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CAESAREAN SECTION SURGICAL SITE INFECTION SURVEILLANCE

ALL WALES

ANNUAL REPORT 2008

The Temple of Peace & Health, Cathays Park, Cardiff, CF10 3NW
Y Deml Heddwch ac Iechyd, Parc Cathays, Caerdydd, CF10 3NW
Tel/Ffon: 029 2040 2473
Fax:/Ffacs: 029 2040 2526

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SUMMARY

- This is the third annual report covering the mandatory surveillance of C-section procedures in Wales (2008). The report covers both lower and upper uterine segment procedure categories and excludes C-section hysterectomy.

- A total of 5772 questionnaires were received for 2008. Only 4836 (84%) of forms could be further analysed for determining SSI rates (this compares with 73% for 2007).

- The all Wales compliance with the surveillance was 58%. However, one Trust had only contributed data to the surveillance for the last quarter of 2008. Removing this partially complying Trust increased the all Wales compliance to 69%. Trust compliance varied between 18% and 93%.

- Overall 737 infections were detected either during the hospital stay or more likely post-discharge, giving a crude inpatient SSI rate of 1.0% and a crude overall SSI rate of 15.2% (compared with 20.1% 2007). Trust overall rates varied from 10.7% to 29.3%.

- The SSI rates should be treated with caution due to the compliance with the surveillance coupled with some data being invalid. An average overall rate by the eight Trusts was therefore included, providing a rate of 17.0% (median of 15.2%).

- Superficial infections accounted for 80% of SSIs. The overall SSI rate broken down by type was 12.2% superficial infections and 2.1% deep seated infections, with 1.0% unknown. A similar trend was also noted for post-discharge SSIs.

- Overall a post discharge form was received for 93% of procedures. To take into account the Trust variation in follow up, rates were also calculated by 1000 days of patient follow up. The overall SSI rate was 7.6 per 1000 days followed.

- The risk of a SSI significantly ($p<0.05$) increased with increased BMI, particular in obese patients.

- Antibiotic prophylaxis was given to 92% of patients with 81% of patients receiving their antibiotics after incision, 19% prior to incision. Data for 2008 has shown that the SSI rate decreased when antibiotics were given after incision. This contradicts the findings in the 2007 annual report. More data are thus required for analysis, especially on antibiotics given prior to incision.

- Use of dissolvable or removable sutures did not change the SSI rate significantly. Use of staples increased the SSI rate but more data are required for statistical analysis.

- The mean length of midwifery care following a C-section procedure was approximately 22-25 days.

- The mean onset of infection was 11 days with the greatest number of infections captured between days 5 to 11 (highest on day 7).

- The all Wales 2008 data indicates that a 28 day follow-up post surgery is required to capture the greatest number of SSI. 21 days, 14 days and 10 days follow-up allowed for 91%, 74% and 55% of infections to be captured, respectively. It is however difficult to determine if all SSIs were captured in the dataset due to variance in midwifery length of care by Trusts.

- In general, in patient SSI rates in Wales for 2008 are lower than inpatient rates from other countries (Europe, America and Canada). Wales does appear to have a higher overall SSI rate but comparisons are few due to the lack of post-discharge surveillance carried out in and outside of Europe.

- Wales remains one of the few countries to carry out continuous post-discharge surveillance, where the majority of infection data will be collected.

- Trend data over time has shown the SSI rate to decrease since 2007. This is especially noticeable since the introduction of the simplified and shorter form at the beginning of 2008.

INTRODUCTION

In September 2004, the Welsh Assembly Government launched 'Healthcare Associated Infections – 'A Strategy for Hospitals in Wales', stating that current mandatory surgical site infection surveillance involving orthopaedic surgery would be extended to other specialities (section 5.8, page 30). Consequently, the Welsh Healthcare Associated Infection Programme (WHAIP) was instructed to develop and support the implementation of surveillance of infections following Caesarean section procedures undertaken in NHS Trusts in Wales. A Welsh Health Circular was issued to Chief Executives informing them of this (WHC (2005) 093).

