GIG CYMRU NHS WALES
Iechyd Cyhoeddus Cymru
Public Health Wales

Caesarean Section Surgical Site Infection Surveillance

2017 Annual Report:

Appendix C:

Betsi Cadwaladr UHB

Includes data from 01/01/2017 – 31/12/2017

Version 1

Issued: 31/07/2018

The Healthcare Associated Infection and Antimicrobial Resistance Programme can be accessed via the Public Health Wales website at:
http://www.publichealthwales.org

Published by Public Health Wales NHS Trust, No. 2 Capital Quarter, Tyndall Street, Cardiff CF10 4BZ

Published 31 July 2018, Version 1

Acknowledgements

We are grateful to the obstetric clinical teams, midwifery teams, infection control teams and audit teams from all participating hospitals for continuing to provide surveillance data to Public Health Wales.

Report authors: Christopher Roberts, Wendy Harrison

Reference this document as:

Public Health Wales NHS Trust. 2017 Annual report on Caesarean Section Surgical Site Infection 2017: Appendix C, Wales.

Data requests and queries should be addressed to:

Public Health Wales NHS Trust
HCAI and AMR Programme
4th floor, No. 2 Capital Quarter
Tyndall Street
Cardiff CF10 4BZ

Email: harp@wales.nhs.uk

Contents

Tables 3
Figures 3
Summary 4
Data interpretation 5
Section 1: Data completeness 6
Compliance 6
Completion rates of surveillance forms 7
Section 2: SSI rate 8
Incidence of inpatient, post-discharge and overall SSI 8
Annual SSI rates 8
Incidence of SSI by infection type 11
Section 3: Demographics 12
Incidence of SSI by age 12
Incidence of SSI by BMI 13
Incidence of SSI by number of previous C sections 14
Section 4: Details of the surgical procedure 15
SSI risk score 15
Incidence of SSI by procedure type 16
Incidence of SSI by antibiotic prophylaxis 17
Incidence of SSI by skin closure type 18
Section 5: Post-procedure details and onset of infection 19
Length of stay in hospital 19
Length of midwifery care 20
Time to onset of infection 21
References 21

Tables

Table 1 – Coverage of the C section SSI surveillance compared to the expected number of forms. 6
Table 2 – Completion rates of the SSI field (along with its associated type and infection date fields). 7
Table 3 – Incidence of inpatient and post-discharge SSIs. 8
Table 4 – Overall, elective and emergency SSI rates for the last five years. (Unknowns excluded). 9
Table 5 – Types of SSI in C section procedures by proportion. 11
Table 6 – SSI rates broken down by type. 11
Table 7 – Incidence of SSI by age group 12
Table 8 – Incidence of SSI by BMI category. 13
Table 9 – Incidence of SSI by the number of previous C sections. 14
Table 10 – Incidence of SSI by procedure type. 16
Table 11 – Incidence of SSI by timing of prophylactic antibiotics. 17
Table 12 – Incidence of SSI by type of skin closure. 18
Table 13 – Incidence of SSI by type of skin closure in mothers with BMI≥30. 18
Table 14 – Incidence of SSI by length of hospital stay. 19
Table 15 – Incidence of SSI by length of midwifery care post-procedure. 20

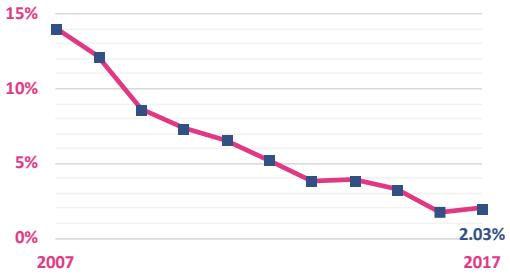
Figures

Figure 1 – Trend rate for compliance 2007-2017. 6
Figure 2 – Overall, elective and emergency SSI rates for 2007-2017 8
Figure 3 – Cumulative SSI number for the year, and their relative change compared to the previous year. 10
Figure 4 – Graph showing the incidence of SSI by age group. 12
Figure 5 – Graph showing the incidence of SSI by BMI category. 13
Figure 6 – Graph showing incidence of SSI by the number of previous C sections. 14
Figure 7 – Graph showing spread of risk score across all procedures (as percentage of all procedures reported). The score has a theoretical range of -7 to 33 for C section procedures in Wales. 15
Figure 8 – Graph showing incidence of SSI by type of procedure. 16
Figure 9 – Graph showing incidence of SSI by timing of prophylactic antibiotics. 17
Figure 10 – Graph showing incidence of SSI by type of skin closure used. 18
Figure 11 – Graph showing the incidence of SSI by skin closure in mothers with BMI≥30. 18
Figure 12 – Graph showing incidence of SSI by length of hospital stay. 19
Figure 13 – Graph showing incidence of SSI by length of midwifery care post-procedure. 20
Figure 14 – Graph showing cumulative SSIs up to 14 days post-procedure. Blank infection dates excluded. 21

Summary

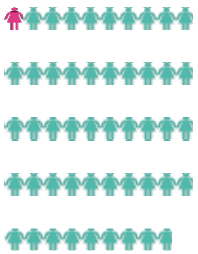
NOTE: The information in this annual report may differ from that found in the quarterly report due to delays in data arriving at Public Health Wales and amendments being made following the publication of the quarterly reports.

SSI rate



1 in 49

mothers had an SSI attributable to their C section procedure



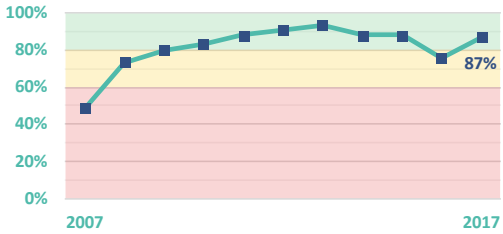
86%

reduction in SSI rate since 2007, which equates to

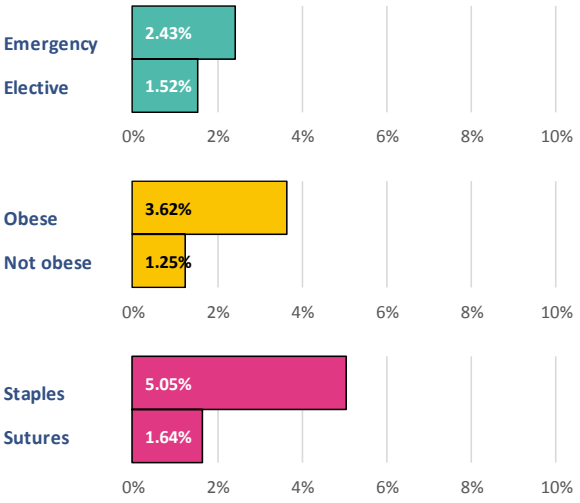
532

infections prevented (based on 2007 rates)

