the causes of health inequalities is complex, as many of the factors are interlinked, and therefore out of the scope of this report (7). In assessing analyses of SSI risk distribution by selected social determinants of health, it is important to recognise that these do also serve as proxies of wider, more complex social dynamics that influence health outcomes in society. Results for Other ethnicity group should be also interpreted with caution due to this being a heterogenous group including dissimilar groups of people when looking at more granular level (2021 Census lists 68 subcategories for the Other high-level ethnic group).

The SSI risk by category and ethnic group was based on 5-year data between April 2019 and March 2024. Of the 574,700 operations reported to the SSISS during this period, 2.7% did not link to HES data, while 3.2% had the ethnic group recorded in HES as ‘not known’ or ‘not stated’. During this period, the most commonly reported ethnicity was White (90.60%), followed by Asian, Black, Mixed and Other ethnicity reported in 3.7%, 1.6%. 0.5% and 0.3% of operations, respectively.

Table 5 shows the proportion of patients by ethnic group and surgical category. Across all surgical categories the proportion of patients of White ethnicity ranged from 73.8% (CABG) to 97% for vascular surgery. The proportion of non-white patients varied by surgical category with, the highest proportion observed in CABG (23%), cranial surgery (13.9%), cardiac surgery (non-CABG) (13.3%), abdominal hysterectomy (11.5%) and spinal surgery (9.3%). The highest proportion of records with missing or unknown ethnicity was found in cardiac (non-CABG) and breast surgery (4.8% and 4.7%, respectively).

Figures 4a-i show SSI risk and risk ratios to compare the risk between ethnic groups (using White ethnicity as the reference group) for categories with more than 5 hospitals participating during the 5-year period. These comparisons lack statistical power due to the very low surgical volumes in some of the non-white ethnic groups (Table 5). Therefore, care should be taken when interpreting these results. The risk ratios are also unadjusted estimates, which means the estimates do not account for other factors which may play a role in explaining some of the differences such as underlying co-morbidities.

There was some evidence that Black ethnicity was associated with increased SSI risk in reduction for long bone fracture compared to White ethnicity (RR 2.96, 95% CI 1.11 to 7.94) (Figure 4c). There was also some evidence that SSI risk in CABG surgery was lower in the Asian ethnic group (RR 0.75; 0.62 to 0.91) (Figure 4h) compared to people of White ethnicity.

There was no evidence for differences in SSI risk by ethnicity for other categories of surgery and it is likely that these analyses were affected by the low numbers of operations when stratified by ethnic group as described in the Table 5.

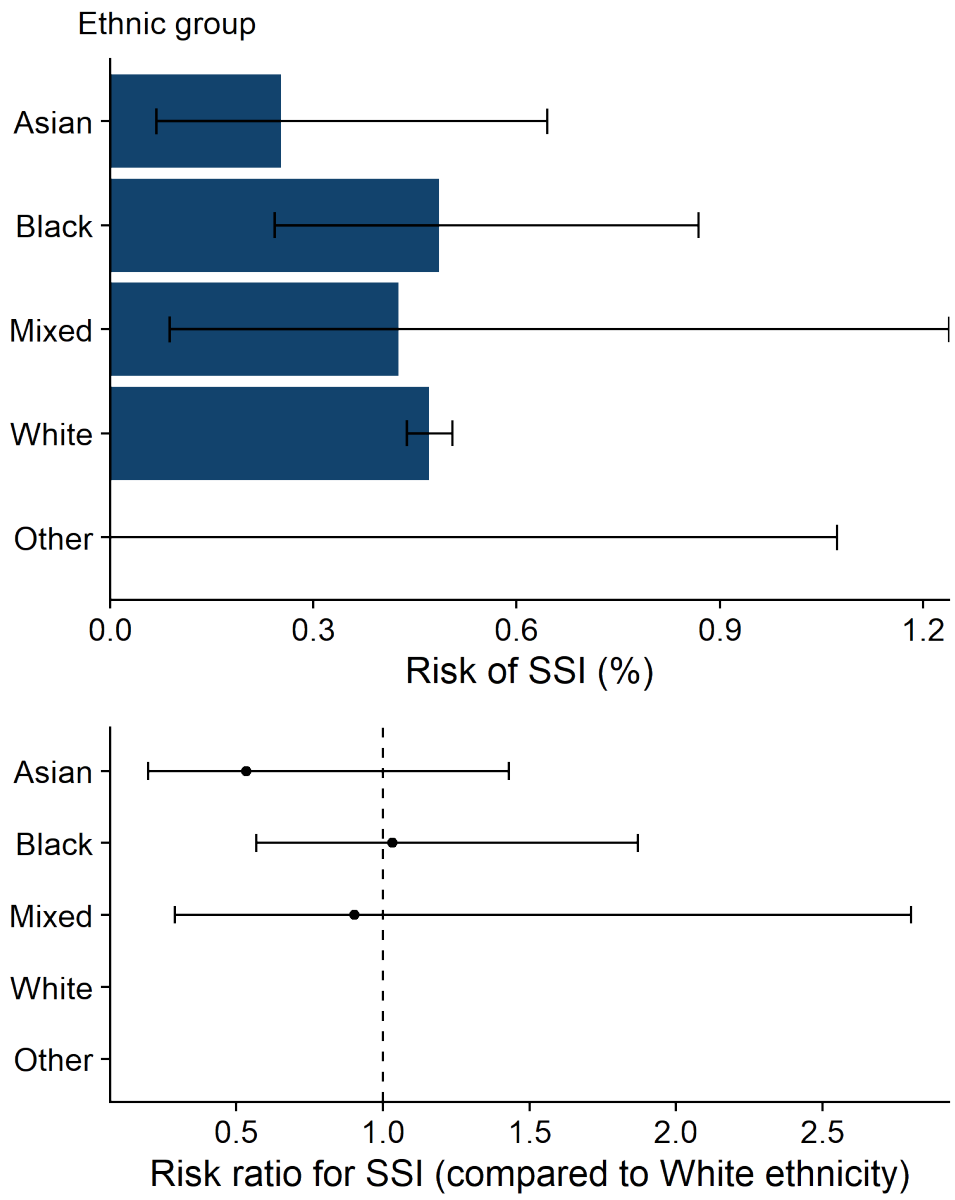
A previous study showed differences in the unadjusted risk of SSI according to patient ethnicity, but with this difference diminished after adjusting for IMD and patient and surgery related risk factors (8). Based on 5-year data between April 2019 and March 2024, there was some indication of an increased risk of SSI for non-white ethnic groups compared to White patients, however confidence intervals overlapped in all of these meaning statistical significance for these differences was not reached.

Table 5. Patient distribution by ethnic group and surgical category, NHS hospitals England, April 2019 to March 2024

Surgical category	Asian number (%)	Black number (%)	Other ethnicity number (%)	Mixed or multiple ethnicity number (%)	White number (%)	Missing or Unknown number (%)	Total number (%)
Abdominal hysterectomy	44 (4.3)	56 (5.4)	8 (0.8)	11 (1.1)	879 (85.5)	33 (3.2)	1,031 (100)
Bile duct, liver or pancreatic surgery	18 (2.1)	14 (1.6)	1 (0.1)	8 (0.9)	807 (92.7)	23 (2.6)	871 (100)
Breast surgery	316 (2.4)	159 (1.2)	55 (0.4)	100 (0.8)	12,018 (90.6)	624 (4.7)	13,272 (100)
Cardiac surgery (non-CABG)	1,449 (8.5)	549 (3.2)	126 (0.7)	158 (0.9)	14,038 (81.9)	819 (4.8)	17,139 (100)
Cholecystectomy	16 (2.7)	16 (2.7)	4 (0.7)	5 (0.8)	535 (89.6)	21 (3.6)	597 (100)
CABG	5,313 (19.1)	573 (2.1)	270 (1.0)	246 (0.9)	20,584 (73.8)	895 (3.2)	27,881 (100)
Cranial surgery	421 (6.1)	386 (5.6)	58 (0.8)	89 (1.3)	5,680 (82.8)	222 (3.3)	6,856 (100)
Gastric surgery	18 (1.6)	14 (1.2)	3 (0.3)	14 (1.2)	1,054 (91.4)	50 (4.3)	1,153 (100)
Hip replacement	1,586 (0.9)	2,264 (1.3)	342 (0.2)	705 (0.4)	162,04 (93.5)	6,384 (3.7)	173,330 (100)
Knee replacement	9,330 (5.4)	3,554 (2.1)	413 (0.2)	862 (0.5)	154,243 (89.3)	4,373 (2.6)	172,775 (100)

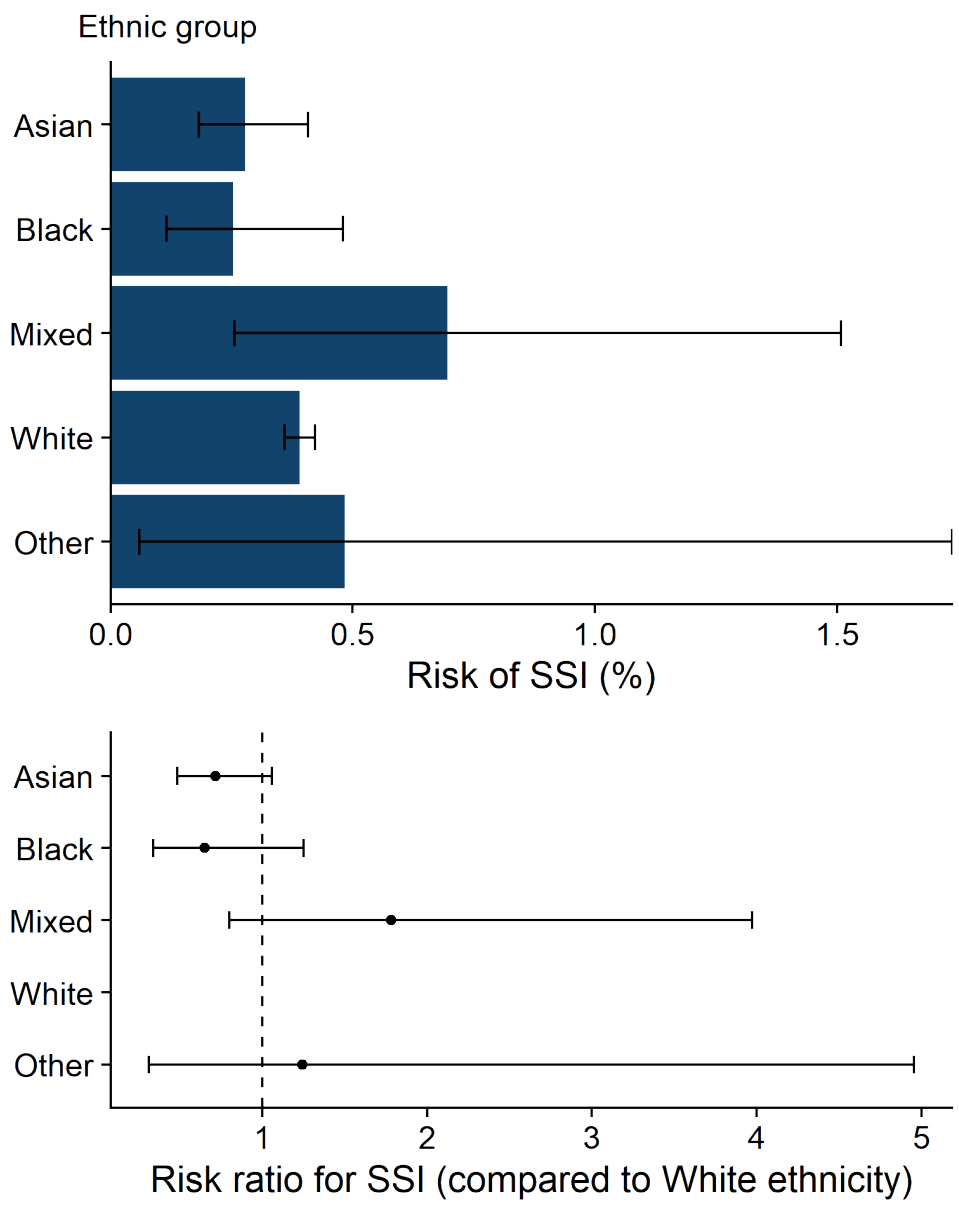
Surgical category	Asian number (%)	Black number (%)	Other ethnicity number (%)	Mixed or multiple ethnicity number (%)	White number (%)	Missing or Unknown number (%)	Total number (%)
Large bowel surgery	171 (1.6)	116 (1.1)	39 (0.4)	72 (0.7)	9,849 (91.8)	478 (4.4)	10,725 (100)
Limb amputation	19 (2.7)	14 (2.0)	3 (0.4)	1 (0.1)	646 (93.1)	11 (1.5)	694 (100)
Reduction of long bone fracture	284 (1.7)	176 (1.1)	101 (0.6)	127 (0.8)	15,519 (92.7)	530 (3.1)	16,737 (100)
Repair of neck of femur	1,086 (1.1)	354 (0.4)	201 (0.2)	253 (0.3)	92,553 (95.0)	2,997 (3.1)	97,444 (100)
Small bowel surgery	53 (2.7)	25 (1.3)	9 (0.5)	14 (0.7)	1,765 (91.5)	62 (3.2)	1,928 (100)
Spinal surgery	1,346 (4.6)	951 (3.2)	102 (0.3)	351 (1.2)	25,886 (88.1)	741 (2.6)	29,377 (100)
Vascular surgery	11 (0.4)	5 (0.2)	7 (0.2)	14 (0.5)	2,804 (97.0)	49 (1.7)	2,890 (100)

Figure 4a. Risk of SSI in patient undergoing hip replacement by ethnic group, NHS hospitals England, April 2019 to March 2024



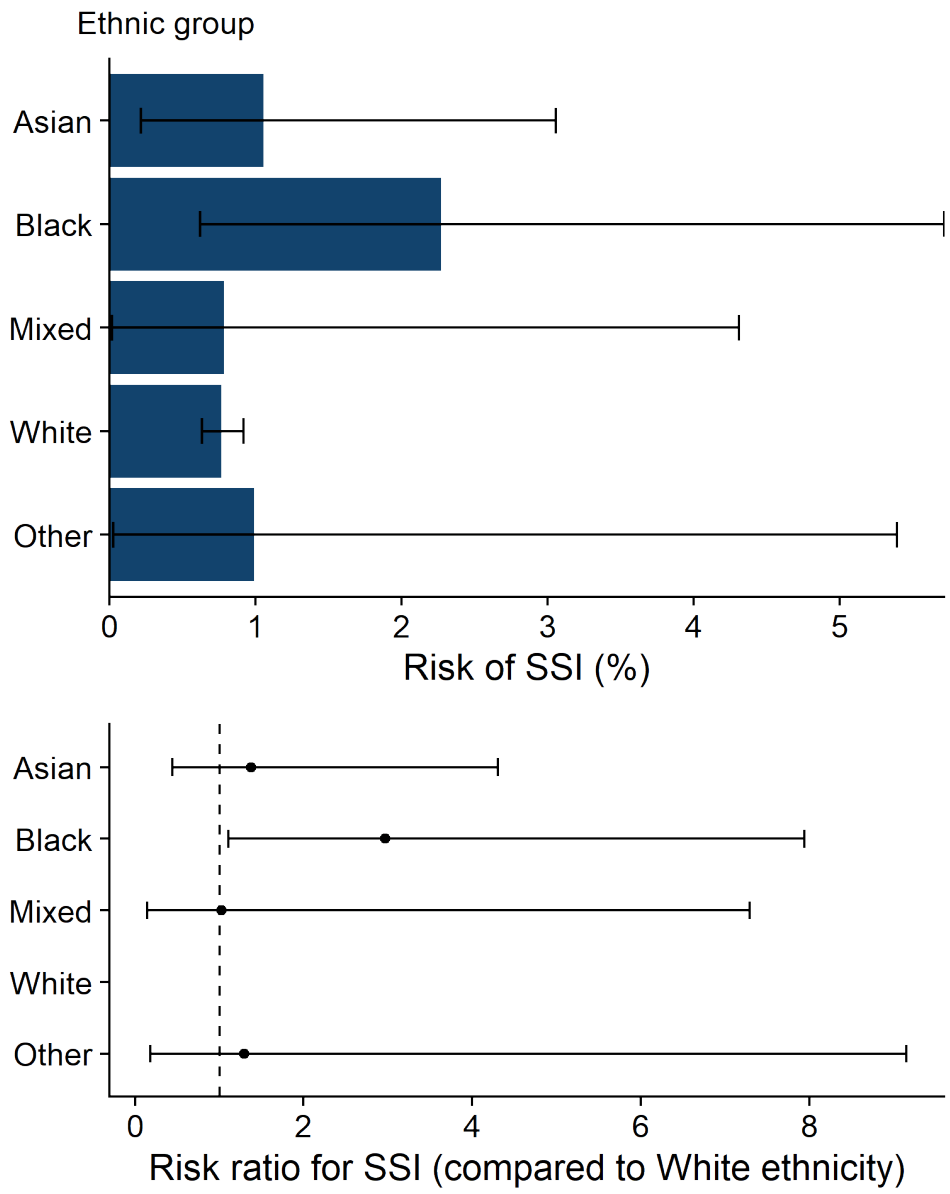
See data table 4a in accompanying data tables spreadsheet.

Figure 4b. Risk of SSI in patient undergoing knee replacement by ethnic group, NHS hospitals England, April 2019 to March 2024



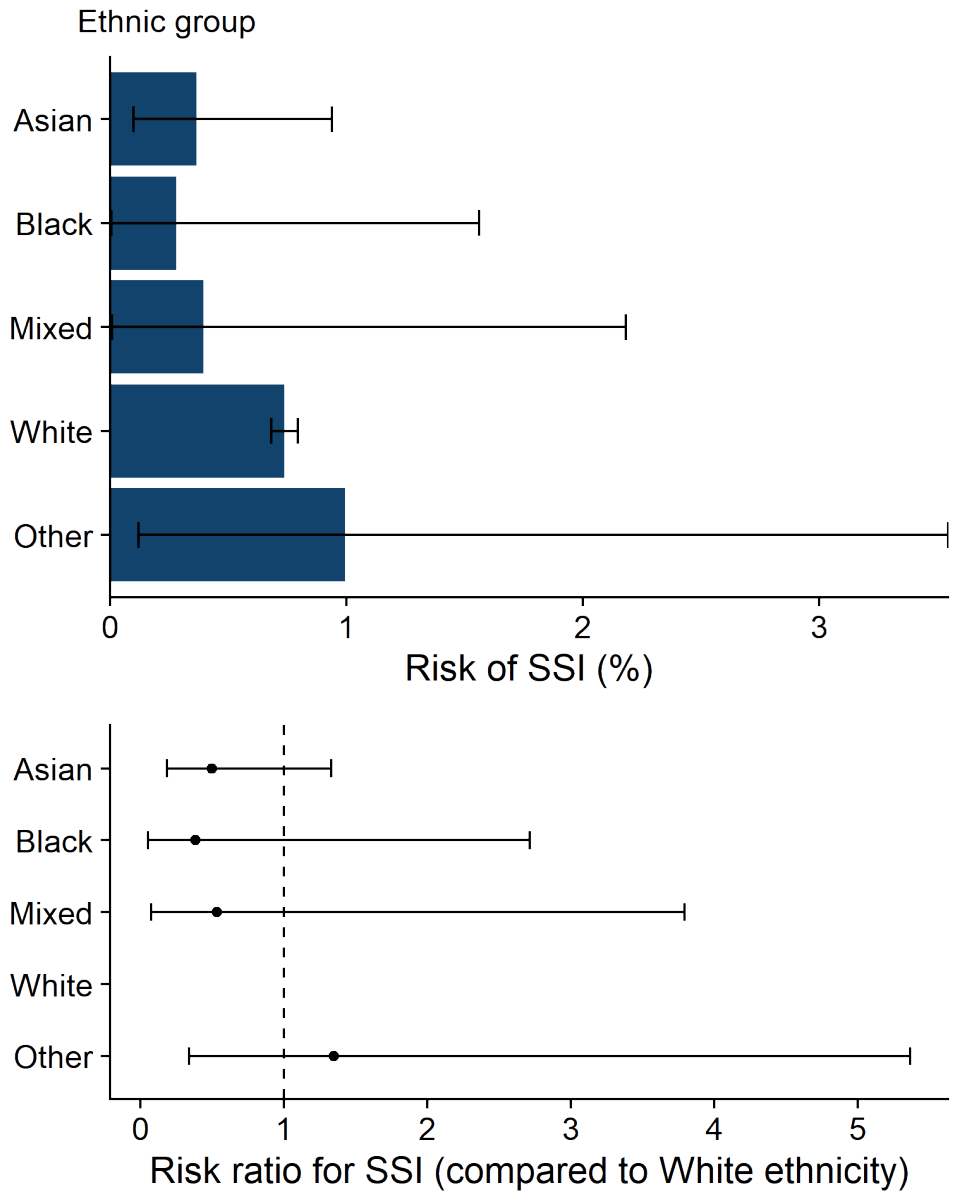
See data table 4b in accompanying data tables spreadsheet.

Figure 4c. Risk of SSI in patient undergoing reduction of long bone fracture by ethnic group, NHS hospitals England, April 2019 to March 2024



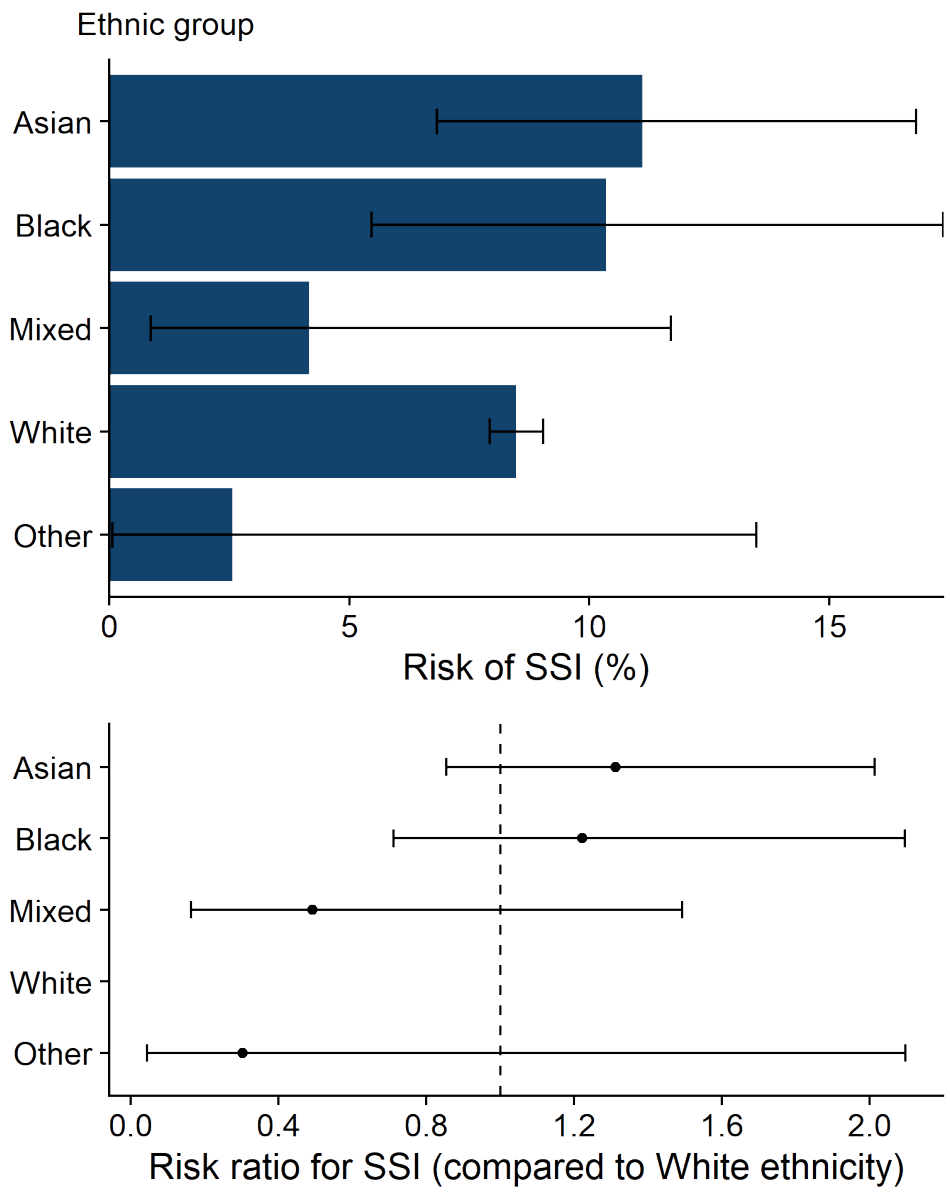
See data table 4c in accompanying data tables spreadsheet.

