

South Australian Healthcare-associated Infection
Surveillance Program

Surgical Site Infection

Annual Report 2020

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SA Healthcare-associated Infection Surveillance Program
Surgical Site Infection 2020 Annual Report

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This annual report can be accessed
at the Department for Health and Wellbeing
Internet site www.sahealth.sa.gov.au/HAIstatistics

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Disclaimer

The data presented in this report were correct at the time of publication and reflect rates based on the numerator and denominator data supplied. Minor discrepancies with previous reports may occur as data adjustments are made retrospectively.

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Key Findings

For the five year reporting period 2015 to 2019

- > The total number of procedures under surveillance increased 8%, from 7598 in 2015 to 8183 in 2019 and the majority (68%) were performed in public hospitals.
- > Between 2015 and 2019:
 - the surgical site infection (SSI) rate in hip arthroplasty procedures ranged from 1.09 to 1.80 per 100 procedures, median = 1.32 per 100 procedures
 - the SSI rate in knee arthroplasty procedures ranged from 0.67 to 1.04 per 100 procedures, median = 0.91 per 100 procedures
 - the SSI rate in caesarean section procedures ranged from 1.00 to 2.05 per 100 procedures, median = 1.36 per 100 procedures

For the reporting period 2020

Superficial SSI case numbers and rates for 2020 should be interpreted with caution as routine follow up practices were likely impacted by the coronavirus 2019 pandemic with reduced outpatient appointments occurring in hospitals and no formal post-discharge surveillance in place.

- > In 2020, 84 SSIs were reported from a total of 8642 included surgical procedures, consisting of:
 - 40 SSI out of 2097 hip arthroplasty procedures for a rate of 1.91 per 100 procedures
 - 19 SSI out of 2148 knee arthroplasty procedures for a rate of 0.88 per 100 procedures
 - 25 SSI out of 4397 caesarean section procedures for a rate of 0.57 per 100 procedures
- > Of the 84 SSI reported, 52 (62%) were classified as deep or organ space infections.
- > The overall hip arthroplasty SSI rate increased from 1.19 per 100 procedures in 2019 to 1.91 per 100 procedures in 2020 ($p=0.03$).
- > The overall knee arthroplasty SSI rate increased from 0.67 per 100 procedures in 2019 to 0.88 per 100 procedures in 2020 ($p=0.22$).
- > The overall caesarean section SSI rate decreased from 1.18 per 100 procedures in 2019 to 0.57 per 100 procedures in 2020 ($p=0.001$).
- > Of the included procedures in 2020, private hospitals performed the majority (67%) of knee arthroplasty procedures and 54% of hip procedures, however only 8% of the caesarean section procedures were undertaken by private hospital contributors.

Introduction

The Infection Control Service, Communicable Disease Control Branch, of the South Australian (SA) Department for Health and Wellbeing coordinates the collection of surveillance data for healthcare-associated bloodstream infection, targeted surgical site infections, methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant enterococci (VRE), multidrug-resistant Gram-negative organisms and *Clostridioides difficile* infection.

The Infection Control Service regularly reports aggregated and individual hospital level data to contributors and other relevant stakeholders with the intention of providing information that assists in the process of risk reduction and supports continuous quality improvement activities.

The South Australian surgical site infection (SSI) surveillance report has been generated from data contributed by 10 South Australian metropolitan and country hospitals (6 public and 4 private facilities).

A surgical site infection is an infection that occurs after surgery in the part of the body where the surgery took place. Surgical site infections can sometimes be superficial infections involving the skin only, however, other surgical site infections are more serious and can involve tissues under the skin, organs, or implanted material.

SSI are among the most common healthcare-associated infections (HAIs)⁽¹⁾, they are associated with longer post-operative hospital stays, antimicrobial treatment, additional surgical procedures, treatment in intensive care units and higher mortality⁽²⁾.

This inaugural report includes surveillance data submitted to the SA Health healthcare-associated infection (HAI) surveillance program based on targeted surgical procedures which took place from January 2015 to December 2020, with a focus on the latest calendar year.

Methods

SSI data are collected by the Infection Prevention and Control Units of participating hospitals in accordance with agreed statewide surveillance definitions. Current definitions are available from the Infection Control Service website: www.sahealth.sa.gov.au/infectionprevention. Data are submitted monthly to the Infection Control Service and undergo quality checks prior to entry into the state surveillance database.

The SA Health SSI surveillance program is based on the National Healthcare Safety Network (NHSN) Patient Safety Component Manual, Centers for Disease Control and Prevention (CDC) SSI module⁽³⁾.

Numerator

The numerator includes all patients who undergo a targeted procedure (both primary and revision procedures) resulting in a SSI within the designated surveillance period for that specific procedure i.e. either 30 or 90-day surveillance.

Denominator

The denominator is the number of targeted procedures (including both primary and revision procedures) undertaken by contributors to the SA Health surgical site surveillance program during the surveillance reporting period.

The current denominator submitted by contributors is an overall count for each procedure group and is not stratified by patient risk criteria and as such does not allow for true analysis of infection risk. Further information can be located in the SSI definitions www.sahealth.sa.gov.au/infectionprevention and in the [Risk Stratification](#) section below.

Case finding

SA Health SSI contributors are encouraged to undertake active, patient-based, prospective surveillance. Post-discharge infections are included when identified; these are usually picked up on readmission as most contributors do not undertake formal post-discharge surveillance.

SA Health public contributors utilise an automated state-wide information notification and management system which allows public SSI contributing facilities to identify patients who present at other public facilities with potential SSI, this may allow for identification of additional SSI cases which may previously have been lost to follow up.

Risk stratification

The patient risk score is a method of stratification for infections associated with surgical patients based on their estimated risk relative to other patients undergoing the same surgery. The higher the risk score the higher the risk the patient has of developing a SSI.

