



Caesarean-Section Surgical Site Infection Surveillance

Annual report All Wales

Includes data from 01/01/2016 – 31/12/2016

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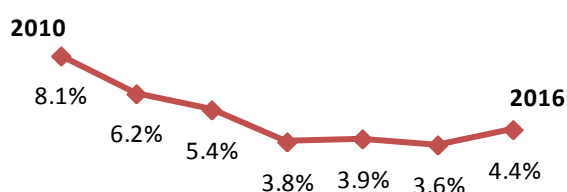
2016 Summary

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.

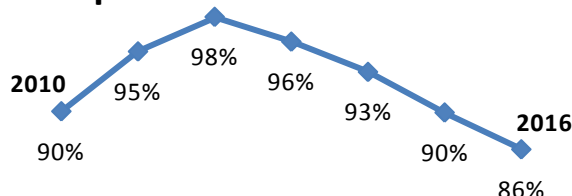
7,220 forms were received in 2016 and, of these forms, 7,051 (98.2%) of them were valid forms that could be used for analysis. Where an inpatient form was received, an associated post-discharge form was received on 97.7% of occasions (7,089). All Wales compliance was 86%.

The surgical site infection (SSI) rate in 2016 (4.4%) was higher than in 2015 (3.6%). The most recent year with a higher SSI rate was 2012 (5.4%).

SSI rate



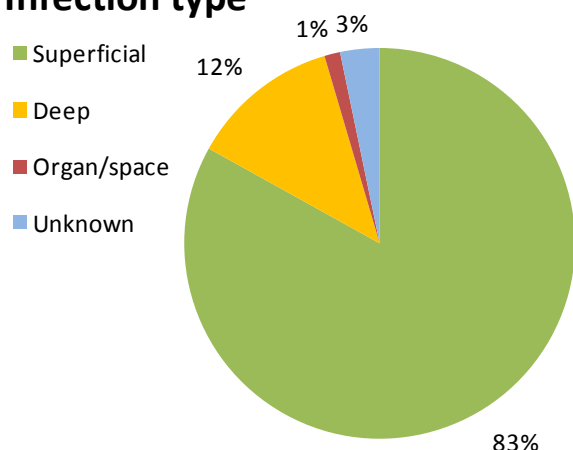
Compliance



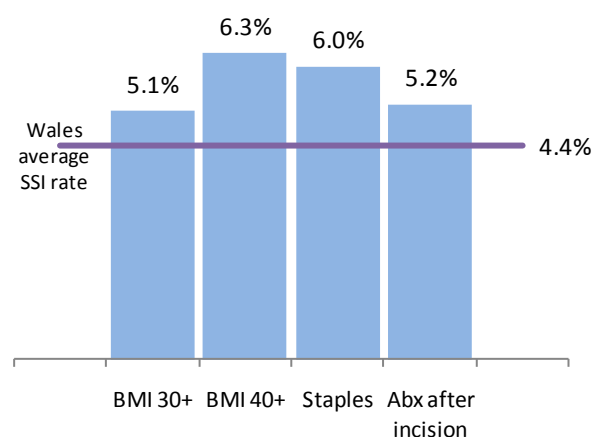
307 infections were reported, of which the most common type of infection was superficial (255, 83% of the total SSIs).

The SSI rate was higher than the Wales average (4.4%) in overweight patients (BMI 30+, 5.1%), obese patients (BMI 40+, 6.3%), patients whose incisions were closed using staples (6.0%), and patients who received antibiotics after the surgical incision (5.2%).

Infection type



Risk factors



Introduction

The Healthcare Associated Infections team within the Communicable Disease Surveillance Centre (CDSC; part of the Public Health Wales Health Protection division) were instructed by the Welsh Government to develop and support the implementation of surveillance following Caesarean section procedures undertaken in NHS hospitals in Wales, which was a mandatory process from January 2006.

Surgical Site Infection (SSI) is an important area for surveillance and remains a complication of surgery where human and financial costs are high [1] [2]. Additionally, most infections are preventable [3]. An SSI is the second most common infection following a C-section, within a group of patients who are generally considered to be young, fit and well females [4].

Serious patient consequences can result from SSIs, including pain, suffering and, on some occasions, they require additional surgical interventions [4]. It is important to recognise that SSIs can range from a relatively trivial wound discharge with no other complications, to a life-threatening condition. Other clinical outcomes of SSIs include poor scars that are cosmetically unacceptable, persistent pain and itching, restriction of movement, particularly when over joints, and a significant impact on emotional wellbeing.

