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ANNUAL REPORT: 2015

Caesarean-Section Surgical Site Infection Surveillance

(Includes data from 01/01/2015 - 31/12/2015)

ALL WALES

VERSION 1

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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.

- 7278 SSI forms were received in 2015 and, of these forms, 7185 (98.7%) of them were valid forms that could be used in this analysis.
- 99.8% of expected post-discharge forms were received.
- All data items had a completion rate of over 85% except BMI, where 20.9% of records were left blank. There is also lack of standardisation for this data item, and Public Health Wales are looking into this.
- All Wales compliance was 92% in 2015.
- The infection rate in 2015 was slightly higher than 2014, at 5.06%, compared to 4.96%.
- 364 infections were reported, of which the most common type of infection was superficial, at 81.7% (343) of all infections.
- There was a significantly higher rate of infection in obese patients ($P < 0.01$), and patients whose wounds were closed with staples (< 0.001).
- The mean length of midwifery care following the procedure was 19.8 days, and this rose to 22.1 days if there was an infection.
- The mean onset of infection was 12 days after the procedure. The highest number of infections occurred on day 7, with the bulk of infections occurring on week 2 post procedure (days 8-14). Follow up at 14 and 21 days allows for 70% and 92% of infections to be captured, respectively.

Introduction

The Welsh Healthcare Associated Infection Programme (WHAIP) is part of the Communicable Disease Surveillance Centre (CDSC) within the Public Health Wales Health Protection division. WHAIP 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 2015.

Section 1: Results

Surveillance form returns

Table 1.1 Number of inpatient, post-discharge and valid forms returned for the surveillance in 2015.

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*
7278	7278	7262 (99.8)	7185	98.7 (7185/7278)

The SSI rate provided throughout this report is based on the overall infection rate (infections captured before or after discharge) unless otherwise stated. To obtain the overall SSI rate, only valid forms were used in data analysis.

*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 7278 inpatient forms returned for 2015, 99.8% (7262/7278) 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 98.7%. The percentage of valid forms in 2015 was higher than in 2014 (97%).

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. Table 1.3 displays other data items on the inpatient and post-discharge form that have a completion of less than 85%.

The procedure date has not been included as a data item in table 1.2 and 1.3 since all data extractions are based on a record having a procedure date.

All data items were completed above 85% apart from BMI, which was 79.1% complete. It is also unclear at what point the BMI data is filled in and who is responsible for it, and we are looking to standardise the procedure for recording BMI in future.

Table 1.2 % completion of the SSI field on the C-section surveillance form (inpatient and post-discharge) for Wales (2015).

Data Item	No. completed	No. expected	% complete
Inpatient SSI (Yes/No)	6995	7278	96.1
If Yes, SSI type	17	21	81.0
If Yes, Infection date	16	21	76.2
Post-discharge SSI* (Yes/No)	7183	7260	98.9
If Yes, Infection date	336	343	98.0
If Yes, SSI type	329	343	95.9

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

Table 1.3 Data items on the C-section SSI surveillance form with less than 85% completion for Wales in 2015.

Data Item	No. completed	No. expected	% complete
BMI	5760	7278	79.1

Surveillance compliance

Table 1.4 shows the compliance of Wales in the mandatory C-section surveillance for 2015. The table includes the number of surveillance forms returned to WHAIP for 2015 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 WHAIP divided by the number of C-sections reported to NWIS.

Table 1.4 Coverage of the C-section SSI surveillance compared to procedures reported to NWIS in 2015.

No. of surveillance forms returned to WHAIP	No. of valid surveillance forms returned to WHAIP*	No. of C sections reported to PEDW	% compliance (all health boards in Wales)
7278	7183	7775	92.4

The All Wales compliance with C-section SSI surveillance was 92.4% for 2015.

Figure 1.1 displays the compliance trend for 2008-2015. While overall compliance decreased between 2012 and 2014, compliance has remained excellent with levels above 90% since 2011.

