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# Caesarean Section Surgical Site Infection Surveillance

**2017 Annual Report:**

**Appendix B:**

**Aneurin Bevan UHB**

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

Version 1

Issued: 31/07/2018

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### **Reference this document as:**

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# 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

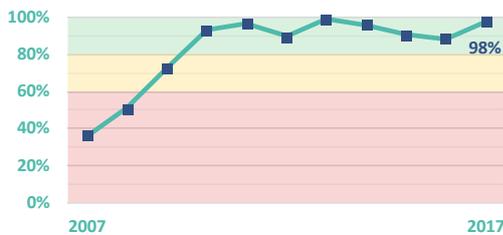


**1 in 17** mothers had an SSI attributable to their C section procedure

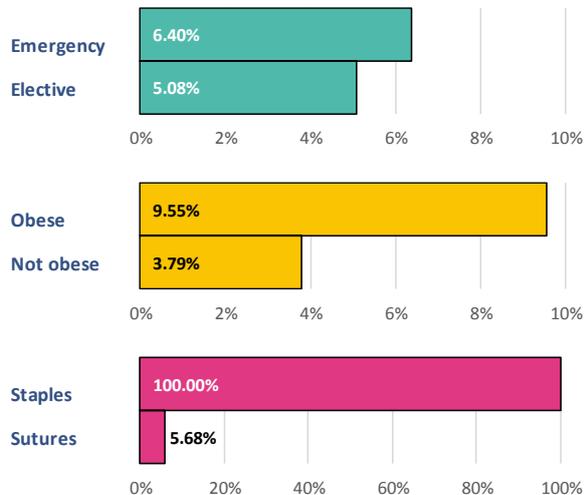


**53%** reduction in SSI rate since 2007, which equates to **509** infections prevented (based on 2007 rates)

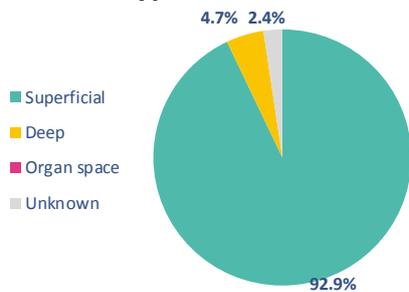
## Compliance



## Risk factors



## Infection type



1492 procedures were performed in 2017 and forms were completed for 98% of these procedures (n=1462). Of these forms, 100% were valid forms that could be used for analysis (n=1462).

There were 85 SSIs reported in 2017, which equates to an SSI rate of 5.8%. 4 of these were complicated infections (deep or organ space), approximately 5% of all infections.

56% of procedures performed in 2017 were emergencies. The SSI rate in emergency procedures was not significantly higher than elective procedures.

## Data interpretation

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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.

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

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

The health board's compliance with the surveillance is excellent, and this year was at a level of 98%, after a moderate drop in compliance between 2013 and 2016. This can be largely attributed to the fact that we receive data from this health board electronically, which means there is limited scope for delayed/missing paperwork and errors when filling out forms, as can sometimes be the case in other health boards.

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

	2015	2016	2017
Expected number of forms*	1545	1515	1492
Surveillance forms returned	1473	1493	1462
Valid surveillance forms	1400	1343	1462
Forms returned	95%	99%	98%
Valid forms returned	91%	89%	98%