Before being made mandatory, surveillance of infections following C- sections in Wales was undertaken voluntarily by three hospital Trusts. Through surveillance these Trusts were able to obtain an insight into their local infection rates and thus demonstrate the usefulness of surveillance as a basis for further investigations.

Surgical Site Infection (SSI) is an important area for surveillance and remains an important complication of surgery with both human and financial costs being high[1]. 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[2].

The surveillance scheme for SSI in C-sections was made mandatory in Wales in January 2006. This is the third national report on SSI following C-section procedures in Wales. The data presented here is a summary of information provided by all eight Trusts (based on the Trust configurations in 2008). Note one Trust only contributed data for the last quarter of this calendar year. The 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[3], allowing Welsh data to be compared with and be incorporated into other international databases, such as the HELICS European SSI database[4]. The purpose of the surveillance in the early years of data collection is to provide an initial baseline infection rate to assist Trusts in monitoring both their system of data collection and to aid with reducing infection over time. In particular, a clear understanding of how to diagnose an SSI is crucial to accurate data collection. In addition the surveillance relies heavily on post-discharge surveillance to capture the majority of infections. This increases the complexity of the surveillance carried out and is an area that requires additional research.

RESULTS

Questionnaire returns

Table 1. Number of inpatient, post-discharge and valid questionnaires returned for the surveillance in 2008.

No. of in-patient forms returned	No. of expected post-discharge forms	No. of expected post-discharge forms returned	No. of valid forms used for data analysis*	% of valid forms for data analysis*
5772	**5772**	**5356 (93%)**	**4836**	**84 (4836/5772)**

The SSI rate provided throughout this report is based on an overall infection rate (infections captured pre-discharge or post-discharge), unless otherwise stated. To obtain the overall SSI rate only valid forms could be utilised in data analysis.

*Valid forms include procedure records with an SSI complete on the main form or where infection data could be updated by the completion of a post-discharge form.

% of valid forms = no. forms analysed / no. of main forms received x 100.

For example, a pre-discharge SSI (noted on the main form) or post-discharge SSI (noted on the post-discharge form) will be a valid questionnaire. However, if a main form has 'no' to an SSI but the post-discharge form SSI question is blank then this patient record is not valid. We cannot assume overall that the patient did not have an SSI. A blank on the form is not assumed to be a 'no'.

Of the 5772 forms returned for 2008, 93% (5356 / 5772) had a corresponding post-discharge form. Some forms had an incomplete SSI field, especially on the main form thus reducing the number of valid forms overall for inclusion in data analysis to 84%. However, the % of valid forms in 2008 was greater than 2007, 84% compared with 73% in 2007.

Completion rates

Details on the completion of the SSI field on the main and post-discharge form for all Wales (2008) is shown in table 2. Completion of all other data items on the main and post-discharge form is shown in table 3.

The procedure date has not been included as a data item in table 2 and 3 since all data extractions are based on a record having a procedure date.

Table 2. Percentage completion of the SSI field on the C-section questionnaire (main and post-discharge) for Wales (2008).

Data Item	No. completed	No. expected	% Complete
Inpatient SSI (Yes/No):	5177	5772	89.7
If Yes, SSI type	40	49	81.6
If Yes, Infection date	42	49	85.7
Post-discharge SSI* (Yes/No):	5153	5356	96.2
If Yes, Infection date	622	684	90.9
If Yes, SSI type	648	684	94.7
Overall SSI**	4836	5772	83.8

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

** Includes procedures with an SSI complete on the main form or updated by completion of the SSI field on a post-discharge form.

Table 3. Percentage completion of data items on the C-section SSI questionnaires for Wales in 2008. Data pertains to the main form apart from the date of discharge from midwifery care which is present on the post-discharge form.