Figure 4d. Risk of SSI in patient undergoing repair of neck of femur by ethnic group, NHS hospitals England, April 2019 to March 2024



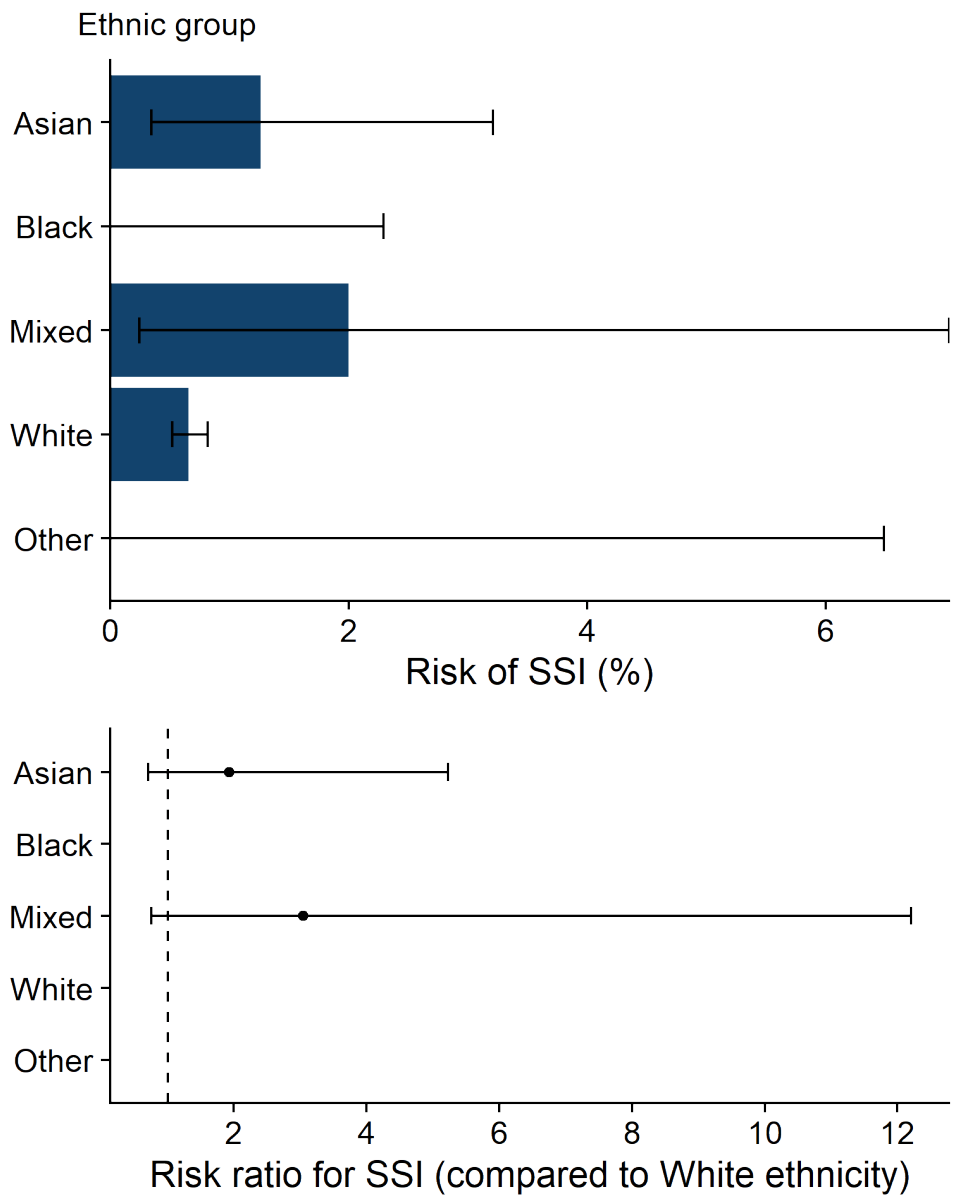
See data table 4d in accompanying data tables spreadsheet.

Figure 4e. Risk of SSI in patient undergoing large bowel surgery by ethnic group, NHS hospitals England, April 2019 to March 2024



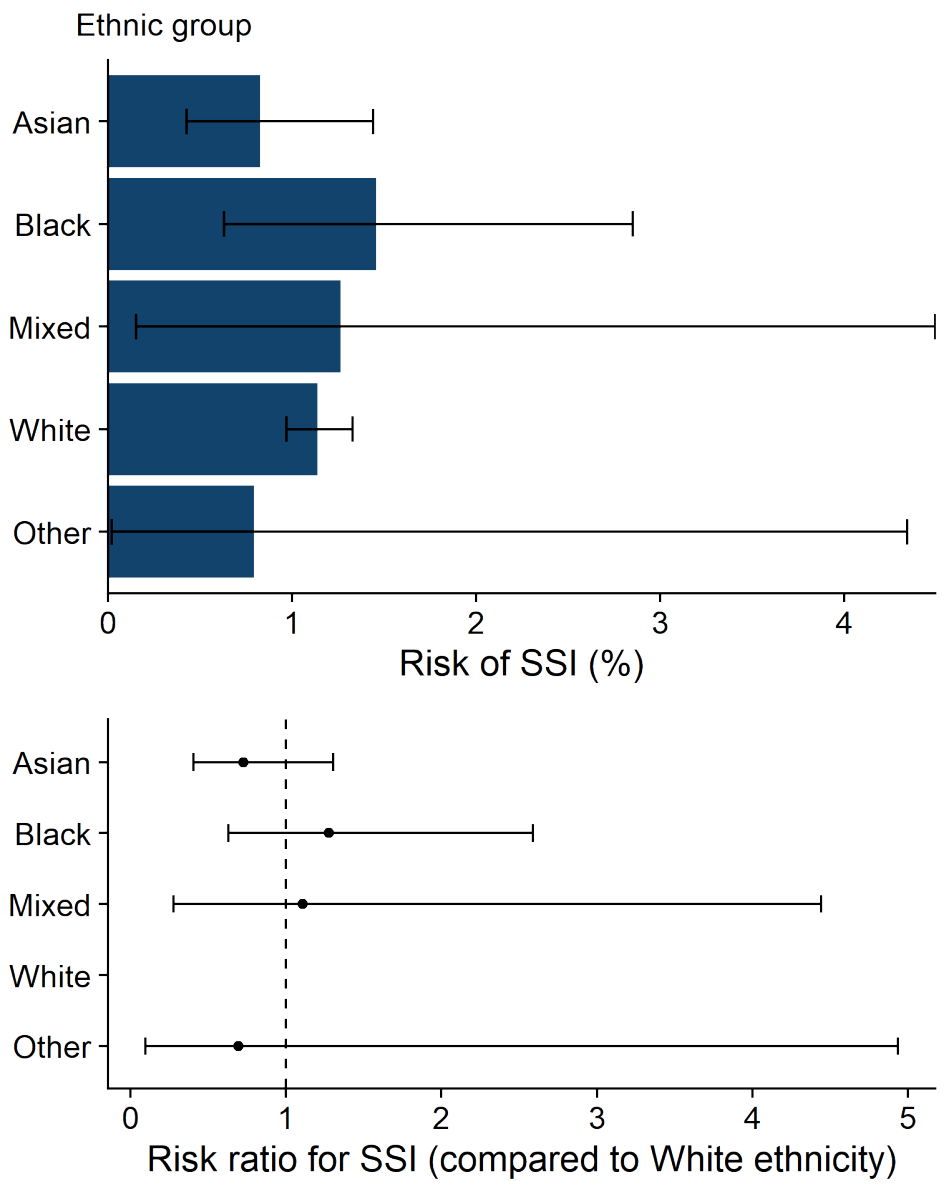
See data table 4e in accompanying data tables spreadsheet.

Figure 4f. Risk of SSI in patient undergoing breast surgery by ethnic group, NHS hospitals England, April 2019 to March 2024



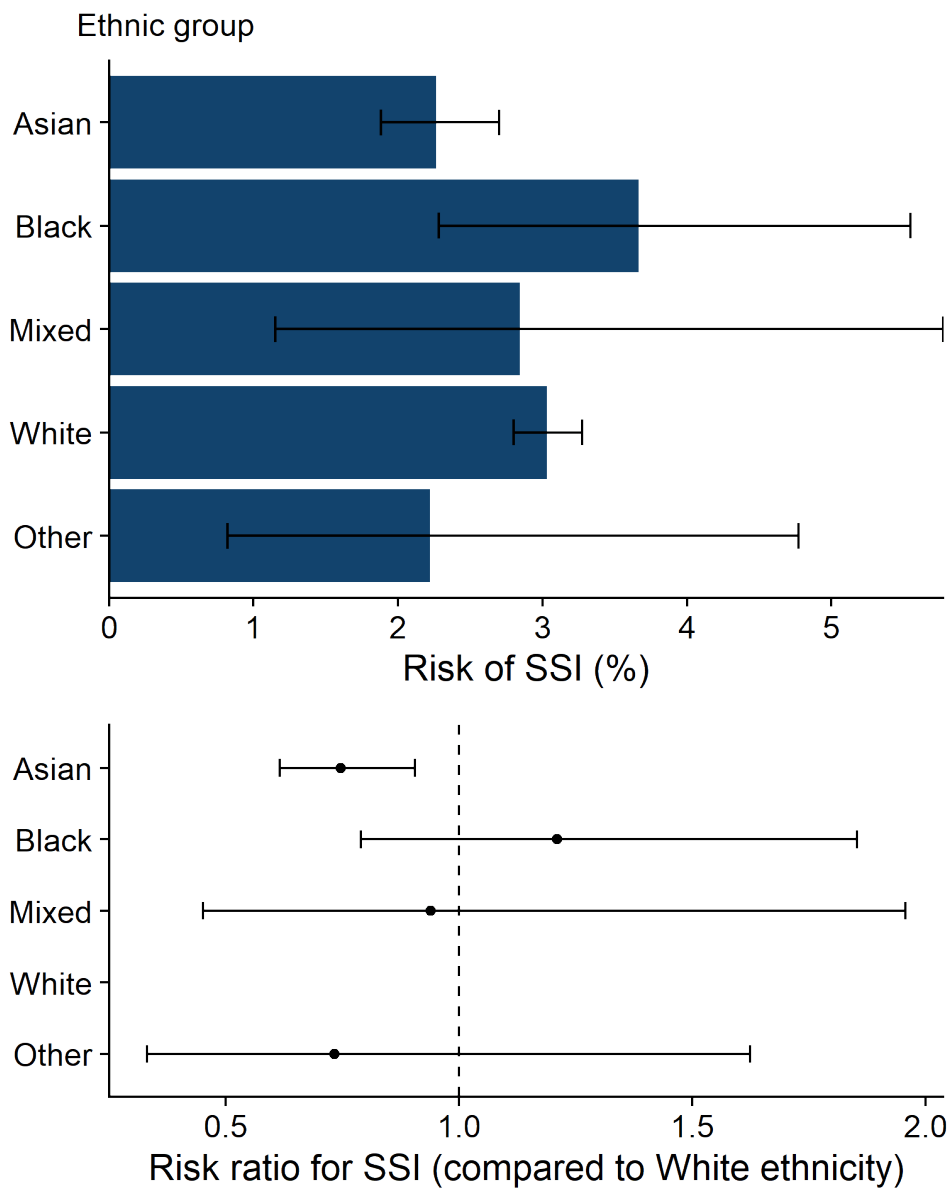
See data table 4f in accompanying data tables spreadsheet.

Figure 4g. Risk of SSI in patient undergoing cardiac surgery (non-CABG) by ethnic group, NHS hospitals England, April 2019 to March 2024



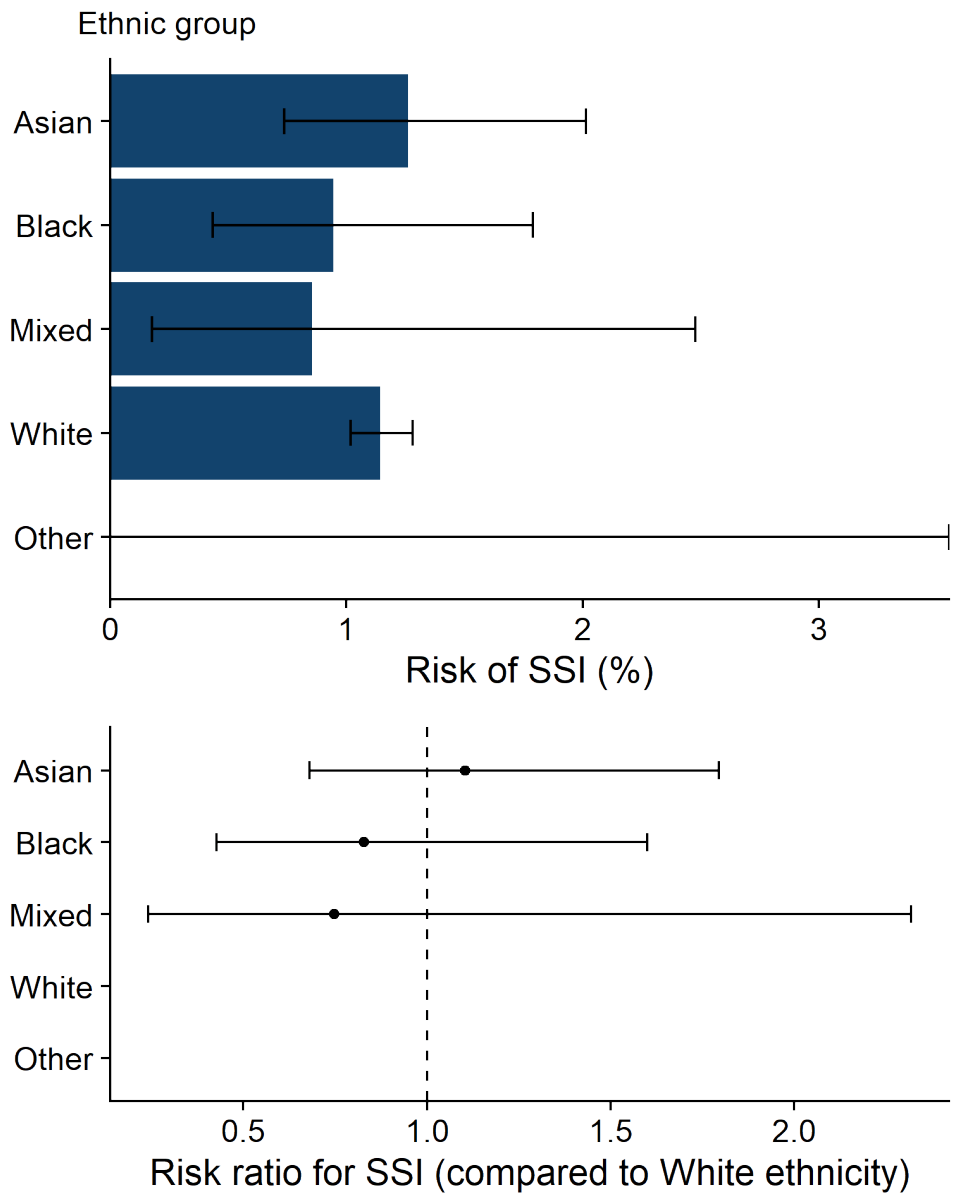
See data table 4g in accompanying data tables spreadsheet.

Figure 4h. Risk of SSI in patient undergoing CABG by ethnic group, NHS hospitals England, April 2019 to March 2024



See data table 4h in accompanying data tables spreadsheet.

Figure 4i. Risk of SSI in patient undergoing spinal surgery by ethnic group, NHS hospitals England, April 2019 to March 2024



See data table 4i in accompanying data tables spreadsheet.

IMD

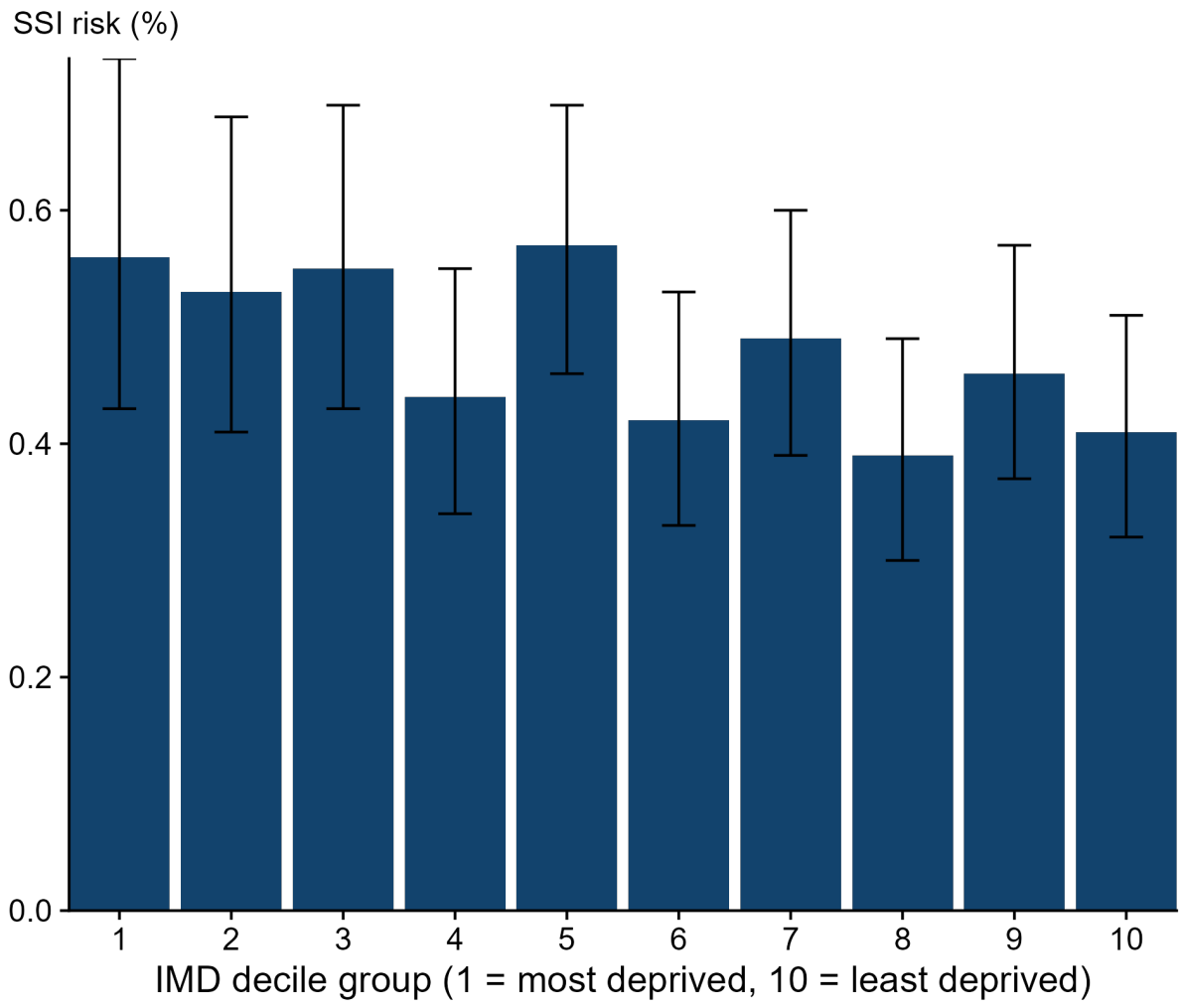
Index of multiple deprivation is a weighted composite measure of socioeconomic deprivation consisting of 7 domains counted at a level of lower-super output area (LSOA) equalling about 1,500 residents or 650 households). Therefore, individual's risk of SSI is not directly reflected by IMD score of area they reside in, but it can be a helpful indication of circumstances that may impact their risk of SSI.

The proportion of records with missing IMD score fluctuated by surgical category between 1.2% for breast surgery and 9.0% for hip replacement (Appendix 4); the proportion of missing records was around 1.5% each financial year in last 5-year period.

Figures 5a-i show SSI risk by IMD deciles in a selection of surgical categories based on hospital participation (minimum of 5 hospitals submitted data in the current financial year). Overall, the risk of SSI appeared to be higher in deciles representing higher deprivation with 6 of the displayed surgical categories having the highest SSI risk in the most deprived decile (knee replacement, repair of neck of femur, large bowel surgery, breast surgery, cardiac surgery (non-CABG) and CABG).

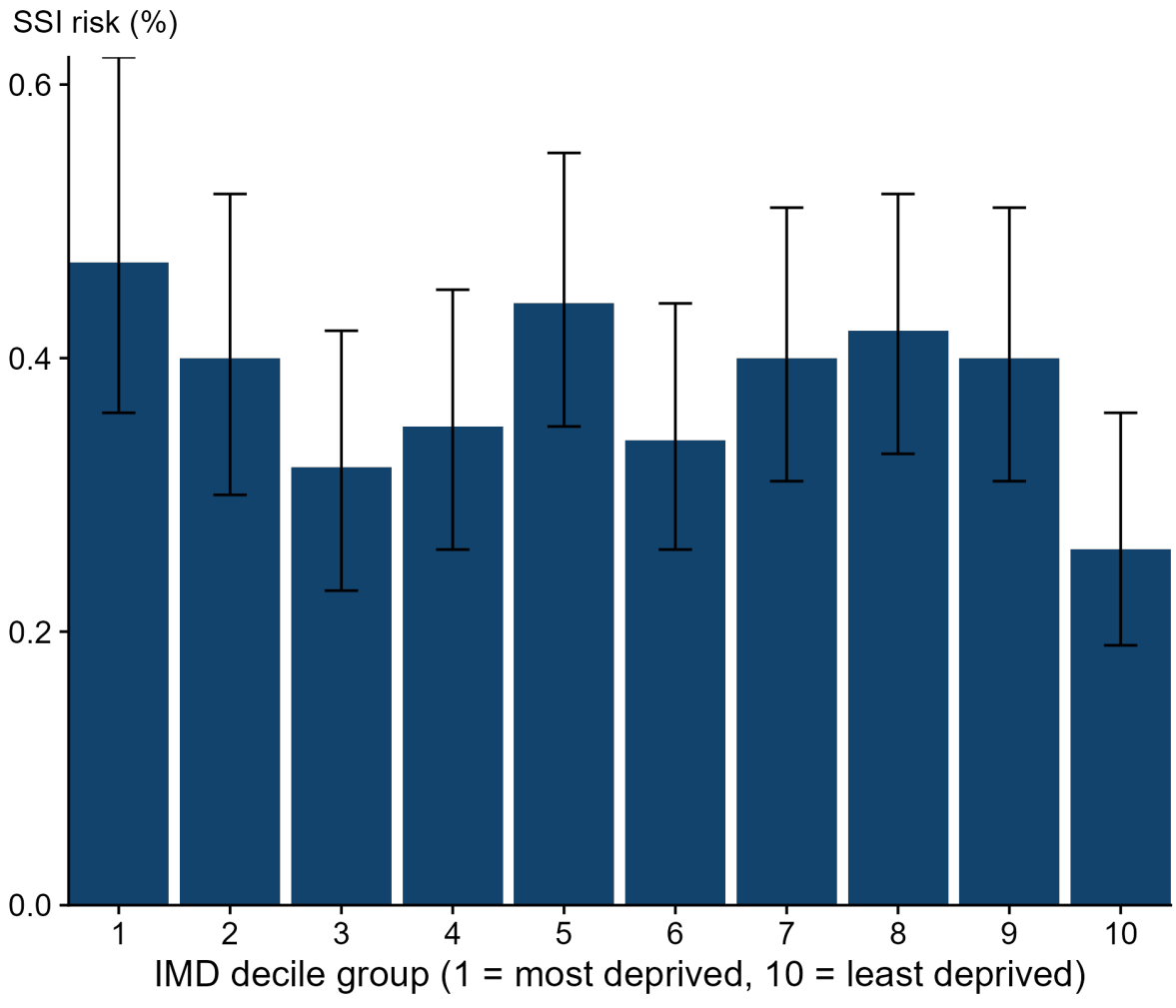
As observed for the SSI risk by ethnicity, the confidence intervals for SSI risk by IMD deciles for all surgical categories overlapped indicating larger uncertainty around true difference between deciles. There was a high degree of variation in the risk of SSI by deprivation decile group amongst surgical categories. While, overall, there were higher risks of SSI among people resident in areas with greater relative deprivation, there were exceptions to this in some decile groups for both hip and knee replacements. For example, the second least deprived decile group (decile group 9) for knee replacement had a higher risk of SSI than the third and fourth most deprived decile groups (decile groups 3 and 4). In contrast, the risk of SSI in reduction of long bone fracture surgery was higher among patients resident in areas of low relative deprivation than among patients resident in areas of high relative deprivation. For repair of neck of femur, the SSI risk appeared to be higher in most and least deprived deciles (repair of neck of femur: deciles 1,2, 9 and 10) and lower in between.