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

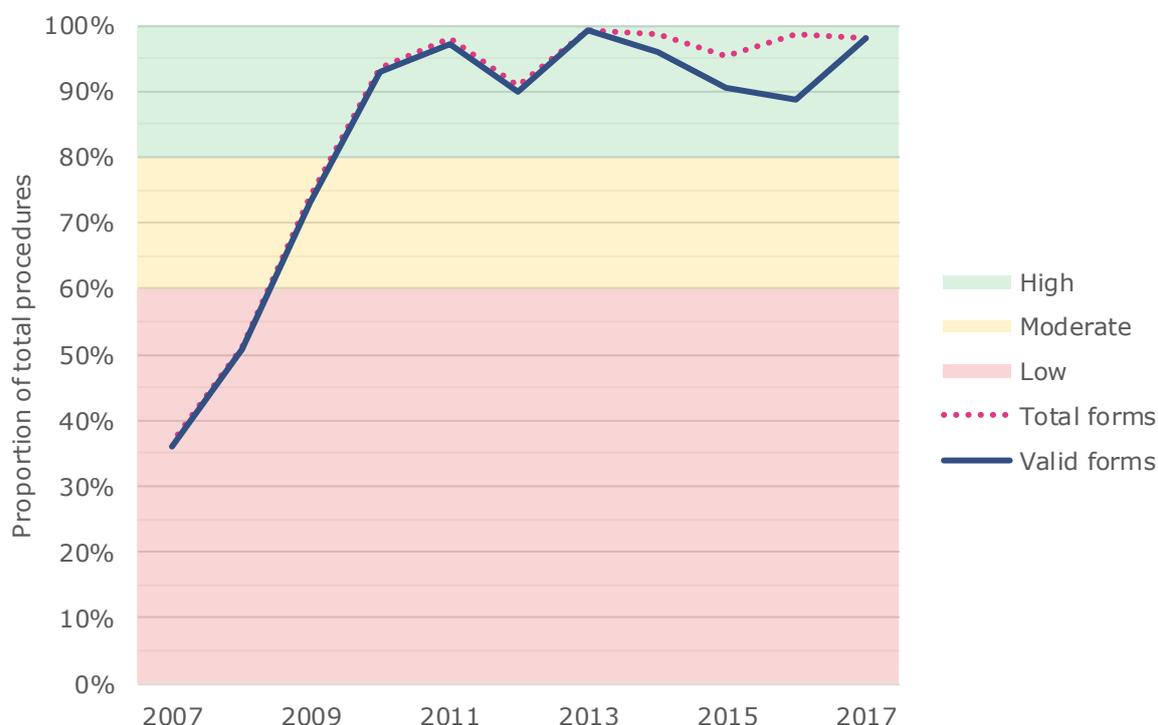


Figure 1 – Trend rate for compliance 2007-2017

## Completion rates of surveillance forms

The vast majority of inpatient records received at Public Health Wales have a completed SSI status field (where either yes or no are selected), with 1434 of records having a completed SSI field (of 1462 forms, 98.1%). Following on from these inpatient records, 100.0% of post-discharge records were received (1462/1462). Of the post discharge records that were sent in, all 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)	1462	1434	98.1%
If yes, SSI type	5	3	60.0%
If yes, infection date	5	0	0.0%
Post-discharge SSI* (Yes/No)	1462	1462	100.0%
If yes, SSI type	155	155	100.0%
If yes, infection date	155	149	96.1%

## 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 five inpatient SSIs were recorded, giving an inpatient SSI rate of 0.34%. The vast majority of SSIs (94%) occurred following hospital discharge, giving a rate of 5.47%.

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	1462	5	0.34% (0.04-0.64)
Post-discharge	1462	80	5.47% (4.31-6.64)
Overall	1462	85	5.81% (4.61-7.01)

### Annual SSI rates

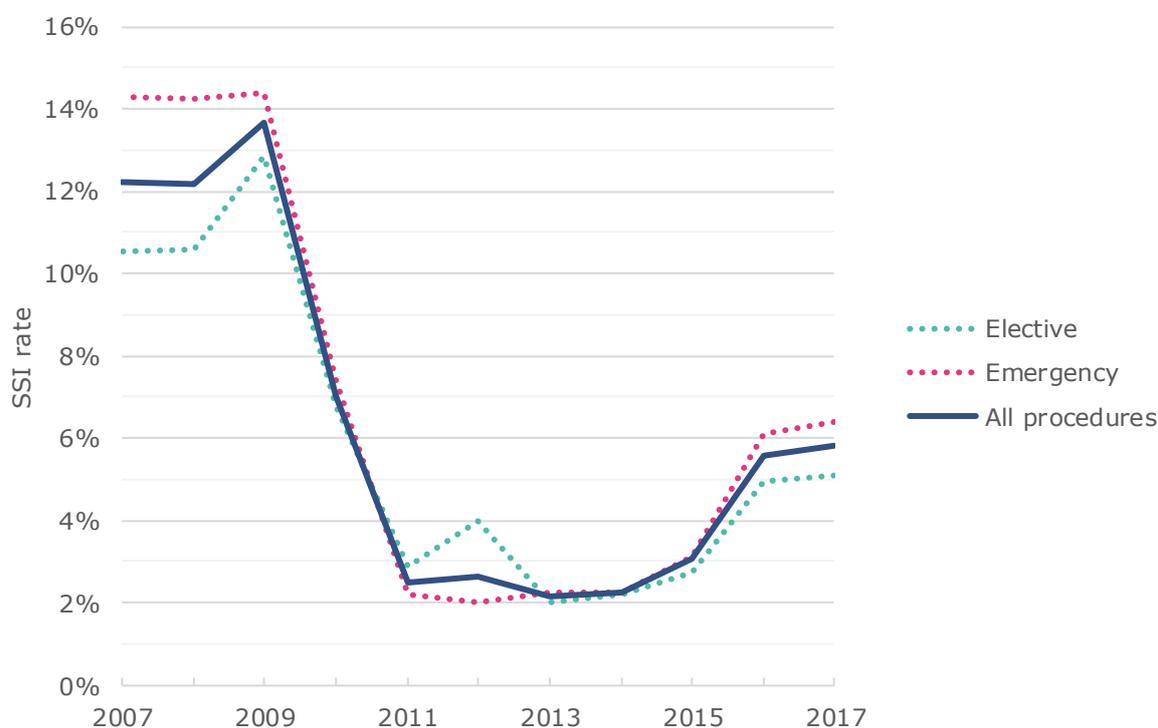


Figure 2 – Overall, elective and emergency SSI rates for 2007-2017

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	1462	85	5.81% (4.61-7.01)
	2016	1343	75	5.58% (4.36-6.81)
	2015	1400	43	3.07% (2.17-3.98)
	2014	1614	36	2.23% (1.51-2.95)
	2013	1728	37	2.14% (1.46-2.82)
Elective	2017	649	33	5.08% (3.39-6.77)
	2016	605	30	4.96% (3.23-6.69)
	2015	581	16	2.75% (1.42-4.08)
	2014	634	14	2.21% (1.06-3.35)
	2013	647	13	2.01% (0.93-3.09)
Emergency	2017	813	52	6.40% (4.71-8.08)
	2016	738	45	6.10% (4.37-7.82)
	2015	799	25	3.13% (1.92-4.34)
	2014	976	22	2.25% (1.32-3.19)
	2013	1057	24	2.27% (1.37-3.17)