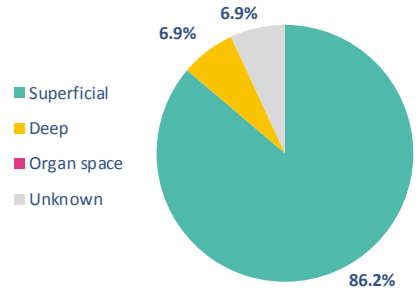
Compliance



Risk factors



Infection type



1643 procedures were performed in 2017 and forms were completed for 90% of these procedures (n=1486). Of these forms, 96% were valid forms that could be used for analysis (n=1430).

There were 29 SSIs reported in 2017, which equates to an SSI rate of 2.0%. 2 of these were complicated infections (deep or organ space), approximately 7% of all infections.

58% of procedures performed in 2017 were emergencies. The SSI rate in emergency procedures was not significantly higher than elective procedures.

Data interpretation

Surgical site infection (SSI) rates in this report are calculated as the number of infections (inpatient and post-discharge) as a proportion of valid procedures. This is reported as a rate per 100 procedures.

$$SSI\ rate\ = \frac{number\ of\ SSI}{number\ of\ valid\ procedures} \times 100\%$$

A valid procedure is one where an SSI is recorded, or one where there is confirmation of no SSI on both inpatient and post-discharge forms. "Number of procedures" refers only to valid procedures, unless otherwise specified.

In keeping with the regular reports, all SSI rates reported in this document are those that occurred up to 14 days post-procedure. Due to the different discharge policies and treatment plans in place at all health boards, we are confident in the consistency of rates up to 14 days, but we are unable to guarantee consistency between hospitals after this point.

Section 1: Data completeness

Compliance

Following a decrease down to moderate compliance in 2016, the health board has increased compliance in 2017 to 87%, with 90% of forms being received.

While this is not as high as the peak in 2013, there were issues at the time with the PEDW dataset, and some hospitals reporting more procedures to us than existed in the PEDW dataset, which indicated that there were coding issues at the hospital.

Table 1 – Coverage of the C section SSI surveillance compared to the expected number of forms.

	2015	2016	2017
Expected number of forms*	1734	1724	1643
Surveillance forms returned	1536	1353	1486
Valid surveillance forms	1530	1308	1430
Forms returned	89%	78%	90%
Valid forms returned	88%	76%	87%

*Total number of procedures performed at hospital, irrespective of whether or not a form was received.

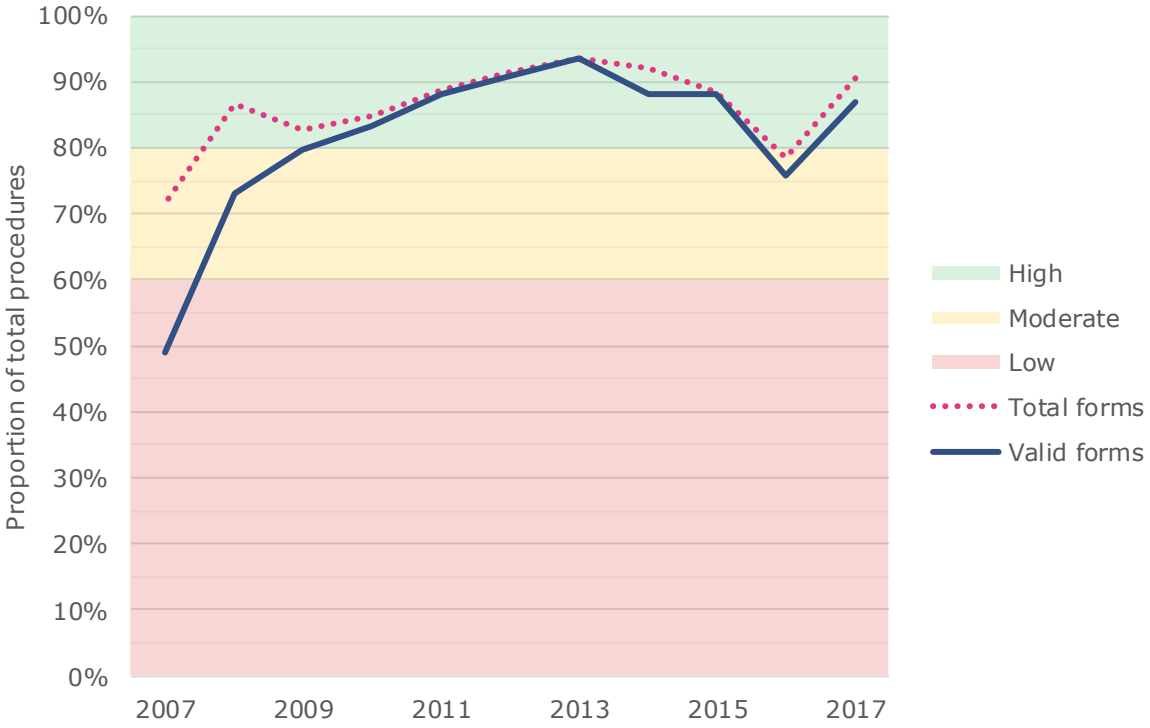


Figure 1 – Trend rate for compliance 2007-2017.

Completion rates of surveillance forms

The vast majority of inpatient forms received at Public Health Wales have a completed SSI status field (where either yes or no are selected), with 1468 of forms having a completed SSI field (of 1486 forms, 98.8%). Following on from these inpatient forms, 97.0% of post-discharge forms were received (1441/1486) with the remaining 3.0% either not sent in at all, or being sent in blank. Of the post discharge forms that were sent in, over 99% had a completed SSI field.