Figure 5a. Risk of SSI in patients undergoing hip replacement by IMD decile, NHS hospitals England, April 2019 to March 2024



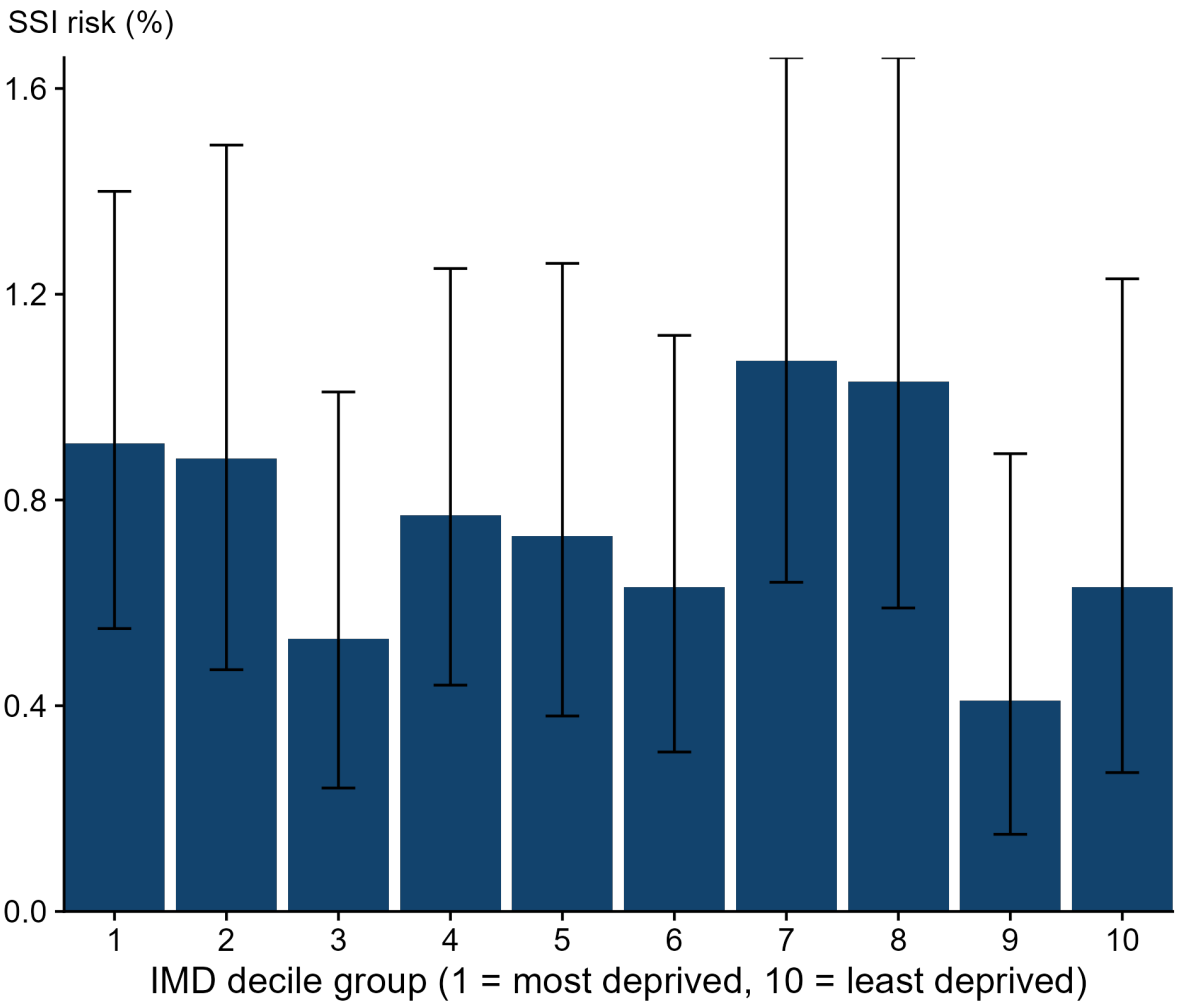
See data table 5a in accompanying data tables spreadsheet.

Figure 5b. Risk of SSI in patients undergoing knee replacement by IMD decile, NHS hospitals England, April 2019 to March 2024



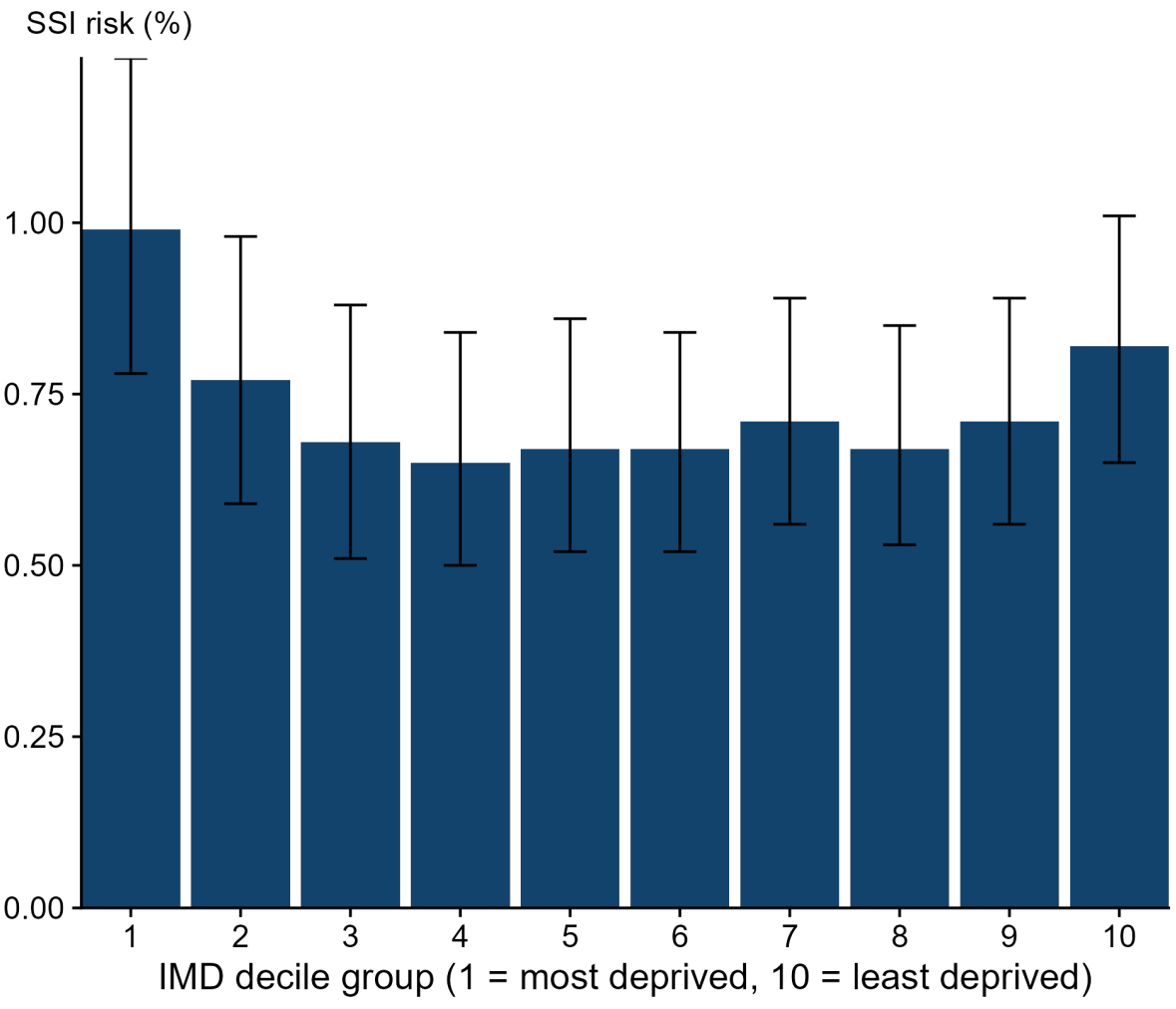
See data table 5b in accompanying data tables spreadsheet.

Figure 5c. Risk of SSI in patients undergoing reduction of long bone fracture by IMD decile, NHS hospitals England, April 2019 to March 2024



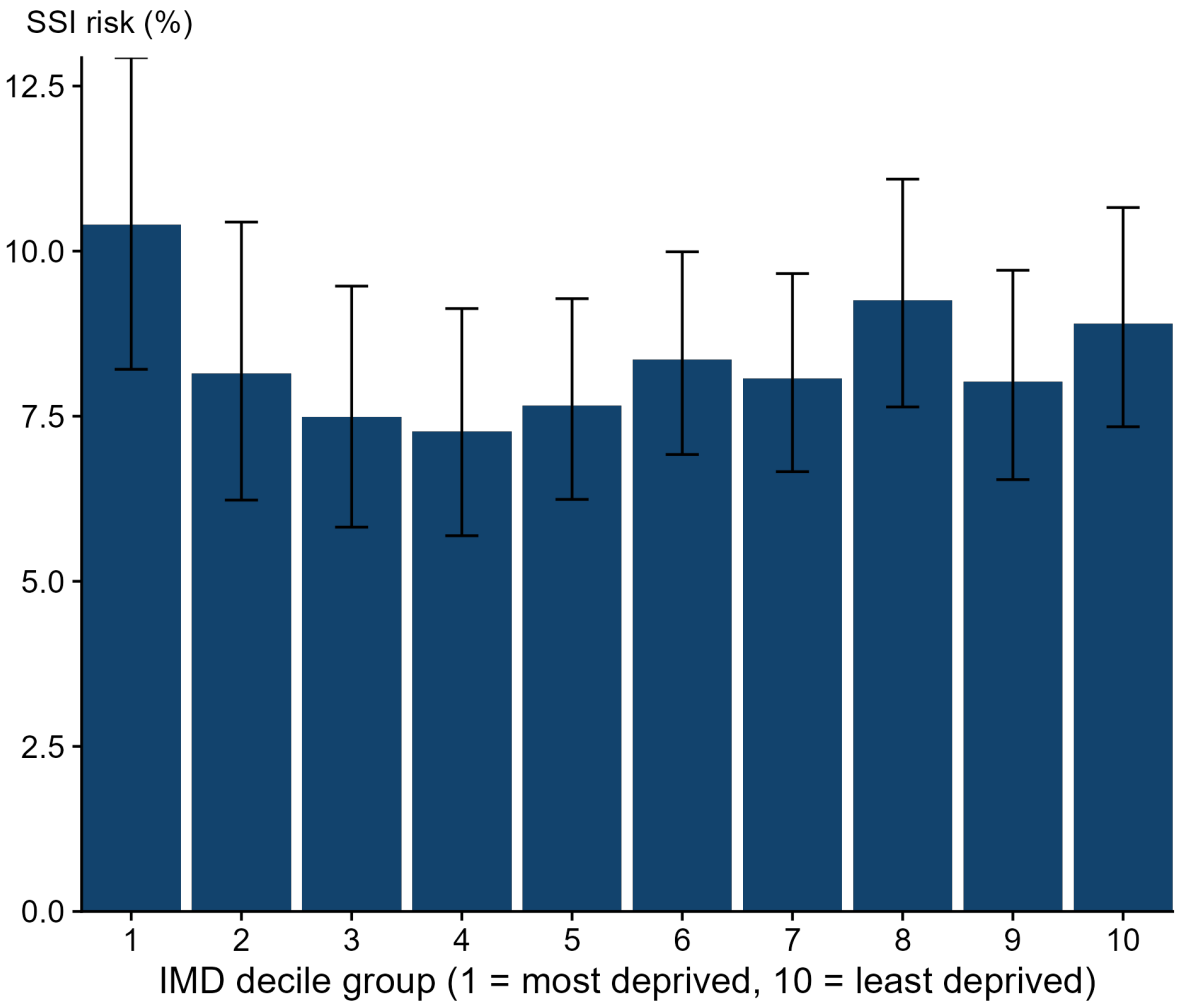
See data table 5c in accompanying data tables spreadsheet.

Figure 5d. Risk of SSI in patients undergoing repair of neck of femur by IMD decile, NHS hospitals England, April 2019 to March 2024



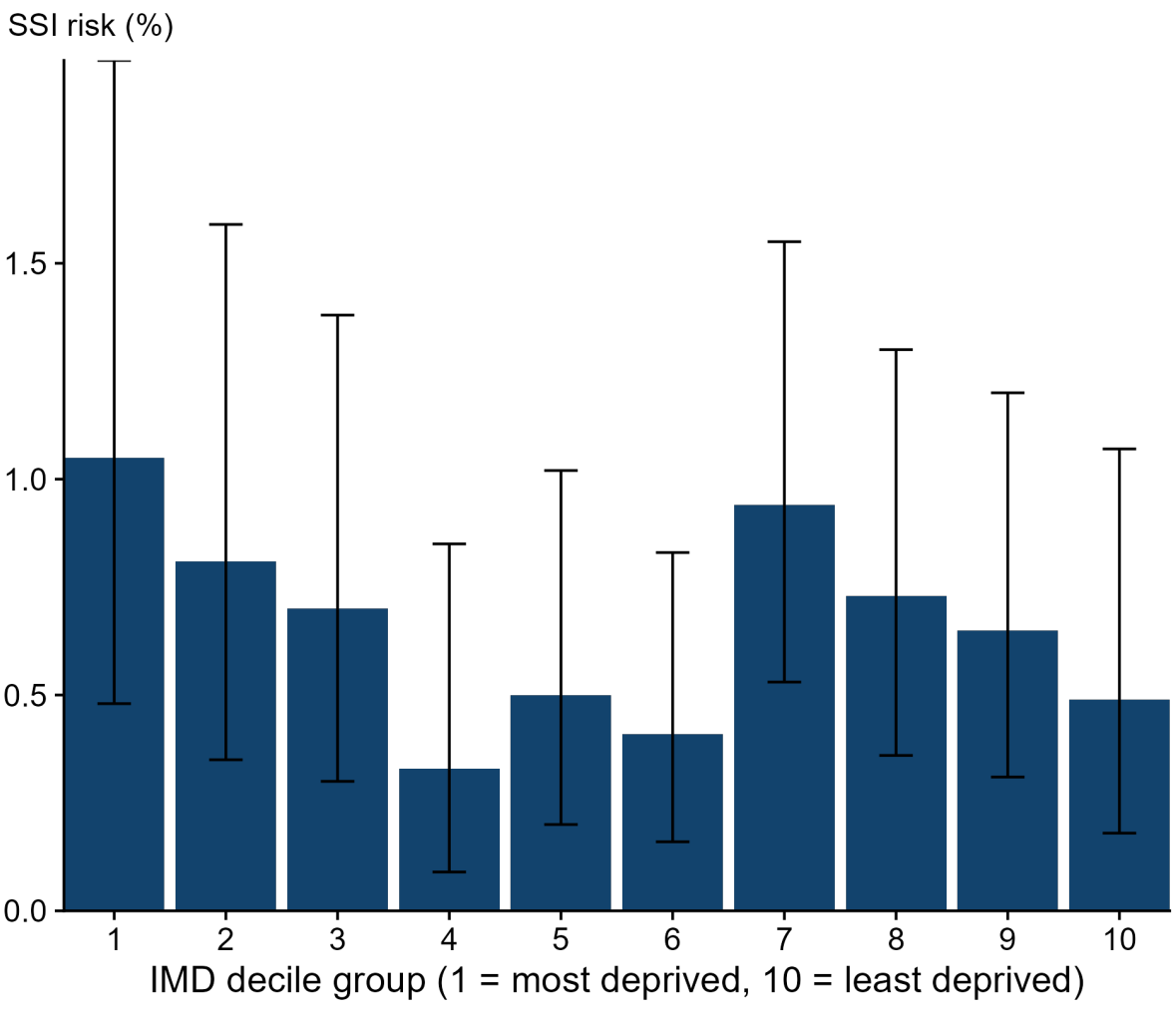
See data table 5d in accompanying data tables spreadsheet.

Figure 5e. Risk of SSI in patients undergoing large bowel surgery by IMD decile, NHS hospitals England, April 2019 to March 2024



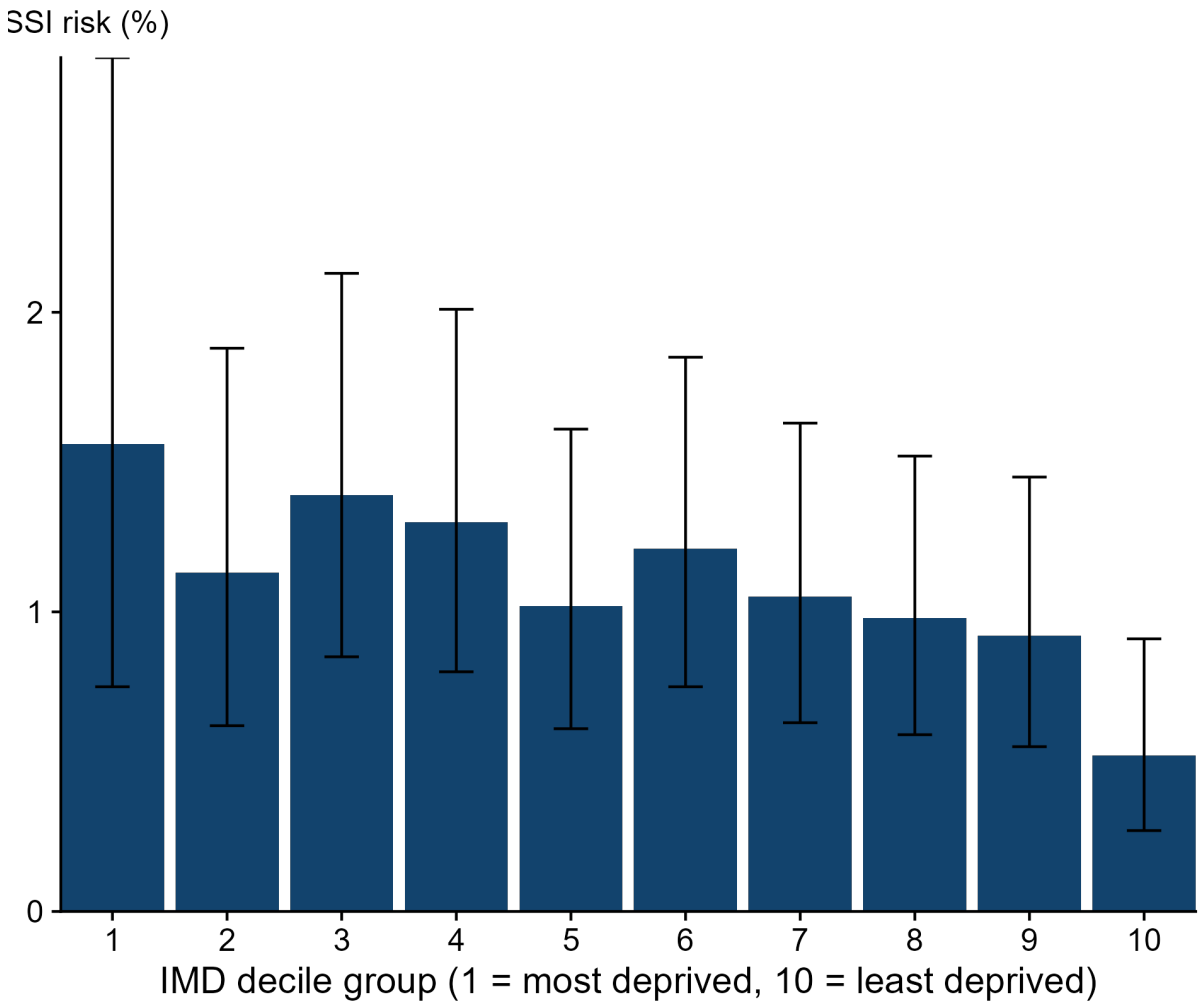
See data table 5e in accompanying data tables spreadsheet.

Figure 5f. Risk of SSI in patients undergoing breast surgery by IMD decile, NHS hospitals England, April 2019 to March 2024



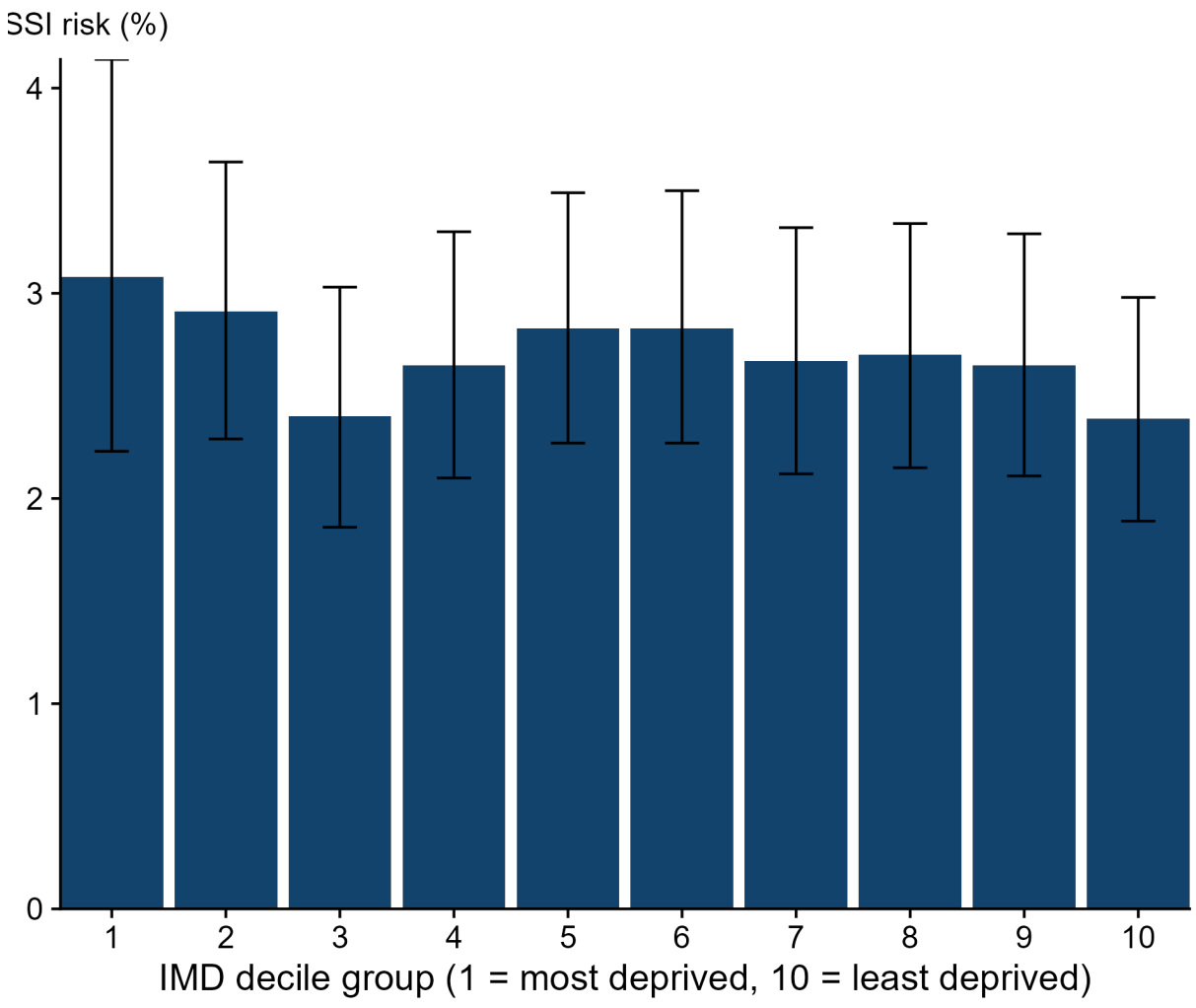
See data table 5f in accompanying data tables spreadsheet.

Figure 5g. Risk of SSI in patients undergoing cardiac surgery (non-CABG) by IMD decile, NHS hospitals England, April 2019 to March 2024



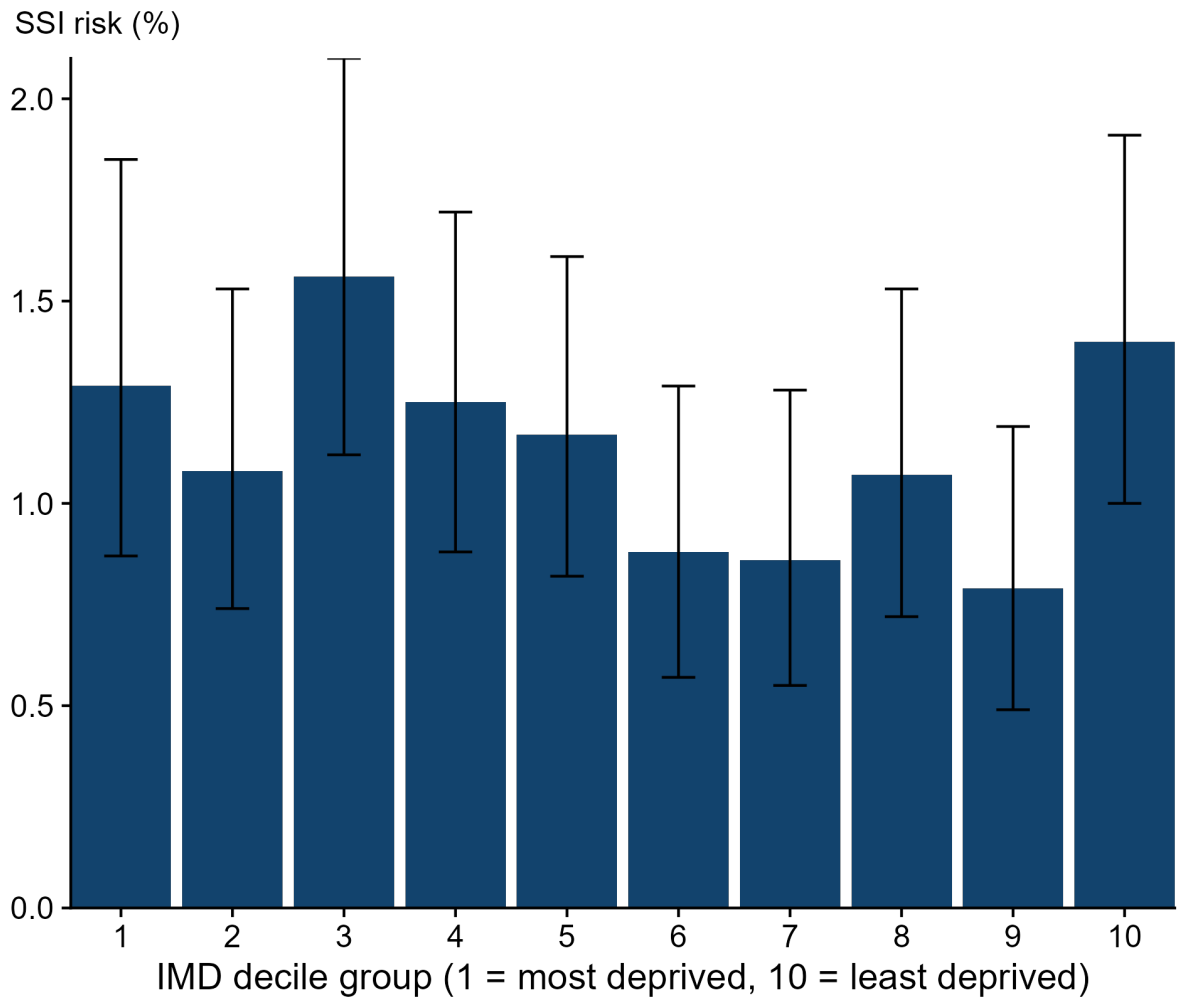
See data table 5g in accompanying data tables spreadsheet.