The SSI rate at the health board decreased until 2011, and then plateaued for a few years, but the rate is now increasing and has reached 5.81% this year. Based on some recent audits conducted at the health board, this could be due to a tendency to over report infections.

Despite this increase, the SSI rate is still lower than the 12.24% when surveillance started in 2007. When using this 2007 rate as a baseline, there has been a reduction of 53% in the years following. This represents an estimated 509 mothers who have been saved from an infection.

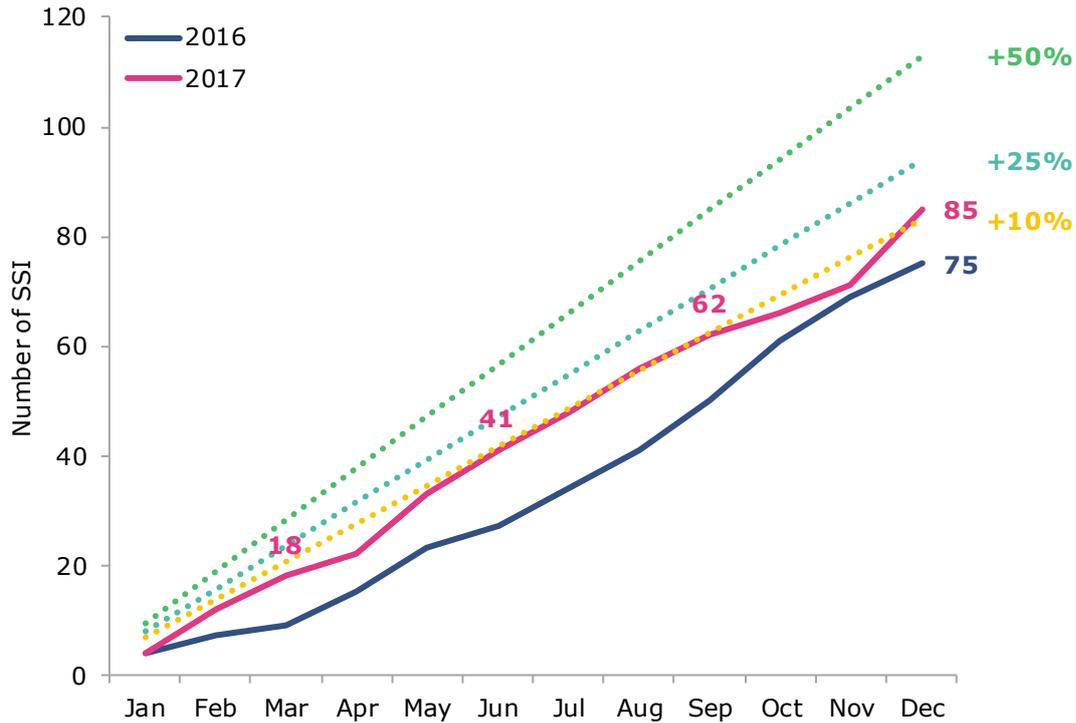


Figure 3 – Cumulative SSI number for the year, and their relative change compared to the previous year.

Throughout the health board, there were 85 SSIs reported in 2017. When compared to the previous year’s 75 SSIs, this is an increase of 13% in raw SSI numbers (i.e. without factoring in the denominator) and means there were 10 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	79	92.9%
Deep infection	4	4.7%
Organ space infection	0	0.0%
Unknown	2	2.4%

Table 6 – SSI rates broken down by type.

SSI type	No. of procedures	SSI	SSI rate (95% CI)
Superficial infection	1462	79	5.40% (4.24-6.56)
Deep infection	1462	4	0.27% (0.01-0.54)
Organ space infection	1462	0	0.00% (0.00-0.00)
Unknown	1462	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 four 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