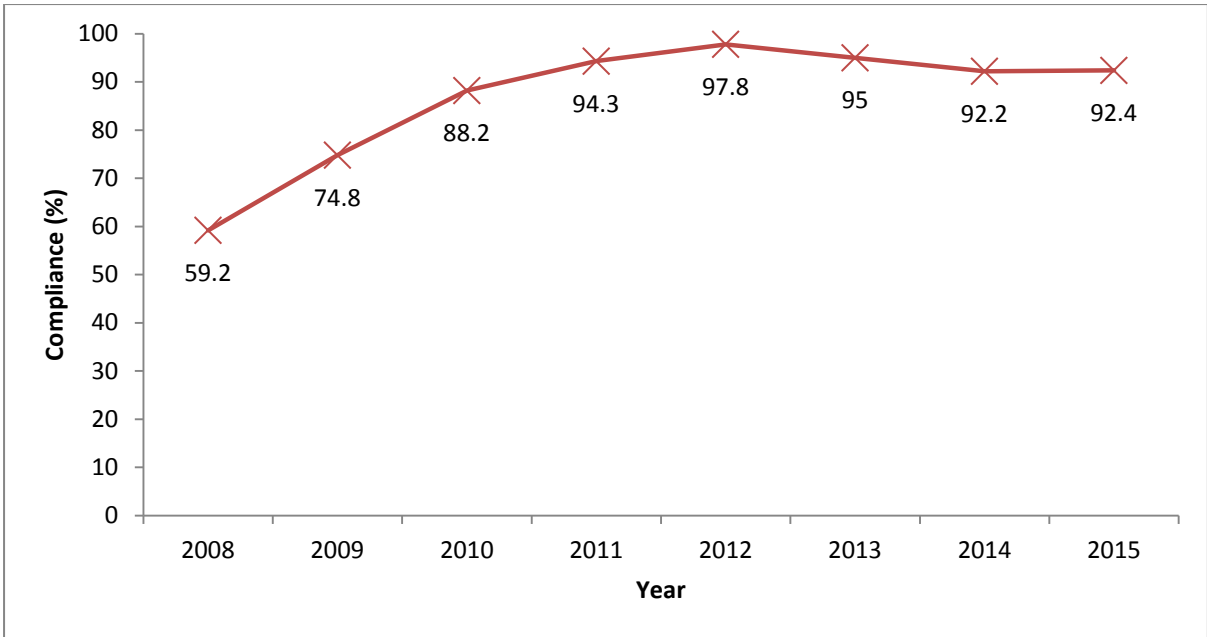


Figure 1.1 Trend rate for compliance in Wales from 2008 to 2015.

Summary:

98.7% of data received could be used for analysis.

Data items on the form were mostly completed well. The BMI field is still poorly completed, with the field being left blank in 20.9% of records. We are looking into standardising the completion of this item on the form.

All Wales compliance has increased this year for the first time since 2012. Overall compliance has been excellent since 2011, with compliance being over 90% for this period.

Section 2: SSI rate

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 21 inpatient SSIs were identified giving an inpatient rate of 0.30%. 343 post-discharge SSIs were identified giving a post-discharge SSI rate of 4.78%. When looking at the overall data, there are a total of 364 SSIs, meaning an overall SSI rate of 5.06%. All rates are based on valid forms only.

The SSI rates calculated in the remainder of this report are based on an overall rate unless otherwise specified. 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.

Table 2.1 Incidence of inpatient and post-discharge SSIs in 2015.

	No. of procedures analysed	No. of SSI*	SSI rate (%)* (95% CI)
Inpatient	6995	21	0.30 (0.17-0.43)
Post-discharge	7183	343	4.78 (4.29-5.29)
Overall**	7199	364	5.06 (4.55-5.56)

*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 – 2015 and broken down by elective and emergency procedures. Figure 2.1 provides the SSI trend over the same time period.