This report includes data captured both during the hospital stay and post-discharge within the community. The surveillance incorporates data collected by clinical teams and midwives and uses internationally agreed definitions [5], allowing Welsh data to be compared with and incorporated into other international databases, such as the ECDC European SSI database. This report details results obtained for surveillance data captured in 2016.

Switch to 14 day surveillance

All the SSI numbers and rates in this report are based on 14 day SSI status. This rate will be different to the previously reported 30 day SSI status. This change is being introduced for increased consistency in SSI rates between different hospitals and across different time periods, as the timeframe for discharging patients from community midwifery care varies across sites. We know that all health boards are following patients up at 14 days, but not all are following up past this point.

Any historic data in this annual report (i.e. years prior to 2016) are showing 14 day SSI status, and the last issued quarterly report (quarter 4, 2016) also includes 14 day SSI status.

We would like to stress that all hospitals should continue to report SSIs and return forms in the same manner as previously, as we are determining SSI status at the data analysis stage using the infection dates. Any hospitals following up patients for longer than 14 days should continue to do so, and SSIs occurring after 14 days should still be reported. Where there is an infection, ***it is important that the infection date is filled out*** – we currently receive a number of forms where this information is missing and, as a result, we must assume that these infections have occurred within the 14 day period.

Section 1: Results

Surveillance form returns

Table 1.1 Number of inpatient, post-discharge and valid forms returned for the surveillance in 2016.

No. of inpatient forms returned	No. of expected post-discharge forms	No. of post-discharge forms returned (% forms returned)	No. of valid forms used for data analysis*	% of valid forms used for data analysis*
7220	7220	7089 (98.2)	7051	97.7 (7051/7220)

*Valid forms are forms where the SSI field is completed on the main (inpatient) form, or the infection data is subsequently updated at completion of a post-discharge form. A blank SSI field cannot be assumed to mean there is no infection, so these forms are considered invalid.

$$\% \text{ of valid forms} = \frac{\text{Number of valid forms analysed}}{\text{Number of inpatient forms received}} \times 100$$

Of the 7220 inpatient forms returned for 2016, 98.2% (7089/7220) had a corresponding post-discharge form. Some of the forms had an incomplete SSI field, reducing the number of valid forms available for inclusion in the data analysis to 97.7%. The percentage of valid forms in 2016 was higher than in 2015 (98.7%).

Completion rates of surveillance forms

Details on the completion of the SSI field on the inpatient and post-discharge form for all Wales is shown in table 1.2. The procedure date has not been included as a data item in table 1.2 since all data extractions are based on a record having a procedure date. All data items were completed above 85% for Wales as a whole.

Table 1.2 % completion of the SSI field on the C-section surveillance form (inpatient and post-discharge) for Wales (2016).

Data Item	No. completed	No. expected	% complete
Inpatient SSI (Yes/No)	7110	7220	98.5
If Yes, SSI type	18	23	78.3
If Yes, Infection date	14	23	60.9
Post-discharge SSI* (Yes/No)	7054	7110	99.2
If Yes, Infection date	266	287	92.7
If Yes, SSI type	265	287	92.3

*Number expected is based on the number of post-discharge forms received.

Surveillance compliance

Table 1.3 shows the compliance of Wales in the mandatory C-section surveillance for 2016. The table includes the number of surveillance forms returned to Public Health Wales for 2016 and the number of valid surveillance forms returned (as detailed in table 1.1). The compliance figure is derived from the number of valid surveillance forms returned to Public Health Wales divided by the number of C-sections performed at the hospital.