The additional information on post-discharge SSIs (type and date) is provided in most cases, with only a small number of forms missing this information. The additional information is provided less often in the case of inpatient SSIs, however, the numbers involved are too small to extrapolate any real meaning from them.

Table 2 – Completion rates of the SSI field (along with its associated type and infection date fields).

Data Item	Expected	Completed	Proportion
Inpatient SSI (Yes/No)	1486	1468	98.8%
If yes, SSI type	2	2	100.0%
If yes, infection date	2	2	100.0%
Post-discharge SSI* (Yes/No)	1441	1430	99.2%
If yes, SSI type	43	41	95.3%
If yes, infection date	43	43	100.0%

Section 2: SSI rate

Incidence of inpatient, post-discharge and overall SSI

The following table provides the SSI rates separated out as an inpatient and a post-discharge rate. A total of two inpatient SSIs were recorded, giving an inpatient SSI rate of 0.14%. The vast majority of SSIs (93%) occurred following hospital discharge, giving a rate of 1.89%.

The length of hospital stay is shorter now than it was at the start of the surveillance period as more of an emphasis is being placed on community midwifery care. As a result, fewer inpatient SSIs are being identified than previously, and these are instead being picked up in the community.

Table 3 – Incidence of inpatient and post-discharge SSIs.

	No. of procedures	SSI	SSI rate (95% CI)
Inpatient	1430	2	0.14% (0.00-0.33)
Post-discharge	1430	27	1.89% (1.18-2.59)
Overall	1430	29	2.03% (1.30-2.76)

Annual SSI rates

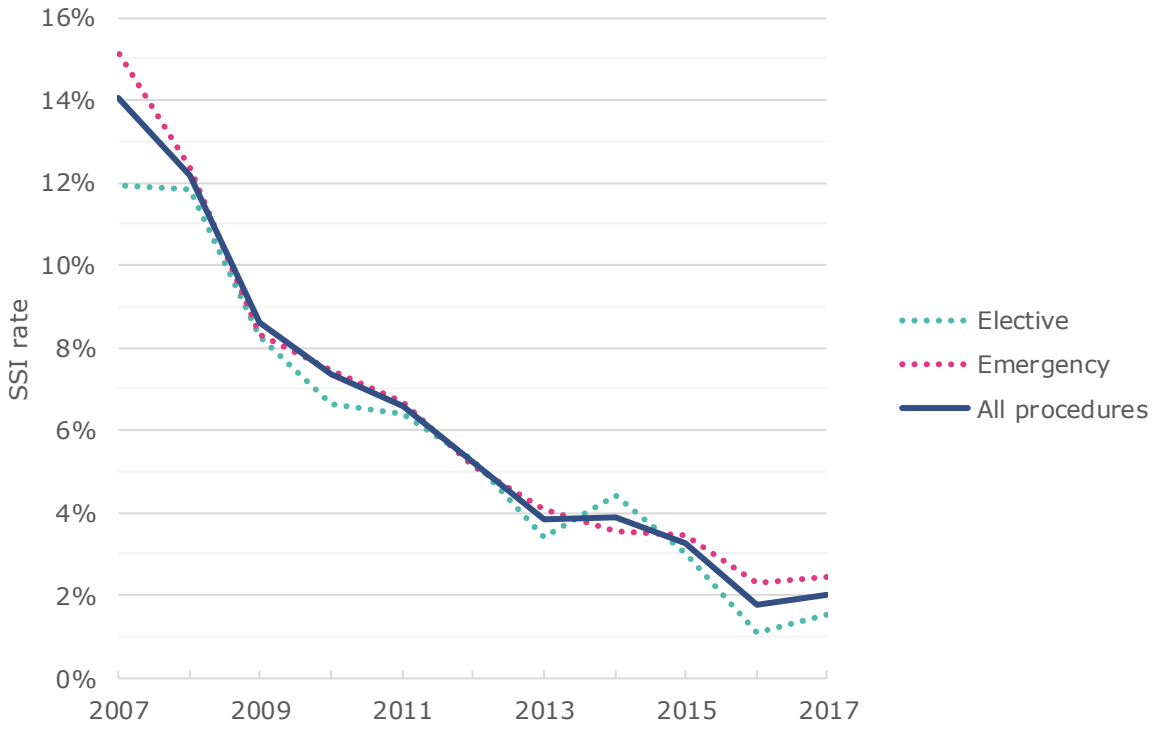


Figure 2 – Overall, elective and emergency SSI rates for 2007-2017

Table 4 – Overall, elective and emergency SSI rates for the last five years. (Unknowns excluded).

Operation type	Year	No. of procedures	SSI	SSI rate (95% CI)
All C-section procedures	2017	1430	29	2.03% (1.30-2.76)
	2016	1308	23	1.76% (1.05-2.47)
	2015	1530	50	3.27% (2.38-4.16)
	2014	1571	61	3.88% (2.93-4.84)
	2013	1687	65	3.85% (2.93-4.77)
Elective	2017	593	9	1.52% (0.53-2.50)
	2016	561	6	1.07% (0.22-1.92)
	2015	661	20	3.03% (1.72-4.33)
	2014	635	28	4.41% (2.81-6.01)
	2013	673	23	3.42% (2.04-4.79)
Emergency	2017	823	20	2.43% (1.38-3.48)
	2016	734	17	2.32% (1.23-3.40)
	2015	865	30	3.47% (2.25-4.69)
	2014	924	33	3.57% (2.37-4.77)
	2013	1001	41	4.10% (2.87-5.32)

The SSI rate at the health board increased this year to 2.03%, however, this is only a slight increase, and follows the general downward trend in rates that has occurred since the start of surveillance in 2007. The SSI rate back in 2007 was 14.05% and, when using this rate as a baseline, there has been a reduction of 86% in the years following. This represents an estimated 532 mothers who have been saved from an infection.