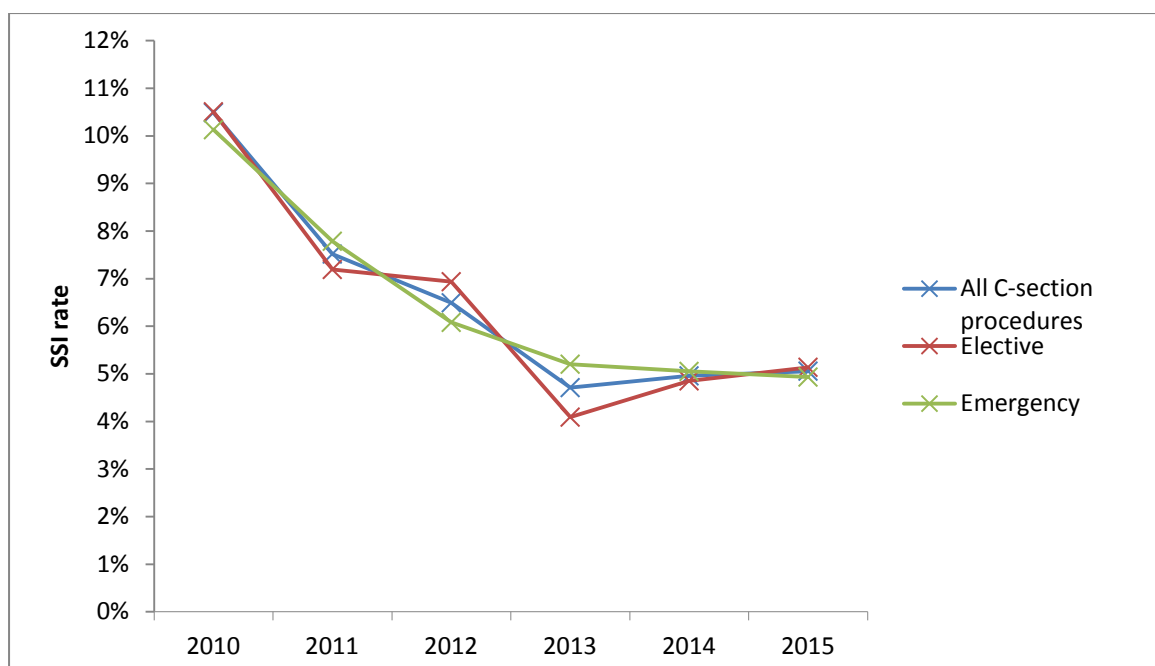


Figure 2.1 Overall, elective and emergency procedures SSI rates for 2010-2015.

Table 2.2 Overall SSI rate in Wales for 2010-2015.

Operation type	Year	No. of procedures	No. of SSI	%SSI (95% CI)
All C-section procedures	2015	7199	364	5.06 (4.55-5.56)
	2014	7402	367	4.96 (4.46-5.45)
	2013	7962	375	4.71 (4.24-5.18)
	2012	8193	532	6.49 (5.96-7.03)
	2011	7756	583	7.52 (6.93-8.10)
	2010	7456	782	10.49 (9.79-11.18)
Elective	2015	3212	165	5.14 (4.37-5.90)
	2014	3112	151	4.85 (4.10-5.61)
	2013	3349	137	4.09 (3.42-4.76)
	2012	3316	230	6.94 (6.07-7.80)
	2011	3170	228	7.19 (6.29-8.09)
	2010	3055	321	10.51 (9.42-11.59)
Emergency	2015	3893	192	4.93 (4.25-5.61)
	2014	4197	212	5.05 (4.39-5.71)
	2013	4479	233	5.2 (4.55-5.85)
	2012	4687	285	6.08 (5.40-6.76)
	2011	4431	345	7.79 (7.00-8.58)
	2010	4136	419	10.13 (9.21-11.05)

The SSI rate is slightly higher for elective C-sections than for emergency C-sections, but the difference is not statistically significant. Both elective and emergency SSI rates have been decreasing since 2010, and show reductions of 51.1% and 51.3% from the 2010 rate, respectively. Elective SSI rates have increased since 2013, with the 2015 rate being 25.7% higher than the 2013 rate (although still less than half the 2010 rate).

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 2015.

SSI type	%
Superficial infections	81.6
Deep seated infections	12.6
Organ/space infections	0.8
Unknown	4.9

Table 2.4 Overall SSI rate (%) broken down by SSI type for Wales in 2015.

SSI type	No. SSI	% SSI (95% CI)
Superficial infections	298	4.14 (3.68-4.60)
Deep seated infections	46	0.64 (0.45-0.82)
Organ/Space infections	3	0.04 (0.00-0.09)
Unknown	18	0.25 (0.13-0.37)

Table 2.5 Post-discharge SSI rate (%) broken down by SSI type for Wales in 2015.