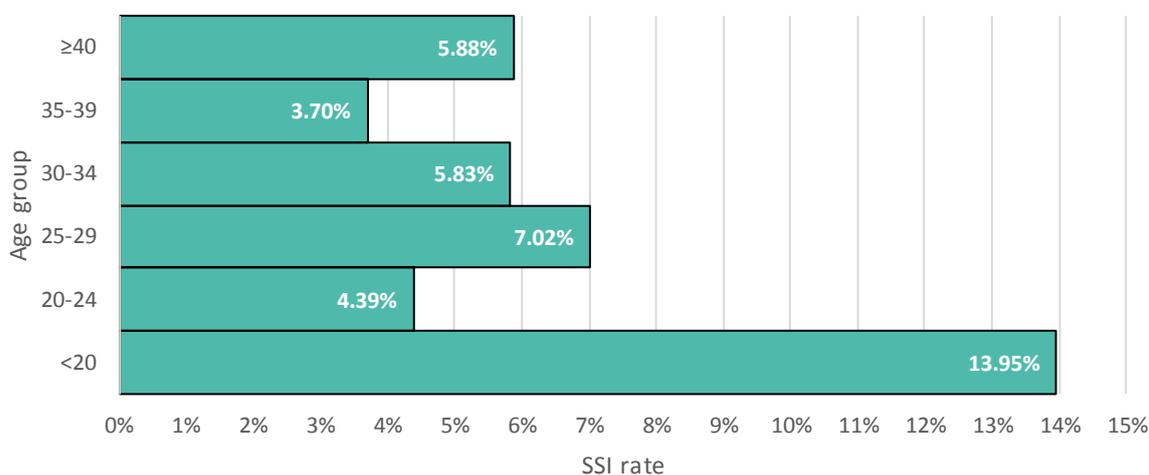


Figure 4 – Graph showing the incidence of SSI by age group.

Table 7 – Incidence of SSI by age group

Age group	No. of procedures	SSI	SSI rate (95% CI)
<20	43	6	13.95% (5.30-27.93)
20-24	205	9	4.39% (2.03-8.17)
25-29	413	29	7.02% (4.75-9.93)
30-34	463	27	5.83% (3.88-8.37)
35-39	270	10	3.70% (1.79-6.71)
≥40	68	4	5.88% (1.63-14.38)
Unknown	0	0	0.00% (0.00-0.00)

In 2017, there was a substantially higher SSI rate in women under the age of 20, however, this age group is the smallest and the sample size could be a contributory factor. Unlike in the All Wales aggregate data, age does not appear to be a significant factor in the probability of having an SSI ( $P=0.121$ ), although this could be due to the relatively small number of SSIs. The entire sample group had a mean age of 30.2 (median 30), and this was slightly lower at 29.2 when only including those who had an SSI (median 29).

## Incidence of SSI by BMI

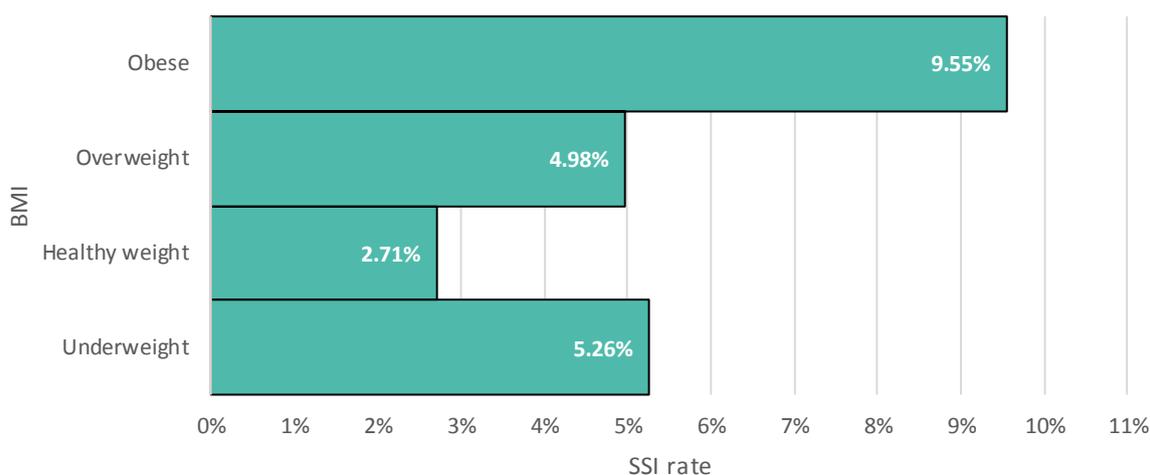


Figure 5 – Graph showing the incidence of SSI by BMI category.

Table 8 – Incidence of SSI by BMI category.

BMI	No. of procedures	SSI	SSI rate (95% CI)	
Underweight	<18.5	19	1	5.26% (0.13-26.03)
Healthy weight	18.5-24.9	479	13	2.71% (1.45-4.60)
Overweight	25.0-29.9	402	20	4.98% (3.07-7.58)
Obese	≥30.0	513	49	9.55% (7.15-12.43)
Unknown		49	2	4.08% (0.50-13.98)

In 2017, there was a very clear association between BMI and the probability of having an SSI. The mean BMI for all procedures was 29.1 (median of 27.3), but this went up to 32.7 (median 32.4) when only those with an SSI were included (but this trend at the health board level was just short of significance at  $P=0.056$ ). 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 ( $P<0.001$ ). The sample group of underweight patients was too small to show any significant trends ( $P=0.909$ ).