Figure 5h. Risk of SSI in patients undergoing CABG surgery by IMD decile, NHS hospitals England, April 2019 to March 2024



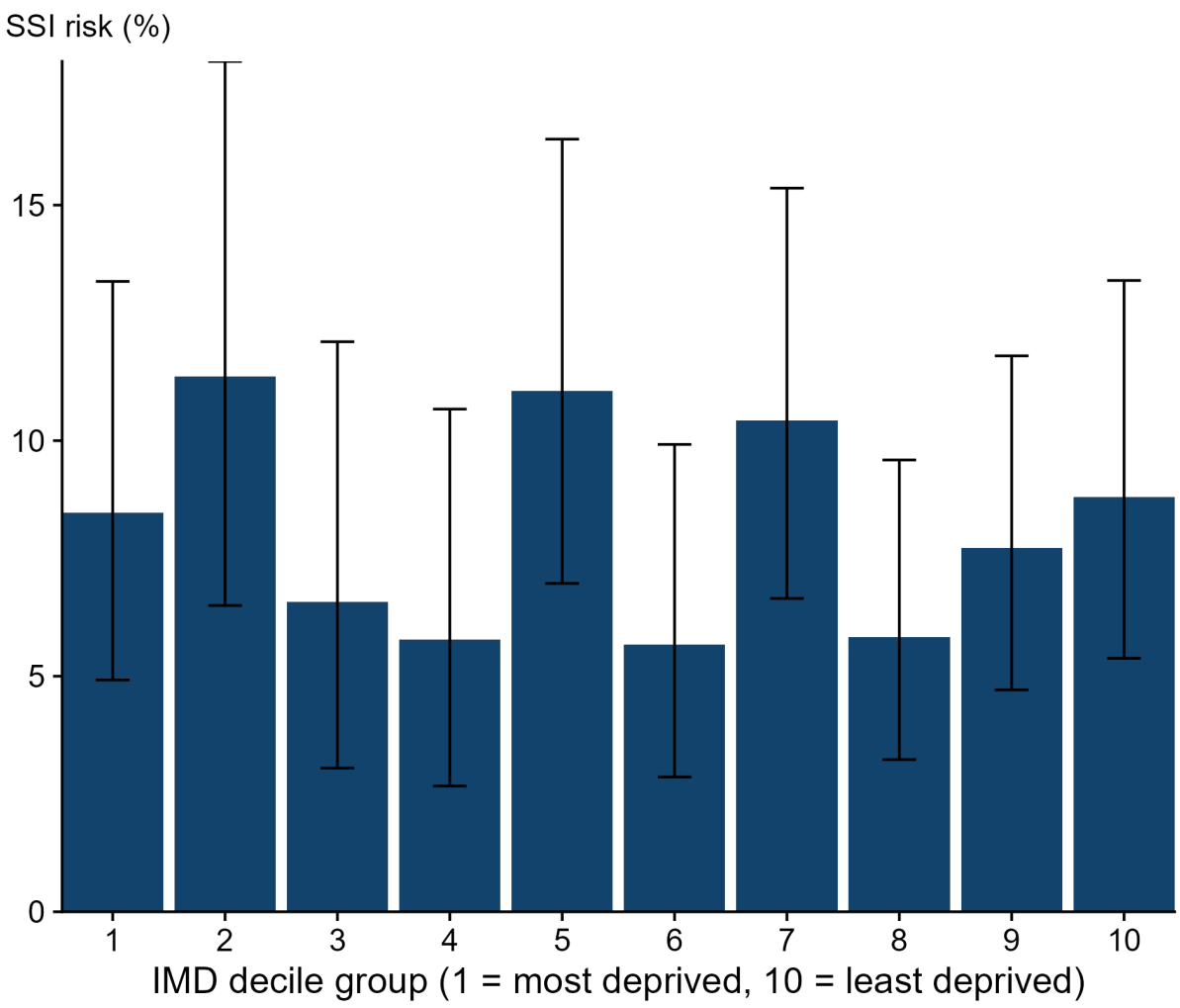
See data table 5h in accompanying data tables spreadsheet.

Figure 5i. Risk of SSI in patients undergoing spinal surgery by IMD decile, NHS hospitals England, April 2019 to March 2024



See data table 5i in accompanying data tables spreadsheet.

Figure 5j. Risk of SSI in patients undergoing small bowel surgery by IMD decile, NHS hospitals England, April 2019 to March 2024



See data table 5j in accompanying data tables spreadsheet.

Trends in SSI risk

Figures 6a-j show 10-year trends in annual SSI incidence (risk) for all surgical categories. SSI incidence is broken down by detection method: inpatient, readmission and combined inpatient and readmission. Trend analyses were not performed for surgical categories with fewer than 5 participating hospitals in the most recent financial year. It is important to note that annual trends use crude SSI incidence and do not account for potential changes in risk factors for SSI over time, hospital participation or other factors affecting healthcare delivery such as length of inpatient stay.

Over the past 10 years, inpatient and readmission SSI incidence following hip and knee replacement surgery has been relatively stable, with annual decreases from financial year 2014 to 2024 (Figure 6a and Figure 6b). In the current financial year, SSI risk remained stable for hip replacement (0.41%; 0.35 to 0.47) and knee replacement (0.41%; 0.35 to 0.48) in comparison to the previous year. The trend for the inpatient and readmission SSI risk following reduction of long bone fracture has shown greater variability over the years (Figure 6c). After a peak in financial year 2014 to 2015 at 1.40% (0.95 to 2.00), the rate showed a decreasing trend; however, since 2020 to 2021 it has shown a year-on-year increase from 0.44% (0.22 to 0.78) to 1.39% (1.03 to 1.82). The SSI risk for repair of neck of femur (Figure 6d) remained relatively stable over the 10-year period with no statistically significant difference between financial year 2014 to 2015 (1.03% (0.90 to 1.18) and 2023 to 2024 (0.83% (0.71 to 0.96).

Figure 6e shows an overall decreasing 10-year trend for CABG with peaks at 3.84% (3.37 to 4.34) in financial year 2016 to 2017 and 3.24% (2.82 to 3.70) in 2019 to 2020; the SSI risk has increased steadily from 1.96% (1.53 to 2.47) since 2020 to 2021 to 2.93% (2.53 to 3.38) in 2023 to 2024. This included infections at vein harvesting sites and the sternum. Cardiac surgery (non-CABG) also shows fluctuating 10-year trend in annual SSI risk reaching a peak at 1.72% (1.32 to 2.19) in financial year 2016 to 2017, before decreasing to the lowest of 0.84% (0.56 to 1.22) in the financial year 2022 to 2023 and 1.08% (0.78 to 1.44) in the current financial year. (Figure 6f).

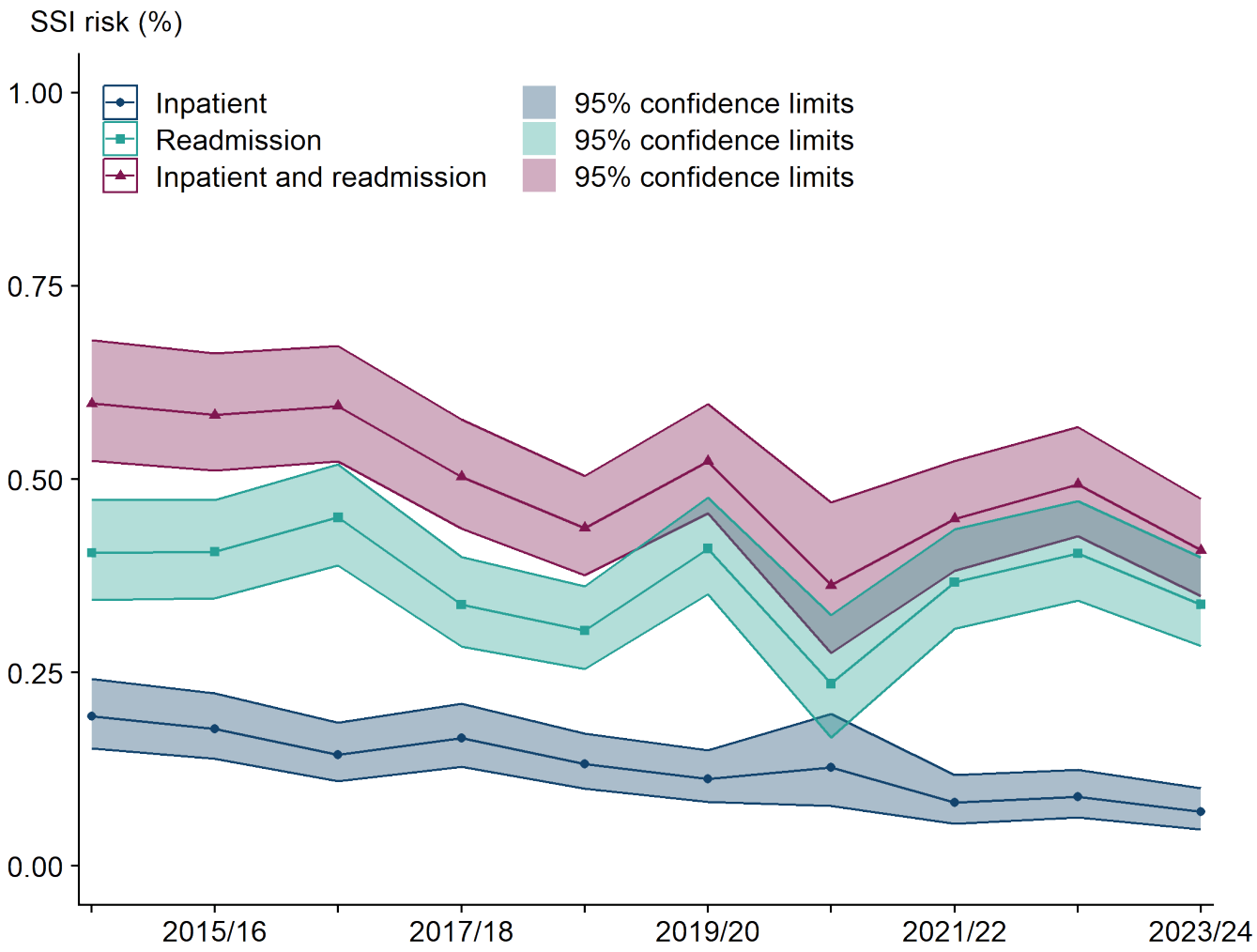
For large bowel surgery (Figure 6g) the SSI risk remained similar to last year (8.85%; 7.77 to 10.03 and 8.15%; 7.09 to 9.32). The same was observed for small bowel surgery (Figure 6h) (8.14%;5.60 to 11.35 and 7.79%; 5.52 to 10.62).

The SSI risk after spinal surgery (Figure 6i) has decreased steadily from its peak at 1.79% (1.51 to 2.11) in financial year 2015 to 2016 to 0.9% (0.67 to 1.18) in 2021 to 2022 before increasing marginally to 1.14% (0.89 to 1.44) in 2023 to 2024. The SSI risk following breast surgery (Figure 6j) has been decreasing between financial years 2017 to 2018 (1.12%; 0.81 to 1.51) and 2020 to 2021 (0.11%; 0.00 to 0.64)) and increased thereafter, albeit confidence intervals for the latest 3 financial years overlap (2021 to 2022 (0.63%, 0.39 to 0.98), 2022 to 2023 (0.69%, 0.41 to 1.09) and 2023 to 2024 (0.89%, 0.60 to 1.28).

In financial year 2023 to 2024, 10-year trends in the annual inpatient and readmission SSI risk showed that 8 of 10 surgical categories assessed showed a declining trend or remained stable, including all of the mandatory orthopaedic categories. In the most recent 2 financial years all operations except for hip and knee replacement and cardiac (non-CABG) surgery have shown an increasing trend in SSI risk (between 2021 to 2022 and 2023 to 2024). The fluctuation in trend for most categories assessed may be due to changes in infection prevention control measures implemented during the COVID-19 pandemic. Changes in trends of SSI risk post-pandemic were akin to changes in trends observed in mandatory reporting of blood stream infections and *Clostridium difficile* infections (9).

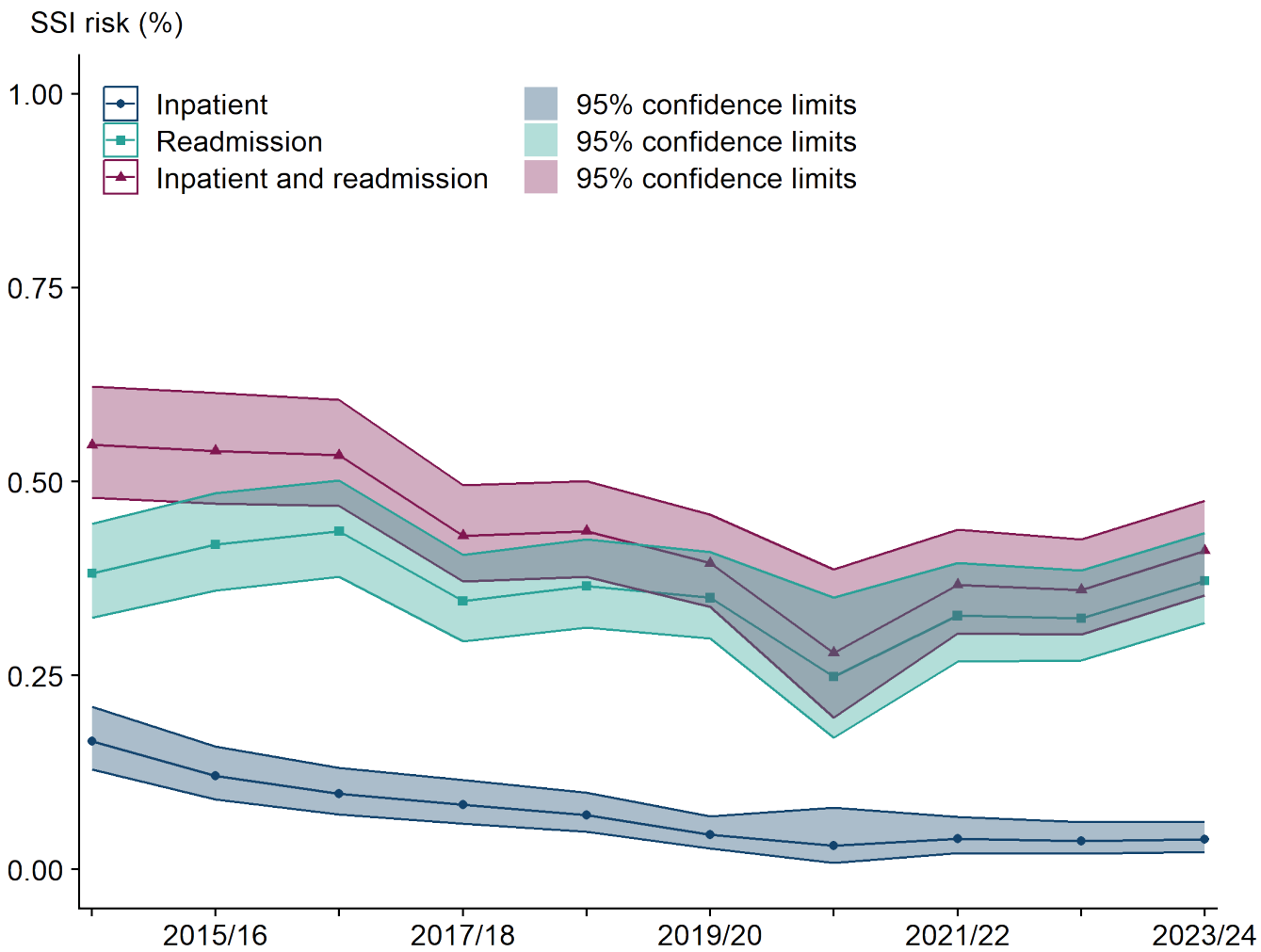
Reduction of long bone fracture increased from 0.76% (0.51 to 1.07) in financial year 2022 to 2023 to 1.39% (1.03 to 1.82) in 2023 to 2024, which is comparable to the highest SSI risk in 10 years observed in financial year 2014 to 2015 (1.40%, 0.95 to 2.00). The SSI risk for large bowel surgery increased to 8.85% (7.77 to 10.03) after previous reductions in 2021 to 2022 (8.04%, 6.96 to 9.22) from a peak observed in 2020 to 2021 (10.46%, 8.83 to 12.27).
The considerable inter-hospital variation in SSI risk following large bowel surgery, with 5-year hospital rates ranging from 0.0% to 38.1% persisted. This indicates that there may be room for improvement through review of infection prevention control, sharing of best practice from mentor hospitals, bowel preparation prior to surgery in conjunction with oral antibiotics and case ascertainment practices (10). However, there may be differences in the distribution of patient risk factors between hospitals, or other risk factors such as emergency surgery, which was recorded in 6.3% of large bowel operations in 2023 to 2024.

Figure 6a. Trends in annual SSI risk for hip replacement, NHS hospitals England, April 2014 to March 2024



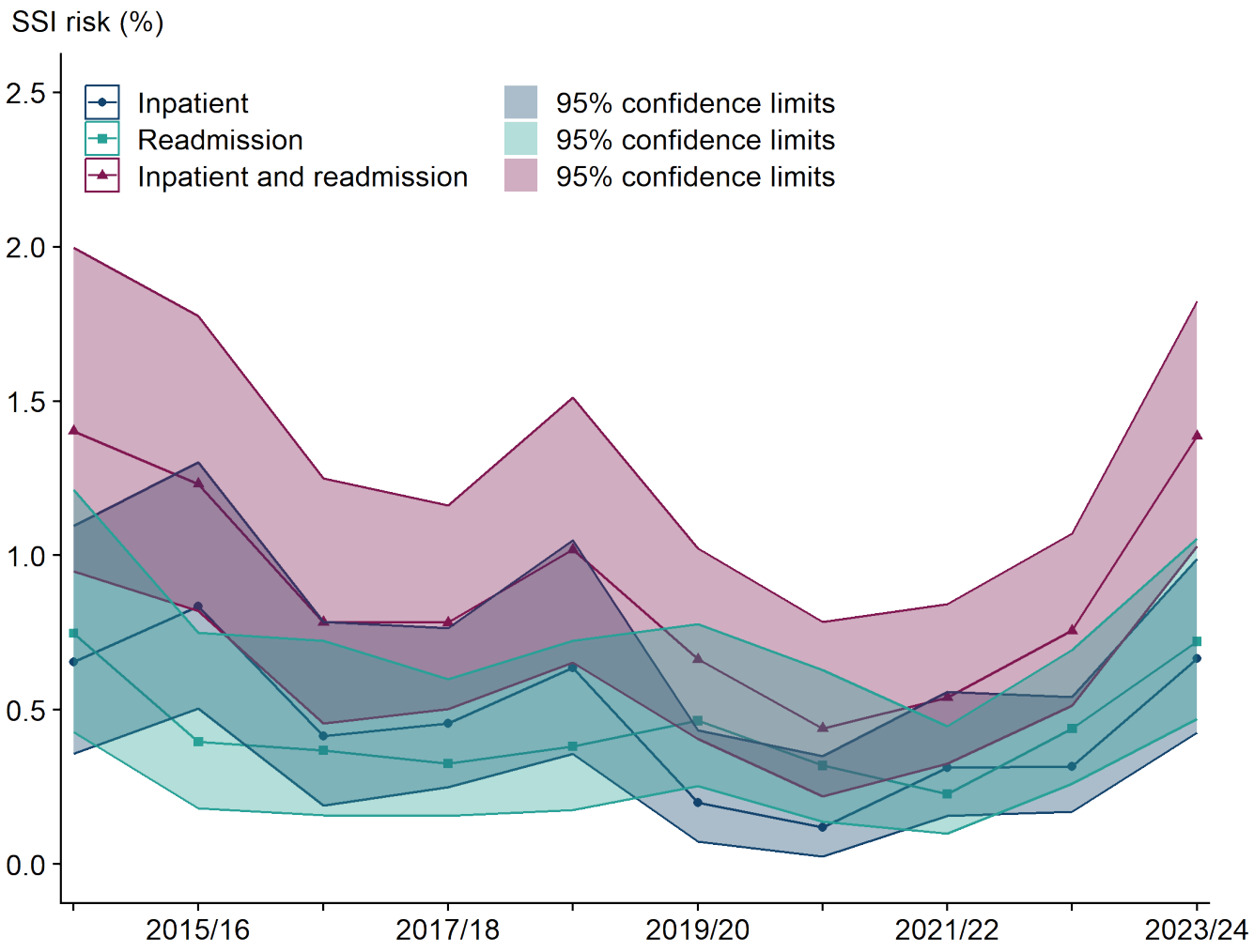
See data table 6a in accompanying data tables spreadsheet.

Figure 6b. Trends in annual SSI risk for knee replacement, NHS hospitals England, April 2014 to March 2024



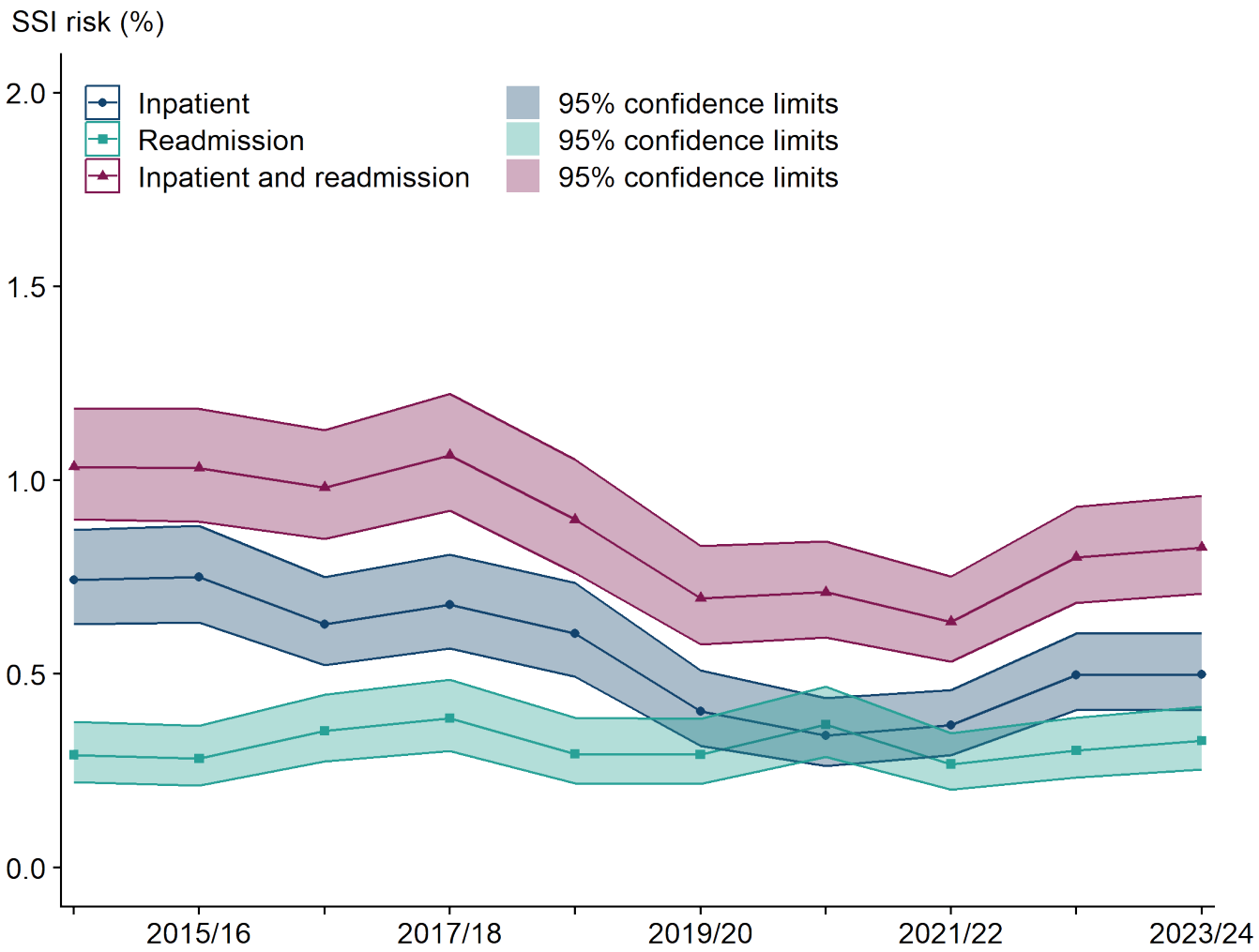
See data table 6b in accompanying data tables spreadsheet.