SSI type	No. SSI	% SSI (95% CI)
Superficial infections	282	3.93 (3.48-4.38)
Deep seated infections	45	0.63 (0.44-0.81)
Organ/Space infections	3	0.04 (0.00-0.09)
Unknown	0	0.00 (0.00-0.05)

Summary:

The all Wales SSI rate following C-section procedures in 2015 was 5.1% compared to 5.0% and 4.7% in 2014 and 2013, respectively.

The most common infection type is superficial (81.7% of infections).

The overall SSI rate in Wales, broken down by SSI type: 4.1% superficial, 0.6% deep seated, and <0.1% organ/space infections.

The post-discharge SSI rate in Wales, broken down by SSI type: 3.9% superficial, 0.6% deep seated, and <0.1% organ/space infections.

Both elective and emergency SSI rates have been decreasing since 2010, and 2015 rates show a reduction of over 50%. Elective SSI rates have increased since 2013, but are still less than half of 2010 rates.

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

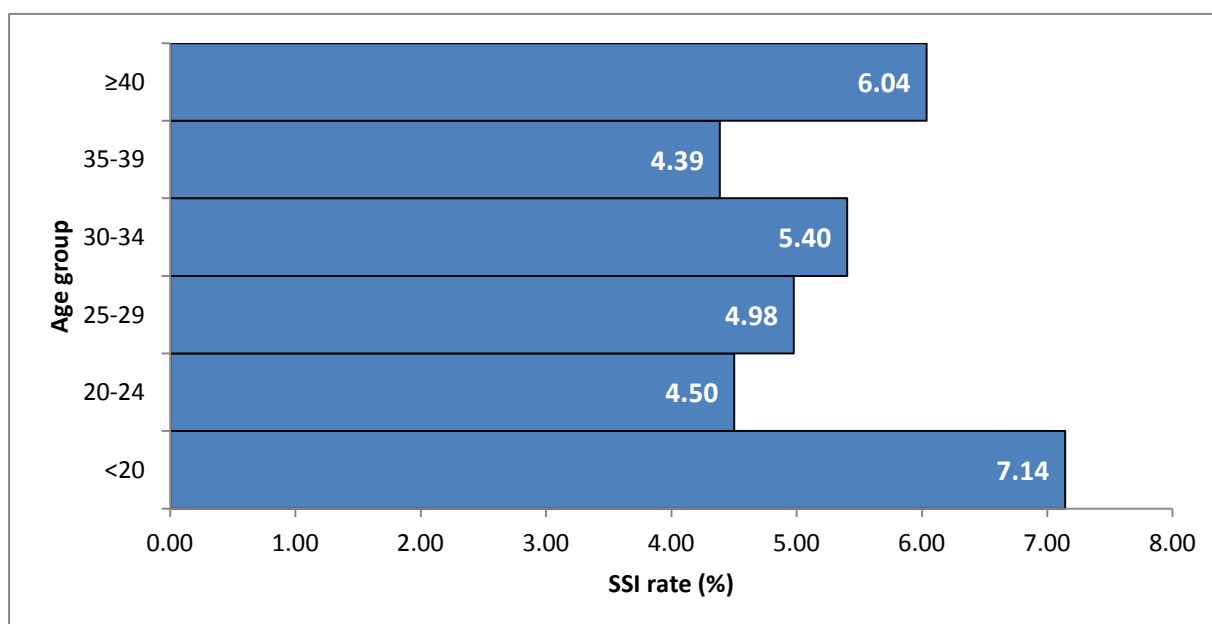


Figure 3.1 Pyramid plot showing age and corresponding SSI rate (%).

Table 3.1 C-section SSI by age in Wales in 2015. Procedures where age information was not provided were excluded.

Age group	No. of valid procedures	No. of SSI	% SSI (95% CI)
<20	196	14	7.14 (3.54-10.75)
20-24	1066	48	4.50 (3.26-5.75)
25-29	1969	98	4.98 (4.02-5.94)
30-34	2202	119	5.40 (4.46-6.35)
35-39	1254	55	4.39 (3.25-5.52)
≥40	497	30	6.04 (3.94-8.13)

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 2015. Procedures where BMI information was not provided were excluded.