## Incidence of SSI by number of previous C sections

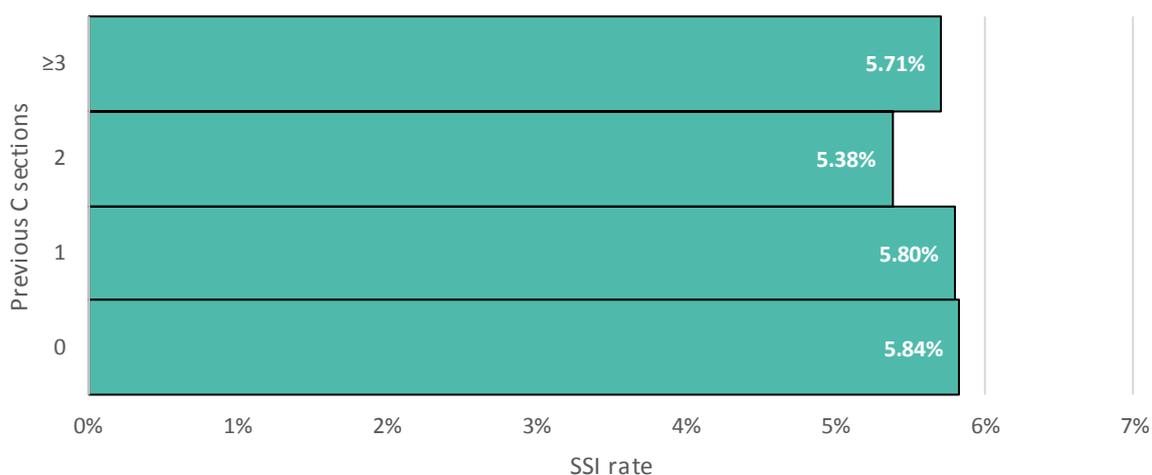


Figure 6 – Graph showing incidence of SSI by the number of previous C sections.

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

Previous C sections	No. of procedures	SSI	SSI rate (95% CI)
0	891	52	5.84% (4.39-7.58)
1	379	22	5.80% (3.67-8.66)
2	130	7	5.38% (2.19-10.78)
≥3	35	2	5.71% (0.70-19.16)
Unknown	27	2	7.41% (0.91-24.29)

When comparing the number of C sections a mother has undergone prior to the current procedure, there are no apparent trends and the SSI rate is fairly consistent across these groups.

## 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

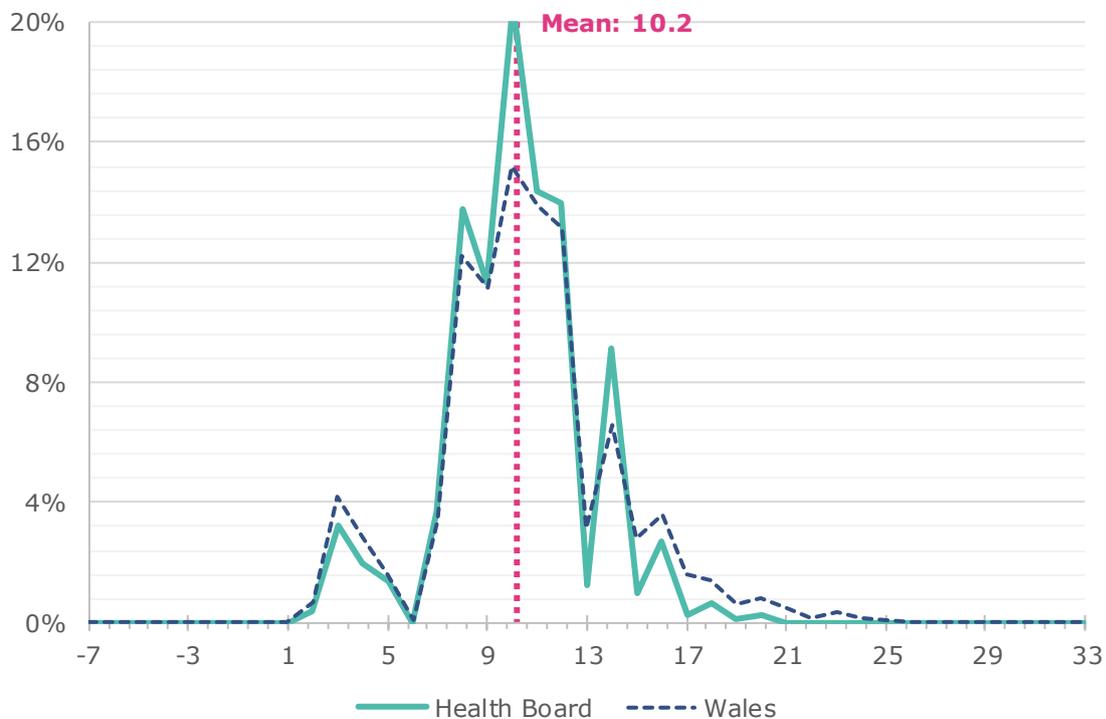


Figure 7 – Graph showing spread of risk score across all procedures (as percentage of all procedures reported). The score has a theoretical range of -7 to 33 for C section procedures in Wales.