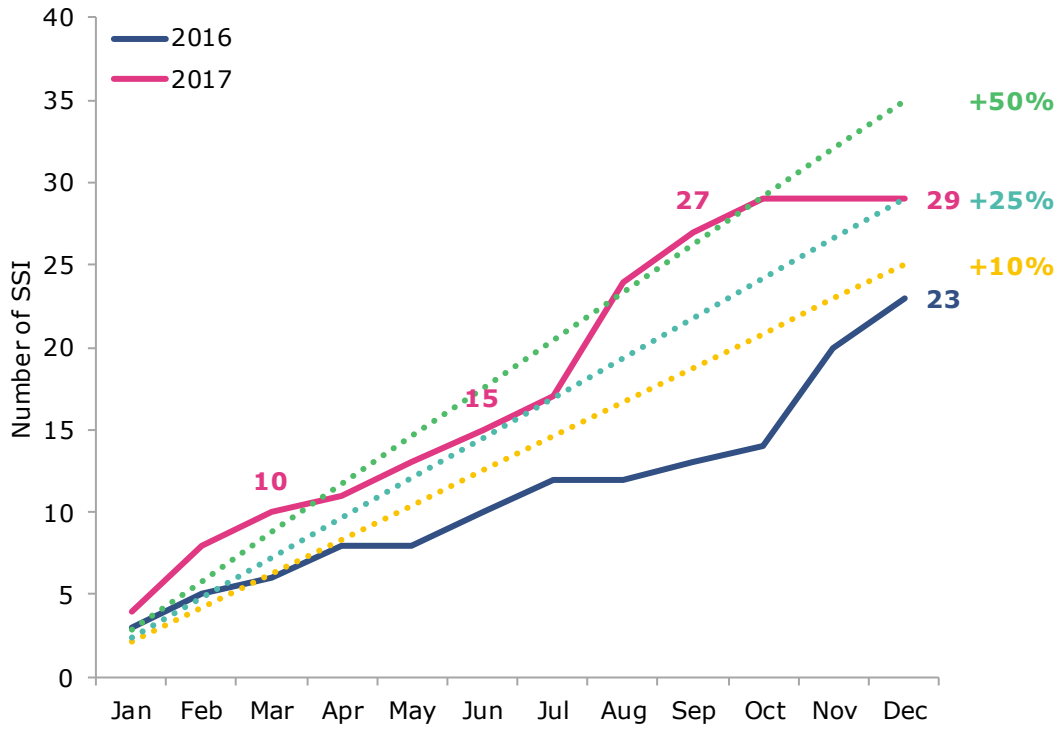


Figure 3 – Cumulative SSI number for the year, and their relative change compared to the previous year.

Throughout the health board, there were 29 SSIs reported in 2017. When compared to the previous year's 23 SSIs, this is an increase of 26% in raw SSI numbers (i.e. without factoring in the denominator) and means there were 6 more infections in 2017 than in 2016.

Incidence of SSI by infection type

The type of SSI recorded on the surveillance form can be categorised into either superficial, deep seated or organ space infections. These all have specific definitions and diagnostic criteria and remain standardised across Europe. The following tables show the split between different SSI types, and their corresponding rates.

Table 5 – Types of SSI in C section procedures by proportion.

SSI type	n	%
Superficial infection	25	86.2%
Deep infection	2	6.9%
Organ space infection	0	0.0%
Unknown	2	6.9%

Table 6 – SSI rates broken down by type.

SSI type	No. of procedures	SSI	SSI rate (95% CI)
Superficial infection	1430	25	1.75% (1.07-2.43)
Deep infection	1430	2	0.14% (0.00-0.33)
Organ space infection	1430	0	0.00% (0.00-0.00)
Unknown	1430	2	0.14% (0.00-0.33)

The split between different types of infection is as expected – the vast majority of infections reported are superficial, with two deep infections, and no organ space infections.

Section 3: Demographics

This section provides information about the mother which is not affected by the procedure itself and is known beforehand; namely age, BMI and the number of prior C section procedures.

Incidence of SSI by age

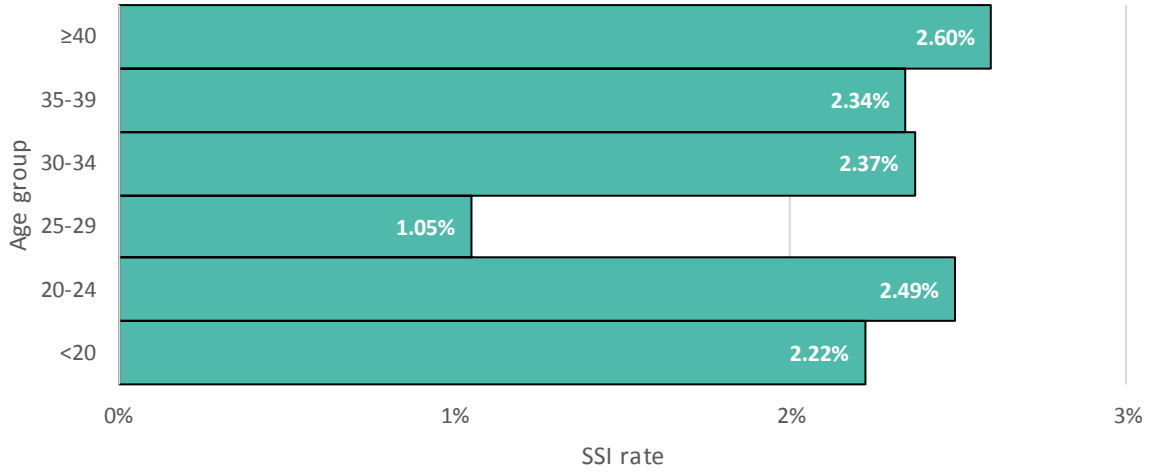


Figure 4 – Graph showing the incidence of SSI by age group.

Table 7 – Incidence of SSI by age group

Age group	No. of procedures	SSI	SSI rate (95% CI)
<20	45	1	2.22% (0.06-11.77)
20-24	241	6	2.49% (0.92-5.34)
25-29	380	4	1.05% (0.29-2.67)
30-34	422	10	2.37% (1.14-4.31)
35-39	256	6	2.34% (0.86-5.03)
≥40	77	2	2.60% (0.32-9.07)
Unknown	9	0	0.00% (0.00-33.63)

In 2017, there were no clear trends in relation to age and SSI rates.