The report includes rates with risk-adjusted numerator data; however, procedure specific risk stratified rates cannot currently be determined due to denominator limitations (refer to [Denominator](#) section).

Risk score grouping within this report:

Patient risk score 0 = Low risk, 1 = Medium risk, 2 or 3 = High risk

Statistical methods

The relative risks for incidence rate comparisons were calculated using the “ir” command in Stata version 13.

Surveillance definitions

Surgical site infection surveillance definitions including the patient risk score formula can be found at the following web page: <http://www.sahealth.sa.gov.au/infectionprevention>.

Targeted Procedures

KPRO – Knee arthroplasty procedures

HPRO – Hip arthroplasty procedures

CSEC – Lower segment caesarean section procedures

Participating hospitals

Table 1: Participating hospitals and targeted procedures under surveillance

Public Hospitals	KPRO	HPRO	CSEC
Flinders Medical Centre	from Jul-19	from Jul-19	from 2015
Lyell McEwin Hospital	✓	✓	✓
Queen Elizabeth Hospital	✓	✓	
Royal Adelaide Hospital	✓	✓	
Women's & Children's Hospital			✓
Port Lincoln Hospital			✓
Calvary North Adelaide Hospital	✓	✓	✓
St. Andrew's Hospital (from 2015)	✓	✓	
Calvary Adelaide Hospital	✓	✓	
Western Hospital (from 2016)	✓	✓	

Results

1. Overall trend in surgical site infections

Overall, there were 84 surgical site infections from 8642 surgical procedures reported in 2020. Figure 1 shows trends over the reporting period for targeted procedures by hospital demographic.

The SSI rate in hip procedures undertaken by private facilities rose from 0.90 in 2019 to 1.33 per 100 procedures in 2020 ($p=0.18$) along with the corresponding SSI rate in public facilities from 1.47 in 2019 to 2.58 per 100 procedures in 2020 ($p=0.04$).

Knee SSI rates increased from 0.38 in 2019 to 0.55 per 100 procedures in 2020 ($p=0.27$) for private contributors, while public contributors showed an increase from 1.26 to 1.57 per 100 procedures ($p=0.32$) in the corresponding time frame.

Public facilities have shown a significant reduction ($p<0.0001$) in caesarean section SSI from a high of 2.12 in 2016 to its lowest rate of 0.59 per 100 procedures in 2020 and the SSI rates in caesarean section undertaken in private facilities have also reduced from a high of 1.37 in 2015 to a low of 0.29 per 100 procedures in 2020 ($p=0.08$).

Figure 1: SSI numbers and rate by hospital type, procedure group and year, SA, 2015 – 2020



Figure 1 shows the distribution of procedures between public and private hospital facilities. Of the included procedures in 2020, private hospitals performed the majority (67%) of knee arthroplasty procedures and 54% of hip procedures, however, only 8% of the included caesarean section procedures were undertaken by private hospital contributors.

Unfortunately, as denominator data are not available by patient risk stratification, it is not possible to determine whether the differences in SSI rate between public and private hospitals is attributable to pre-existing differences in patient risk.

a. Analysis by organism

Between 2015 and 2020, 588 organisms were isolated from 453 SSI where positive wound microbiology was reported, with *S. aureus* being the leading causative organism across procedure groups (refer Table 2). Hip surgery had the highest proportion of SSI cases with accompanying microbiology (91%), followed by knee surgery at 81% and 69% for caesarean section SSI.

NOTE: positive microbiology is not essential to meet the SSI case definition

Figure 2: Counts and proportions of organism groups reported as causing SSI by procedure group, SA, 2015 – 2020 combined

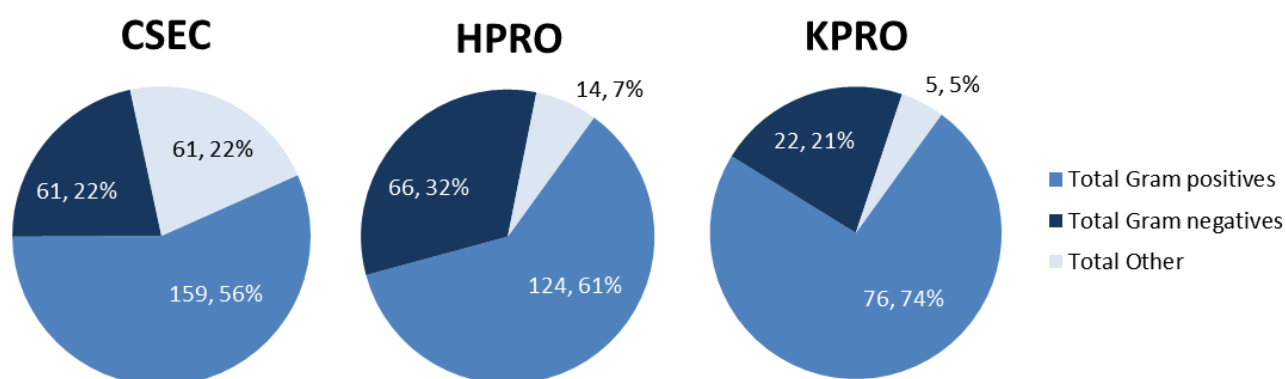


Figure 2 shows the distribution of organism groups for each targeted procedure group. Gram positive organisms are the predominant organism across all procedure groups with *S. aureus* the key causative organism.