BMI category		No. of procedures	No. of SSI	% SSI (95% CI)
Underweight	<18.5	79	1	1.27 (0.00-3.73)
Healthy weight	18.5-24.9	1769	60	3.39 (2.55-4.24)
Overweight	25.0-29.9	1897	77	4.06 (3.17-4.95)
Obese	≥30.0	3439	226	6.57 (5.74-7.40)

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 was no significant difference in the SSI rate by age in 2015.

There was a significant increase in the SSI rate for obese patients in 2015, compared with healthy weight and overweight patients.

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 2015. Procedures where this information was not provided were excluded.

Operation type	No. of procedures	No. of SSI	% SSI (95% CI)
Elective procedure	3212	165	5.14 (4.37-5.90)
Emergency procedure	3893	192	4.93 (4.25-5.61)

The SSI rate in the elective category has increased since 2013, and is approximately 25% higher than the 2013 rate (4.09%). The SSI rate in the emergency category has continued to decrease since 2010, and there was a 2.4% reduction from the 2014 rate (5.05%).

There was no significant difference in the SSI rates between elective and emergency procedures in 2015.

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 2015.

Timing of antibiotic prophylaxis	No. of procedures	%
Prior to incision	6124	91.2
After incision	591	8.8

Procedures where no antibiotics were given were excluded.

Table 4.2.2 C-section SSI by antibiotic prophylaxis in Wales in 2015.

Was prophylactic antibiotic given?	No. of procedures	No. of SSI	% SSI (95% CI)
Yes, prior to incision	6124	317	5.18 (4.62-5.73)
Yes, after incision	591	19	3.21 (1.79-4.64)
No	25	1	4.00 (0.00-11.68)

Procedures where no antibiotic information was given were excluded.

591 procedures received antibiotic prophylaxis after incision, contrary to NICE recommendations that prophylaxis should be administered prior to incision [3]. When the

numbers were analysed, a statistical significance was found in SSI rates between patients given antibiotics before and after incision (P=0.037), with rates being lower in those given antibiotics after incision. Despite this finding, the number of procedures where antibiotics were given after incision was less than 10% of overall procedures and, as a result was more susceptible to confounding factors. As a result, **Public Health Wales recommends that sites continue to follow NICE recommendations 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. The AWMSG has published recommendations [6] on antimicrobials to be prescribed, and they 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 2015. Procedures where this information was not available were excluded.

Type of wound closure	No. of procedures	%
Dissolvable suture	5132	76.6
Removable suture	988	14.8
Staples	579	8.6

In 2015, over three quarters of C-section incisions were closed with dissolvable sutures, which is a large increase from 2014 (49.7%). There was a slight increase in the use of staples, with 8.6% in 2015 compared to 7.0% in 2014.

Table 4.4 C-section SSI rates by type of skin closure in Wales in 2015. 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)	6120	262	4.28 (3.77-4.79)
<i>Dissolvable suture</i>	<i>5132</i>	<i>213</i>	<i>4.15 (3.60-4.70)</i>
<i>Removable suture</i>	<i>988</i>	<i>49</i>	<i>4.96 (3.61-6.31)</i>
Staples	579	66	11.40 (8.81-13.99)

There was a significant difference in SSI rates between procedures where staples were used and procedures where sutures (all types) were used (P<0.001). There was also a difference

between staples and both types of suture individually (both $P < 0.001$). There was no significant difference between dissolvable sutures and removable sutures ($P = 0.250$).

Summary:

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

Antibiotic prophylaxis was given to 99.6% of patients.

91.2% of patients received their antibiotic prophylaxis prior to incision, with the remainder receiving antibiotics after incision.

91.4% of wounds were closed using sutures (76.6% dissolvable, 14.8% removable). The remainder used staples.

Wounds closed using staples showed a significantly higher infection rate than those using sutures (11.4% 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	6778	326	4.81 (4.30-5.32)
6-9 days	269	24	8.92 (5.52-12.33)
10+ days	114	14	12.28 (6.26-18.31)

The mean length of stay in hospital was 2.5 days, and the median was 2 days. This increased to a mean of 2.6 days (median 2) when the patient had an SSI. This increase was not significant (P=0.616).