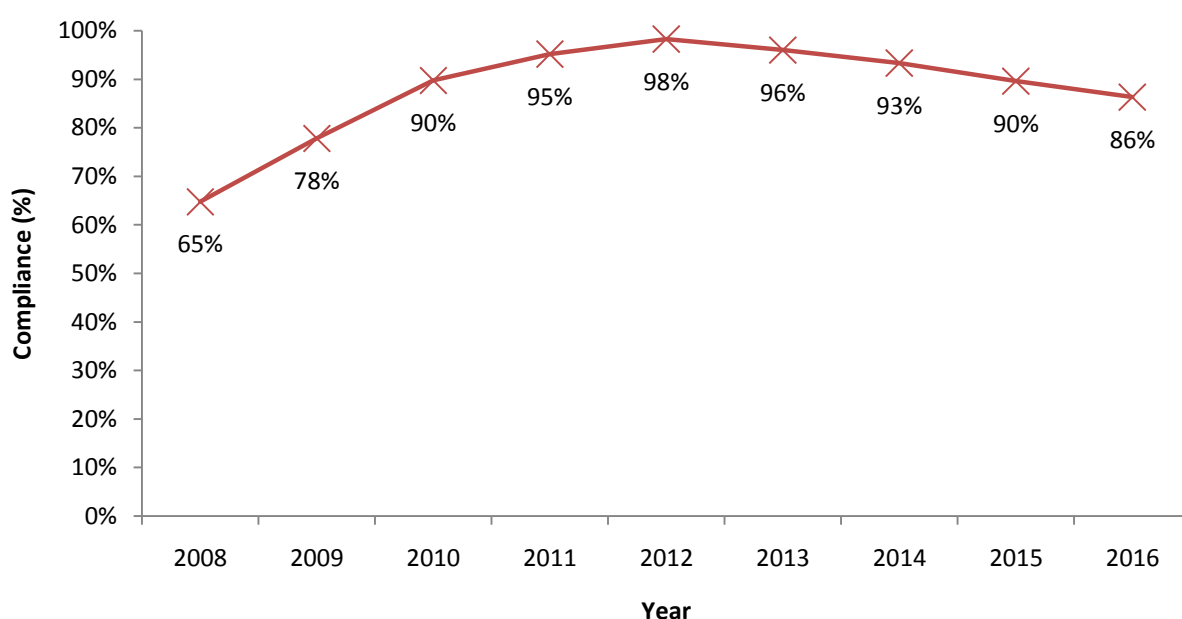
Table 1.3 Coverage of the C-section SSI surveillance compared to self reported procedure numbers in 2016.

No. of surveillance forms returned to PHW	No. of valid surveillance forms returned to PHW*	No. of C sections reported to PHW	% compliance (all health boards in Wales)
7220	7063	8181	86.3

The All Wales compliance with C-section SSI surveillance was 86.3% for 2016.

Figure 1.1 displays the compliance trend for 2008-2016. There was a period of over-compliance from 2011 to 2013 in some health boards, indicating the possibility of coding issues. The denominator for compliance is now provided by the hospital, rather than clinical coding data in PEDW. As a result, the drop in compliance from 2015 to 2016 could at least be partially attributed to this and reflect a truer value for compliance.

Figure 1.1 Trend rate for compliance in Wales from 2008 to 2016.



Summary:

97.7% of data received could be used for analysis.

All Wales compliance has decreased this year; however, a contributing factor to this may be a change in the denominator, and the new rates may be a truer reflection of compliance.

Section 2: SSI rate

SSI rate calculation

Surgical site infection (SSI) rates in this report are calculated as the number of infections (inpatient and post-discharge) divided by the number of valid procedures, and reported as an infection rate per 100 procedures. Since the length of hospital stay after a C-section is generally between two and four days, the majority of SSIs will be captured post-discharge in the community.

Incidence of inpatient, post-discharge and overall SSI

Table 2.1 provides the inpatient and post-discharge SSI rates post C-section surgery. A total of 23 inpatient SSIs were identified giving an inpatient rate of 0.33%. This is slightly higher than 2015 when 21 inpatients SSIs were identified giving an inpatients rate of 0.30%. 284 post-discharge SSIs were identified giving a post-discharge SSI rate of 4.08%. This is slightly higher than in 2015 when 241 post discharges were identified giving a rate of 3.36%. When looking at the overall data, there are a total of 307 SSIs, meaning an overall SSI rate of 4.36%. This is higher than in 2015 when 262 SSIs were identified overall giving a rate of 3.64%. All rates are based on valid forms only.

Table 2.1 Incidence of inpatient and post-discharge SSIs in 2016.

	No. of procedures analysed	No. of SSI*	SSI rate (%)* (95% CI)
Inpatient	7039	23	0.33 (0.19-0.46)
Post-discharge	7039	284	4.03 (3.57-4.49)
Overall**	7039	307	4.36 (3.88-4.84)

*Figures based on valid surveillance forms only. This only includes procedures with either an SSI field completed on the inpatient form or where the infection data is updated post-discharge.

**Overall SSI rate is based on the valid forms rule as described in this document, and is not simply based on addition of the inpatient SSIs to the post-discharge SSIs.

Incidence of SSIs over time

It is important to note that initially not all health boards were participating in the surveillance, and some health boards were participating but with low compliance rates. Data became more reliable from 2010 onwards when all health boards were participating. Table 2.2 provides the overall SSI rate for 2010 – 2016 and broken down by elective and emergency procedures. Figure 2.1 provides the SSI trend over the same time period.