Table 2: Organisms* reported as causing SSI by procedure group, SA, 2015 – 2020 combined

Organism Group	CSEC	HPRO	KPRO
Total Gram positives	159	124	76
Staphylococcus aureus total	128	61	41
<i>Staphylococcus aureus</i> (methicillin sensitive)	104	49	38
<i>Staphylococcus aureus</i> (methicillin resistant)	24	12	3
coagulase negative staphylococci	10	29	20
<i>Enterococcus</i> spp. (inc vancomycin-resistant enterococci)	3	17	9
<i>Streptococcus</i> spp.	18	17	6
Total Gram negatives	61	66	22
<i>Escherichia coli</i>	14	11	4
<i>Pseudomonas aeruginosa</i>	6	19	7
<i>Klebsiella</i> spp.	6	6	0
<i>Enterobacter</i> spp.	9	6	3
Proteus group	10	12	4
Other gram-negative bacteria	16	12	4
Total Other	61	14	5
Anaerobe	38	4	2
Candida/yeast	2	3	2
miscellaneous other	21	7	1
Grand Total	281	204	103

*organisms from polymicrobial SSI are listed individually.

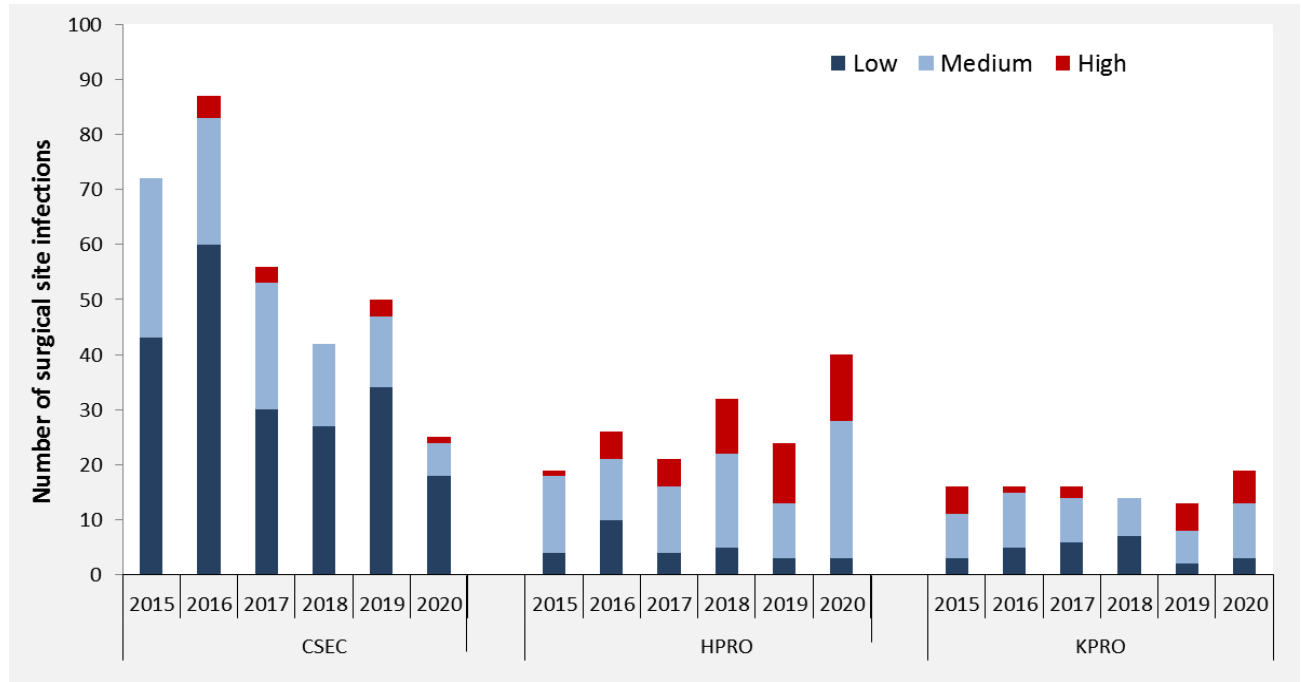
S. aureus remains the most commonly identified causative organism of SSI, responsible for approximately 46% of caesarean section SSI, 40% of knee arthroplasty SSI and 30% of hip arthroplasty SSI.

The proportion of *S. aureus* blood stream infections (BSIs) caused by methicillin-resistant strains (MRSA) was 20% in hip arthroplasty SSI, 19% in caesarean section SSI and 7% for knee arthroplasty SSI.

b. Analysis by risk group

Application of a patient risk score is an internationally accepted way of accounting for differences in patient risk in similar surgery groups. This risk stratification process apportions a score based on the Anaesthesiologist’s Society of America (ASA) score, surgery duration and surgical wound classification (further information on the patient risk score calculation can be found at the following web page: <http://www.sahealth.sa.gov.au/infectionprevention>) and results in a score of between 0 and 3. Analysis in this report groups these figures as Low (0), Medium (1) and High (2 or 3) risk.

Figure 3: Number of SSI by procedure group and patient risk group, SA, 2015 – 2020



Hip and knee arthroplasty procedures have a consistently higher proportion of SSI associated with medium and high risk groups which often result in more serious SSIs.

Figure 4: Counts and proportions of SSI by infection classification, by procedure group, SA, 2015 - 2020 combined