Incidence of SSI by BMI

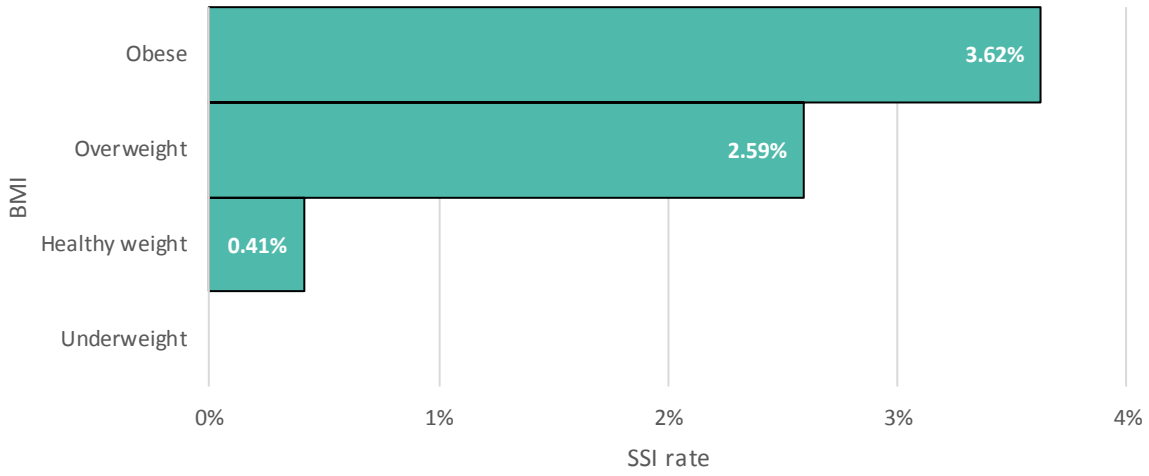


Figure 5 – Graph showing the incidence of SSI by BMI category.

Table 8 – Incidence of SSI by BMI category.

BMI		No. of procedures	SSI	SSI rate (95% CI)
Underweight	<18.5	24	0	0.00% (0.00-14.25)
Healthy weight	18.5-24.9	483	2	0.41% (0.05-1.49)
Overweight	25.0-29.9	386	10	2.59% (1.25-4.71)
Obese	≥30.0	469	17	3.62% (2.13-5.74)
Unknown		68	0	0.00% (0.00-5.28)

In 2017, there was a very clear association between BMI and the probability of having an SSI. The mean BMI for all procedures was 28.6 (median of 26.5), but this went up to 33.2 (median 32) when only those with an SSI were included. When comparing BMI groups, the SSI rate in overweight mothers (including obese mothers) was significantly higher (P=0.001), and this was also true when comparing obese mothers to all other BMI groups (P=0.006).

Incidence of SSI by number of previous C sections

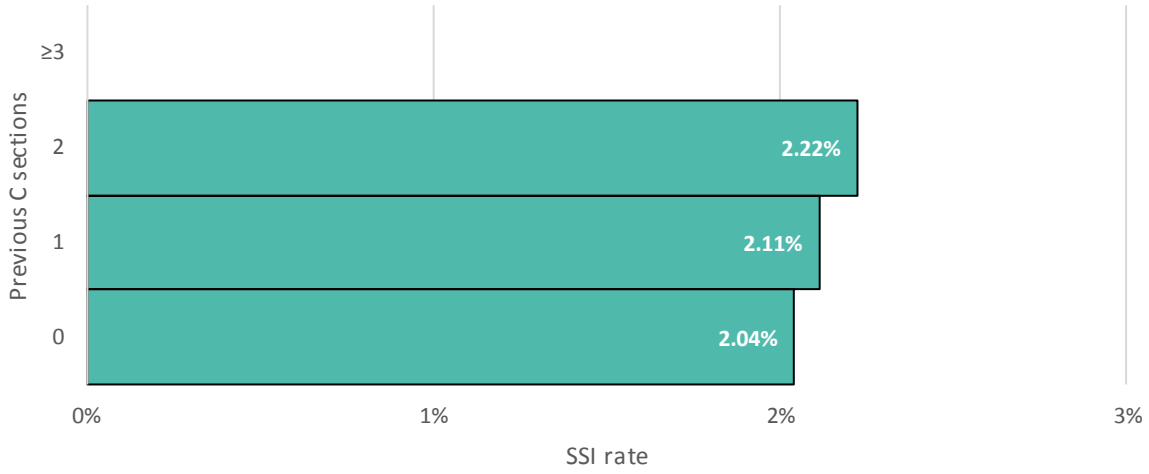


Figure 6 – Graph showing incidence of SSI by the number of previous C sections.

Table 9 – Incidence of SSI by the number of previous C sections.

Previous C sections	No. of procedures	SSI	SSI rate (95% CI)
0	833	17	2.04% (1.19-3.25)
1	426	9	2.11% (0.97-3.97)
2	135	3	2.22% (0.46-6.36)
≥3	31	0	0.00% (0.00-11.22)
Unknown	5	0	0.00% (0.00-52.18)

There is no clear trend in relation to SSI rate and the number of previous C sections.

Section 4: Details of the surgical procedure

The following section provides information on the variables relating to the procedure itself (including procedure type, prophylaxis and skin closure).