Figure 6c. Trends in annual SSI risk for reduction of long bone fracture, NHS hospitals England, April 2014 to March 2024



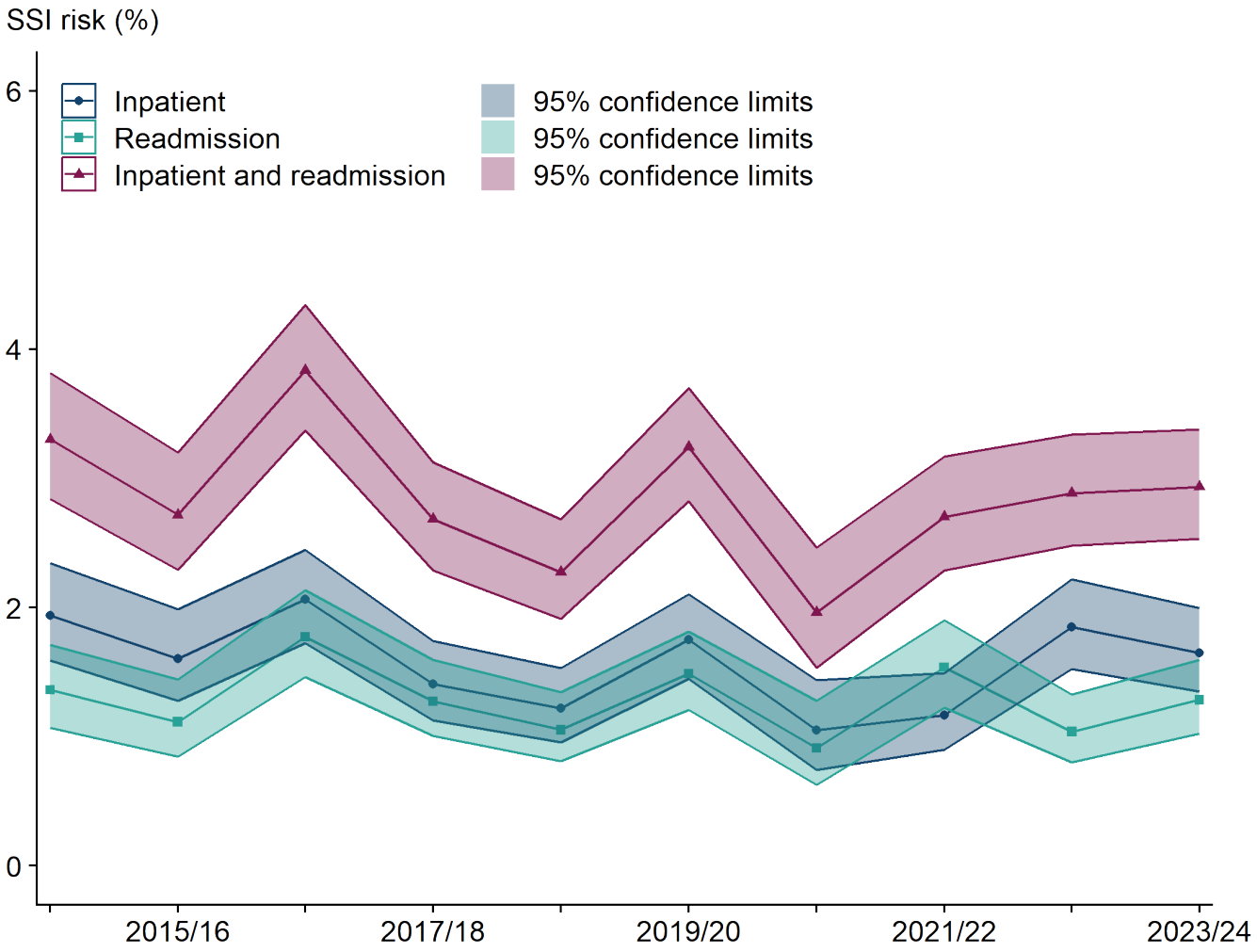
See data table 6c in accompanying data tables spreadsheet.

Figure 6d. Trends in annual SSI risk for repair of neck of femur, NHS hospitals England, April 2014 to March 2024



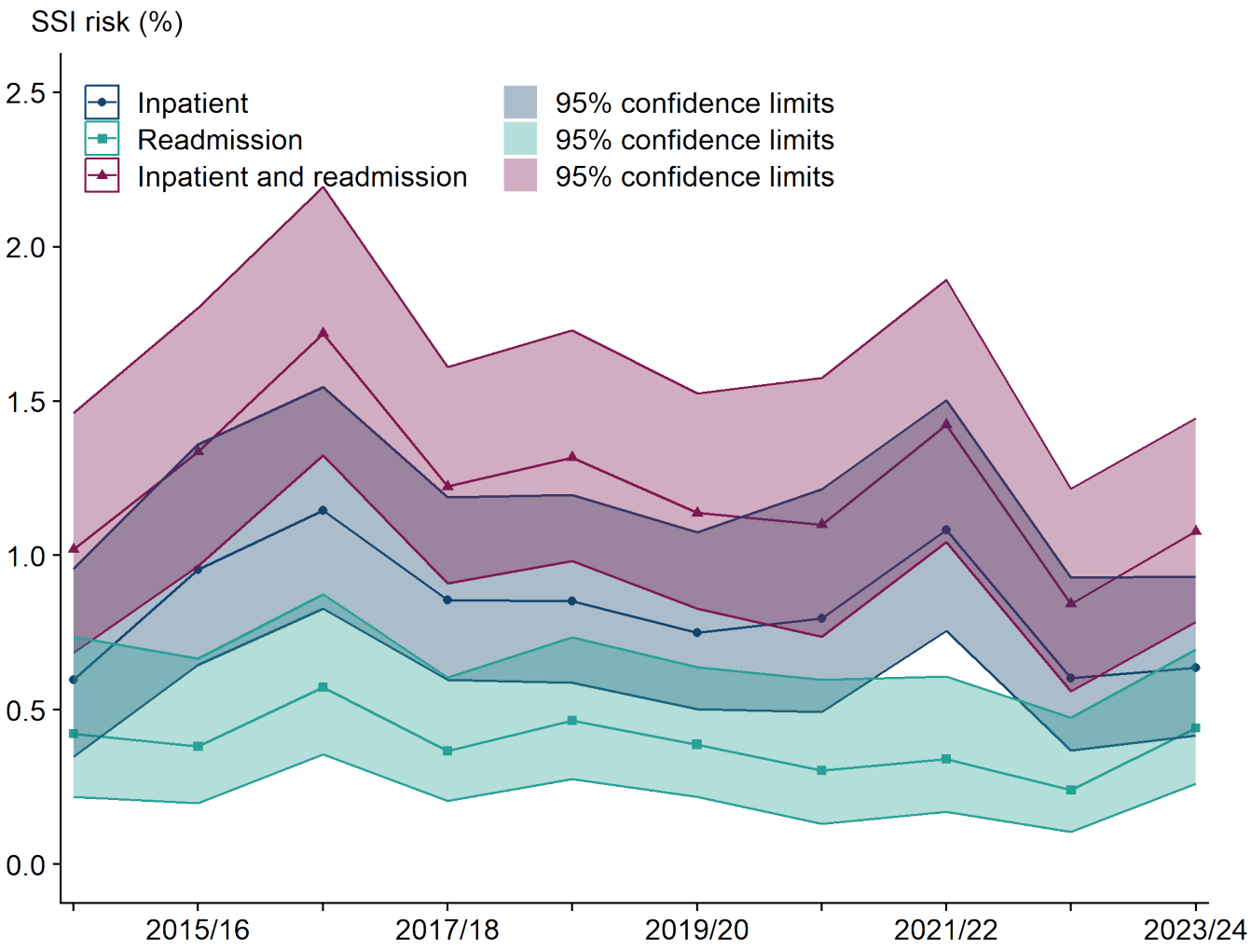
See data table 6d in accompanying data tables spreadsheet.

Figure 6e. Trends in annual SSI risk for coronary artery bypass graft (CABG) surgery, NHS hospitals England, April 2014 to March 2024



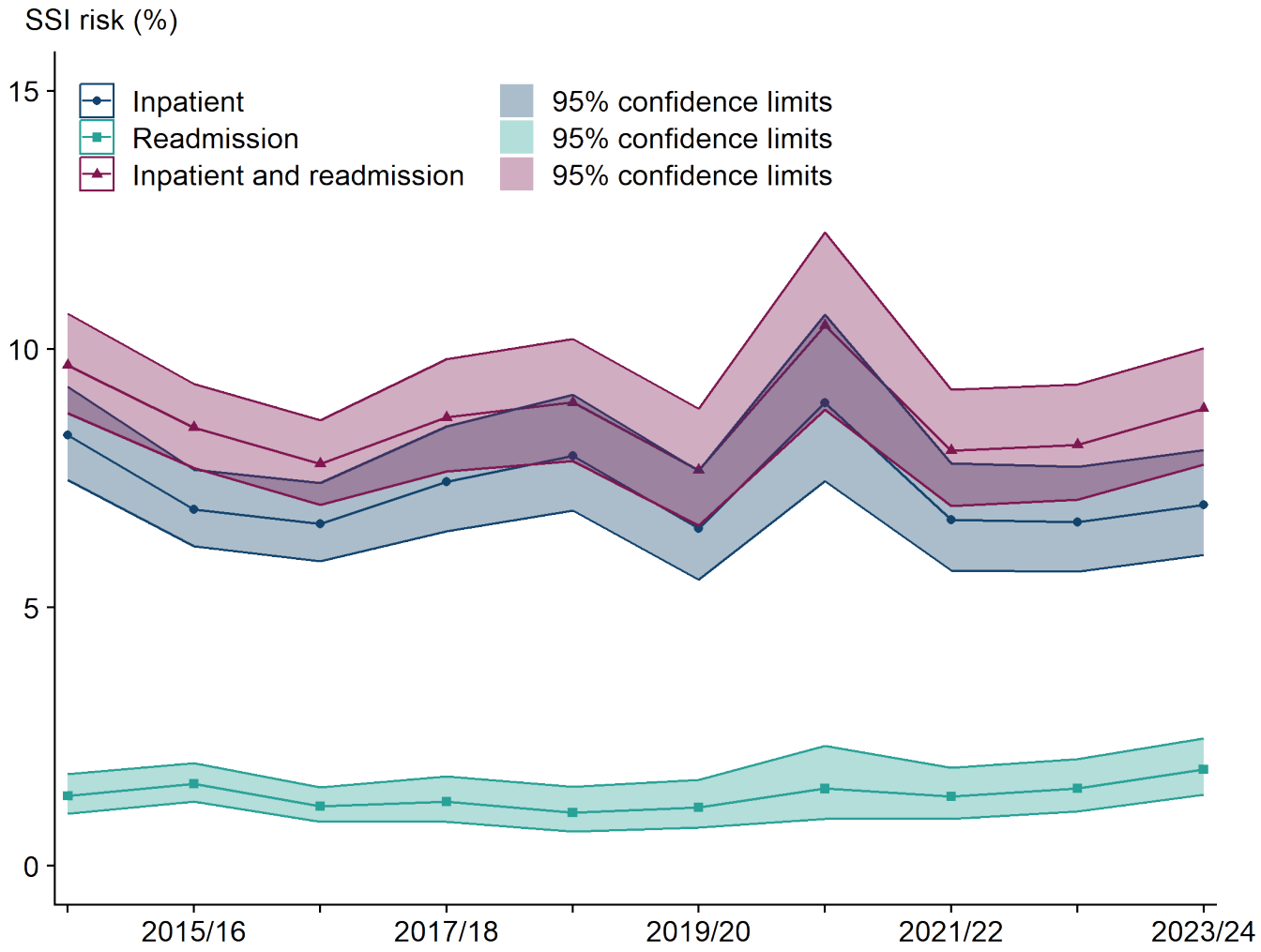
See data table 6e in accompanying data tables spreadsheet.

Figure 6f. Trends in annual SSI risk for cardiac (non-CABG) surgery, NHS hospitals England, April 2014 to March 2024



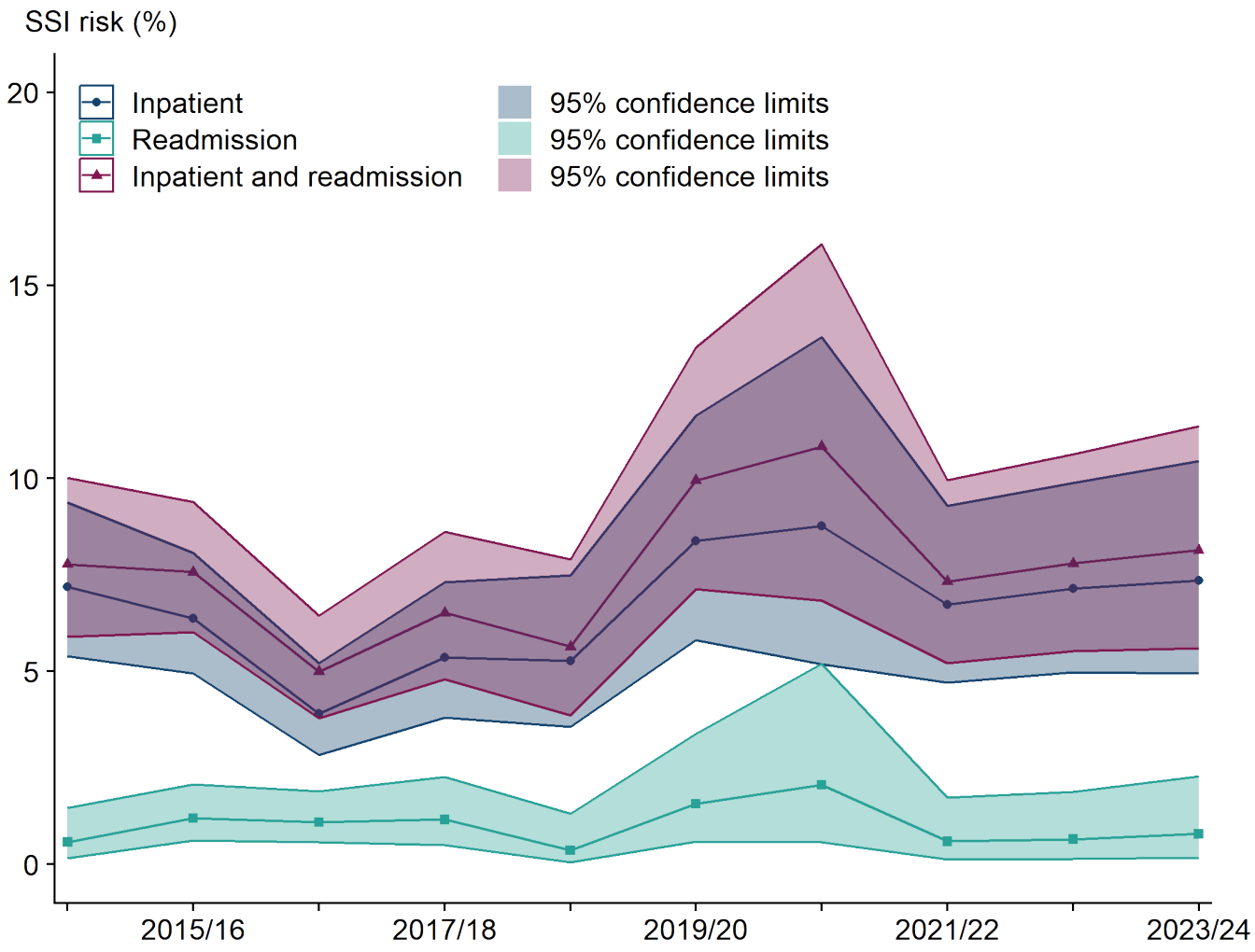
See data table 6f in accompanying data tables spreadsheet.

Figure 6g. Trends in annual SSI risk for large bowel surgery, NHS hospitals England, April 2014 to March 2024



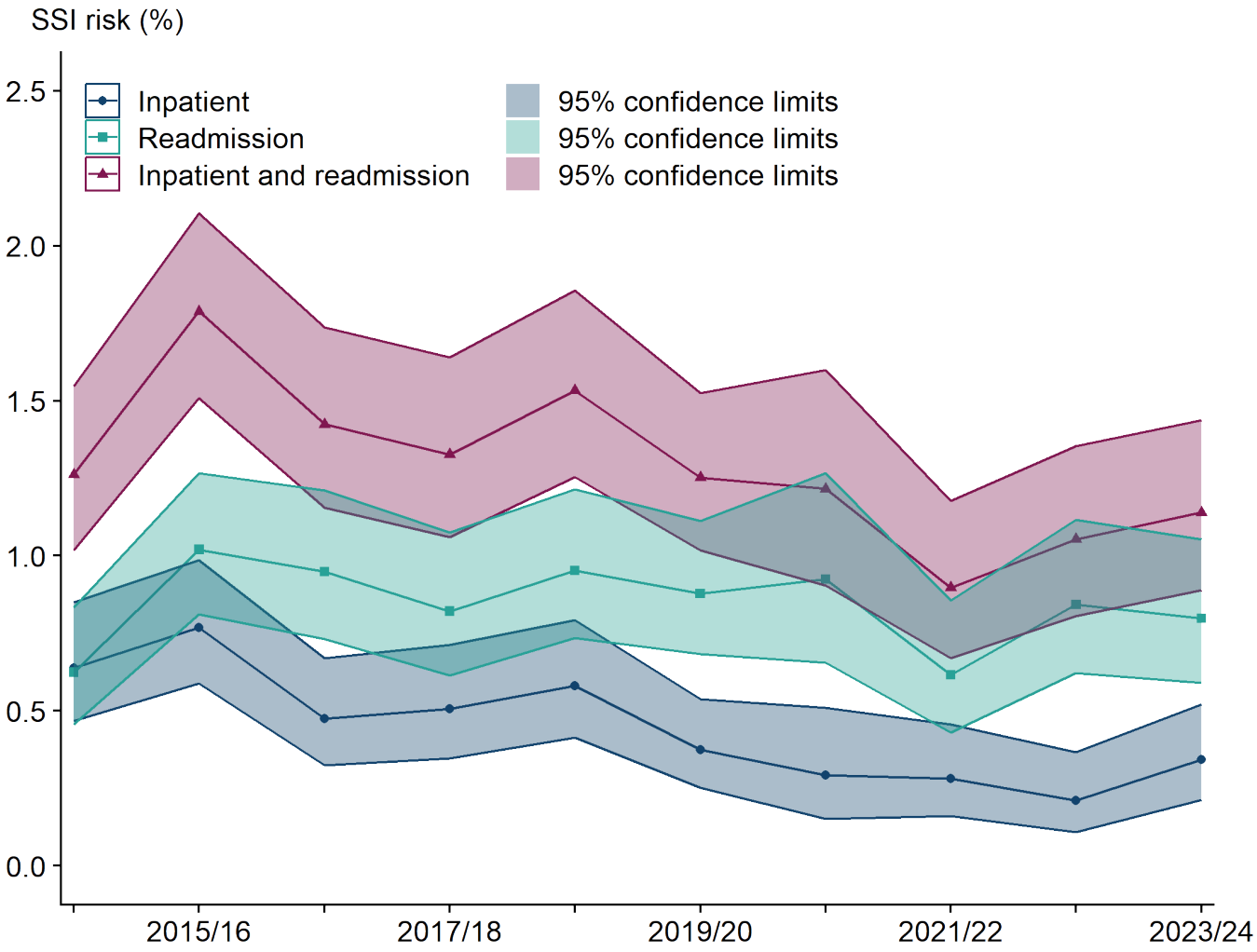
See data table 6g in accompanying data tables spreadsheet.

Figure 6h. Trends in annual SSI risk for small bowel surgery, NHS hospitals England, April 2014 to March 2024



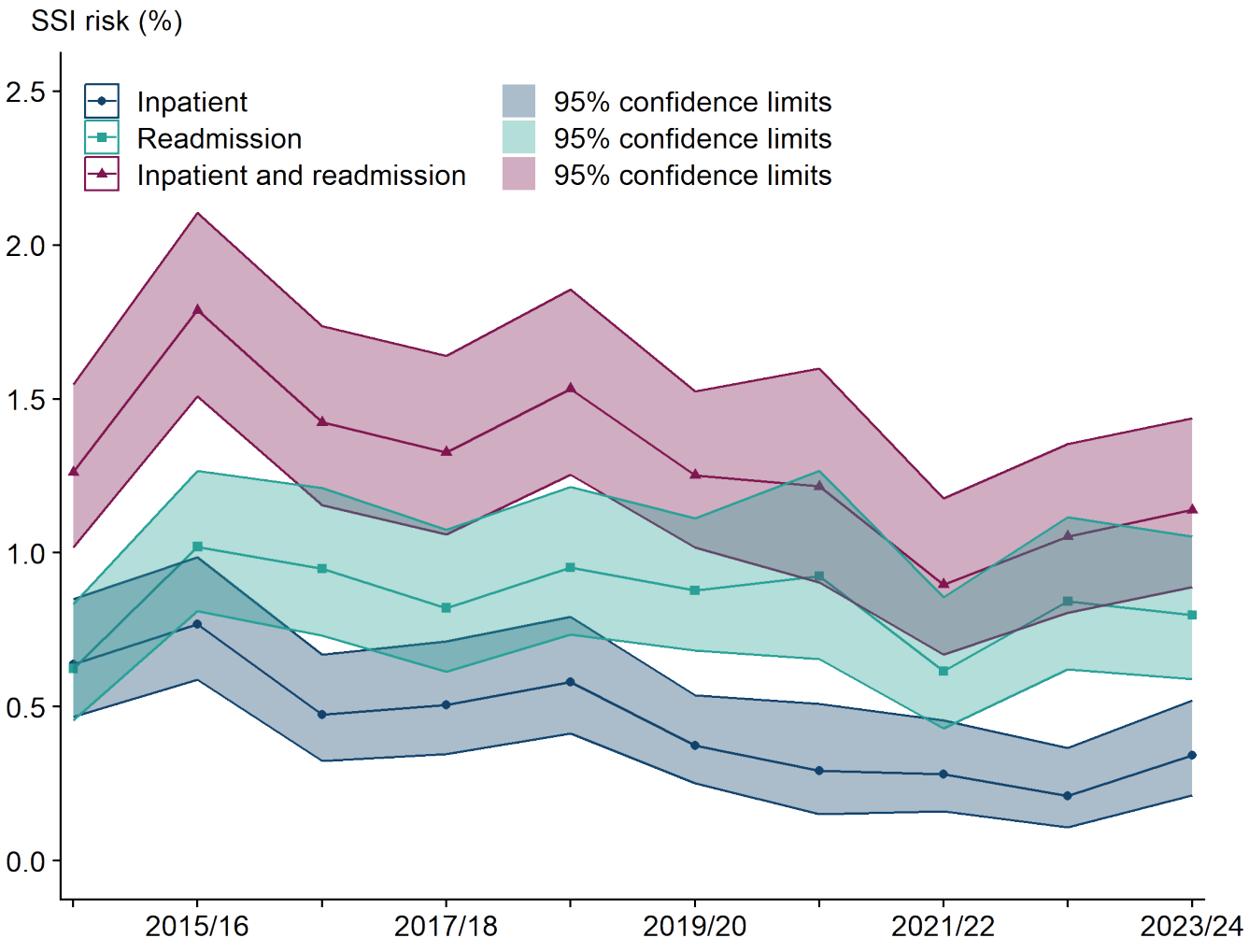
See data table 6h in accompanying data tables spreadsheet.

Figure 6i. Trends in annual SSI risk for spinal surgery, NHS hospitals England, April 2014 to March 2024



See data table 6i in accompanying data tables spreadsheet.

Figure 6j. Trends in annual SSI risk for breast surgery, NHS hospitals England, April 2014 to March 2024



See data table 6j in accompanying data tables spreadsheet.

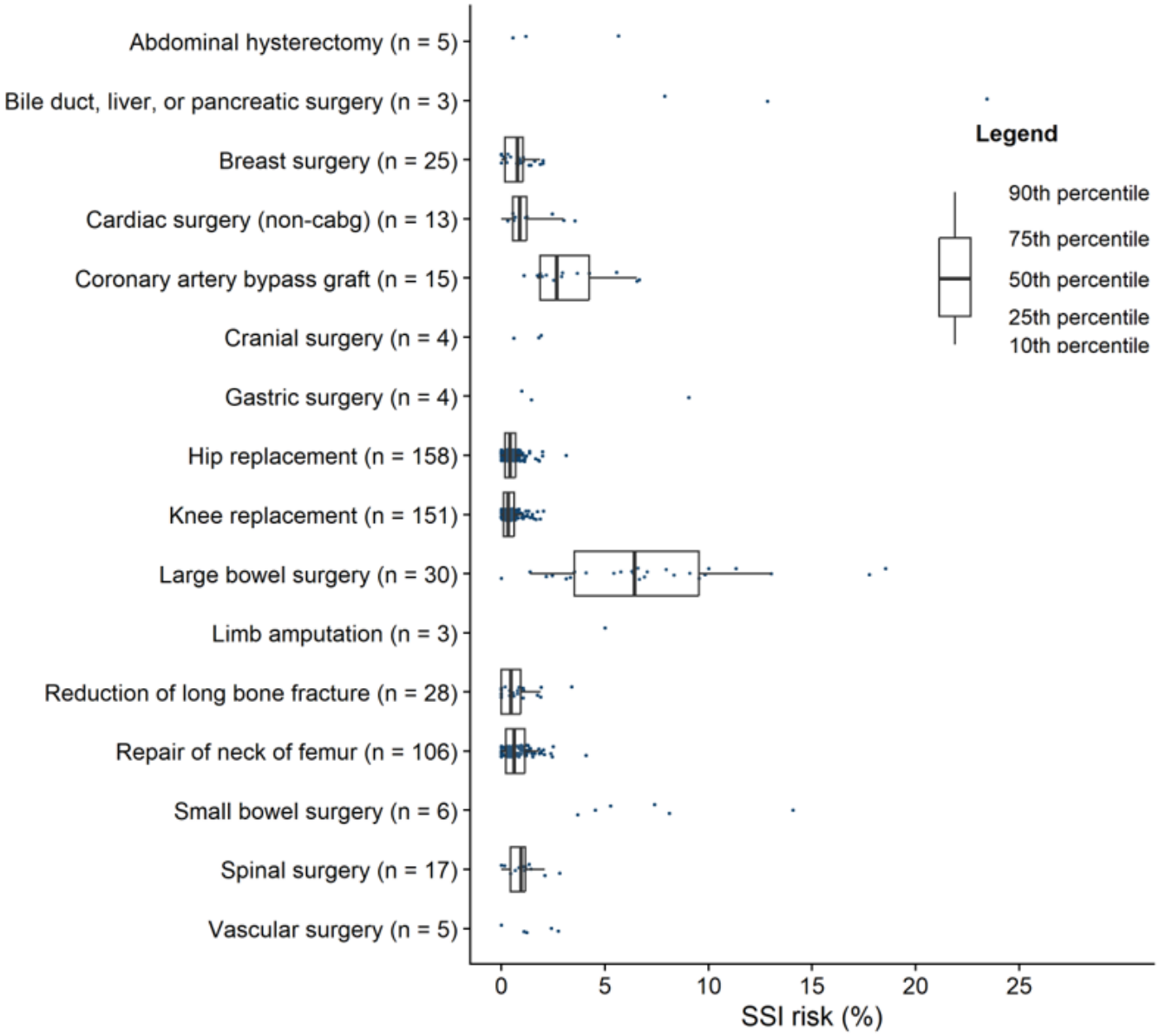
Variation in SSI risk between hospitals

Figure 7 shows the distribution of the SSI risk, based on 5 years of cumulative data, across participating hospitals by surgical category using box-and-whisker plots. The box is formed of a lower quartile group (25th to 50th percentile) and an upper quartile group (50th to 75th percentile), defining an expected range of results. The ‘whiskers’, which are used to indicate variability outside the upper and lower quartile, use the 10th and 90th percentile to represent the extreme ends of the distribution and highlight hospital outliers, which fall outside this range. Each teal dot represents a participating hospital.