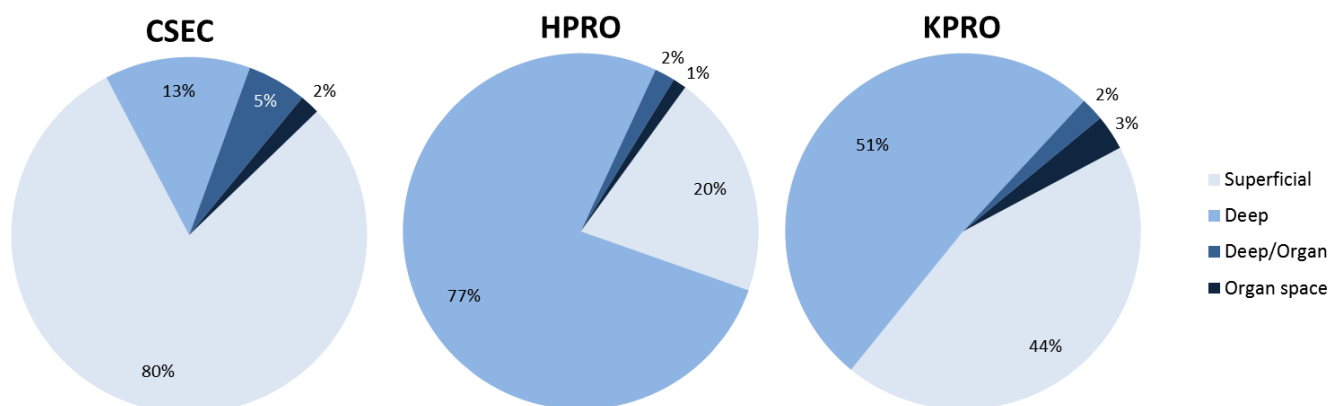
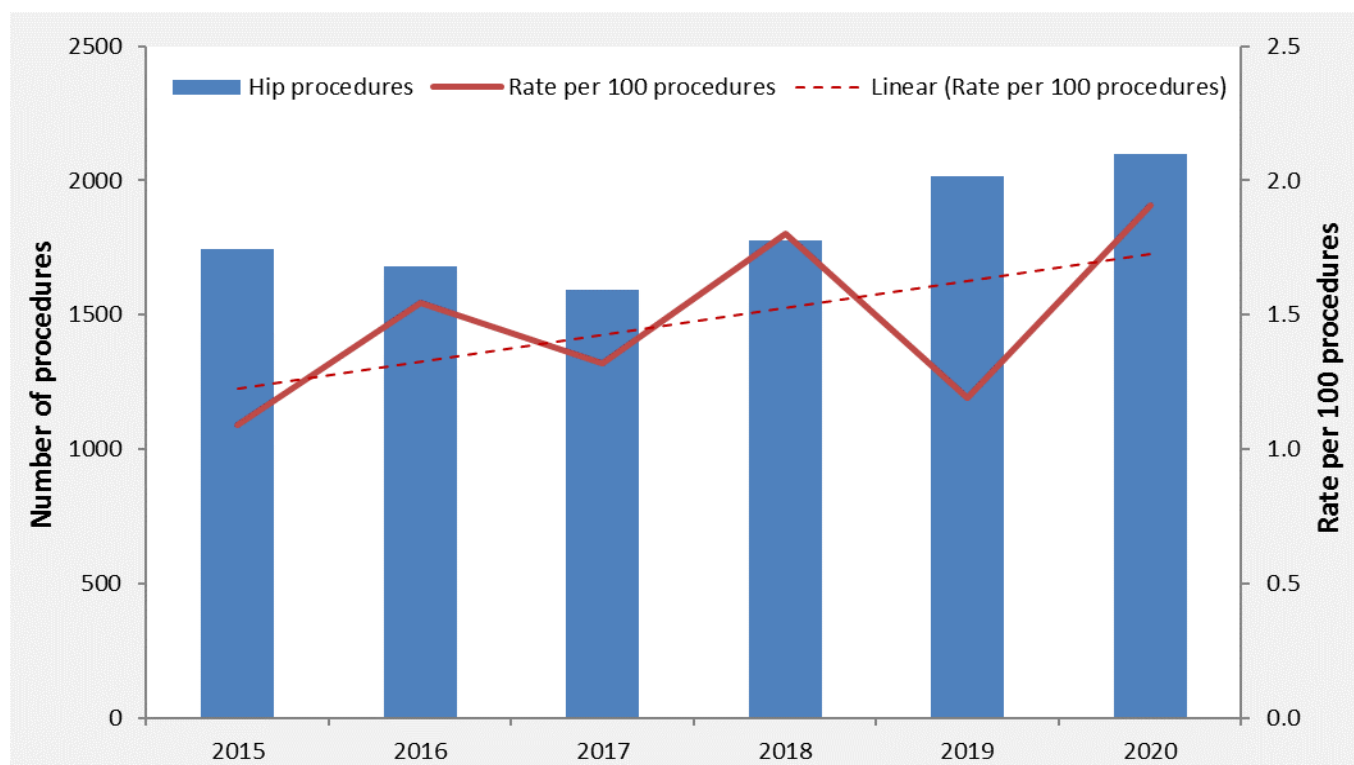


Figure 4 shows the difference in the infection severity proportionately between surgical groups. The data shows that hip arthroplasty procedures result in a higher proportion of deep/organ space infections; this appears to correlate with the proportion of hip SSI occurring in patients with a high patient risk score.

2. Surgical site infection following hip arthroplasty

Between 2015 and 2020, a total of 10904 hip arthroplasty procedures were performed by contributing facilities. There has been a 20% increase in the number of hip arthroplasty procedures included in the SSI surveillance program between 2015 and 2020, from 1743 to 2097 procedures.

Figure 5: Number of hip arthroplasty procedures and hip arthroplasty SSI rate, by year, SA, 2015 - 2020



The SSI rate in hip arthroplasty procedures ranged from 1.09 to 1.91 per 100 procedures (median 1.43) in the six years to 2020 and while the yearly rate shows variation, the trend shows a steady increase over this period.

Table 3: Hip arthroplasty SSI counts and rates by infection classification and year, SA, 2015 - 2020

	2015	2016	2017	2018	2019	2020
Number of participating hospitals	6	7	7	7	8	8
Number of procedures	1743	1681	1591	1778	2014	2097
Number of SSI	19	26	21	32	24	40
Total SSI rate	1.09	1.55	1.32	1.80	1.19	1.91
Number of Deep/Organ space SSI	15	24	18	24	20	28
Deep/Organ space SSI rate	0.86	1.43	1.13	1.35	0.99	1.34

The hip arthroplasty SSI rate has shown an increase from 1.19 in 2019 to 1.91 per 100 procedures in 2020 ($p=0.03$). Deep/organ space SSIs have also shown an increase from a 0.99 to 1.34 per 100 procedures across the same period.