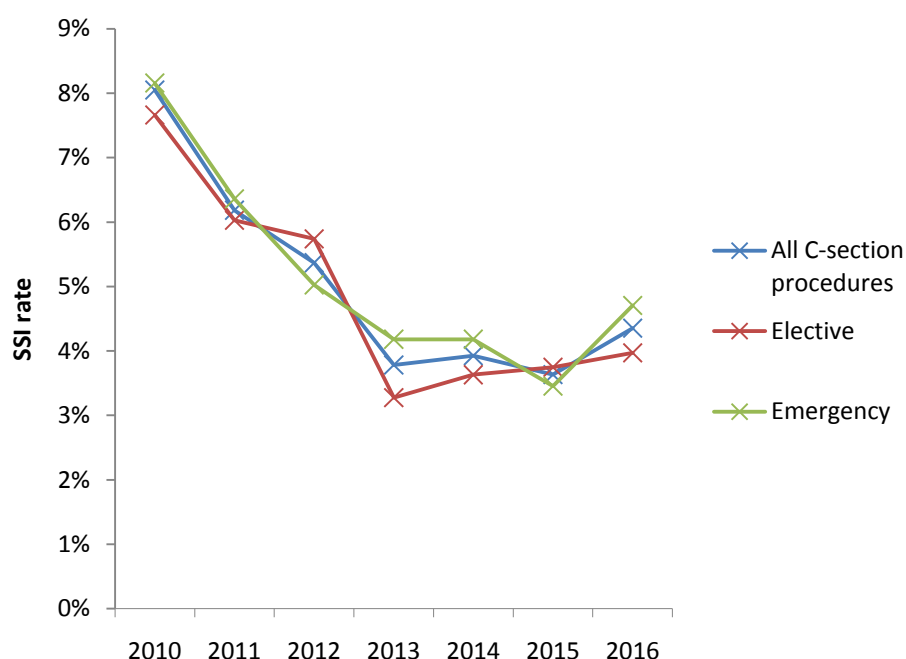


Figure 2.1 Overall, elective and emergency procedures SSI rates for 2010-2016 where procedure type was not blank.

Table 2.2 Overall SSI rate in Wales for 2010-2016.

Operation Type	Year	No. Of Procedures	No. SSI	%SSI (95% CI)
All C-section procedures	2016	7051	307	4.35 (3.88-4.83)
	2015	7212	262	3.63 (3.20-4.06)
	2014	7539	296	3.93 (3.49-4.36)
	2013	8041	304	3.78 (3.36-4.20)
	2012	8233	442	5.37 (4.88-5.86)
	2011	7827	484	6.18 (5.65-6.72)
	2010	7590	611	8.05 (7.44-8.66)
Elective	2016	3299	131	3.97 (3.30-4.64)
	2015	3227	121	3.75 (3.09-4.41)
	2014	3166	115	3.63 (2.98-4.28)
	2013	3387	111	3.28 (2.68-3.88)
	2012	3327	191	5.74 (4.95-6.53)
	2011	3201	193	6.03 (5.20-6.85)
	2010	3106	238	7.66 (6.73-8.60)
Emergency	2016	3654	172	4.71 (4.02-5.39)
	2015	3906	135	3.46 (2.88-4.03)
	2014	4279	179	4.18 (3.58-4.78)
	2013	4519	189	4.18 (3.60-4.77)
	2012	4716	237	5.03 (4.40-5.65)
	2011	4465	284	6.36 (5.64-7.08)
	2010	4206	343	8.16 (7.33-8.98)

The SSI rate is slightly higher for emergency C-sections than for elective C-sections, but the difference is not statistically significant.

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, which all have specific definitions. Table 2.3 breaks down the infections by type of SSI. Tables 2.4 and 2.5 show the overall infection rate and post-discharge infection rate broken down by SSI type.

Table 2.3 Types of SSI for C-section procedures carried out in Wales in 2016.

SSI type	%
Superficial infections	83.06
Deep seated infections	12.38
Organ/space infections	1.30
Unknown	3.26

Table 2.4 Overall SSI rate (%) broken down by SSI type for Wales in 2016.

SSI type	No. SSI	% SSI (95% CI)
Superficial infections	255	3.62 (3.19-4.06)
Deep seated infections	38	0.54 (0.37-0.71)
Organ/Space infections	4	0.06 (0.00-0.11)
Unknown	10	0.14 (0.05-0.23)

Table 2.5 Post-discharge SSI rate (%) broken down by SSI type for Wales in 2016.

SSI type	No. SSI	% SSI (95% CI)
Superficial infections	229	3.25 (2.84-3.67)
Deep seated infections	33	0.47 (0.31-0.63)
Organ/Space infections	4	0.06 (0.00-0.11)
Unknown	18	0.26 (0.14-0.37)

Summary:

The all Wales SSI rate following C-section procedures in 2016 was 4.36% compared to 3.63% in 2015 and 3.93% in 2014.