Similar to previous years, large bowel surgery showed the greatest variability with hospital SSI risk ranging from 0.0% to 38.10%, which could in part be due to variation in emergency surgeries but may also indicate room for improvement in infection prevention, and case ascertainment. Hip and knee replacement showed the least variation, with most hospitals hovering around the median. However, high outlier hospitals can still be identified for these categories.

Of the 9 surgical categories with more than 10 participating hospitals, 5 had a narrower interquartile range (difference between the 25th and 75th percentiles) than the previous financial year, indicating less variation. All of the remaining 5 surgical categories had a wider interquartile range. When the current interquartile range was compared to the previous year, cardiac (non-CABG) surgery had the greatest percentage decrease (53.6% decrease) meaning there was less variation seen this year in the SSI risk across hospitals. This is in contrast to reduction of long bone fracture surgery that had the greatest percentage increase (25.9% increase) in interquartile range between financial year 2022 to 2023 and 2023 to 2024.

Figure 7. Distribution of inpatient and readmission SSI risk by surgical category [note 1], NHS hospitals England [note 2], April 2019 to March 2024



Note 1: categories with fewer than 10 hospitals participating within this time period are presented as a distribution without a box plot.

Note 2: NHS hospitals with less than 95 operations for hip replacement, knee replacement or abdominal hysterectomy are excluded from analysis for that category. NHS hospitals with less than 45 operations for any other category are excluded from analysis for that category.

See data table 7 in accompanying data tables spreadsheet.

Outlier assessment

In financial year 2023 to 2024, only one NHS trust performing orthopaedic surgery did not comply with the mandatory requirements for participation in the SSISS. This trust was notified by letter; they did not participate in the previous financial year either. For the mandatory orthopaedic categories, outliers are assessed at the end of each financial year across all NHS trusts and treatment centres using funnel plots to account for differences in surgical volume.

Figures 8a to 8d show funnel plots displaying variation in the SSI risk among trusts in financial year 2023 to 2024 for orthopaedic categories. The cumulative incidence of SSI per 100 operations is plotted against the number of operations for each participating NHS trust or treatment centre. The upper and lower 95% confidence limits (red lines) define the 'limits' of expected variation. Trusts lying outside these limits are considered outliers. The 99% confidence limits (dashed lines) are presented to represent the expected variation within which 99% of results should fall. The 95% confidence limits represent warning lines, whereas falling outside of the 99% confidence limits would signify the need for more immediate action.

Results showed similar variation across trusts and grouping around the national benchmark with fewer trusts being above 95% confidence intervals for hip and knee replacement surgery in financial year 2023 to 2024 compared to the previous financial year. Compared to financial year 2022 to 2023, there was also slightly less variation in SSI risk for repair of neck of femur surgery.

Two NHS acute trusts or treatment centres were identified as statistical high outliers (falling above the 95% upper confidence limits with one of these being above 99% upper confidence limit) for repair of neck of femur in financial year 2023 to 2024. Seven NHS acute trusts or treatment centres were identified as statistical low outliers (falling below the 95% lower confidence limits) in financial year 2023 to 2024 (2 for hip replacement, one for knee replacement and reduction of long bone fracture and 3 for repair of neck of femur). One of the 2 providers notified as high outliers this financial year was also a high outlier in the same category last financial year, and 2 of the 7 the providers deemed low outliers were also a low outlier in the same category in the previous financial year.

Low outlier status may be indicative of low case ascertainment or exceptional patient care. Annual trust outlier assessments are unadjusted for differences in the patient population and important risk factors.

Aside from the annual outlier analysis, the SSISS team also undertake quarterly outlier analysis after each data submission deadline and hospitals with SSI risk above 90th percentile or below 10th percentile receive an outlier notification letter. Hospitals have an option of further in-depth analyses considering risk factors in the data set.

Hospitals who receive outlier notifications are encouraged to investigate possible reasons for higher-than-expected risks of infection. This would include examination of surveillance data at a more granular level through web-based hospital reports which include risk-stratified data, reviewing IPC policies and surgical practice, such as the use of prophylactic antimicrobials and contacting the SSIS team for further support.

As part of this report, SSI risk results by NHS acute trust (and NHS treatment centres) for the last 2 financial years (2022 to 2023 and 2023 to 2024) are published in separate accompanying tables.

Annual trust-level results for hip and knee replacement surgery are also made available through UKHSA's public reporting tool, Fingertips. The tool also allows users to group results by trust type (namely, teaching, non-teaching, and specialty) or NHS sub-region and compare to a corresponding overall group average.

Figure 8a. Distribution of inpatient and readmission SSI risk for hip replacement, NHS acute trusts and treatment centres England, April 2023 to March 2024

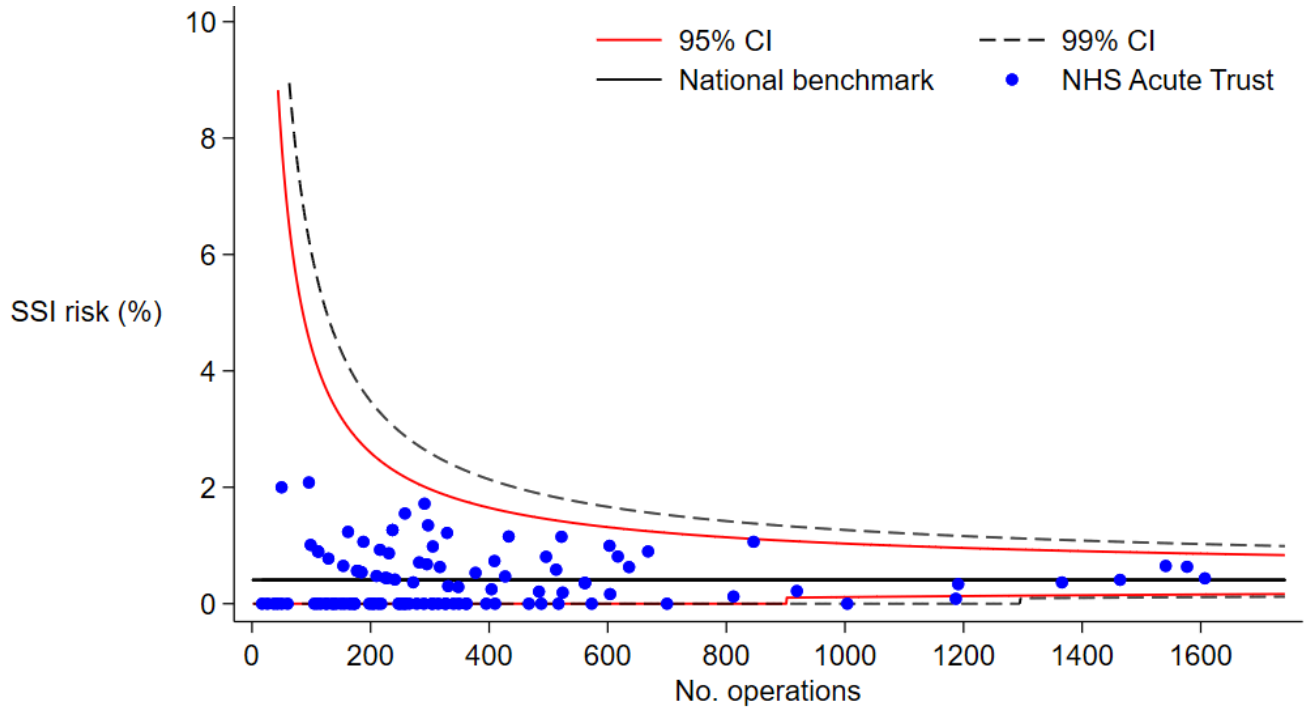


Figure 8b. Distribution of inpatient and readmission SSI risk for knee replacement, NHS acute trusts and treatment centres England, April 2023 to March 2024

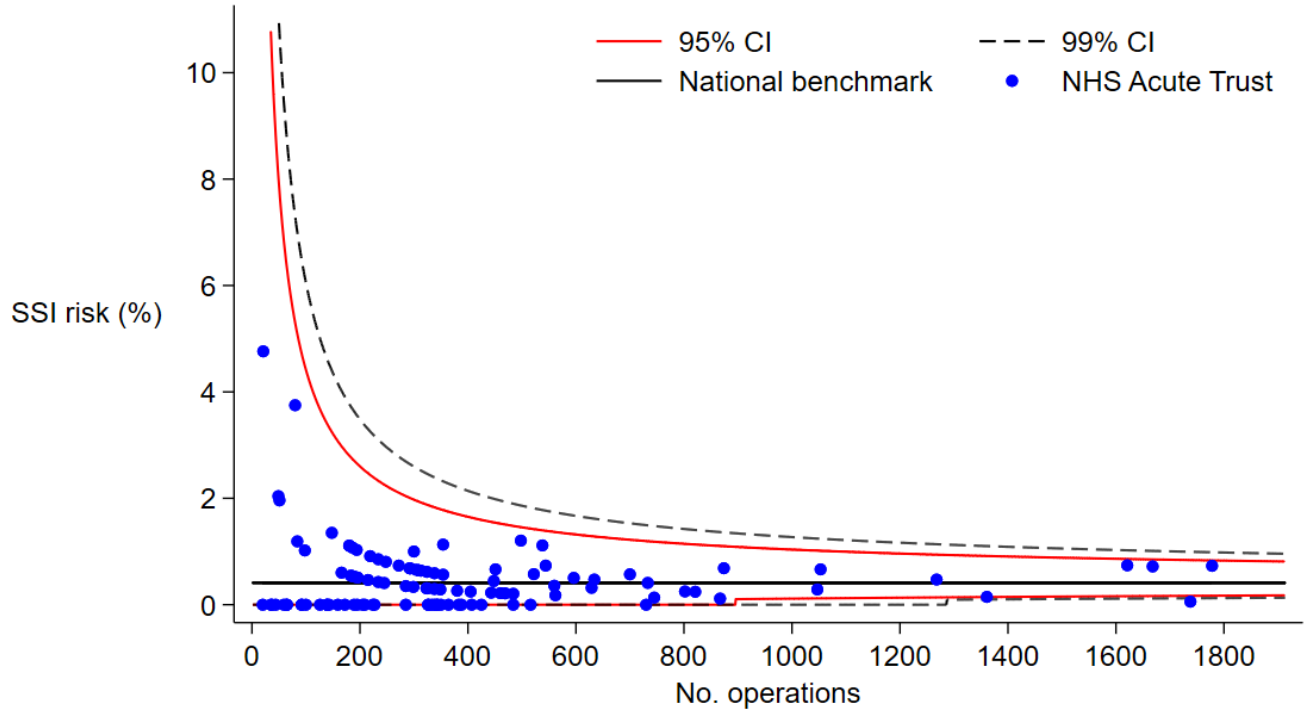


Figure 8c. Distribution of inpatient and readmission SSI risk for reduction of long bone fracture, NHS acute trusts and treatment centres England, April 2023 to March 2024

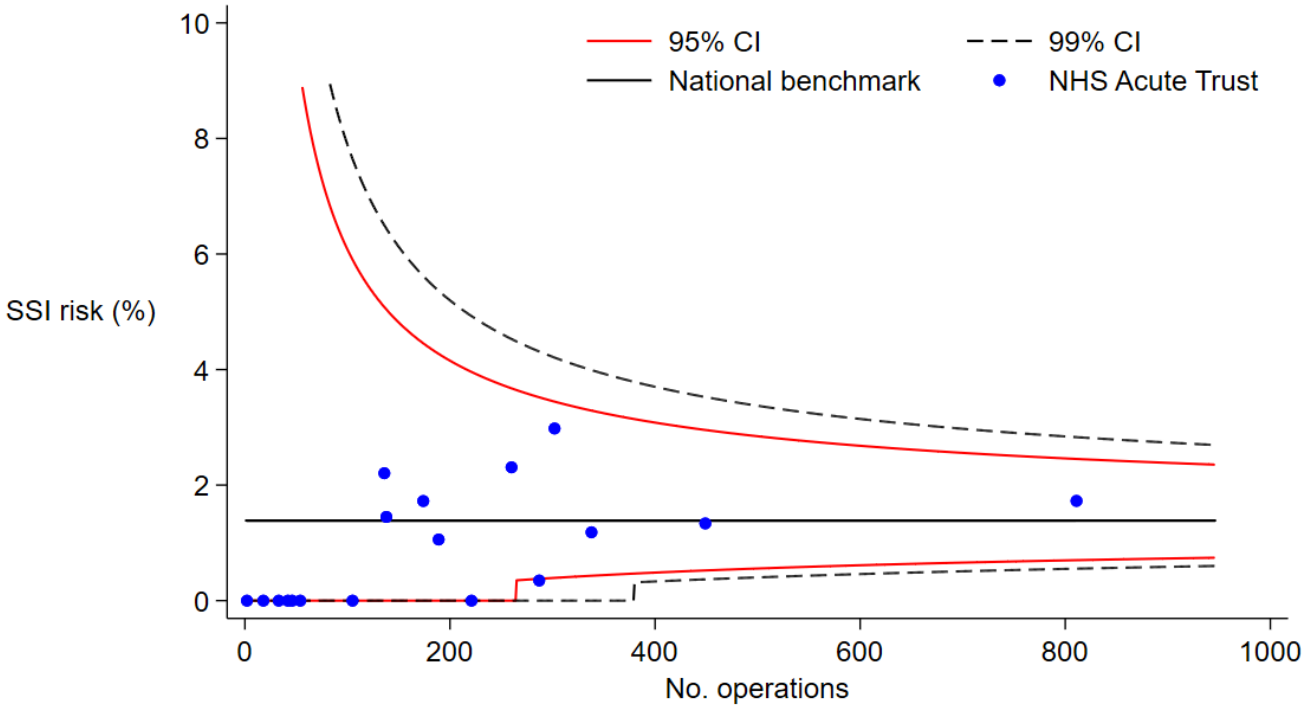
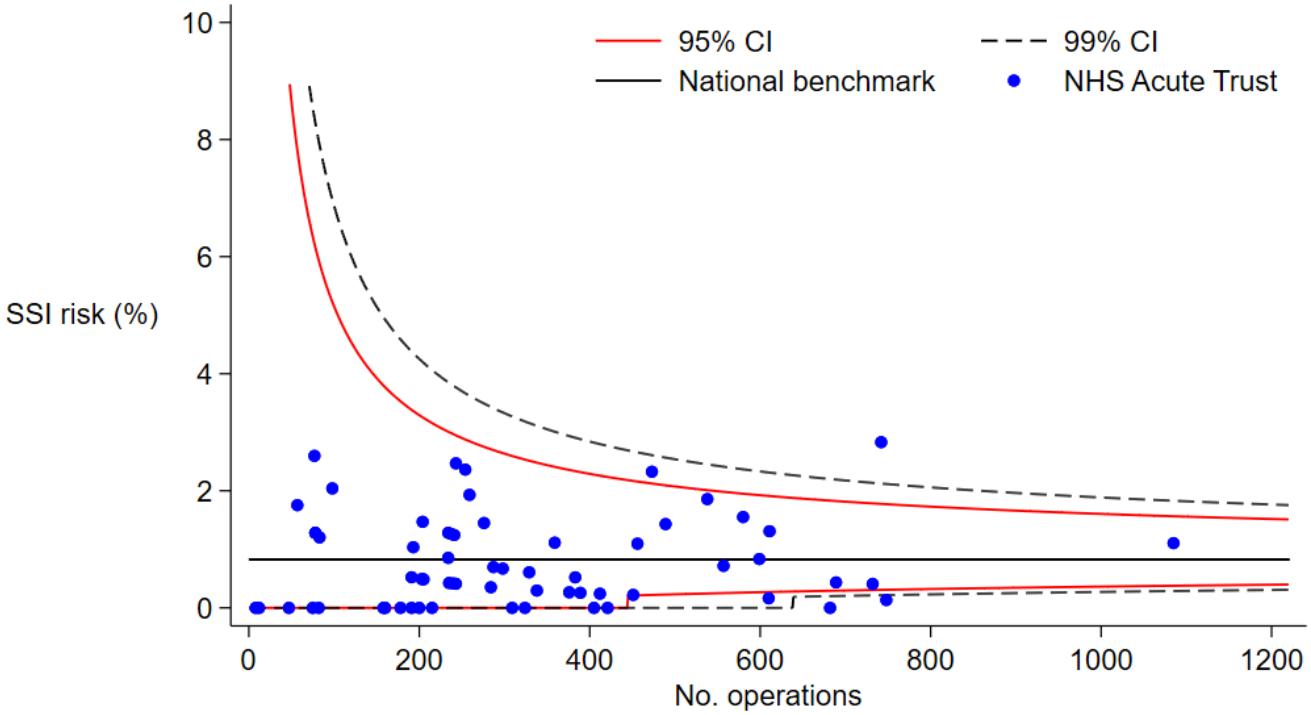


Figure 8d. Distribution of inpatient and readmission SSI risk for repair of neck of femur, NHS acute trusts and treatment centres England, April 2023 to March 2024



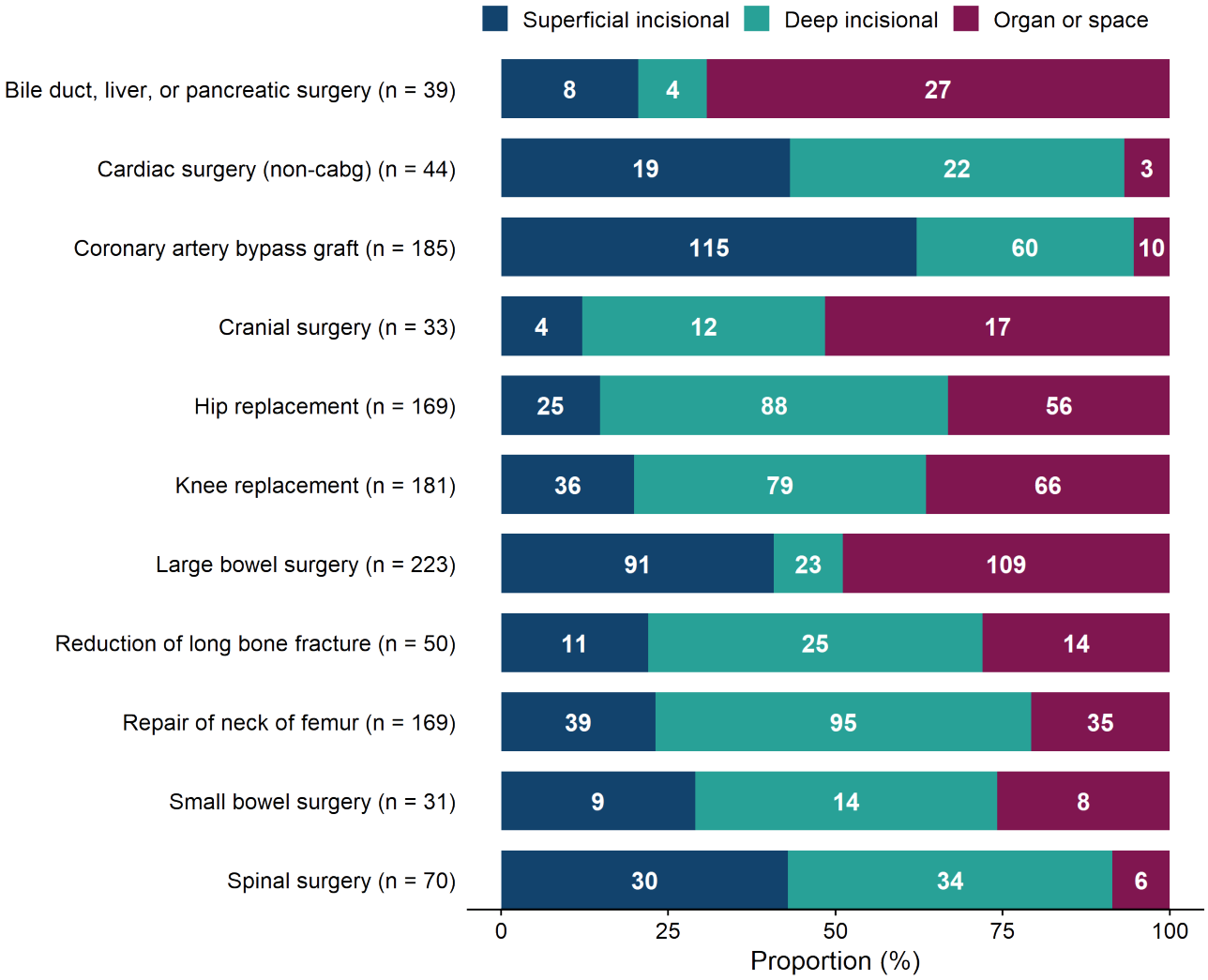
Characteristics of SSIs

Focus of SSI

Figure 9 shows the distribution of SSI types (superficial, deep or organ and space) by surgical category in financial year 2023 to 2024, where the number of inpatient and readmission SSIs per category was ≥30. The distribution of type of infection varied by surgical category and may be attributed to differences in length of stay in hospital and follow-up care. Surgical categories with a shorter stay in hospital see relatively more readmission-detected SSIs, which increases the proportion of more serious wound complications. Patients undergoing operations with a longer stay in hospital will undergo regular wound reviews so that infections may be more likely to be detected and treated earlier during the inpatient stay, and therefore may be more likely to be less severe.

In financial year 2023 to 2024, CABG and spinal surgery had the highest proportions of superficial incisional infections (62.2% and 42.9%, respectively). Compared to previous reports (financial year 2022 to 2023), the proportion of superficial, deep and organ or space SSIs following hip replacement surgery was similar (14.8 % and 16.2%, 52.1% and 49.2% and 33.1% and 34.6%), while the proportion of superficial SSIs for knee replacement decreased (26.2% to 19.9%) and the proportion of organ or space SSIs increased (28.5% to 36.5%). Among the 11 categories, the highest proportion of organ or space SSIs was following bile duct, liver or pancreatic surgery (69.23%) and large bowel surgery (48.9%, an increase from 38.8% in 2022 to 2023). The proportion of organ or space SSIs following CABG decreased between previous and this financial year from 12.6% to 5.4%.

Figure 9. Proportion of SSI type for inpatient and readmission-detected SSIs by surgical category, NHS hospitals England, April 2023 to March 2024



See data table 9 in accompanying data tables spreadsheet.

Time to infection

Figure 10 shows the distribution of time to infection for inpatient and readmission SSIs (superficial, deep or organ and space) by surgical category in financial year 2019 to 2024, where the number participating hospitals per category was ≥5. The distribution of time to infection varied by surgical category and is affected by the time of follow up after surgery that differs according to presence or absence of an implant (patients are followed up for up to 30 days for operations without an implant and for superficial infections for operations with an implant or up to one year for deep or organ/space infections after operations with an implant). SSIs with date of onset beyond these follow up limits were excluded as not meeting SSI definitions.