Figure 6: Number of hip arthroplasty SSI by patient risk group and year, SA, 2015 – 2020

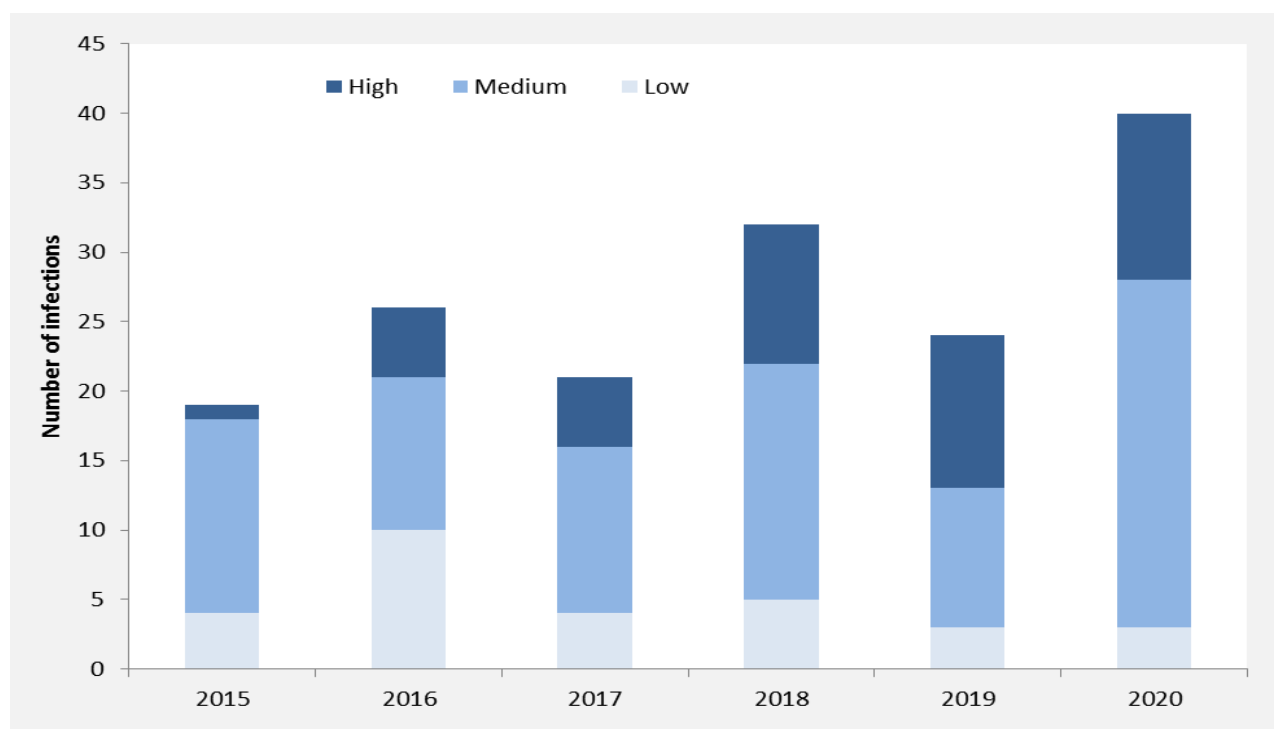


Figure 6 shows the aggregated SSI rate following hip arthroplasty by patient risk group for the period 2015 to 2020, with the majority (63%) of hip SSIs being identified from patients in the medium risk group and a further 30% from the high risk group during this period.

Table 4: Hip arthroplasty benchmarking by financial year ^(4, 5)

Financial Year	South Australia				Western Australia				Public Health England			
	Count of contributor	SSI	Count of PROC	Rate per 100 procedures	Count of contributor	SSI	Count of PROC	Rate per 100 procedures	Count of contributor	SSI	Count of PROC	Rate per 100 procedures
2014/15	6	18	1530	1.18	21	34	3604	0.94	113	281	42124	0.67
2015/16	6	20	1748	1.14	22	49	4522	1.08	117	228	39417	0.58
2016/17	7	26	1690	1.54	22	36	4613	0.78	113	236	41009	0.58
2017/18	7	24	1564	1.53	21	37	4833	0.77	114	190	39513	0.48
2018/19	7	26	1911	1.36	22	43	5046	0.85	111	183	41680	0.44
2019/20	8	15	1082	1.39	22	21	4910	0.43	108	207	41067	0.50

Data are presented by financial year to align as closely as possible with the Western Australian and Public Health England’s reporting periods, the latter of which reports April to March.