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	269	6	2.23 (0.47-4.00)
8-14	2236	49	2.19 (1.58-2.80)
15-21	1890	105	5.56 (4.52-6.59)
22-28	1880	105	5.59 (4.55-6.62)
29+	892	99	11.1 (9.04-13.16)

The mean length of midwifery care in 2015 was 19.8 days (with a median of 18). If the patient had an SSI, this increased to a mean of 22.1 days (with a median of 21). The difference was significant (P<0.001).

Time to onset of infection

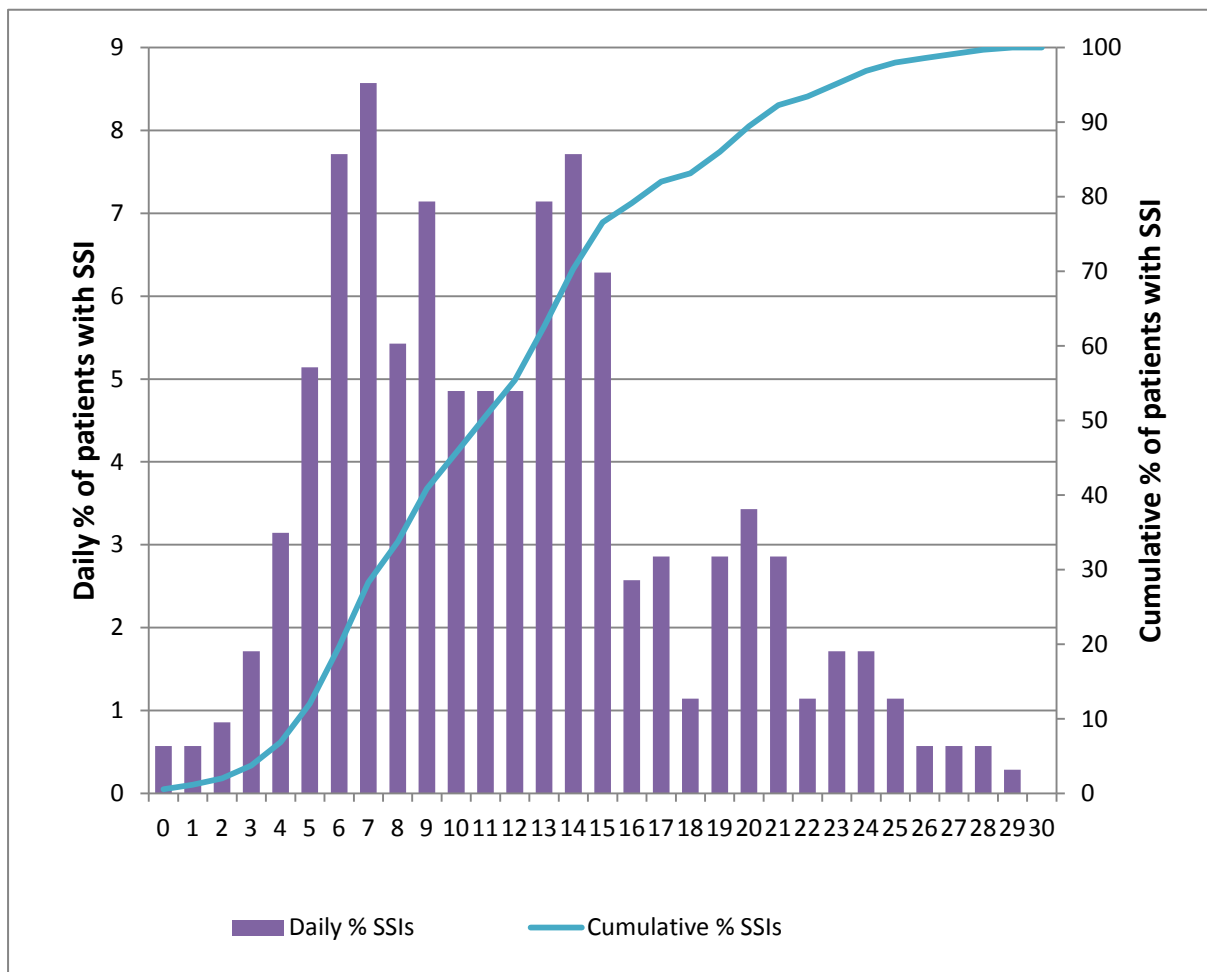


Figure 5.1 The occurrence of SSIs over time (number of days post-surgery), with percentages being calculated out of the total number of infections. Procedures without an infection date or procedure date were excluded, as were infections that occurred more than 30 days after surgery.