The SSI risk score [1] is based on a number of different factors; including procedure type, wound type, ASA class, BMI and procedure duration<sup>1</sup>. 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 10.2 (median 10). When counting only those who have developed an SSI, the mean risk score increases to 11.3 (median 11), which means that mothers who developed an SSI had a significantly higher aggregate risk score than those who did not ( $P < 0.001$ ). The risk profile of the health board was slightly lower than the Wales mean (10.6, median 10).

<sup>1</sup> 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

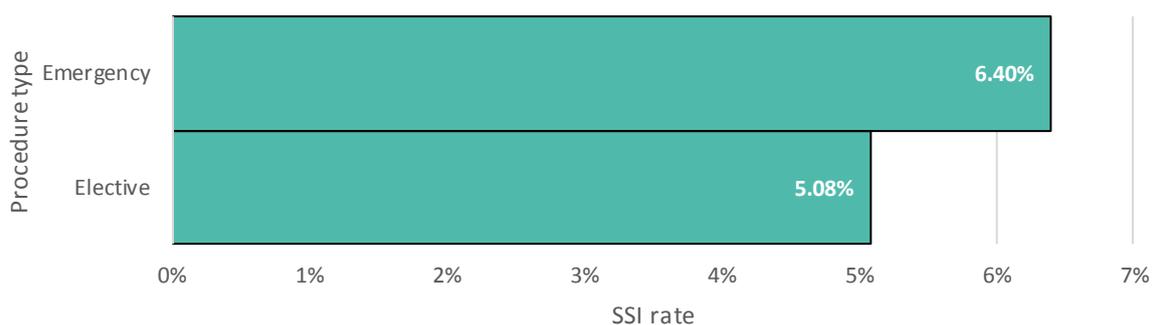


Figure 8 – Graph showing incidence of SSI by type of procedure.

Table 10 – Incidence of SSI by procedure type.

Age group	No. of procedures	SSI	SSI rate (95% CI)
Elective	649	33	5.08% (3.53-7.07)
Emergency	813	52	6.40% (4.81-8.30)
Unknown	0	0	0.00% (0.00-0.00)

In 2017, the SSI rate in emergency procedures was higher than in elective procedures, but not significantly so (26% increase,  $P=0.287$ ). The split of procedures is fairly even, with 44.4% of procedures being classed as emergencies (CS1, CS2 and CS3) and the remaining 55.6% being classed as elective (CS4). Emergency procedures are more common at the All Wales level.s

## Incidence of SSI by antibiotic prophylaxis

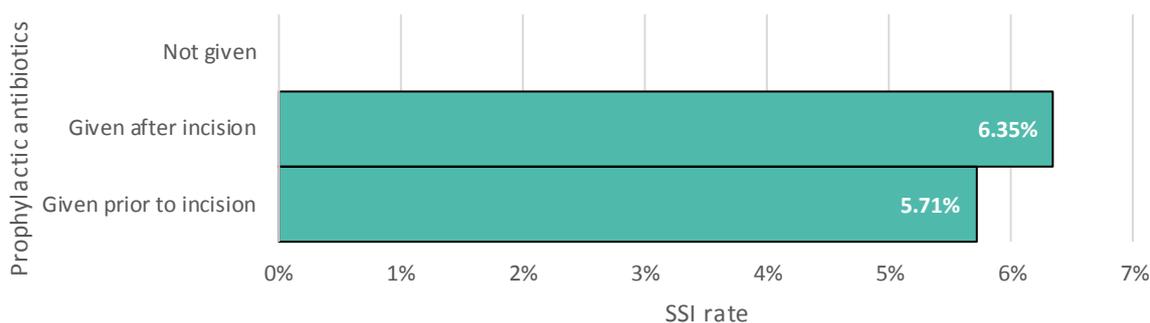


Figure 9 – Graph showing incidence of SSI by timing of prophylactic antibiotics.

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

Prophylactic antibiotics	No. of procedures	SSI	SSI rate (95% CI)
Given prior to incision	1383	79	5.71% (4.55-7.07)
Given after incision	63	4	6.35% (1.76-15.47)
Not given	0	0	0.00% (0.00-0.00)
Unknown	16	2	12.50% (1.55-38.35)

All mothers were given prophylactic antibiotics and, of these, 95.6% were given prior to surgical incision. There is a slightly higher SSI rate when antibiotics are administered after incision, but this was not significant (11% increase,  $P=0.832$ ).