Data Item	No. completed	No. expected	% Complete
Age	5351	5772	92.7
BMI	4915	5772	85.2
Previous C-sections	5641	5772	97.7
Active labour	5466	5772	94.7
Membrane rupture	5527	5772	95.8
Wound class	5460	5772	94.6
ASA classification	5348	5772	92.7
Operation type	5610	5772	97.2
Prophylaxis timing	5363	5772	92.9
Operating surgeon code	4621	5772	80.1
Skin closure type	5390	5772	93.4
Incision time	5301	5772	91.8
Closure time	5181	5772	89.8
Date of discharge from hospital	4972	5772	86.1
Date of discharge from midwifery care*	5074	5356	94.7

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

Surveillance Compliance

Table 4 shows the compliance of Wales in the mandatory C-section surveillance for 2008. The table includes the number of questionnaires returned to WHAIP for 2008 and the number of valid questionnaires returned (as previously detailed in table 1.). The compliance figure is derived from the number of valid questionnaires returned to WHAIP divided by the number of C-sections reported to the Patient Episode Database for Wales (PEDW) at Health Solutions Wales (HSW). One Trust only contributed data to the surveillance for the last quarter of 2008. For this reason two figures are provided for the compliance.

Table 4 Coverage of the C section SSI Surveillance compared to procedures reported to the PEDW database at HSW for Wales in 2008

	No. of questionnaires returned to WHAIP	No. of valid questionnaires returned to WHAIP*	No. of C sections reported to HSW*	% Compliance (all Trusts in Wales)	% Compliance (excluding the partially compliant Trust)
All Wales	**5772**	**4836**	**8305**	**58**	**69**

*valid questionnaires – procedures with an SSI complete on the main form or where infection data could be updated post-discharge

Procedure codes reported to HSW included R171, R172, R181 and R182.

The All Wales compliance with the C-section surveillance has increased to 58% for 2008. This compares with 41% for 2007 (when basing compliance on valid forms returned to WHAIP). The compliance for 2008 increased when the trust that has only contributed data for the last quarter of 2008 was removed (69%). The number of valid C-sections reported to WHAIP and procedures to HSW was 4685 and 6830, respectively on removal of the partially complying trust.

Key Summary Points

- Completion of the SSI question has improved in 2008 compared with 2007 with the % of valid forms increasing from 73% to 84% for 2008.
- All data items on the form were completed well however the inpatient SSI question does remain blank in 10% of the records.
- All Wales surveillance compliance for 2008 was 58%. This compares with 41% for 2007.
- All Wales compliance increased to 69% for 2008 when HSW data for the partially-complying Trust was removed.

SECTION 1. All Wales SSI rate

Incidence of in-patient, post-discharge and overall SSI

Table 1.1 provides the inpatient SSI rate post C-section surgery. A total of 49 SSI were identified giving an inpatient rate of 1.0%. Table 1.2 provides the number and SSI for infections identified after discharge of the patient from hospital only. A post-discharge rate of 13.3% was noted with 684 SSI identified. Table 1.3 provides the overall SSI rate post C-section surgery and includes all SSI identified either pre or post-discharge from hospital. A total of 737 SSI were captured during the surveillance with an overall SSI rate of 15.2% for 2008. All rates are based on valid forms only. The SSI rates calculated and provided in the remainder of this report are based on an overall rate unless otherwise stated. As the length of hospital stay after such a procedure has been reduced the majority of SSIs will be captured post-discharge in the community.

Table 1.1 Incidence of inpatient SSI in Wales for 2008

	No. of procedures analysed	**No. of SSI***	**Overall SSI rate (%)* (95% CI)**
All Wales	4836	49	1.0 (0.7-1.3)

Table 1.2 Incidence of post-discharge SSI in Wales for 2008

	No. of procedures analysed	**No. of SSI***	**Overall SSI rate (%)* (95% CI)**
All Wales	5153	684	13.3 (12.3-14.3)

Table 1.3 Incidence of overall SSI in Wales for 2008

	No. of procedures analysed	**No. of SSI***	**Overall SSI rate (%)* (95% CI)**
All Wales	4836	737	15.2** (14.2-16.4)

*Figures based on valid questionnaires only. This only includes procedures with either an SSI field completed on the main form or where infection data could be updated post-discharge.