The mean onset of infection for Wales as a whole in 2015 was 12 days after the procedure, with the median onset being 11 days after the procedure. The greatest number of infections were captured in days 8-14 (n=147), with the highest number of infections on day 7 (n=30).

Summary:

The mean length of hospital stay was 2.5 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 19.8 days, with a median of 18. This increased to a mean of 22.1 (median 21) in patients with an SSI.

The greatest number of infections were captured in days 8-14 (n=147), with the highest number on day 7 (n=30).

Based on 2015 data, follow up at 21, 14, 10 and 7 days allowed for 92%, 70%, 46% and 28% of SSIs to be captured, respectively.

Discussion

Compliance with the mandated C-section surveillance continued to be above 90% for 2015 (92%). All data fields were reliably completed apart from the BMI where approximately 21% of records were left blank. There is also a lack of consistency in this item with variations in which point in the pregnancy this data is collected. Public Health Wales are looking to standardise this field in future to ensure the data is comparable between hospitals.

The overall SSI rates have increased slightly at 5.06% (up from 4.96% in 2014). This trend is reflected in the elective rates (5.14% in 2015 from 4.85% in 2014), but not in the emergency rates (4.93% in 2015 from 5.05% in 2014). The lower rates in 2013 and 2014 coincide with a period of lower compliance and there is a chance that the increase in rate is due to underreporting in the previous years rather than an actual increase in infection rates. The changes in infection rates between 2014 and 2015 are minor with overlapping confidence intervals, so any inferences made from changes in infection rate should be interpreted with caution.

As in 2014, obesity has been identified as a significant risk factor for infection following surgery ($P < 0.001$ when compared to both healthy weight and overweight patients). An increase in SSI rate was also noted when staples were used to close wounds ($P < 0.001$ when compared to sutures). This trend exists when staples are compared with dissolvable sutures, removable sutures, and both combined; and the rate is substantially higher (11.40% for staples, compared to 4.28% for all types of suture). There was no significant difference in the infection rate between dissolvable and removable sutures ($P = 0.250$).

Public Health Wales were alerted to an increased use of staples by two participating hospitals. This may be attributable to the reduced availability of removable sutures (prolene beads) and individual surgeon preference. Since 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.**

99.6% of patients in Wales were given antibiotic prophylaxis, however, there is still some variation in the timing of this prophylaxis. Of those given prophylactic antibiotics, 8.8% were given after the incision. This was associated with a decrease in the rate of infection from 5.18% to 3.21% ($P = 0.037$), although there is variation in this data between different years and no significant difference was found in the rates in 2014. As it is not possible to counter for all confounding factors, **Public Health Wales recommends that all sites continue to follow NICE recommendations that prophylactic antibiotics are given prior to surgical incision.** In addition, there is some variation in the type of antimicrobial being used between the health boards, and the All Wales Medicines Strategy Group has issued recommendations on this matter (see page 16). In addition, WHAIP will conduct an audit to determine which antibiotics are currently being prescribed.

Very few infections captured by the surveillance programme are inpatient infections, and the vast majority of infections occur once a patient has been discharged. As a result, the importance of post-discharge surveillance cannot be overstated. In 2015, the mean onset of

infection was 12 days following the procedure (median 11 days), and it is safe to assume that most patients will have been discharged at this point (the mean hospital stay following the procedure was 2.5 days). There is still some variation in the period of time patients are followed up but, based solely on 2015 data, Public Health Wales recommends post-discharge follow-up of an absolute minimum of 14 days post-surgery, as most infections occur in days 8-14 post-surgery, and 14 days allows for 70% of infections to be captured. Increasing the follow-up period to 21 days allows for 92% of infections to be captured, but there are still some infections that occur after 21 days.

C-section SSI surveillance concentrates on capturing superficial infections, which constitute the majority of infections identified in the community. It is difficult to assess whether under-reporting of deep seated infections is occurring as we do not capture readmission data at present.

There continue to be issues with reporting of infections in 2015, 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) has been introduced 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). The new forms are currently being introduced as of August/September 2016. An all Wales training package (for wound care and management)¹ has also 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.

¹ 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>

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