SSI risk score

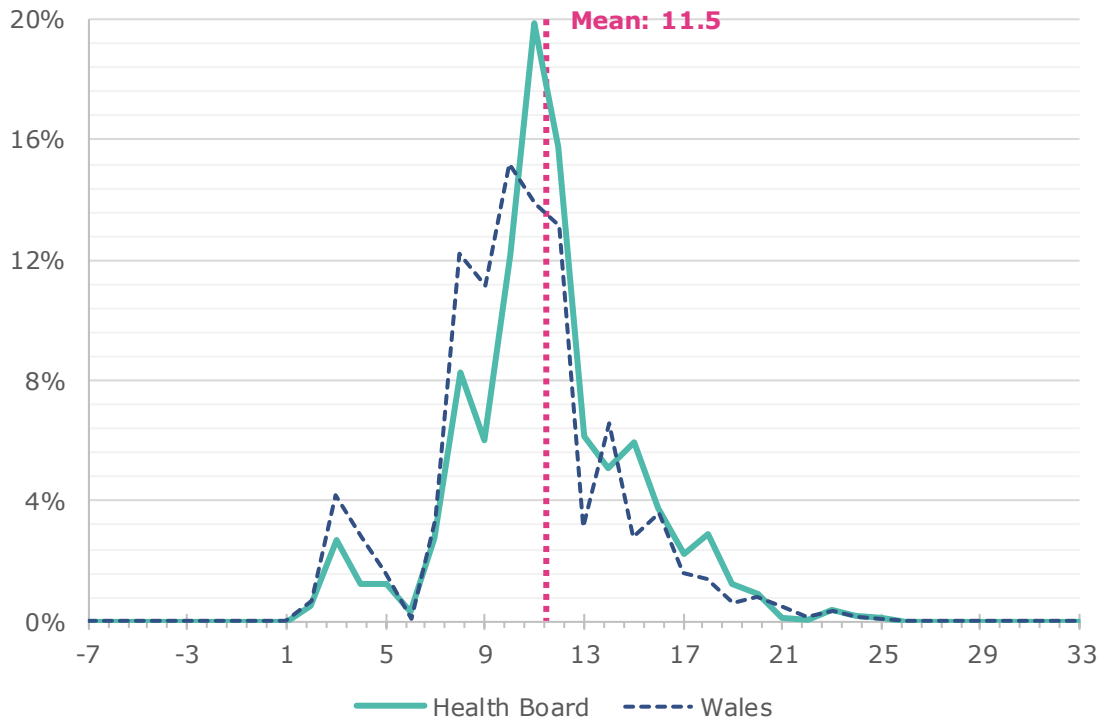


Figure 7 – Graph showing spread of risk score across all procedures (as percentage of all procedures reported). The score has a theoretical range of -7 to 33 for C section procedures in Wales.

The SSI risk score [1] is based on a number of different factors; including procedure type, wound type, ASA class, BMI and procedure duration[1]. This yields a score that categorises mothers by their risk of developing an SSI (with higher scores equating to higher risk).

In 2017, the mean risk score for all mothers undergoing C section at the health board was 11.5 (median 11). When counting only those who have developed an SSI, the mean risk score increases to 13.0 (median 13), which means that mothers who developed an SSI had a significantly higher aggregate risk score than those who did not (P=0.019). The risk profile of the health board was higher than the Wales mean (10.6, median 10).

[1] There are additional metrics used in the calculation of this score which we are unable to use since they are not reported as part of our surveillance. These are the number of concurrent procedures, type of anaesthetic, smoking status, presence of metastatic cancer or peripheral vascular disease, and use of steroids.

Incidence of SSI by procedure type

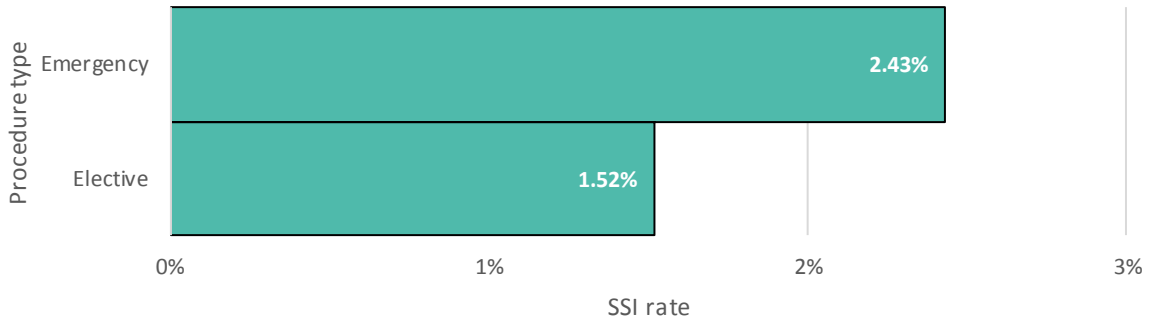


Figure 8 – Graph showing incidence of SSI by type of procedure.

Table 10 – Incidence of SSI by procedure type.

Age group	No. of procedures	SSI	SSI rate (95% CI)
Elective	593	9	1.52% (0.70-2.86)
Emergency	823	20	2.43% (1.49-3.73)
Unknown	14	0	0.00% (0.00-23.16)

In 2017, the SSI rate in emergency procedures was higher than in elective procedures, but not significantly so (60% increase, P=0.232). The procedure split is weighed in favour of emergency procedures (CS1, CS2 and CS3), accounting for 58.1% of procedures, compared to 41.9% being elective (CS4).

Incidence of SSI by antibiotic prophylaxis

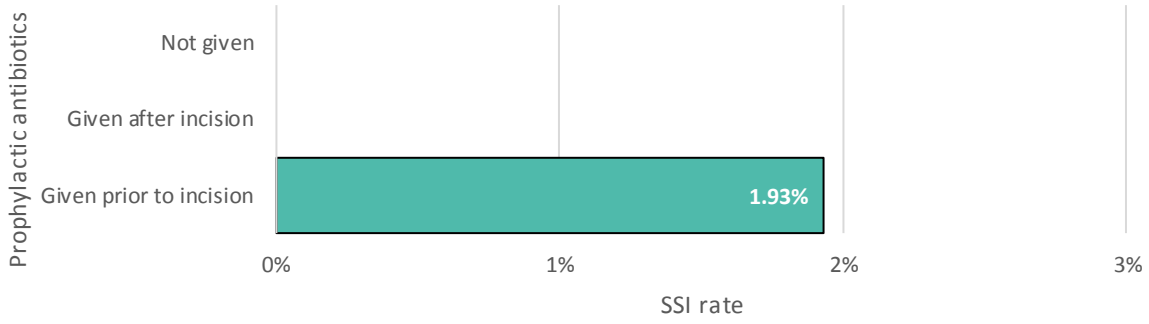


Figure 9 – Graph showing incidence of SSI by timing of prophylactic antibiotics.

Table 11 – Incidence of SSI by timing of prophylactic antibiotics.

Prophylactic antibiotics	No. of procedures	SSI	SSI rate (95% CI)
Given prior to incision	1292	25	1.93% (1.26-2.84)
Given after incision	21	0	0.00% (0.00-16.11)
Not given	8	0	0.00% (0.00-36.94)
Unknown	109	4	3.67% (1.01-9.13)

99.4% of mothers were given prophylactic antibiotics and, of these, 98.4% were given prior to surgical incision. There were no SSIs reported in patients who received antibiotics after incision (or not at all), but this was not a significant trend (P=0.520).