Despite this increase not being statistically significant, 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

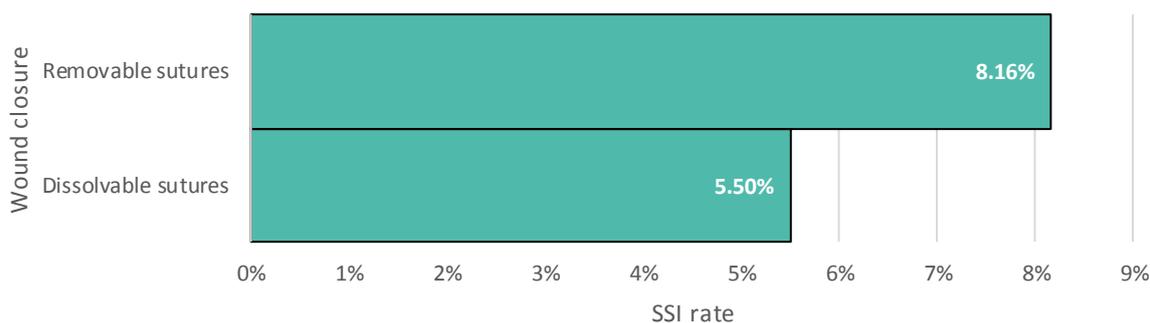


Figure 10 – Graph showing incidence of SSI by type of skin closure used.

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)	1443	82	5.68% (4.49-6.88)
Dissolvable sutures	1345	74	5.50% (4.34-6.86)
Removable sutures	98	8	8.16% (3.59-15.45)
Staples	1	1	100.00% (2.50-100.00)
Unknown	18	2	11.11% (1.38-34.71)

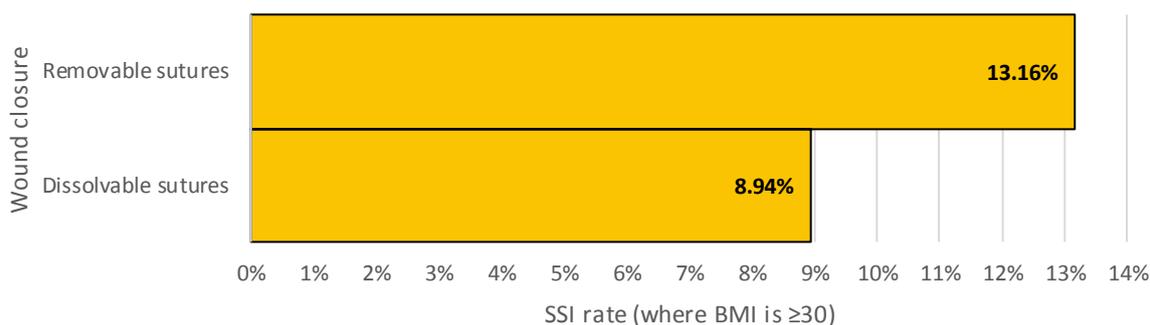


Figure 11 – Graph showing the incidence of SSI by skin closure in mothers with BMI ≥ 30.

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)	508	47	9.25% (6.73-11.77)
Dissolvable sutures	470	42	8.94% (6.52-11.89)
Removable sutures	38	5	13.16% (4.41-28.09)
Staples	1	1	100.00% (2.50-100.00)
Unknown	4	1	25.00% (0.63-80.59)

In 2017, only one patient at the health board had staples as a method of skin closure, and this one patient developed an SSI (giving staples an SSI rate of 100%). As a result, it is not shown on the graph.

## 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

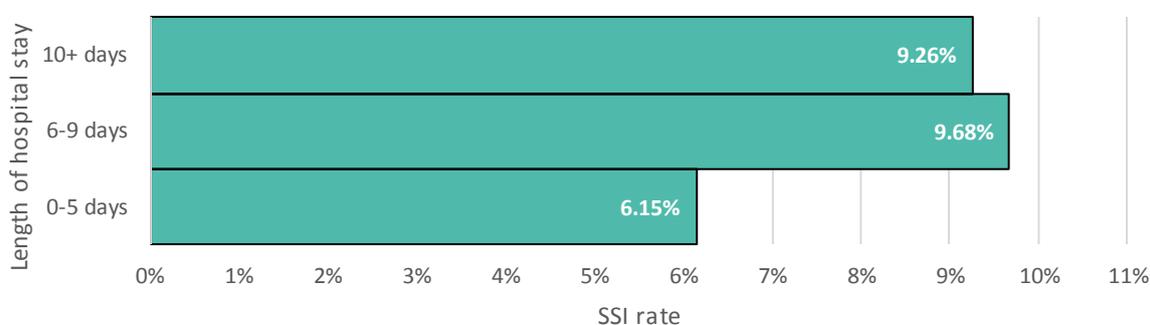


Figure 12 – Graph showing incidence of SSI by length of hospital stay.

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	699	43	6.15% (4.49-8.20)
6-9 days	31	3	9.68% (2.04-25.75)
10+ days	108	10	9.26% (4.53-16.37)
Unknown	624	29	4.65% (3.13-6.61)

For all patients undergoing a C section, the mean hospital stay following the procedure is 7.9 days (median of 2). When only mothers who have had an SSI are included, this was lower at a mean of 10.3 days (median 2). This trend was not significant ( $P=0.225$ ). The large variation between the mean and the median indicates that most patients have short hospital stays lasting a few days, with some patients having extended inpatient stays due to complications relating to the pregnancy (not necessarily related to any SSIs).