** **Note**: the overall SSI rate (%) is based on the valid forms rule previously described and is not based on the inpatient SSI rate combined with the post-discharge SSI rate.

Although the majority of Trusts in Wales have similar SSI rates, 2 out of 7 Trusts have rates above 20%. If an average of the Trust rates were calculated then the SSI rate quoted for Wales in 2008 would be 17.0% with a median of 15.2%. The inpatient SSI rate noted for Wales 2008 is now lower when compared with inpatient rates in other countries, e.g. America, Germany, Hungary, Europe wide (HELICS) and

Scotland [5-11]. Comparing the post-discharge rates and overall rates obtained is difficult due to the lack of surveillance carried out in other countries. Where comparisons could be made, the post-discharge rate in Wales is higher than that noted in Canada[12], whilst the overall rate is lower than surveillance rates in America[8] but higher than in Scotland[13].

Incidence of SSI by infection type

The type of SSI recorded on the questionnaire could be categorised into either superficial, deep or organ/space infections. Table 1.5 details the percentage of infections by type of SSI. The SSI are categorised into superficial infections and deep seated infections. The latter includes deep and organ / space infections. Table 1.6 and 1.7 provides the overall SSI rate and post-discharge SSI rate, respectively, broken down by SSI type in 2008.

Table. 1.5 Type of SSI, specifically superficial and deep seated infections (deep, organ/space) for C-section procedures carried out in Wales for 2008

SSI type	**%**
Superficial infections	80
Deep seated infections	14
Unknown	6

Table. 1.6 Overall SSI rate (%) broken down by SSI type for Wales in 2008

SSI type	**No. SSI**	**% SSI (95% CI)**
Superficial infections	589	12.2 (11.2-13.2)
Deep seated infections	102	2.1 (1.7-2.6)
Unknown	46	1.0 (0.7-1.3)

Table 1.7 Post-discharge SSI rate (%) broken down by SSI type, specifically superficial and deep seated infections (deep, organ/space) for Wales in 2008

SSI type	**No. SSI**	**% SSI (95% CI)**
Superficial infections	551	10.7 (9.8-11.6)
Deep seated infections	97	1.9 (1.5-2.3)
Unknown	36	0.7 (0.5-1.0)

SSI incidence density

The infection rates based on the number of SSI per 100 procedures calculated do not take into account the length of time the patients are followed up. Post-discharge follow up vary between Trusts and in some instances the inpatient length of stay. The following table therefore provides an incidence density rate, based on a denominator of 1000 days followed up.

Table 1.4 Total SSI rate/1000 days followed up in Wales in 2008

	Valid Records	SSI	Days followed up	SSI/1000 days followed	95% CI
All Wales	4799	734	96831	7.6	7.0-8.1

Note: there were fewer numbers of valid records and SSI utilised for the incidence density analysis compared with the overall SSI rate calculation. The mean number of days followed was 20 (median 21; mode 28). From the table it is evident that the rate is reduced when the number of days followed up is included.

Key Summary Points

- The All Wales overall SSI rate following a C-section procedure in Wales for 2008 was 15.2% compared with a rate of 20.1% for 2007.
- The overall SSI rate broken down by SSI type was 12.2% superficial infections and 2.1% deep seated infections.
- The post-discharge SSI rate for all Wales in 2008 was 13.3% compared with a rate of 16.1% in 2007.
- The post-discharge SSI rate broken down by SSI type was 10.7% superficial infections and 1.9% deep seated infections.
- To take into account the variation in post-discharge follow-up, rates were calculated by 1000 days of patient follow-up. The overall rate was 7.6 per 1000 days followed.

SECTION 2. General demographics

This section gives information about the age groups and BMI, in particular SSIs associated with each category.