We continue to recommend that antibiotics are administered prior to incision where possible, in accordance with NICE guidelines [2]. It is also worth taking into consideration that the serum half-life of Cefuroxime is 80 minutes, and NICE recommend that a repeat dose is administered when the length of the procedure exceeds this time. (In the case of mothers on second line antibiotics, both Clindamycin and Gentamicin have a serum half-life of two hours).

1st line	If allergic to penicillin
Cefuroxime 1.5g IV	**Clindamycin 600mg IV/PO**
+	**+**
Metronidazole 500mg IV	**Gentamicin 1.5mg/kg IV**

Incidence of SSI by skin closure type

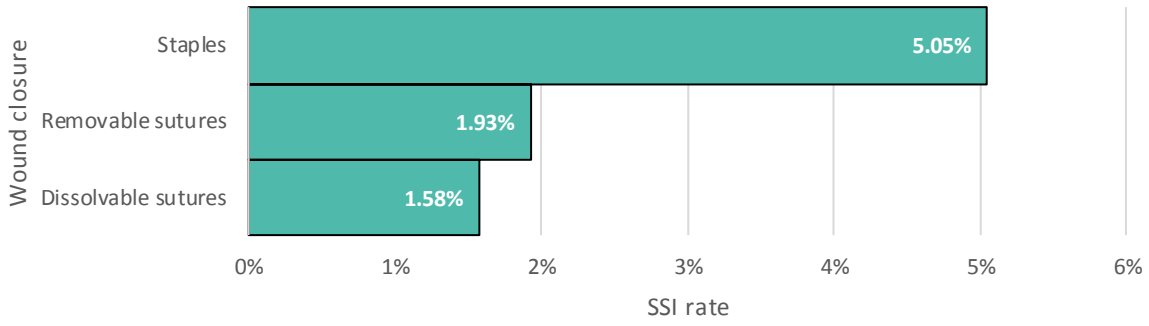


Figure 10 – Graph showing incidence of SSI by type of skin closure used.

Table 12 – Incidence of SSI by type of skin closure.

Type of wound closure	No. of procedures	SSI	SSI rate (95% CI)
Sutures (all types)	1282	21	1.64% (0.94-2.33)
Dissolvable sutures	1075	17	1.58% (0.92-2.52)
Removable sutures	207	4	1.93% (0.53-4.87)
Staples	99	5	5.05% (1.66-11.39)
Unknown	49	3	6.12% (1.28-16.87)

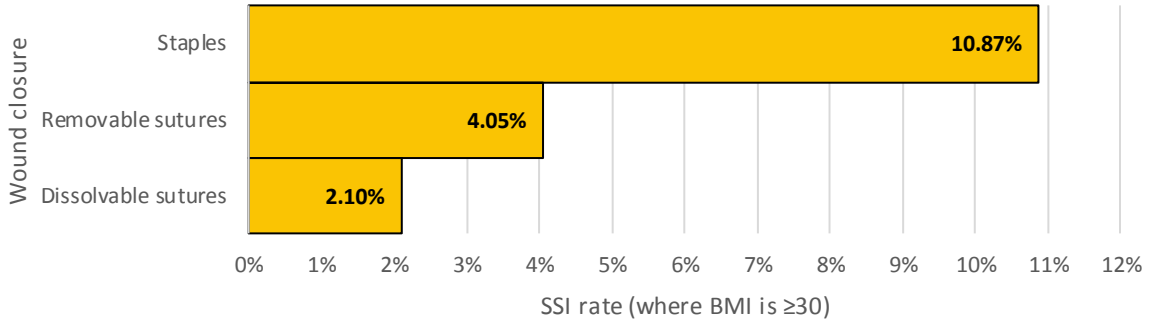


Figure 11 – Graph showing the incidence of SSI by skin closure in mothers with BMI≥30.

Table 13 – Incidence of SSI by type of skin closure in mothers with BMI≥30.

Type of wound closure	No. of procedures	SSI	SSI rate (95% CI)
Sutures (all types)	407	10	2.46% (0.95-3.96)
Dissolvable sutures	333	7	2.10% (0.85-4.28)
Removable sutures	74	3	4.05% (0.84-11.39)
Staples	46	5	10.87% (3.62-23.57)
Unknown	16	2	12.50% (1.55-38.35)

In 2017, the SSI rate when staples were used as a method of skin closure was 208% higher than when sutures were used (P=0.016), and this trend was even more significant when only obese patients were included (increase of 342%, P=0.002).

Section 5: Post-procedure details and onset of infection

This section deals with the time period after the procedure has occurred and the time to onset of infection.

Length of stay in hospital

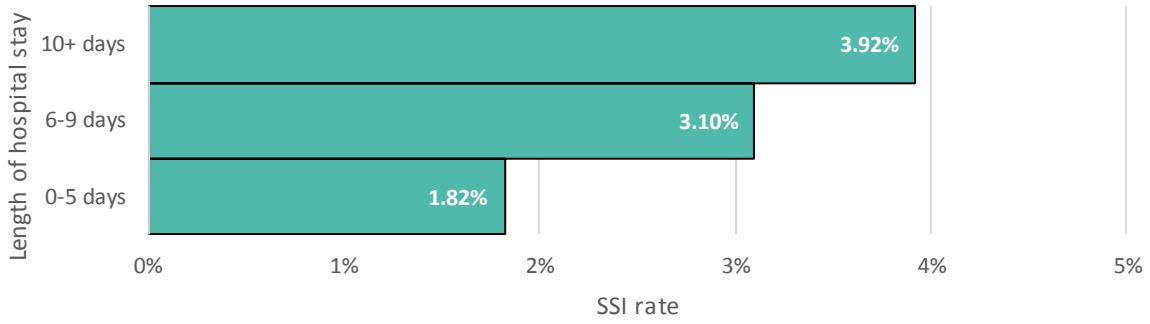


Figure 12 – Graph showing incidence of SSI by length of hospital stay.

Table 14 – Incidence of SSI by length of hospital stay.

Length of hospital stay	No. of procedures	SSI	SSI rate (95% CI)
0-5 days	1099	20	1.82% (1.12-2.80)
6-9 days	129	4	3.10% (0.85-7.75)
10+ days	51	2	3.92% (0.48-13.46)
Unknown	151	3	1.99% (0.41-5.70)

For all patients undergoing a C section, the mean hospital stay following the procedure is 3.8 days (median of 2). When only mothers who have had an SSI are included, this was lower at a mean of 3.2 days (median 2). This trend was not significant (P=0.705).