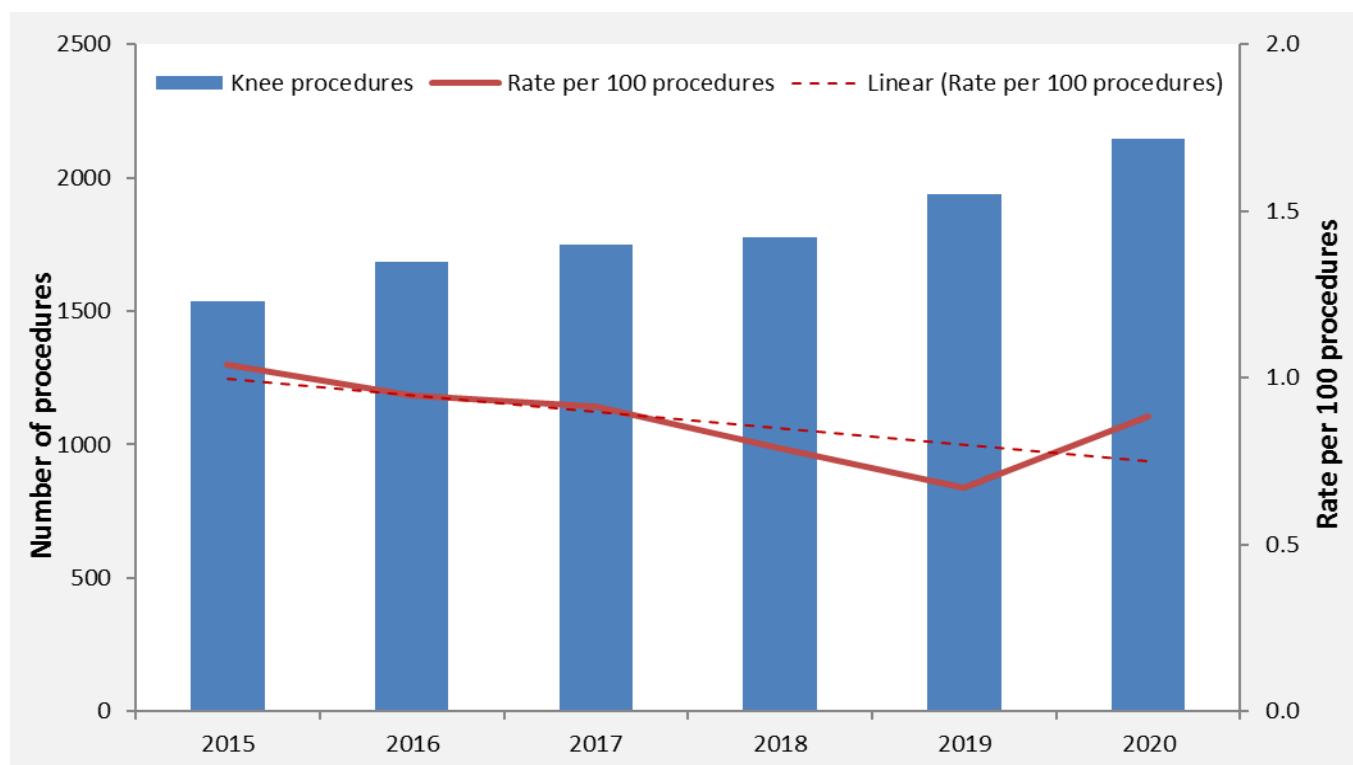
To ensure valid comparison, collection methodologies for included comparators is similar to the patient-based, prospective surveillance undertaken by SA Health SSI contributors.

SA hip arthroplasty SSI rates remain higher than both the reported rates for both Western Australia and Public Health England for 2019/20. In the absence of detailed data for all data sets, further analysis cannot be undertaken.

3. Surgical site infection following knee arthroplasty

Between 2015 and 2020, a total of 10839 knee arthroplasty procedures were performed by contributing facilities. There has been a 40% increase in the number of knee arthroplasty procedures included in the SSI surveillance program between 2015 and 2020, from 1539 to 2148 procedures.

Figure 7: Number of knee arthroplasty procedures and knee arthroplasty SSI rate, by year, SA, 2015 - 2020



The SSI rate in knee arthroplasty procedures ranged from 0.67 to 1.04 per 100 procedures (median 0.90) in the six years to 2020, the trend has shown a steady decline over this period.

Table 5: Knee arthroplasty SSI counts and rates by infection classification and year, SA, 2015 – 2020

	2015	2016	2017	2018	2019	2020
Number of participating hospitals	6	7	7	7	8	8
Number of procedures	1539	1686	1750	1777	1939	2148
Number of SSI	16	16	16	14	13	19
Total SSI rate	1.04	0.95	0.91	0.79	0.67	0.88
Number of Deep/Organ space SSI	8	12	6	7	7	13
Deep/Organ space SSI rate	0.52	0.71	0.34	0.39	0.36	0.61

The knee arthroplasty SSI rate has increased from 0.67 in 2019 to 0.88 per 100 procedures in 2020 (p=0.22). Deep/organ space SSIs have also increased from 0.36 in 2019 to 0.61 per 100 procedures in 2020.

Figure 8: Number of knee arthroplasty SSI by patient risk group and year, SA, 2015 - 2020