## Length of midwifery care

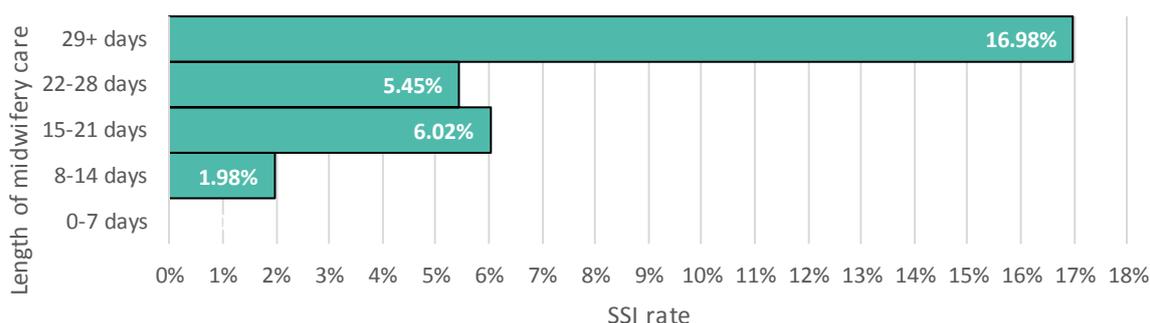


Figure 13 – Graph showing incidence of SSI by length of midwifery care post-procedure.

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	3	0	0.00% (0.00-70.76)
8-14 days	101	2	1.98% (0.24-6.97)
15-21 days	249	15	6.02% (3.41-9.74)
22-28 days	257	14	5.45% (3.01-8.97)
29+ days	53	9	16.98% (8.07-29.80)
Unknown	799	45	5.63% (4.14-7.46)

**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 21.1 days under the care of a midwife (median of 21), 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 rises to a mean of 23.5 days (median of 23.5) indicating that SSIs are causing women to be under midwifery care for longer than they would be otherwise. At the health board level, this trend was significant ( $P=0.014$ ).

## Time to onset of infection

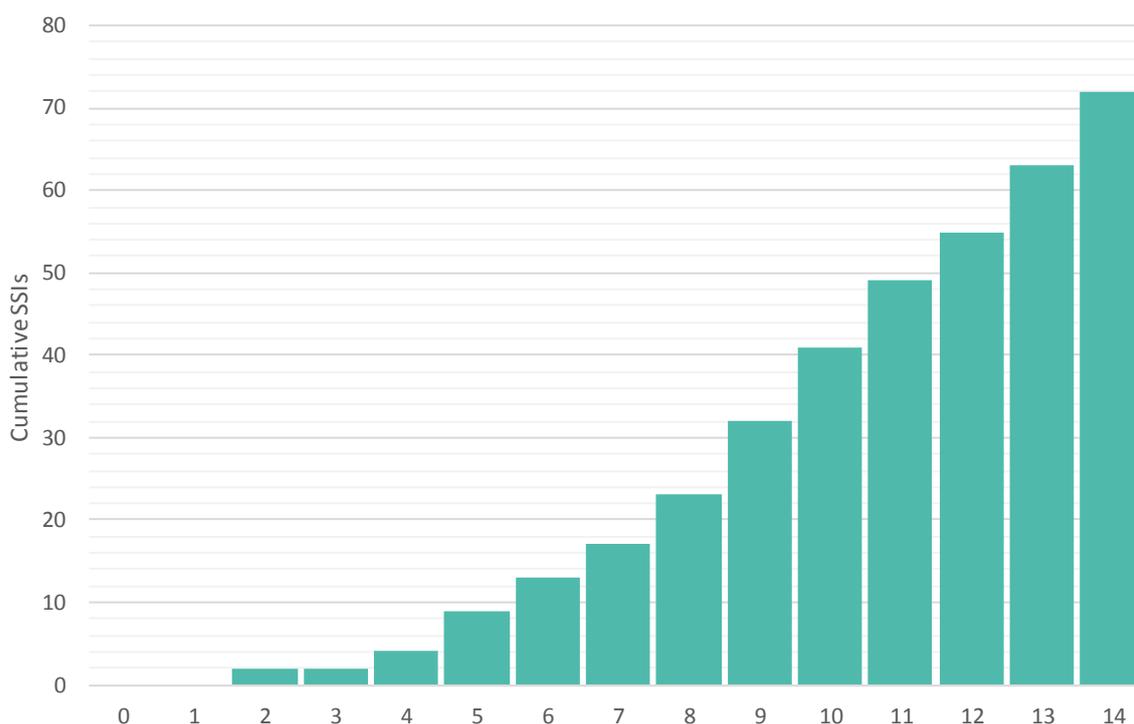


Figure 14 – Graph showing cumulative SSIs up to 14 days post-procedure. Blank infection dates excluded.

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 were 13 (15%) infections where the date of onset was not recorded. Within the first 14 days, the mean time to infection was 9.7 days, with a median of 10. The greatest number of infections were reported on day 9 (n=9).

## 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>.