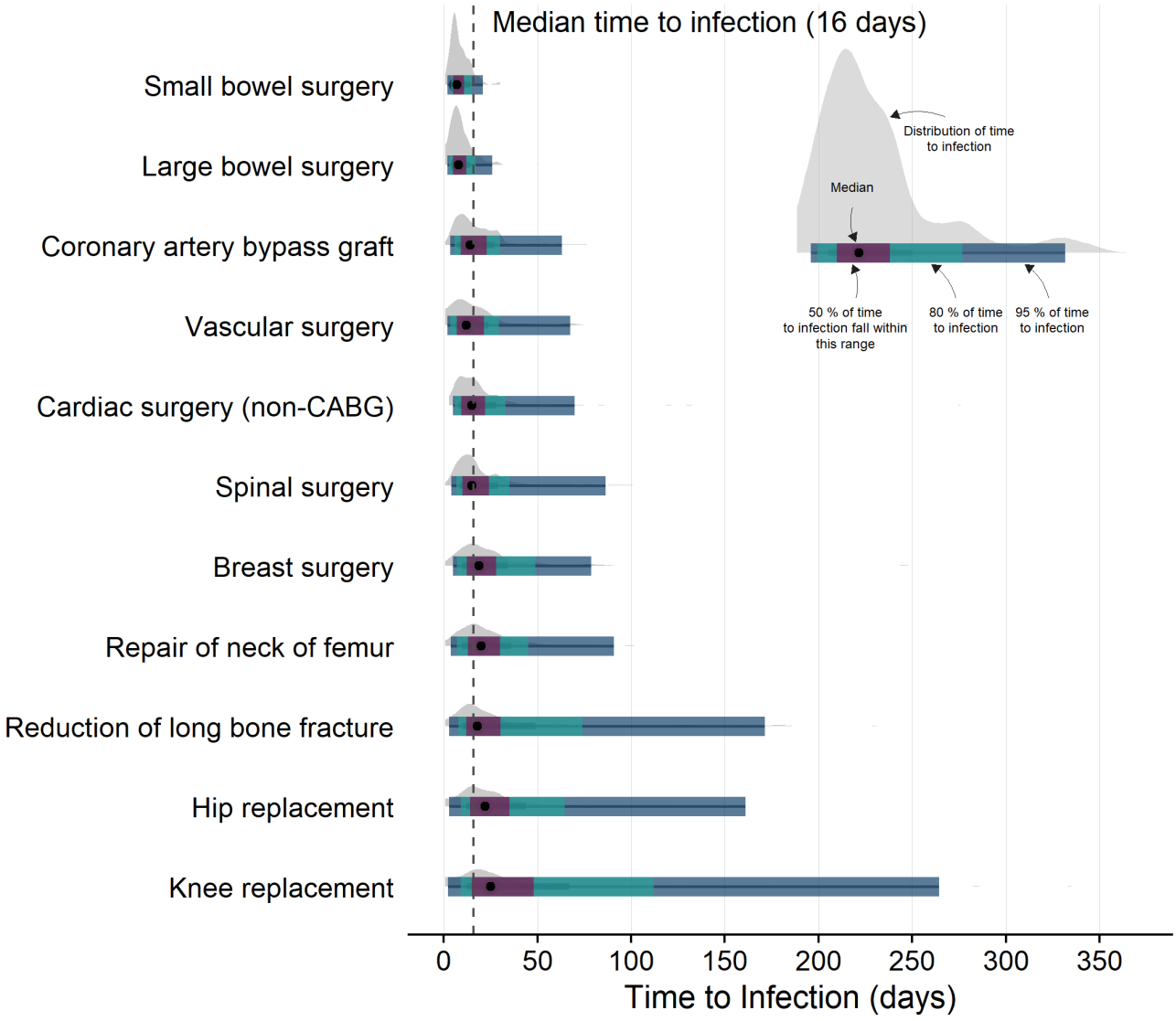
Overall, median time to infection across all categories was 16 days. It was shortest for surgical categories with higher wound contamination or with a smaller proportion of operations

involving an implant, namely small bowel (7 days) and large bowel (8 days) surgery. Median time to infection was the longest for orthopaedic categories: reduction of long bone fracture (18 days), repair of neck of femur (19 days), hip replacement (22 days) and knee replacement (25 days).

The IQR for time to infection for most surgical categories was less than 20 days. The exception to this were hip replacement and knee replacement, where IQR for time to infection was 21 days and 33 days respectively.

Hip replacement and knee replacement showed the widest distribution in time-to-infection, with 95 centiles of 103.0 and 262.3 days, respectively.

Figure 10. Time to infection for inpatient and readmission-detected SSIs by surgical category, NHS hospitals England, April 2019 to March 2024



See data table 10 in accompanying data tables spreadsheet.

Causative micro-organisms

Figure 11 shows 10-year trends in microbial aetiology of inpatient and readmission-detected superficial and deep or organ and space SSIs across all surgical categories. During this period there were 12,565 inpatient and readmission-detected SSIs reported, 72.6% (N=9,126) of which had accompanying microbiological confirmation. This proportion has increased from 68.1% in financial year 2014 to 2015 to 75.5% in 2023 to 2024. According to the UKHSA SSISS case definitions, positive microbiology is not essential to meet the SSI case definition provided there are other clinical indicators. Hospital surveillance staff have the option to provide information on up to 3 causative organisms per SSI. Hence, data presented here represents the proportion of infections in which an organism was detected and not the proportion of infections caused by a given organism.

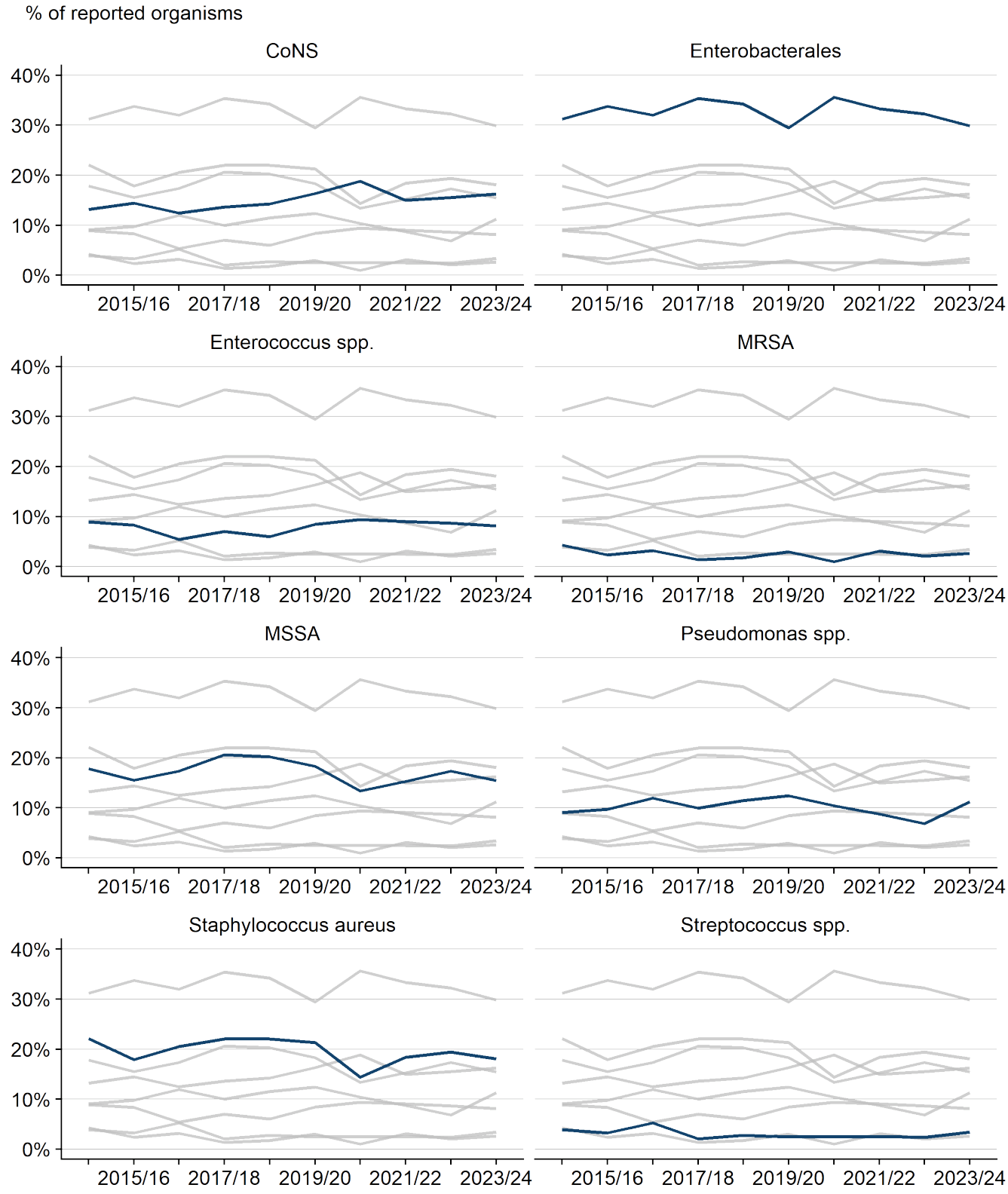
Enterobacterales remain the most commonly reported organisms for all SSIs in financial year 2023 to 2024 but showed a decreasing 10-year trend for superficial incisional SSIs. Enterobacterales were indicated in 29.9% of superficial SSIs and 30.1% of deep incisional or organ and space SSIs. The most common Enterobacterales species was *Escherichia coli*. The second most prevalent organism was *Staphylococcus aureus* (*S. aureus*) for both superficial SSIs (18.2%) and deep incisional or organ and space SSIs (19.6%). *S. aureus* decreased marginally for both superficial SSIs (from 19.4% to 18.2%) and deep incisional or organ and space SSIs (20.9% to 19.6%) in financial year 2022 to 2023 compared to the previous financial year.

For both superficial and deep or organ and space infections, meticillin-sensitive *S. aureus* (MSSA) represents a much greater proportion of *S. aureus* infections than meticillin-resistant *S. aureus* (MRSA) (87.1% and 88.0% versus 12.9% and 12.0%, respectively). Among both types of infections, the proportion of MRSA reports increased slightly between the previous financial year and the current financial year (from 2.1% to 2.3% for superficial and from 2.3% to 2.4% for deep or organ and space). In contrast, the proportion of MSSA decreased from 17.3% to 15.9% for superficial and from 18.4% to 17.2% for deep or organ and space infections between the latest 2 financial years.

For MRSA, the proportion in 2023 to 2024 was lower than pre-pandemic for superficial SSIs (2.3% versus 3.0%) and deep or organ and space (2.4% versus 2.5%), while MSSA remained lower than pre-pandemic (superficial: 15.9% versus 18.3%; deep or organ and space: 17.2% versus 21.8%).

Figure 11. Micro-organisms reported in inpatient and readmission SSIs, all surgical categories, NHS hospitals England, April 2014 to March 2024

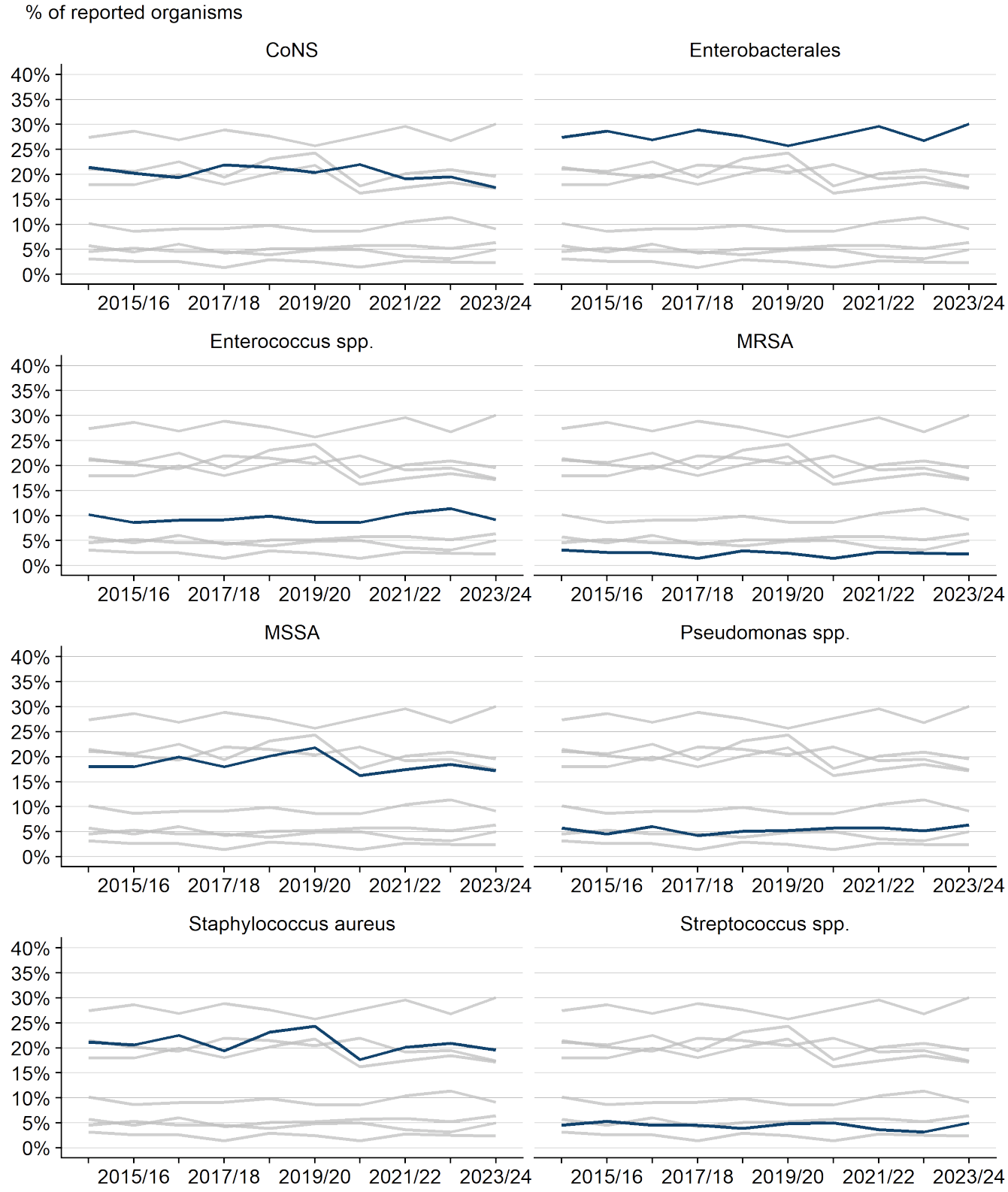
11a. Superficial SSIs



See data table 11a in accompanying data tables spreadsheet.

Note 1: *Staphylococcus aureus* proportion consisting of MRSA and MSSA.

11b. Deep or organ and space SSIs



See data table 11b in accompanying data tables spreadsheet

Tables 6a to 6b provide a breakdown of the distribution of organisms reported in inpatient and readmission-detected SSIs by surgical category for superficial and deep or organ and space

SSIs. Five years of data was used for these analyses (April 2019 to March 2024) to increase sample sizes.

Between April 2019 and March 2024, there were 2,482 monomicrobial (60.4%) and 1,626 polymicrobial (39.6%) inpatient and readmission SSIs.

Among both superficial and deep or organ and space monomicrobial SSIs (single organism reported as causing SSI), MSSA is the most commonly reported organism for hip replacement (46.2% and 38.6%), knee replacement (54.8% and 45.6%) and spinal surgery (51.2% and 43.8%). Coagulase-negative Staphylococci (CoNS) make up almost a quarter of monomicrobial organisms associated with deep or organ and space SSIs for 2 of the 6 categories assessed including repair of neck of femur (31.1%) and CABG (26.3%). Compared to deep or organ and space SSIs, superficial SSIs reported a smaller proportion of CoNS causative microorganisms, except for CABG surgery (30.3%).

Enterobacterales were most prevalent in large bowel surgery SSIs, contributing 51.4% of superficial SSIs and 60.7% of deep or organ and space SSIs. Compared to the previous financial year, the proportion of deep or organ space SSIs with Enterobacterales isolates following knee replacement increased (14.5% versus 8.62%). Repair of neck of femur surgery showed the greatest decrease in proportion of deep or organ and space SSIs due to Enterobacterales between 2022 to 2023 and 2023 to 2024 (from 24.7% to 20.9%, respectively).

Polymicrobial SSIs (cases with more than one organism reported as causing SSI) were most common in large bowel surgery (39.5%), CABG (36.2%) and knee replacement (35%). For large bowel surgery, the proportions were greater in deep or organ and space SSIs (62.5%) compared to superficial SSIs (39.5). Around a third to a half of deep or organ and space polymicrobial infections involved a combination of Gram-positive and Gram-negative organisms across all surgical categories (from 37.4% for hip replacement to 59.3% for large bowel surgery). Among superficial SSIs, the proportions of combined Gram-positive and Gram-negative infections were slightly lower (from 23.8% for hip replacement to 56.0% for CABG).

The proportion of polymicrobial SSIs with combinations of Gram-negative bacteria was highest for spinal surgery for superficial SSIs (25.0%) and CABG surgery for deep of organ and space SSIs (17.2%). Gram-positive only combinations dominated in both superficial and deep or organ and space SSIs for hip replacement (61.9% and 46.8%, respectively) and deep or organ and space infections for knee replacement (43.3%). The proportion of Gram-positive only species combinations in superficial SSIs increased for hip and knee replacement between 2022 to 2023 and 2023 to 2024 (hip: 43.5% to 61.9%; knee: 14.3% to 29.4%).

The UK 5 year (2019 to 2024) national action plan (NAP) for antimicrobial resistance set out to reduce healthcare-associated Gram-negative bloodstream infections (BSI) by 50% (11).

In addition, the 2024 to 2029 UK 5-year NAP set out the target to prevent any increases in Gram-negative bloodstream infections in humans from the 2019 to 2020 financial year baseline by 2029 (12). Given this concern it is important that we continue to monitor the proportion of SSI caused by Gram-negative bacteria such as Enterobacterales. In financial year 2023 to 2024, superficial SSIs but not deep or organ and space SSIs showed a decreasing 10-year trend in the proportion of Enterobacterales SSIs, which highlights the need for ongoing surveillance.

In financial year 2023 to 2024, the proportion of SSIs from which MRSA was isolated increased for superficial but not deep or organ and space infections in contrast to the proportion of SSIs caused by MSSA which decreased in both foci of infections. The proportions of MRSA decreased to below pre-pandemic levels.

Capture of microbial aetiology continues to play a key role in prevention of SSI through optimising choice of antibiotic prophylaxis in surgery and may result in downstream reduction of bacteraemia caused by SSI.

Table 6a. Micro-organisms reported as causing inpatient and readmission detected SSIs (superficial SSIs), all surgical categories [note 1], NHS hospitals, England, April 2019 to March 2024

	Hip replacement number (%)	Knee replacement number (%)	Repair of neck of femur number (%)	Large bowel number (%)	Spinal surgery number (%)	CABG number (%)
Reported causative organism						
Monomicrobial						
Meticillin-sensitive *S. aureus*	18 (46.2)	23 (54.8)	26 (33.8)	12 (8.7)	22 (51.2)	21 (15.9)
Meticillin-resistant *S. aureus*	5 (12.8)	1 (2.4)	7 (9.1)	0 (0.0)	1 (2.3)	3 (2.3)
Coagulase-negative staphylococci	2 (5.1)	4 (9.5)	13 (16.9)	9 (6.5)	8 (18.6)	40 (30.3)
Enterobacterales	5 (12.8)	3 (7.1)	19 (24.7)	71 (51.4)	8 (18.6)	32 (24.2)
Pseudomonas	1 (2.6)	2 (4.8)	5 (6.5)	22 (15.9)	3 (7.0)	16 (12.1)
Streptococcus	3 (7.7)	2 (4.8)	0 (0.0)	3 (2.2)	0 (0.0)	1 (0.8)
Enterococcus	2 (5.1)	2 (4.8)	3 (3.9)	11 (8.0)	0 (0.0)	3 (2.3)
Other bacteria	3 (7.7)	4 (9.5)	4 (5.2)	4 (2.9)	0 (0.0)	11 (8.3)

	Hip replacement number (%)	Knee replacement number (%)	Repair of neck of femur number (%)	Large bowel number (%)	Spinal surgery number (%)	CABG number (%)
Reported causative organism						
Fungi including *Candida* spp.	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.7)	0 (0.0)	3 (2.3)
Acinetobacter spp.	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.8)
Anaerobic bacilli	0 (0.0)	1 (2.4)	0 (0.0)	4 (2.9)	1 (2.3)	1 (0.8)
Anaerobic cocci	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.7)	0 (0.0)	0 (0.0)
Total monomicrobial	39 (100)	42 (100)	77 (100)	138 (100)	43 (100)	132 (100)
Polymicrobial						
Gram-positive combinations only	13 (61.9)	5 (29.4)	7 (30.4)	2 (2.2)	3 (37.5)	10 (13.3)
Gram-negative combinations only	0 (0.0)	1 (5.9)	5 (21.7)	19 (21.1)	2 (25.0)	11 (14.7)
Gram positive and gram-negative combinations	5 (23.8)	8 (47.1)	8 (34.8)	49 (54.4)	3 (37.5)	42 (56.0)
Other	3 (14.3)	3 (17.6)	3 (13.0)	20 (22.2)	0 (0.0)	12 (16.0)

	Hip replacement number (%)	Knee replacement number (%)	Repair of neck of femur number (%)	Large bowel number (%)	Spinal surgery number (%)	CABG number (%)
Reported causative organism						
Total polymicrobial	21 (100)	17 (100)	23 (100)	90 (100)	8 (100)	75 (100)
Total cases [note 2]	60 (100)	59 (100)	100 (100)	228 (100)	51 (100)	207 (100)

Note 1: total cases are specific to this analysis and refers to those with available microbiology information.
Note 2: total cases for combined monomicrobial and polymicrobial specimen.

Table 6b. Micro-organisms reported as causing inpatient and readmission detected SSIs (deep and organ space SSIs), all surgical categories [note 1], NHS hospitals, England, April 2019 to March 2024

	Hip replacement number (%)	Knee replacement number (%)	Repair of neck of femur number (%)	Large bowel number (%)	Spinal surgery number (%)	CABG number (%)
Reported causative organism						
Monomicrobial						
Meticillin-sensitive *S. aureus*	110 (38.6)	104 (45.6)	46 (19.6)	3 (3.6)	46 (43.8)	34 (28.8)
Meticillin-resistant *S. aureus*	11 (3.9)	9 (3.9)	20 (8.5)	0 (0.0)	1 (1.0)	2 (1.7)
Coagulase-negative staphylococci	46 (16.1)	34 (14.9)	73 (31.1)	5 (6.0)	19 (18.1)	31 (26.3)

	Hip replacement number (%)	Knee replacement number (%)	Repair of neck of femur number (%)	Large bowel number (%)	Spinal surgery number (%)	CABG number (%)
Reported causative organism						
Enterobacterales	64 (22.5)	33 (14.5)	49 (20.9)	51 (60.7)	17 (16.2)	25 (21.2)
Pseudomonas	13 (4.6)	5 (2.2)	14 (6.0)	3 (3.6)	3 (2.9)	8 (6.8)
Streptococcus	18 (6.3)	24 (10.5)	6 (2.6)	3 (3.6)	0 (0.0)	1 (0.8)
Enterococcus	14 (4.9)	5 (2.2)	13 (5.5)	10 (11.9)	3 (2.9)	4 (3.4)
Other bacteria	6 (2.1)	12 (5.3)	8 (3.4)	0 (0.0)	10 (9.5)	6 (5.1)
Fungi including *Candida* spp.	1 (0.4)	0 (0.0)	0 (0.0)	3 (3.6)	0 (0.0)	6 (5.1)
Acinetobacter spp.	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.2)	0 (0.0)	1 (0.8)
Anaerobic bacilli	2 (0.7)	2 (0.9)	5 (2.1)	5 (6.0)	4 (3.8)	0 (0.0)
Anaerobic cocci	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0)	2 (1.9)	0 (0.0)

	Hip replacement number (%)	Knee replacement number (%)	Repair of neck of femur number (%)	Large bowel number (%)	Spinal surgery number (%)	CABG number (%)
Reported causative organism						
Total monomicrobial	285 (100)	228 (100)	235 (100)	84 (100)	105 (100)	118 (100)
Polymicrobial						
Gram-positive combinations only	65 (46.8)	45 (43.3)	51 (35.9)	5 (3.6)	16 (37.2)	17 (17.2)
Gram-negative combinations only	15 (10.8)	13 (12.5)	18 (12.7)	18 (12.9)	7 (16.3)	17 (17.2)
Gram positive and gram-negative combinations	52 (37.4)	40 (38.5)	65 (45.8)	83 (59.3)	18 (41.9)	53 (53.5)
Other	7 (33.3)	6 (5.8)	8 (5.6)	34 (24.3)	2 (4.7)	12 (12.1)
Total polymicrobial	139 (100)	104 (100)	142 (100)	140 (100)	43 (100)	99 (100)
Total cases [note 2]	424 (100)	332 (100)	377 (100)	224 (100)	148 (100)	217 (100)

Note 1: total cases are specific to this analysis and refers to those with available microbiology information.
Note 2: total cases for combined monomicrobial and polymicrobial specimen.