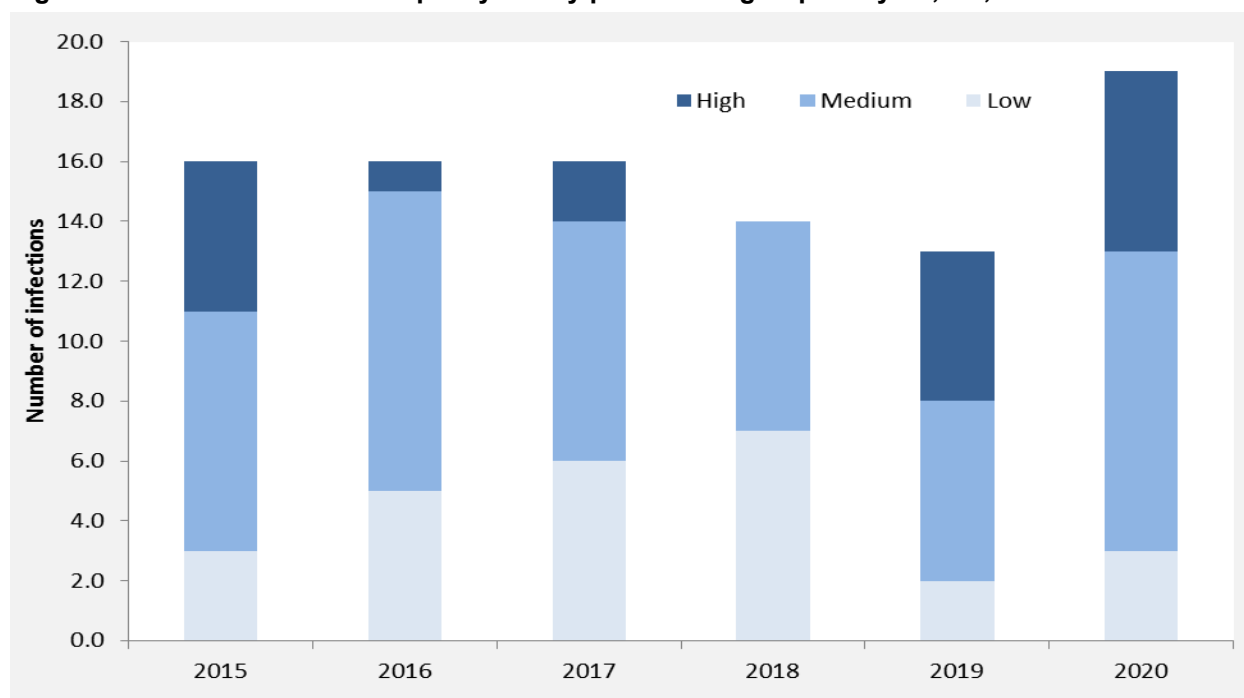


Figure 8 shows the aggregated SSI rate following knee arthroplasty by patient risk group for the period 2015 to 2020. The majority (53%) of knee SSIs were identified from patients in the medium risk group.

Table 6: Knee arthroplasty benchmarking by financial year^(4, 5)

Financial Year	South Australia				Western Australia				Public Health England			
	Count of contributor	SSI	Count of PROC	Rate per 100 procedures	Count of contributor	SSI	Count of PROC	Rate per 100 procedures	Count of contributor	SSI	Count of PROC	Rate per 100 procedures
2014/15	6	12	1412	0.85	21	28	5517	0.51	115	232	43384	0.53
2015/16	6	13	1609	0.81	22	39	6559	0.59	109	214	41665	0.51
2016/17	7	24	1851	1.30	22	48	6951	0.69	110	231	44188	0.52
2017/18	7	11	1670	0.66	21	46	7227	0.64	123	179	43647	0.41
2018/19	7	14	1854	0.76	22	50	7232	0.69	111	191	44755	0.43
2019/20	8	6	990	0.61	23	24	6941	0.35	111	162	44213	0.37

Data are presented by financial year to align as closely as possible with the Western Australian and Public Health England’s reporting periods, the latter of which reports April to March.

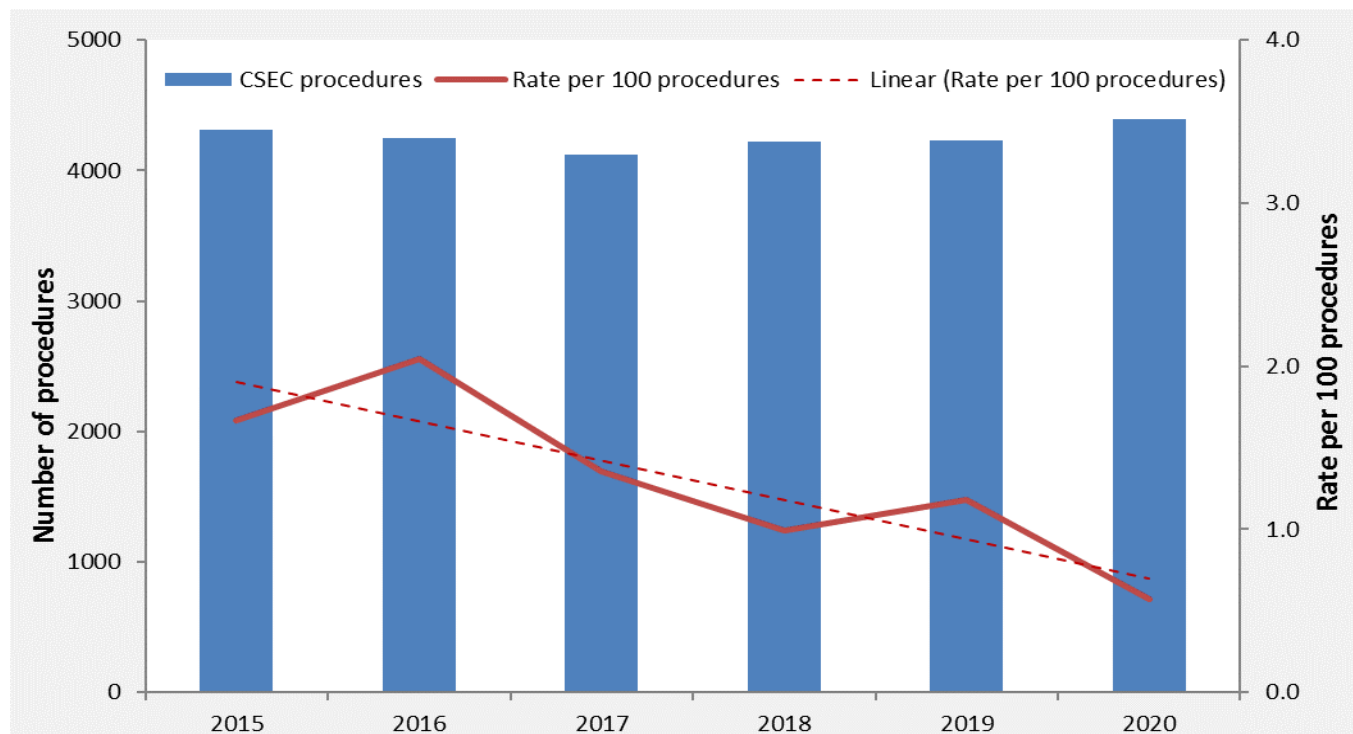
To ensure valid comparison, collection methodologies for included comparators is similar to the patient-based, prospective surveillance undertaken by SA Health SSI contributors.

SA knee arthroplasty SSI rates remain higher than both the reported rates for both Western Australia and Public Health England for 2019/20. In the absence of detailed data for all data sets, further analysis cannot be undertaken.