Length of midwifery care

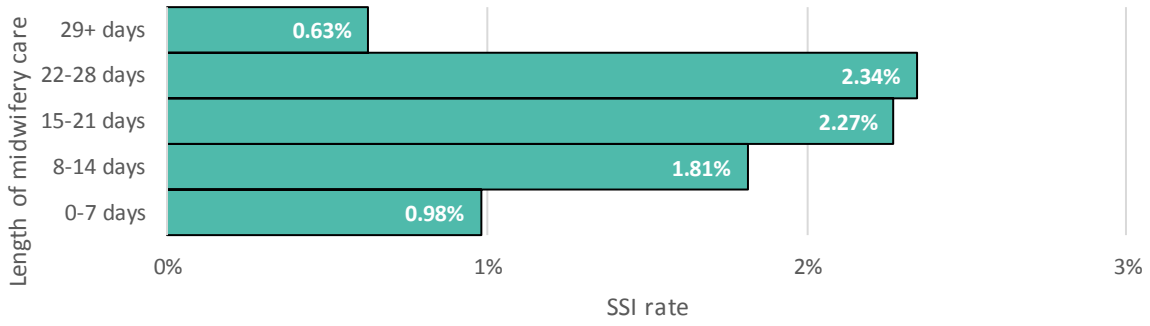


Figure 13 – Graph showing incidence of SSI by length of midwifery care post-procedure.

Table 15 – Incidence of SSI by length of midwifery care post-procedure.

Length of midwifery care	No. of procedures	SSI	SSI rate (95% CI)
0-7 days	102	1	0.98% (0.02-5.34)
8-14 days	386	7	1.81% (0.73-3.70)
15-21 days	308	7	2.27% (0.92-4.63)
22-28 days	256	6	2.34% (0.86-5.03)
29+ days	159	1	0.63% (0.02-3.45)
Unknown	219	7	3.20% (1.29-6.47)

NOTE: All SSIs in this report occurred in the first 14 days post-procedure. Even in mothers who spent 29 or more days in care, the SSI rate does not include any SSIs occurring day 15 or later.

Following the procedure, women spend a mean length of 18.2 days under the care of a midwife (median of 17), including both the time spent in the hospital and the time spent at home with regular visits from a community midwife. If there has been an SSI, this reduces to a mean of 17.9 days (but with a higher median of 19). At the health board level, this trend was not significant (P=0.856).

Time to onset of infection

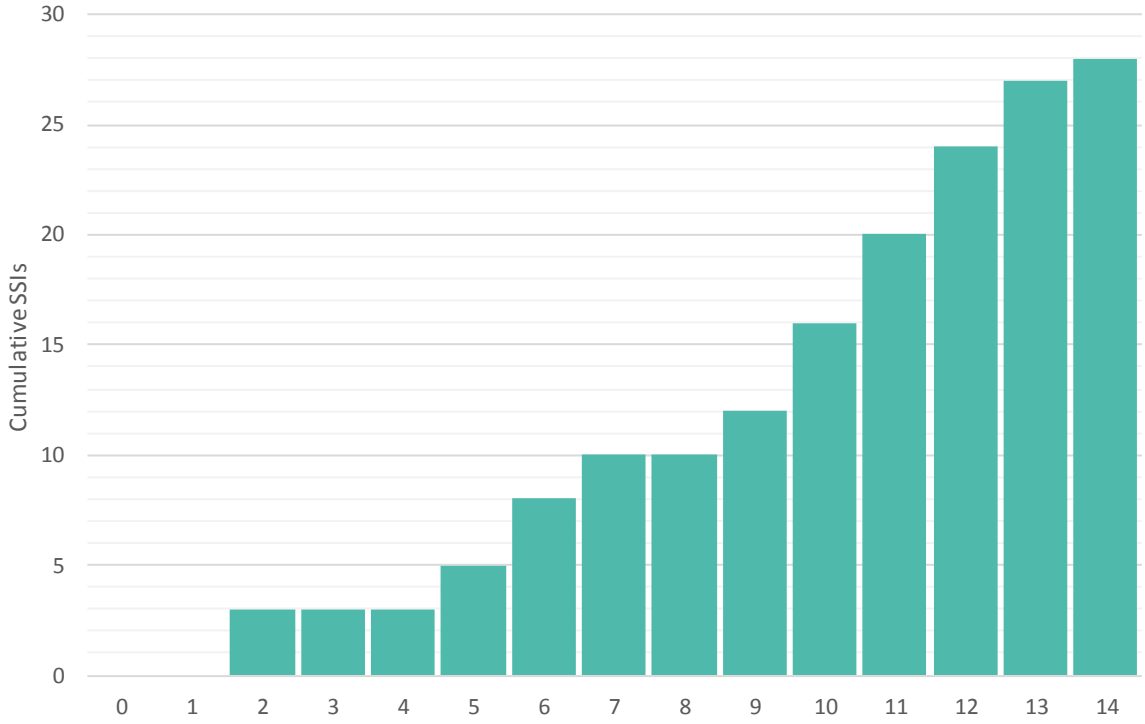


Figure 14 – Graph showing cumulative SSIs up to 14 days post-procedure. Blank infection dates excluded.

While SSIs can be reported on our forms up to 30 days post-procedure, we are only including those up to 14 days for consistency across Wales. Despite this, we do request that hospitals continue reporting up to 30 days as normal, as infections occurring on days 15-30 are still counted and reported to the European Centre for Disease Prevention and Control (ECDC).

Any SSIs reported without an infection date are counted as occurring on day 0 and are included in the SSI rates. There was one (3%) infection where the date of onset was not recorded. Within the first 14 days, the mean time to infection was 9.0 days, with a median of 10. The greatest number of infections were reported on day 10 (n=4).

References

1. van Walraven C, Musselman R. The Surgical Site Infection Risk Score (SSIRS): A Model to Predict the Risk of Surgical Site Infections. PLoS One. 2013; 8(6): p. e67167.

2. National Institute for Health and Care Excellence. Surgical site infections: prevention and treatment. [Online].; 2017 [cited 2018 June 1. Available from: https://www.nice.org.uk/guidance/CG74/chapter/1-Guidance.