Incidence of SSI by age category

Table 2.1 C-section SSI with age in Wales in 2008 (specific age bands based on those utilised by The National Sentinel Caesarean section Audit report)[14]

Age group	No. of procedures*	No. of SSI	% SSI (95% CI)
<20	249	41	16.5 (11.8-22.3)
20-24	834	141	16.9 (14.2-19.9)
25-29	1214	175	14.4 (12.4-16.7)
30-34	1174	185	15.8 (13.6-18.2)
35-39	860	126	14.7 (12.2-17.4)
≥40	206	26	12.6 (8.2-18.5)

*299 procedures have been excluded because the age question was not completed

Incidence of SSI by BMI category

Table 2.2 C-section SSI with BMI in Wales in 2008 (Specific BMI categories based on those utilised by The World Health Organisation)[15]

BMI	No. of procedures*	No. of SSI	% SSI
Underweight <18.5	49	5	10.2 (3.3-23.8)
Healthy weight 18.5 – 24.9	1423	163	11.5 (9.8-13.4)
Overweight 25 – 29.9	1367	201	14.7 (12.7-16.9)
Obese ≥30	1310	275	21.0 (18.6-23.6)

*687 procedures have been excluded because the BMI question was not completed

Key Summary Points

- There was no significant difference in the SSI rate by age in 2008.
- The risk of a SSI increased with increased BMI, particularly in obese patients. There was a significant ($P<0.05$) increase in the SSI rate for obese patients compared with healthy or overweight patients.

SECTION 3. Details of the surgical procedure

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

Incidence of SSI following elective and emergency Procedures

Table 3.1 C-section SSI in elective and emergency surgical procedures in Wales in 2008

Operation Type	No. Procedures*	No. SSI	% SSI (95% CI)
Elective Procedure	2035	297	14.6 (13.0-16.4)
Emergency Procedure	2665	417	15.6 (14.2-17.2)

*****136 procedures have been excluded because the operation type was not completed

Incidence of SSI by timing of antibiotic prophylaxis

Table 3.2(a) Percentage (%) of C-section procedures by timing of antibiotic prophylaxis in Wales in 2008

Timing of antibiotic prophylactic	No. Procedures*	%
Prior to incision	822	19
After incision	3617	81

*****341 procedures have been excluded because the prophylactic antibiotic question was not completed

Table 3.2(b) C-section SSI with antibiotic prophylaxis in Wales in 2008

Was prophylactic antibiotic given?	No. Procedures*	No. SSI	% SSI (95% CI)
Yes prior to incision	822	141	17.2 (14.4-20.2)
Yes after incision	3617	527	14.6 (13.4-15.9)
No	56	9	16.1 (7.3-30.5)

*****341 procedures have been excluded because the prophylactic antibiotic question was not completed

Incidence of SSI by skin closure type

Table 3.3 C-section SSI with type of skin closure used in Wales in 2008

Type of skin closure	No. Procedures*	No. SSI	% SSI (95% CI)
Dissolvable suture	2574	404	15.7 (14.2-17.3)
Removable suture	1378	196	14.2 (12.3-16.4)
Staples	616	100	16.2 (13.2-19.7)
Glue	2	0	0.0 **

*****266 procedures have been excluded because the type of skin closure utilised was not completed

** 95% confidence intervals not included

Key Summary Points

- No difference in SSI rates were noted for elective versus emergency procedures, however there is a need to determine if SSI rates differ when other variables are combined with these type of procedures, e.g., skin closure type, BMI etc.
- Antibiotic prophylaxis was given to 92% of patients.
- 81% of patients received their antibiotic after incision, 19% prior to incision.
- More data on antibiotics given prior to incision are required.
- Use of dissolvable sutures increased the rate of SSI compared with removable sutures as a skin closure type. Use of staples as the skin closure type increases the risk of SSI however more data are required for statistical analysis.