The most common infection type is superficial (83.06% of infections).

The overall SSI rate in Wales, broken down by SSI type: 3.62% superficial, 0.54% deep seated, and 1.3% organ/space infections.

The post-discharge SSI rate in Wales, broken down by SSI type: 3.25% superficial, 0.47% deep seated, and <0.1% organ/space infections.

Both elective and emergency SSI rates have increased since 2015 but the difference is not statistically significant.

Section 3: General demographics

This section gives information about the age groups and BMI of patients and the number of SSIs associated with each category.

Figure 3.1 provides a pyramid plot showing the age and SSI rates and table 3.1 provides the number of SSI by the specified age groups. Table 3.2 displays the number of SSIs by BMI category.

Incidence of SSI by age

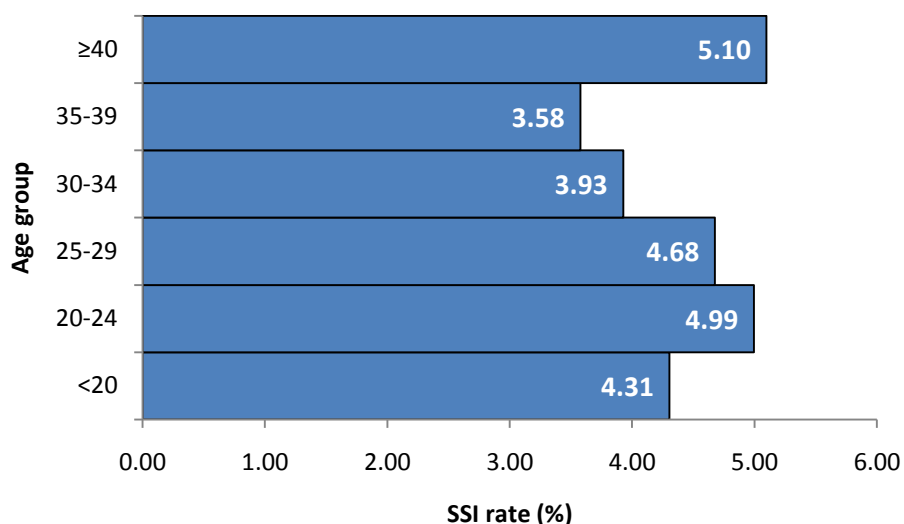


Figure 3.1 Pyramid plot showing age and corresponding SSI rate (%).

Table 3.1 C-section SSI by age in Wales in 2016. Procedures where age information was not provided were excluded.

Age group	No. of valid procedures	No. of SSI	% SSI (95% CI)
<20	209	9	4.31 (1.55-7.06)
20-24	981	49	4.99 (3.63-6.36)
25-29	1925	90	4.68 (3.73-5.62)
30-34	2062	81	3.93 (3.09-4.77)
35-39	1314	47	3.58 (2.57-4.58)
≥40	412	21	5.1 (2.97-7.22)

There was no significant difference in SSI rate between different age categories.

Incidence of SSI by BMI

Table 3.2 C-section SSI rates by BMI in Wales in 2016. Procedures where BMI information was not provided were excluded.

BMI category		No. of procedures	No. of SSI	% SSI (95% CI)
Underweight	<18.5	75	3	4.00 (0.00-8.43)
Healthy weight	18.5-24.9	2026	58	2.86 (2.14-3.59)
Overweight	25.0-29.9	1998	75	3.75 (2.92-4.59)
Obese	≥30.0	2251	141	6.26 (5.26-7.26)

There is a statistically significant difference in SSI rates between obese patients and both healthy weight and overweight patients ($P<0.01$ in both cases), with the SSI rate for obese patients being higher than the other groups.

Summary:

There appears to be no overall trend for SSI rates when comparing between age groups.

There is a general increase in SSI rates as the weight of the patient increases.

Section 4: Details of the surgical procedure

The following section provides SSI rates associated with specific variables, including the type of operation (elective or emergency), use of and timing of antibiotic prophylaxis and skin closure types.

Incidence of SSI following elective and emergency procedures

Table 4.1 C-section SSI in elective and emergency surgical procedures in Wales in 2016. Procedures where this information was not provided were excluded.

Operation type	No. of procedures	No. of SSI	% SSI (95% CI)
Elective procedure	3299	131	3.97 (3.3-4.64)
Emergency procedure	3654	172	4.71 (4.02-5.39)

The SSI rate in the elective category has increased since 2013, and is approximately 21% higher than the 2013 rate (3.28%). The SSI rate in the emergency category has increased in 2016 from 3.46% in 2015 to 4.71 in 2016.