4. Surgical site infection following caesarean section

Between 2015 and 2020, a total of 25534 caesarean section procedures were performed by contributing facilities, with 93% of included caesarean section procedures being performed by public facilities.

Figure 9: Number of caesarean section procedures and caesarean section SSI rate, by year, SA, 2015 - 2020



The SSI rate in caesarean section procedures ranged from 0.57 to 2.05 per 100 procedures (median 1.27) in the six years to 2020 and while the yearly rate shows variation, the trend has shown a steady decline over this period.

Table 7: Caesarean section SSI counts and rates by infection classification and year, SA, 2015 – 2020

	2015	2016	2017	2018	2019	2020
Number of participating hospitals	5	5	5	5	5	5
Number of procedures	4316	4250	4122	4219	4230	4397
Number of SSI	72	87	56	42	50	25
Total SSI rate	1.67	2.05	1.36	1.00	1.18	0.57
Number of Deep/Organ space SSI	10	12	7	15	13	11
Deep/Organ space SSI rate	0.23	0.28	0.17	0.36	0.31	0.25

The caesarean section SSI rate has shown a significant reduction from a high of 2.05 in 2016 to 0.57 per 100 procedures in 2020 ($p < 0.0001$). Deep/organ space SSIs have shown a reduction from 0.31 in 2019 to 0.25 per 100 procedures in 2020.

Superficial infection was the most commonly identified SSI in caesarean section procedures at 56% for 2020; however superficial infections were around 80% of SSIs on average in the preceding 5 years.

Figure 10: Number of caesarean section SSI by patient risk group and year, SA, 2015 - 2020

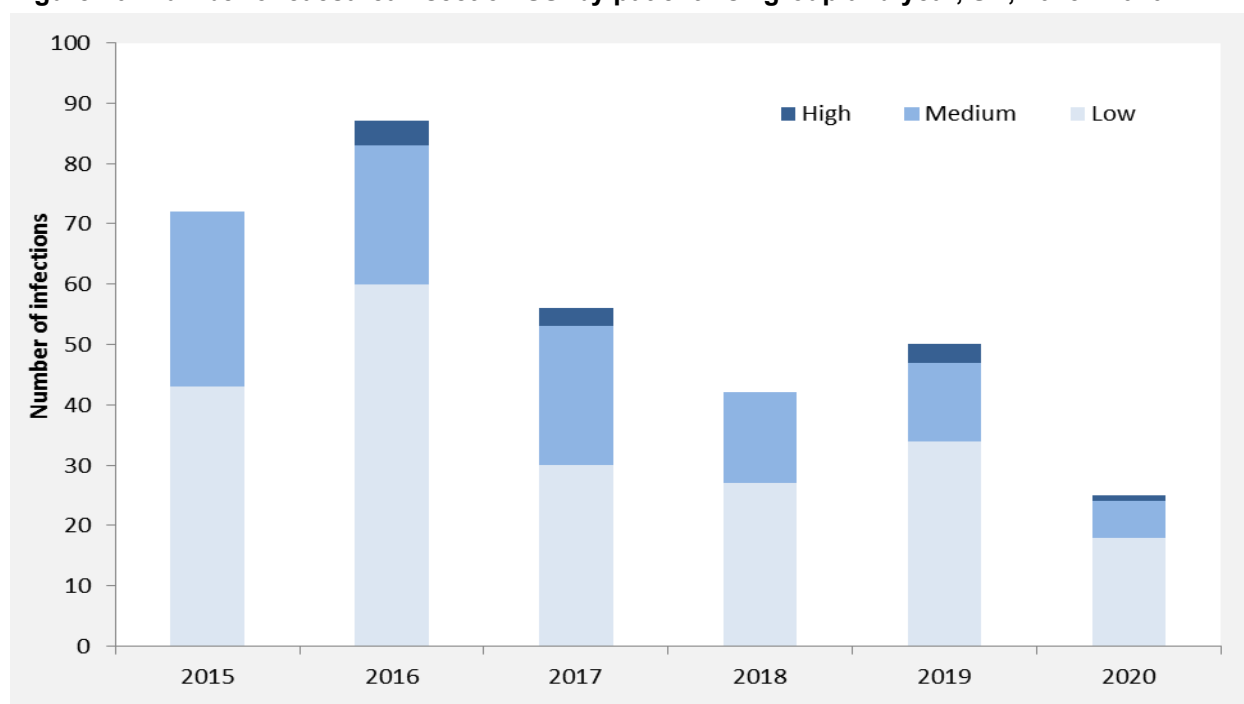


Figure 10 shows the aggregated SSI rate following caesarean section by patient risk for the period 2015 to 2020. The majority (64%) of caesarean section SSIs were identified from patients in the low risk group.

Table 8: Caesarean section benchmarking by financial year ⁽⁴⁾

Financial Year	South Australia				Western Australia			
	Count of contributor	SSI	Count of PROC	Rate per 100 procedures	Count of contributor	SSI	Count of PROC	Rate per 100 procedures
2014/15	5	73	3451	2.12	29	85	9054	0.94
2015/16	5	79	4253	1.86	28	24	10137	0.24
2016/17	5	69	4219	1.64	28	23	10066	0.23
2017/18	5	56	4142	1.35	26	69	9950	0.69
2018/19	5	43	4267	1.01	25	87	7232	1.20
2019/20	5	21	2119	0.99	26	105	6941	1.51

Data are presented by financial year to align with the Western Australian reporting periods. Public reporting of caesarean section rates is not undertaken by Public Health England.

To ensure valid comparison, collection methodologies for included comparators is similar to the patient-based, prospective surveillance undertaken by SA Health SSI contributors.

SA caesarean section SSI rates are lower than the reported rate for Western Australia for 2019/20. In the absence of detailed data for all data sets, further analysis cannot be undertaken.

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