SECTION 4. Post-discharge details and onset of infection

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

Key Summary Points

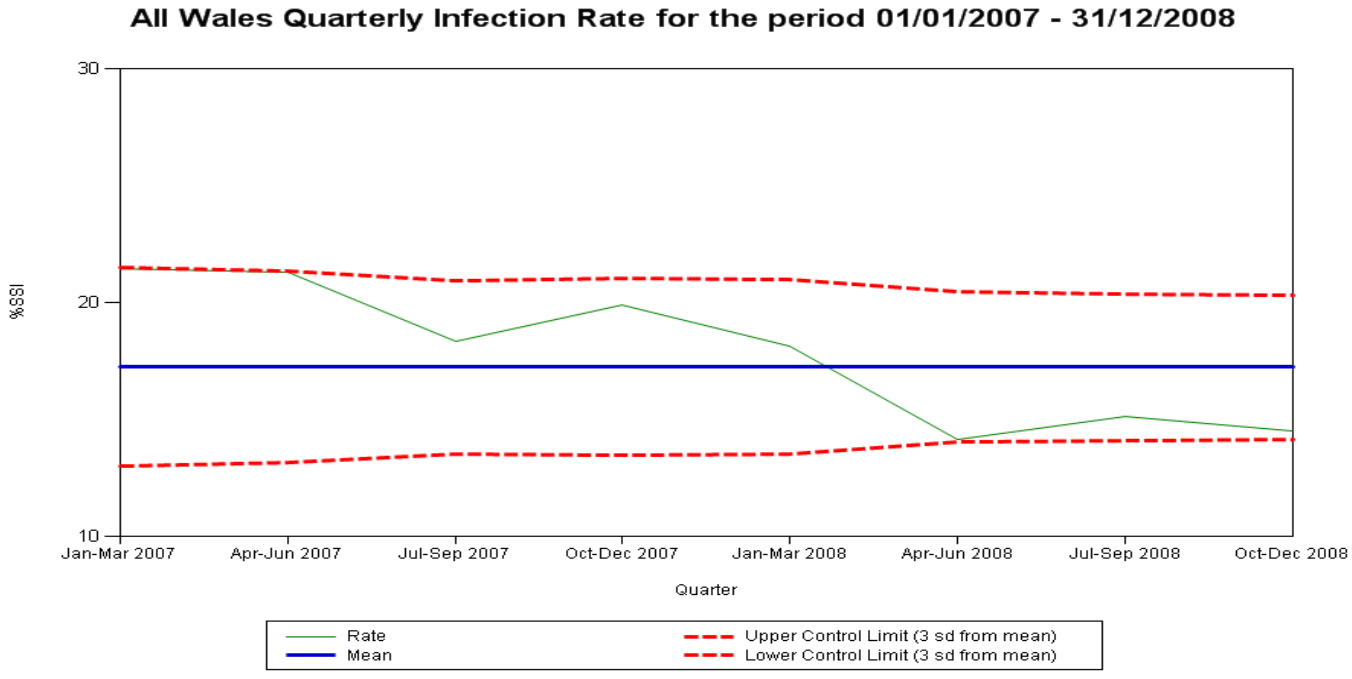
- Mean length of midwifery care following a C-section procedure was approximately 22 – 25 days.
- The length of discharge from midwifery care was increased with the mother having an SSI.
- Mean onset of infection was 11 days after a C-section procedure. This was also noted in the 2007 annual report.
- The greatest numbers of infections were captured between days 5 to day 11, with the highest number captured on day 7.
- The all Wales 2008 data indicates that in order to capture the majority of infections, midwifery care should be followed up until day 28 post-surgery.
- From the 2008 data, 21 days, 14 days and 10 days midwifery follow-up allowed for 91%, 74% and 55% of SSIs to be captured, respectively.
- Due to the differences in the length of midwifery care by Trusts in Wales it is difficult to determine if all SSIs are captured by the scheme. Results should therefore be treated with caution.

SECTION 5. Incidence of SSI over time

Data on C-section SSI surveillance have been collected since 2006. It is important to note that not all hospital Trusts were participating in the surveillance from this time and data should thus be interpreted with caution. Table 5.1 provides the overall SSI rate for 2006, 2007 and 2008 and broken down by elective versus emergency procedures. Figure 5.1 provides the SSI trend over time (2007 – 2008) by quarter.