There was no significant difference in the SSI rates between elective and emergency procedures in 2016.

Incidence of SSI by timing of antibiotic prophylaxis

Table 4.2.1 Percentage (%) of C-section procedures by timing of antibiotic prophylaxis in Wales in 2016.

Timing of antibiotic prophylaxis	No. of procedures	%
Prior to incision	6307	94.81
After incision	345	5.19

Procedures where no antibiotics were given were excluded.

Table 4.2.2 C-section SSI by antibiotic prophylaxis in Wales in 2016.

Was prophylactic antibiotic given?	No. of procedures	No. of SSI	% SSI (95% CI)
Yes, prior to incision	6307	268	4.25 (3.75-4.75)
Yes, after incision	345	18	5.22 (2.87-7.56)
No	19	2	10.53 (0.00-24.33)

Procedures where no antibiotic information was given were excluded.

345 procedures received antibiotic prophylaxis after incision, contrary to NICE recommendations that prophylaxis should be administered prior to incision [3]. Although the SSI rate was higher in patients given antibiotics after incision, the difference was not statistically significant ($P=0.413$). This is most likely due to the greatly reduced number of patients who receive antibiotics after incision, which has reduced the sample size to a point where it can no longer be statistically significant. Despite this, **Public Health Wales recommends that sites continue to follow NICE guidelines that prophylactic antibiotics are given prior to surgical incision.**

The All Wales Medicines Strategy Group (AWMSG) has also found that there is some variation in the type of antimicrobials being prescribed between the health boards [6]. One such antimicrobial being used is co-amoxiclav, which is actively discouraged by NICE guidelines. There has been an improvement since 2015, with more hospitals now using the recommended antibiotics. There are some sites where clindamycin is in use as a second line antibiotic (for those with penicillin allergies), but it is being used on its own without

gentamicin. Public Health Wales recommends that all sites adhere to the AWMSG's published recommendations [6] on antimicrobials to be prescribed, which are as follows:

1 st line		2 nd line (if allergic to penicillin)	
Cefuroxime	1.5g IV	Clindamycin	600mg IV/PO
PLUS		PLUS	
Metronidazole	500mg IV	Gentamicin	1.5mg/kg IV

Incidence of SSI by wound closure type

Table 4.3 Percentage (%) of C-section procedures by type of skin closure in Wales in 2016. Procedures where this information was not available were excluded.

Type of wound closure	No. of procedures	%
Dissolvable suture	5754	83.05
Removable suture	774	11.17
Staples	400	5.77

In 2016, 83.05% of C-section incisions were closed with dissolvable sutures, which is an increase from 2015 (76.61%) and 2014 (49.7%). There was a decrease in the use of staples (5.77%) compared to 8.6% in 2015 and 7.0% in 2014.

Table 4.4 C-section SSI rates by type of skin closure in Wales in 2016. Procedures where closure type information is missing were excluded.

Type of wound closure	No. Of procedures	No. Of SSI	% SSI (95% CI)
Sutures (all types)	6528	281	4.30 (0.00-0.09)
<i>Dissolvable suture</i>	<i>5754</i>	<i>246</i>	<i>4.28 (3.75-4.80)</i>
<i>Removable suture</i>	<i>774</i>	<i>35</i>	<i>4.52 (3.06-5.99)</i>
Staples	400	24	6.00 (3.67-8.33)

There was no significant difference between different closure types; however, the sample size of those receiving staples has reduced to a point where it is unlikely to be significant.

Summary:

There was no significant difference in SSI rates between elective and emergency procedures.

Antibiotic prophylaxis was given to 99.7% of patients.

94.8% of patients received their antibiotic prophylaxis prior to incision, with the remainder receiving antibiotics after incision.

94.2% of wounds were closed using sutures (83.1% dissolvable, 11.1% removable). The remainder used staples.

Wounds closed using staples showed a higher infection rate than those using sutures (6% for staples, compared to 4.3% for sutures).

Section 5: Post-discharge details and onset of infection

The following section provides a summary on post discharge care and infection details.

Length of stay in hospital

Table 5.1 C-section SSI rates by hospital stay length (days). Procedures with a missing discharge date were excluded.

Length of hospital stay (days)	No. of procedures	No. of SSI	% SSI (95% CI)
0-5 days	5996	242	4.04 (3.54-4.53)
6-9 days	515	31	6.02 (3.97-8.07)
10+ days	140	13	9.29 (4.48-14.09)

The mean length of stay in hospital was 2.8 days, and the median was 2 days. This increased to a mean of 3.1 days (median 2) when the patient had an SSI. This increase was not significant ($P=0.291$).