Patient post-discharge questionnaire (PDQ)

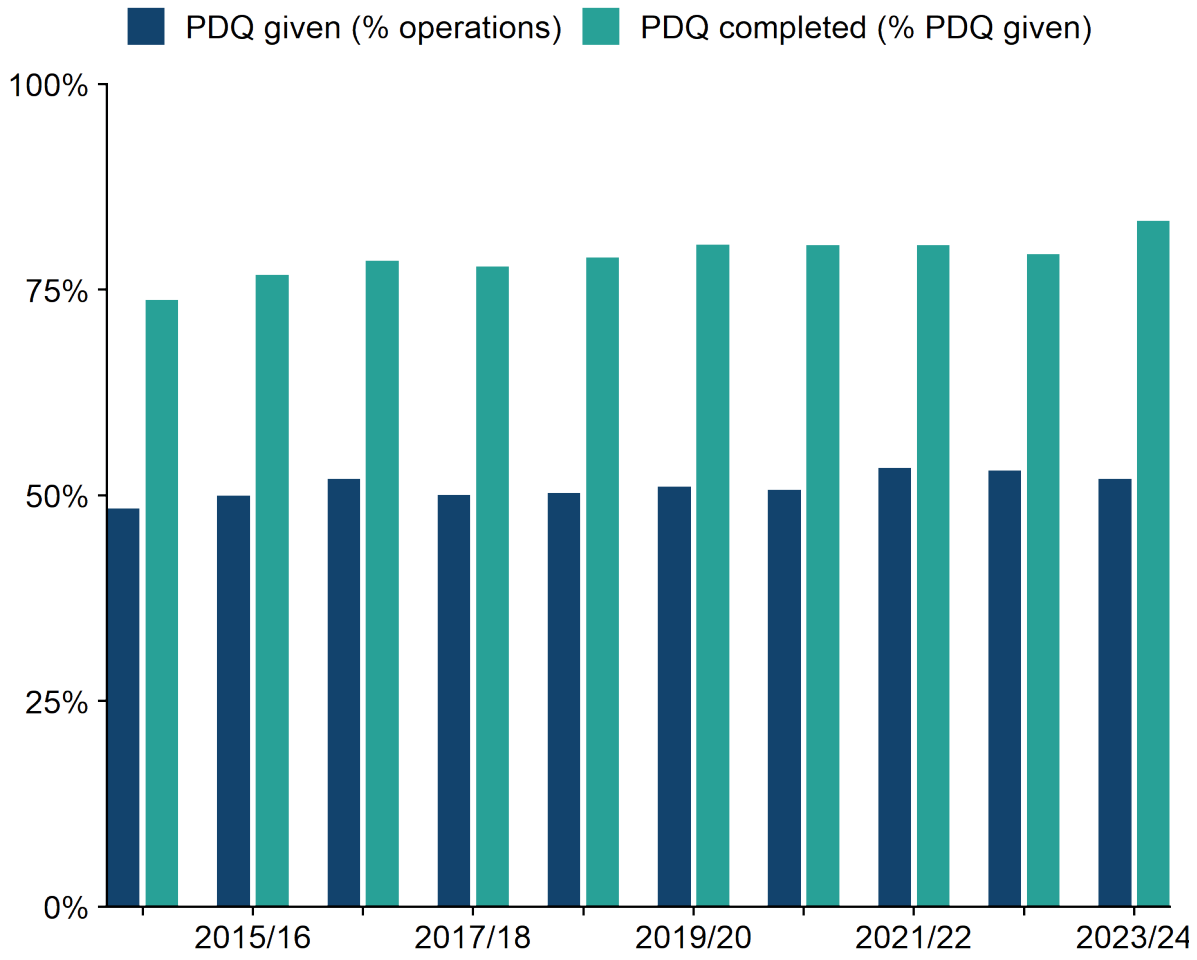
Whilst SSIs detected through optional post discharge surveillance are not included in this annual report, we describe trends in uptake of the existing PDQ (13).

Post-discharge questionnaires are used to capture SSIs managed outside of hospital settings to provide a more sensitive measure of SSI incidence. SSIs detected via PDQ are not included in the data used for this report as this **is** an optional SSI detection method and not all hospitals use this to monitor SSI risk.

Figure 12 shows PDQs given as a percentage of the number of operations, and the proportion of PDQs completed as a percentage of the number of PDQs given (2014 to 2024). The proportion of patients under surveillance given a PDQ indicates the coverage of total operations by PDQ surveillance. This proportion increased from 48.4% in financial year 2014 to 2015 to 52.0% in 2023 to 2024.

The proportion of PDQs completed of those given increased from 73.7% in 2014 to 2015 to 83.4% in 2023 to 2024, showing that where PDQs are given there is a high response rate. Given that not all hospitals are utilising PDQs, the overall proportion of operations with a completed PDQ was less than half over the past 10 years although showing a steady increase from 35.7% to 43.3% (between 2014 to 2015 and 2023 to 2024).

Figure 12. Uptake and completion of PDQs as a proportion of all operations and where PDQ given, by financial year, NHS hospitals England, April 2014 to March 2024



See data table 12 in accompanying data tables spreadsheet.

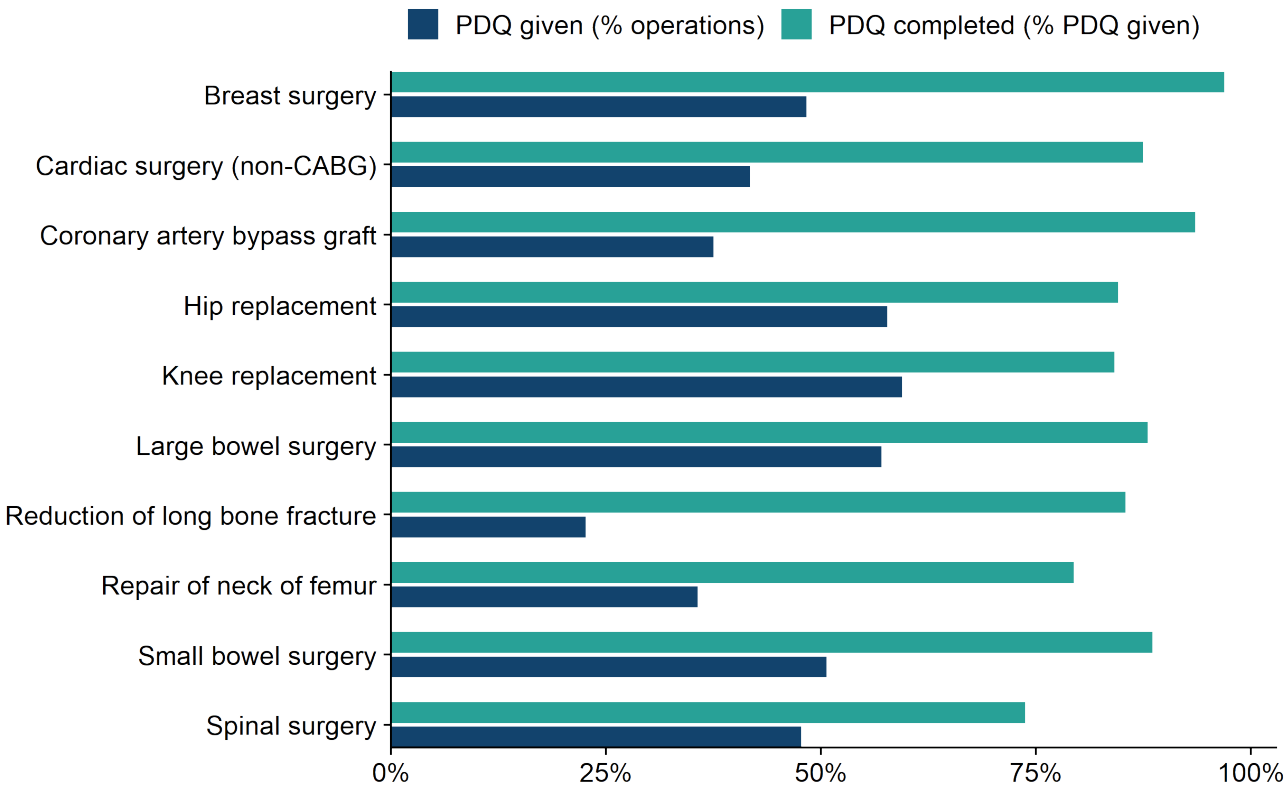
Figure 13 shows the proportion of PDQs given (as a percentage of operations) and PDQs completed (as a percentage of PDQs given) among categories with more than 5 participating hospitals in financial year 2023 to 2024. The proportion of operations with a PDQ given ranged from 22.7% for reduction of long bone fracture to 59.5% for knee replacement. Categories with shorter lengths of stay (median 0 to 3 days) including hip and knee replacement, spinal surgery, and breast surgery had higher uptake of PDQs. The proportion of operations given PDQ for large bowel surgery remained high at 57.1% in 2023 to 2024. The proportion of PDQs completed (of PDQ given) was above 70% for all categories, the highest being for breast surgery (96.9%).

As the provision and completion of PDQs is not mandatory, albeit strongly recommended for operations with short length post-operative stay, SSIs detected through PDQs are not currently included in our analysis. The PDQ is currently paper-based or administered by phone and therefore comes with an administrative overhead. Despite this, over 50% of operations were administered a PDQ illustrating the value hospitals and SSISS place in obtaining more comprehensive estimate of the SSI burden, particularly for categories with short length of stay. The PDQ would be particularly useful to the patients undergoing their operations in the private

sector given the higher likelihood them being readmitted to other hospitals due to post-operative complications.

An electronic PDQ (ePDQ) is in beta phase of development and is expected to increase hospital uptake of PDQ surveillance by reducing the administrative burden and increase response rates by patients. The ePDQ will provide hospitals with a more sensitive SSI measure when looking at trends in their data over time.

Figure 13. Uptake of PDQs as a proportion of all operations and completion of PDQs where PDQ given, by category, NHS hospitals England, April 2023 to March 2024



See data table 13 in accompanying data tables spreadsheet.

Glossary

ASA score

Patient's pre-operative physical status scored by the anaesthetist according to the American Society of Anesthesiologists' classification of physical status. There are 5 ASA scores, ranging from A1 denoting normally healthy patient to A5 denoting moribund patient with little chance of survival.

Confidence intervals

Confidence intervals are used to show where the true range of results might lie. Ninety-five percent confidence intervals are used throughout to provide a guide to the precision of the estimate based on the denominator, number of operations (or days of follow-up), with narrower intervals representing greater confidence in the estimate and broader confidence intervals representing lower certainty in the estimate. given the same sampling, the estimate will fall within the confidence intervals 19 times out 20. The funnel plots use both 95% and 99% confidence limits to represent the limits of expected variation among trusts and establish a threshold for 'warning' of an unexpected result and needing to take 'action'. A 99% confidence range is wider but is offset with a lower margin of error (1%).

Cumulative incidence

The total number of SSIs as a proportion of the total number of patients undergoing a procedure in the same category of surgery per 100 operations (%).

Hospital Episode Statistics (HES)

Curated data product containing details about admissions, outpatient appointments and historical accident and emergency attendances at NHS hospitals in England.

Index of Multiple Deprivation (IMD)

Relative measure of deprivation formed by combining 7 domains of deprivation (income, employment, education, skills and training, health and disability, crime, barriers to housing services) at a level of lower-super output areas (population size of about 1,500 residents or 650 households).

Incidence density

The total number of SSIs (identified through inpatient surveillance) divided by the total number of days of inpatient follow-up expressed as the number of SSIs per 1,000 days of patient follow-up.

Independent sector NHS treatment centres

Centres that provide services to NHS patients but are owned and run by organisations outside the NHS. They perform common elective (non-emergency) surgeries, diagnostic procedures and tests in an effort to help the NHS reduce waiting times.

NHSN Risk Index

The Centres for Disease Control and Prevention National Healthcare Safety Network (NHSN) Risk Index assesses a patient's risk of developing an SSI based on the presence of 3 key risk

factors (ASA score, duration of operation, and wound class). Patients are assigned a cumulative score from 0 to 3 based on the following: an ASA score of 3 or more, duration of surgery exceeding the 75th percentile, and a contaminated or dirty wound class. A score of 3 would indicate a high risk of SSI for a patient after an operation.

Risk ratio

A measure of the risk of a certain event happening in one group compared to the risk of the same event happening in another group. A risk ratio of one means there is no difference between the 2 groups in terms of their risk, based on whether or not they were exposed to a certain factor or possess a certain risk factor. A risk ratio of less than 1 usually means that being exposed to a certain factor or possessing a certain risk factor decreases the risk of infection. A risk ratio greater than 1 means that being exposed to a certain factor or possessing a certain risk factor increases the risk of infection.

Surveillance

Epidemiologic surveillance is the ongoing and systematic collection, analysis, and interpretation of health data in the process of describing and monitoring a health event. This information is used for planning, implementing, and evaluating public health interventions and programs. Surveillance data is used both to determine the need for public health action and to assess the effectiveness of programs (14).

T-time

T-time represents the expected duration for a particular surgical procedure based on the 75th percentile for the duration of all such operations, rounded to the nearest hour. T-times for all surgical categories are as follows:

Table 7. T-time for surgical categories

Surgical category	T-time (hours)
Abdominal hysterectomy	2
Bile duct, liver, or pancreatic surgery	5
Breast surgery	3
Cholecystectomy	2
Cardiac surgery (non-CABG)	5
Coronary artery bypass graft	5
Cranial surgery	4
Gastric surgery	3
Hip replacement	2
Knee replacement	2
Large bowel surgery	3
Limb amputation	1

Surgical category	T-time (hours)
Reduction of long bone fracture	2
Repair of neck of femur	1.5 [note 1]
Small bowel surgery	3
Spinal surgery	3
Vascular surgery	3

Note 1: T-time derived from SSISS data.

Wound class

This describes the degree of wound contamination at the time of the operation, based on an international standard classification system. The classification ranges from W1 denoting a clean uninfected wound outside the respiratory, alimentary, and genital or urinary tract to W4 denoting dirty or infected wounds and include operations in which acute inflammation with pus is encountered or in which perforated viscera are found.

Data sources and methodology

SSISS data collection

The UKHSA SSISS protocol outlines a standard methodology, including case definitions and case finding methods, which all participating hospitals must adhere to (15). Hospitals participating in UKHSA's national SSI surveillance programme are strongly encouraged to have staff attend the UKHSA SSISS quarterly training before starting surveillance in order maintain the quality of surveillance data.

Surveillance data is collected prospectively on a quarterly basis and include all eligible patients undergoing surgery in pre-selected surgical categories during each 3-month period (quarter). Patients are followed up to identify SSIs for 30 days after surgery for non-implant procedures and for one year for procedures involving a prosthetic implant. A set of demographic and surgery-related data is collected for each eligible procedure and submitted to the UKHSA SSISS via a secure web-based application.

Further information on data sources and methodology can be found in the QMI report.

Background information

Surgical Site Infection Surveillance Service

This report summarises data submitted by NHS hospitals and independent sector (IS) NHS treatment centres in England to the national SSI Surveillance Service (SSISS), UK Health Security Agency (UKHSA, previously Public Health England (PHE)). The aim of the national surveillance program is to enhance the quality of patient care by encouraging hospitals to use data obtained from the surveillance to compare their rates of SSI over time and against a national benchmark and to use this information to review and guide clinical practice.

The SSISS provides an infrastructure for hospitals to collect data on 17 surgical categories spanning general surgery, cardiothoracic, neurosurgery, gynaecology, vascular, gastroenterology and orthopaedics. Surveillance is targeted at open surgical procedures, which carry a higher risk of infection than minimally invasive ('keyhole') procedures (16, 17); however laparoscopic-assisted procedures are included for some categories.

The SSISS was established by the Public Health Laboratory Service (PHLS, a predecessor of UKHSA) in 1997. From April 2004, NHS trusts performing orthopaedic surgery have been mandated by the Department of Health and Social Care (DHSC) to carry out surveillance for a minimum of 3 consecutive months per financial year in at least one of 4 orthopaedic categories: hip replacement, knee replacement, repair of neck of femur or reduction of long bone fracture (18). NHS trusts that do not carry out orthopaedic surgery are exempt from mandatory participation and can report on other types of surgery if they choose to do so. NHS hospital participation in other categories remains voluntary.

This report includes surveillance data submitted to the SSISS based on surgery which took place from 1 April 2014 to 31 March 2024, with a focus on the latest financial year (2023 to 2024), and a comparison to the previous financial year (2022 to 2023).

For the first time, we also present detailed data on time to infection by surgical category.

Hospital perspective

Great Ormond Street Hospital (GOSH): a journey towards the reduction of inadvertent hypothermia intraoperatively

Great Ormond Street Hospital (GOSH) has seen high rates of Surgical Site Infections (SSIs) in spinal surgery and has been identified as a high outlier through the national surveillance programme coordinated by UKHSA.

SSIs are known to be multifactorial in causation. One factor that protects against SSI is maintaining a normal body temperature throughout the patients' surgical pathway. At GOSH, approximately three quarters of the spinal population experienced some episodes of hypothermia intraoperatively, despite good practices appearing to be in place.

Steps taken to address the issue

To address the problem, we undertook a project aimed at detecting the common denominator of why hypothermia was still widely present within the spinal population and to implement improvements to reverse the trend.

The most common issue we found was that many patients waiting to enter the induction room had a skin temperature just above 36 degrees Celsius (°C), which rapidly decreased once in the cold induction room. Consequently, despite the use of active warming in both the induction room and theatres, around three quarters of the spinal population experienced some episodes of hypothermia intraoperatively.

In May 2017, a decision was made to use the One Together toolkit to drive improvement. Between May and June 2017 we introduced the pre-warming assessment on the ward, prior to transferring patients to the induction room.

Outcome

Pre-warming at ward level decreased hypothermia rates intraoperatively after an initial two-months trial. After a review of the improved results, an extra active warming device was acquired to stay at ward level, training was delivered to all ward staff and the pre-warming assessment was rolled out at ward level for an extended trial period. Auditing began on all recorded intraoperative core temperatures and the improved results showed that only around a quarter of the spinal population experienced some episodes of hypothermia intraoperatively. Consequently, a noticeable reduction of the overall hypothermia rate was an indicator that the combined efforts of all professionals involved and the utilisation of the One Together materials led to the improved results. Additionally, One Together UK released a Perioperative Warming brochure in November 2017, which was also adopted and beneficial to our ongoing project. In March 2018, due to the positive outcome, it was decided to permanently continue the pre-operative pre-warming assessment on the ward.

Since implementing this project, GOSH's crude SSI rates have gradually decreased when compared to our own SSI rates prior to 2017 but remains higher than UKHSA's national benchmark rate. With the support of UKHSA, we are also reviewing other SSI risk factors as part of GOSH's patient surgical journey.

Limitations and challenges

Although the changes made may appear simple, there were significant challenges with not only implementing systemic changes to the pre-warming assessment at ward level due to resistance

to change practice but also with maintaining the desired improved results over a lengthy period. Therefore, it is crucial to continue to provide education and support to all teams involved. The successfully implemented pre-warming assessment should be taken as part of an ongoing journey and, despite our decreased hypothermia rates, we recognise the continuing need for improvement with our goal being, wherever possible, zero episodes of inadvertent hypothermia intraoperatively.

Learning

The project started with a single member of staff who was inspired by One Together UK. Subsequently, it became a successful collaboration with multiple professionals, who joined forces to drive a positive change for our patients' surgical journey. Although the project for the reduction of hypothermia was a crucial learning step towards the reduction of SSIs, this project reaffirmed to us that learning is an ongoing process, and that we must continue reviewing our practice and optimising our patients' surgical journey.

Acknowledgement

The hospital perspective was written by Great Ormond Street Hospital SSI Officer, Leo Morgan.

Further information and contact details

Feedback and contact information

For queries relating to this document, please contact ssi.data@ukhsa.gov.uk

Acknowledgments

We extend our thanks to all staff across NHS for their continued efforts in collecting surveillance data as well as NHS Information Centre for access to HES data.

Appendix 1

Table 8. Requirements for data fields that inform patient and surgery-related characteristics

Characteristic	Requirement
Patient age	Calculated from mandatory date of birth and date of operation data fields
Patient sex	Mandated for submission, however “unknown” is an available response option
Patient BMI	Calculated from optional height and weight data fields
Patient ASA score	Mandated for submission, however “unknown” is an available response option
Wound class	Mandated for submission, however “unknown” is an available response option
Operation duration	Mandated for submission
Pre-operative stay	Calculated from mandatory date of admission and date of operation data fields
Elective surgery	Mandated for submission, however “missing” is an available response option
Trauma surgery	Mandated for submission, however “missing” is an available response option
Primary indication for surgery	Mandated for submission, however “unknown” is an available response option
Antibiotic prophylaxis given	Mandated for submission, however “unknown” is an available response option

Appendix 2

Table 9a. Data completeness for patient characteristic variables, NHS hospitals England, April 2023 to March 2024

Surgical category	Number of hospitals	Number of operations	Age (%)	Sex (%)	BMI [note 1] (%)	ASA score (%)
Abdominal hysterectomy	4	322	100.0	100.0	96.0	95.3
Bile duct, liver or pancreatic surgery	1	190	100.0	100.0	0.0	99.5
Breast surgery	15	3,247	100.0	100.0	88.0	98.7
Cardiac surgery (non-CABG)	11	4,084	100.0	100.0	82.4	88.8
Cholecystectomy	1	246	100.0	100.0	0.0	100.0
Coronary artery bypass graft	13	6,311	100.0	100.0	83.0	87.6
Cranial surgery	3	1,606	100.0	100.0	88.0	89.2
Gastric surgery	4	332	100.0	100.0	73.8	97.6
Hip replacement	152	41,400	100.0	100.0	70.9	98.9
Knee replacement	148	44,051	100.0	100.0	72.6	99.0
Large bowel surgery	18	2,520	100.0	100.0	65.8	96.2
Limb amputation	4	174	100.0	100.0	74.7	94.3
Reduction of long bone fracture	25	3,605	100.0	100.0	33.6	97.3
Repair of neck of femur	77	20,448	100.0	100.0	40.5	97.3
Small bowel surgery	6	381	100.0	100.0	51.4	97.6
Spinal surgery	12	6,143	100.0	100.0	71.9	98.9
Vascular surgery	4	581	100.0	100.0	91.4	98.3

Note 1: optional data entry field.

Abbreviations

BMI = body mass index
ASA = American Society of Anesthesiologists
op = operation
CI = confidence interval

Table 9b. Data completeness for surgical characteristic variables, NHS hospitals England, April 2023 to March 2024

Surgical category	Wound class (%)	Operation duration (%)	Pre-op stay (%)	Elective surgery (%)	Trauma surgery [note 1] (%)	Primary indication (%)	Antibiotic prophylaxis (%)
Abdominal hysterectomy	100.0	100.0	100.0	100.0	61.2	not applicable	94.1
Bile duct, liver or pancreatic surgery	100.0	100.0	100.0	100.0	100.0	not applicable	100.0
Breast surgery	100.0	100.0	100.0	100.0	94.9	not applicable	95.2
Cardiac surgery (non-CABG)	100.0	100.0	100.0	100.0	99.9	not applicable	99.9
Cholecystectomy	100.0	100.0	100.0	100.0	100.0	not applicable	100.0
Coronary artery bypass graft	100.0	100.0	100.0	100.0	98.4	not applicable	100.0
Cranial surgery	100.0	100.0	100.0	100.0	99.5	not applicable	99.0
Gastric surgery	100.0	100.0	100.0	100.0	99.7	not applicable	98.8
Hip replacement	99.7	100.0	100.0	100.0	1.9	97.6	96.0

Surgical category	Wound class (%)	Operation duration (%)	Pre-op stay (%)	Elective surgery (%)	Trauma surgery [note 1] (%)	Primary indication (%)	Antibiotic prophylaxis (%)
Knee replacement	99.5	100.0	100.0	100.0	1.8	96.9	95.5
Large bowel surgery	100.0	100.0	100.0	100.0	89.6	not applicable	98.6
Limb amputation	100.0	100.0	100.0	100.0	100.0	not applicable	99.4
Reduction of long bone fracture	100.0	100.0	100.0	100.0	94.0	not applicable	90.8
Repair of neck of femur	99.0	100.0	100.0	100.0	2.8	98.5	96.3
Small bowel surgery	100.0	100.0	100.0	100.0	100.0	not applicable	100.0
Spinal surgery	100.0	100.0	100.0	100.0	69.8	not applicable	93.3
Vascular surgery	85.7	98.8	100.0	100.0	100.0	not applicable	94.1

Note 1: optional data entry field.

Abbreviations

BMI = body mass index
ASA = American Society of Anesthesiologists
op = operation
CI = confidence interval

Appendix 3

Table 10. Median BMI and proportion of paediatric patients by surgical category, NHS hospitals England, April 2023 to March 2024

Surgical category	Patient to related characteristic: Median BMI, IQR (kg/m^2)	Patient-related characteristic: Paediatric patients (%)
Abdominal hysterectomy	28.5 (24.5 to 33.2)	0.0
Bile duct, liver or pancreatic surgery	no data	0.5
Breast surgery	27.6 (23.7 to 32.2)	0.2
Cardiac surgery (non-CABG)	27.2 (24.1 to 30.9)	4.7
Cholecystectomy	no data	0.8
Coronary artery bypass graft	28.0 (25.1 to 31.3)	0.0
Cranial surgery	27.0 (23.3 to 30.9)	0.8
Gastric surgery	29.8 (26.1 to 37.3)	0.3
Hip replacement	28.5 (25.1 to 32.5)	0.1
Knee replacement	30.9 (27.3 to 35.0)	0.0
Large bowel surgery	26.7 (23.3 to 30.5)	0.2
Limb amputation	26.3 (22.5 to 31.6)	0.0
Reduction of long bone fracture	25.8 (22.3 to 30.1)	4.0
Repair of neck of femur	23.0 (20.3 to 26.3)	0.0
Small bowel surgery	26.4 (22.2 to 30.5)	0.3

Surgical category	Patient to related characteristic: Median BMI, IQR (kg/m^2)	Patient-related characteristic: Paediatric patients (%)
Spinal surgery	28.2 (24.5 to 32.7)	11.5
Vascular surgery	26.7 (23.8 to 30.4)	0.0

Abbreviations

BMI = body mass index
IQR = interquartile range

Appendix 4

Table 11. Proportion of records with missing IMD by surgical category, NHS hospitals England, April 2019 to March 2024

Surgical category	Missing: number	Missing: (%)
Abdominal hysterectomy	90	8.7
Bile duct, liver or pancreatic surgery	28	3.1
Breast surgery	162	1.2
Cardiac surgery (non-CABG)	1,105	6.8
Cholecystectomy	11	1.8
Coronary artery bypass graft	782	2.8
Cranial surgery	247	3.5
Gastric surgery	17	1.5
Hip replacement	14,392	9.0
Knee replacement	13,029	8.1
Large bowel surgery	228	2.2
Limb amputation	17	2.4
Reduction of long bone fracture	570	3.4
Repair of neck of femur	2,133	2.2
Small bowel surgery	53	2.8
Spinal surgery	2,397	8.6
Vascular surgery	196	6.6

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UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

UKHSA is an executive agency, sponsored by the Department of Health and Social Care.

Prepared by: Miroslava Mihalkova, Iina Hiironen, Simon Thelwall, Theresa Lamagni, Pauline Harrington, Catherine Wloch, Russell Hope and Colin Brown

For queries relating to this document, please contact: ssi.data@ukhsa.gov.uk

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