Table 5.1 Overall SSI rate and SSI rate broken down by elective and emergency procedures in Wales for 2006 - 2008

Operation type	Year	No. Procedures	No. SSI	% SSI (95% CI)
All C-section procedures	2008	4836	737	15.2 (14.2 – 16.4)
	2007	3308	665	20.1 (18.6-21.7)
	2006	2352	505	21.5 (19.6 – 23.4)
Elective	2008	2035	297	14.6 (13.0-16.4)
	2007	1303	255	19.6 (17.2-22.1)
	2006	1014	210	20.7 (18.0 – 23.7)
Emergency	2008	2665	417	15.6 (14.2-17.2)
	2007	1950	397	20.4 (18.4-22.5)
	2006	1274	283	22.2 (19.7-25.0)



Key Summary Points

- The overall C-section SSI rate for 2008 decreased by 4.9% and 6.3% compared to 2007 and 2006 rates, respectively.
- There was over a 1.4 fold decrease in the overall SSI rate for 2008 when compared with the rate for 2006.
- Both elective and emergency rates decreased by over 5% when comparing 2008 data with 2007 and over 6% when comparing 2008 data with 2006.
- The trend graph over time shows that the SSI rate has decreased since 2007. This is especially noticeable since the introduction of the simplified and shorter form at the beginning of 2008.

Conclusions

The Welsh C-section surgical site infection surveillance scheme provides surgical teams with an indication of the current Welsh infection rate and, details of possible risk factors associated with post surgical infection.

In particular, the surveillance for 2008 has identified obesity as a significant ($p<0.05$) risk factor of increased infection post surgery (this compares with data from Scotland)[13]. An increase in the SSI rate was noted when dissolvable sutures were used compared to removable sutures as the skin closure type. Use of staples also increased the SSI rate but more data are required to confirm this. The method of skin closure has been shown to increase SSI rates in other studies[13, 16]. Interestingly, the 2008 data demonstrated a decrease in the SSI rate when the antibiotic prophylaxis was given after incision whilst the 2007 data demonstrated an increase in the rate. Collection of more data for antibiotics given prior to incision is however required. Investigations into the timing of antibiotic prophylaxis have become an increasingly debated topic of interest and Wales has the opportunity to survey such a potential risk factor. There is a need to combine 2006 to 2008 data and with the aid of modelling of the data, determine if there are significant risk factors associated with increased risk of an SSI.

Overall, the rates of infection in general, should be interpreted with caution since for some Trusts; there are still concerns about the reliability of the surveillance, in terms of returning data for all the procedures. The surveillance is currently running at 58 – 69% compliance. However, there has been an improvement in the number of forms available for data analysis. This has increased to 84% compared with 73% in 2007. The overall SSI rate has decreased by 4.9% and 6.3% as compared with rates in 2007 and 2006, respectively. There are some concerns with over reporting of SSI to the surveillance. Validation of the data is crucial to ensure that robust and accurate data are presented. A validation study will commence in 2009.

There are differences between sites in the degree of post-discharge surveillance undertaken, and the length of post-discharge surveillance impacts on their infection rates. From the 2008 data the mean onset of infection was 11 days after a C-section procedure and the surveillance has demonstrated the importance of carrying out post-discharge surveillance for at least 21 days. Only 55% of infections were captured after 10 days follow-up. This increased to 74% and 91% after 14 days and 21 days follow-up, respectively. It is however difficult to determine if all SSIs were captured in the dataset due to the variance in Trust length of midwifery care. The importance of carrying out post-discharge surveillance has been highlighted in this report and is increasingly essential due to the continual decrease in the hospital stay following a C-section procedure. Comparison of SSI rates in other countries within and outside of Europe is difficult as the majority do not have continuous post-discharge surveillance.

This all-Wales report should be used in conjunction with hospital/Trust specific reports and alongside reports from SSI schemes in other countries (with post-discharge surveillance). Continuation of this scheme is required with increased compliance, at least 21 days follow-up and correct reporting of superficial infections, to ensure an accurate all Wales infection rate is calculated and for comparison of rates over time.

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