Length of midwifery care

Table 5.2 C-section SSI rates by length of midwifery care (days). Procedures with a missing date of discharge from midwifery care were excluded.

Length of midwifery care (days)	No. of procedures	No. of SSI	% SSI (95% CI)
0-7	365	6	1.64 (0.34-2.95)
8-14	1877	48	2.56 (1.84-3.27)
15-21	1571	79	5.03 (3.95-6.11)
22-28	1831	90	4.92 (3.93-5.91)
29+	670	13	1.94 (0.90-2.98)

The mean length of midwifery care in 2016 was 19.5 days (with a median of 18). If the patient had an SSI, this increased to a mean of 20.1 days (with a median of 20). In 2015, the mean length of midwifery care was 19.8 days, or 22.1 days with an infection, meaning an infection added an average of over two days to the time spent under the care of a midwife. As this difference has now narrowed, it means the time added onto midwifery care is less than a day on average. The difference in length of care in 2016 is not statistically significant.

Time to onset of infection

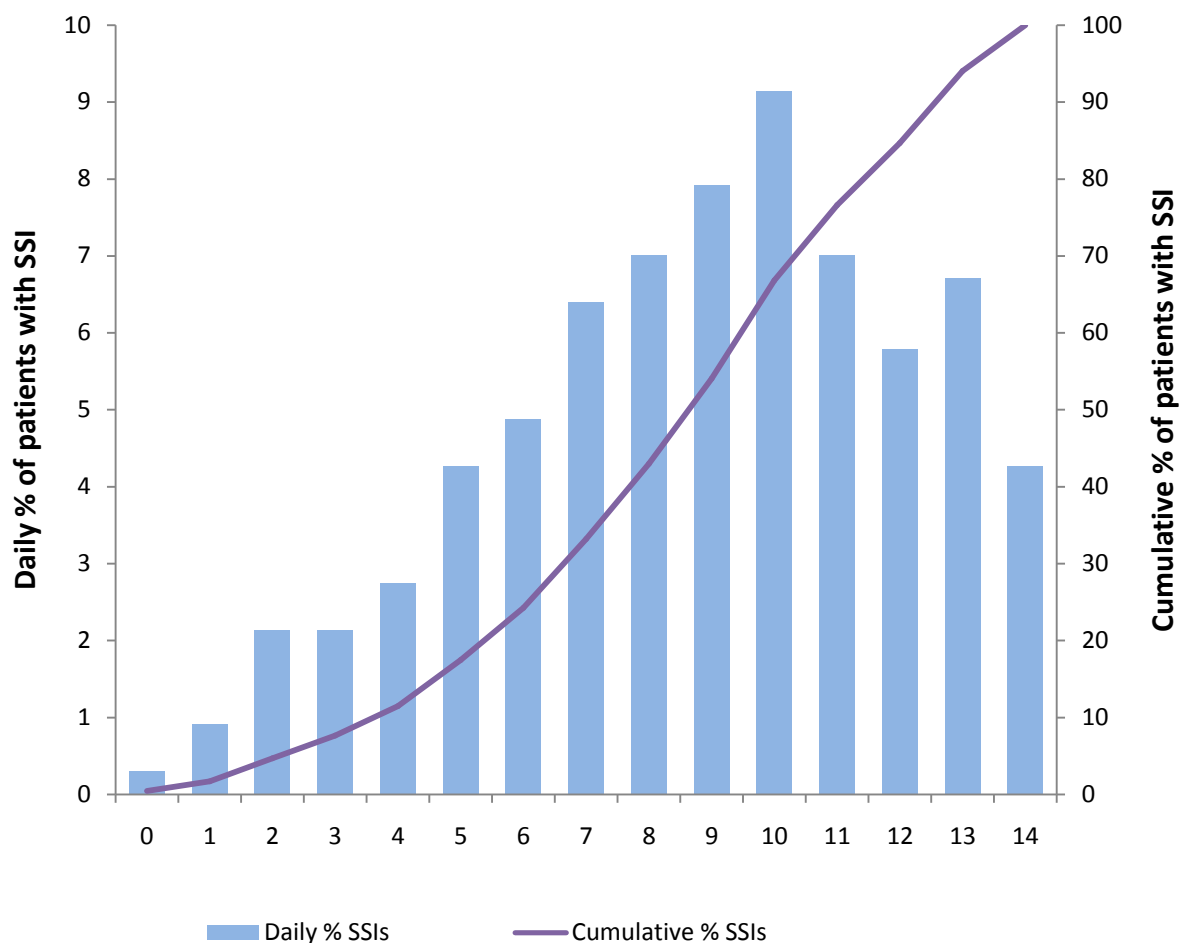


Figure 5.1 The occurrence of SSIs over time (number of days post-surgery), with percentages being calculated out of the total number of infections. Procedures without an infection date or procedure date were excluded, as were infections that occurred more than 14 days after surgery.

The mean onset of infection for Wales as a whole in 2016 was 8.8 days after the procedure, with the median onset being 9 days after the procedure. The greatest number of infections were captured on day 10 (n=30).

Summary:

The mean length of hospital stay was 2.8 days, with a median of 2. There was no difference in the length if patients had an SSI.

The mean length of midwifery care was 19.5 days, with a median of 18. There was no difference in the length if patients had an SSI.

The greatest number of infections were captured on day 10 (n=30).

Discussion

Compliance with C-Section SSI surveillance has dropped to below 90% in 2016 (86.3%). It is however, difficult to attribute this to a single cause. There has been a change in the denominator data in 2016 from the procedure numbers in the Patient Episode Database Wales (PEDW, hosted by NWIS) to self-reported procedure numbers by the hospitals. Since the data in PEDW was reliant on the clinical coding departments in hospitals, the staffing issues present at a number of health boards resulted in the denominator data having lower procedure numbers than the real number performed (which often resulted in compliance rates of over 100%). The change in denominator means this issue should now be resolved, and this is a potential contributory factor in the reduced compliance rates.

The overall SSI rates have increased from the 2015 rates (4.36% in 2016, compared to 3.64% in 2015). This trend is not consistent across the health boards, with three health boards showing a reduction from the previous year, and three showing an increase (the smallest change was a health board with 7% fewer SSIs than 2015, with the remaining five health board having substantial changes in SSI rate). This increase in SSI rate is most pronounced in emergency procedures, but an increase can also be seen in elective procedures, albeit smaller.

As in previous years, obesity can be identified as a significant risk factor for infection following surgery ($P < 0.001$ when compared to both healthy weight and overweight patients). There was also an increase in SSI rate when antibiotic prophylaxis was administered after surgical incision (or not at all) and when staples were used as a method of closure once the procedure was completed. None of these factors showed any statistical significance, but the number of procedures where the risk factor was present is now lower, making statistical significance less likely. When the data for all years is combined, these risk factors are associated with a significantly increased risk of SSI.

Public Health Wales were alerted in 2015 to an increased use of staples by some participating hospitals and, while the use of staples has reduced overall, the use of staples still appears to be localised to the same areas as the previous year, indicating that staple usage may be attributable to individual surgeon preference. While we acknowledge that suturing is a more time consuming procedure, staples represent a substantially higher risk of infection. **We recommend that staples are not used as a routine method of closure, and they should only be used when clinically indicated.**

99.7% of patients in Wales were given antibiotic prophylaxis, and there has been some improvement in this area. More hospitals are using the recommended antibiotics than in 2015, and a larger proportion of these antibiotics are being administered prior to the surgical incision (94.8% of procedures in 2016). The second line antibiotics (for when a patient has an allergy to penicillin) are a combination of clindamycin and gentamicin, but we are aware that some sites are only using clindamycin. **Public Health Wales recommends that all sites continue to follow NICE recommendations that prophylactic antibiotics are administered prior to incision, and that the AWMSC recommended antimicrobials are used** (see page 13 for details).

Inpatient infections continue to be uncommon, as with previous years, and the vast majority of infections occur following discharge from hospital. The most common infections are superficial infections.

There have been issues with reporting of infections, with health boards still not in agreement over the definition of an infection or a trained healthcare worker. Public Health Wales has performed a number of audits to investigate this, and has made a few changes to the reporting procedure. A new caesarean section SSI form (pink form) was introduced in 2016 that collects more specific data on the infections, and allows for better validation of data with less of a need to visit sites and conduct audits (although this cannot be

completely ruled out). These forms have now been rolled out across all sites, but a number of these forms are not being completed fully. When there is an infection, the criteria used in determining an infection should be noted on the form, but this section is being returned blank with just the SSI status being filled in.

An all Wales training package (for wound care and management)ⁱ, which includes an e-learning component, has been developed to help educate the staff involved in the surveillance scheme, with a view to addressing the differences in reporting and standardise infection diagnoses across Wales. It is hoped that this will make data more directly comparable between hospitals and across health boards, and result in increased reliability of the data provided by Public Health Wales.

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ⁱ For further information of the wound care and management training package, please visit the WHAIP intranet site: (<http://howis.wales.nhs.uk/sites3/page.cfm?orgid=379&pid=49916>)