Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Caesarean Section Surgical Site Infection Surveillance

Wexford General Hospital

2009 to 2011 comparative report

Contents **Page**

Executive summary

Healthcare Associated Infection (HCAI) is recognised more and more by patients and public alike as an issue with the capacity to touch everyone's life. There is an increasing demand for consistent valid data regarding HCAIs, not only from the government and the public, but also from the healthcare professions. It is only by monitoring and trying to understand how HCAIs develop that we can put in place measures to reduce their occurrence. Surgical site infection surveillance (SSIS) is a system whereby post-operative patients are included in a surveillance programme for thirty days after their procedure (or one year if surgery involves an implant) to determine if they develop a surgical site infection (SSI). WGH implemented SSI surveillance to caesarean section procedures in January 2009 and expanded to include post discharge surveillance (PDS) in 2010.

This report presents the SSI data collected by Wexford General Hospital (WGH) in 2011 and also provides a comparative analysis of SSI data collected over a 3 year period from 2009-2011.

WGH is an acute general hospital serving a population of 145,000 people (census 2012). The maternity department comprises of four consultant obstetricians and their teams. The unit consists of a 23 bedded ante natal and post natal ward, and a seven bedded labour ward. The department provides an integrated hospital, community midwifery led service (IHCMS) and an out patient service to expectant mothers.

In 2011, the number of births in WGH was 2231, 508 of which were by caesarean section.

Key Points

- In 2011 35 SSIs were recorded out of 302 women that underwent Caesarean Section procedures at WGH. The overall crude SSI rate was 11.6%.

- Four SSIs were recorded as in patient/readmission SSIs and 31 were recorded through full active post discharge surveillance. This highlights the importance of PDS in identifying SSIs in women who have been discharged from hospital.

- The SSI rate was found to increase significantly in our overweight and obese category of patients between 2010 and 2011. The SSI rate in the overweight category in 2010 was 7.2% and in 2011 was 13.2%. In the obese category the SSI rate increased from 12.2% in 2010 to 16.3% in 2011.

- There was no significant difference in the SSI rate for patients who underwent elective or emergency C/Section procedures in 2011. The SSI rate in patients that underwent an urgent C/Section in 2011 reduced to 18.5% from 25.0% in 2010.

- In keeping with international experiences the SSI rate was found to be lower in all patients that had antibiotic prophylaxis prior to incision.

- The SSI rate was highest in patients where staples were used to close the wound.

- Of the 35 SSIs identified, 33 superficial SSIs and two organ space SSIs were recorded. There were no deep SSIs recorded in 2011.

Introduction

Surgical site infections (SSIs) are the second most common HCAI and account for 18.2% of all HCAI in the Republic of Ireland (HPSC 2012). Surgical site infection (SSI) is an important area for surveillance and remains an important complication of surgery with both a high human and financial impact. 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 (Hillan 1995). SSI following caesarean section is a common cause of morbidity, with socioeconomic consequences for the woman and her family (Gould 2007).

Surveillance can contribute to the prevention and control of SSI and therefore HCAI. The links in the chain of surveillance activity include collection of data, management of the data with a view to completing the surveillance cycle and ensuring that data are fed back to the relevant stakeholders (Gaynes and Solomon, 1996).

Surveillance is a key requirement under:

- The Strategy for the prevention of antimicrobial resistance in Ireland (SARI)
- HIQA Infection Prevention and Control Standards 2009-Standards 2.2 & 11
- HSE Infection Prevention Control Action Plan- Say no to Infection (HSE 2007)

The data provides important information to underpin infection prevention and control action plans at local and national levels by:

- Providing risk adjusted measures of performance over time and highlighting potential areas of concern whilst stressing areas of good practice;
- Improving understanding in relation to practice. The ability to compare results with a broad range of service providers both within the UK, Europe and USA will be particularly important in this regard;
- Assist in monitoring the impact of any interventions introduced in surgical practice.

Methodology

Surveillance Methodology

The surveillance methodology is based on a standardized method used by the National Healthcare Safety Network (Horan 2008). The NHSN adopted the National Nosocomial Infection Surveillance (NNIS) System developed by the Centres for Disease Control and Prevention (CDC), Atlanta Georgia, USA (NNIS 1999). The criteria for the specific types of infection can be found in Appendix A.
Any infection reported must meet the NHSN definition of a HCAI. For the purpose of surveillance in the acute care setting, the CDC defines a HCAI as a localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or its toxin(s).
Primary data collection related to the first thirty days post-surgery. If an implantable device was involved this was extended for at least one year post surgery.

Formal Post-discharge surveillance (PDS)

On average most SSIs occur between days 8 and 10 following a surgical procedure (WGH annual reports). Changing surgical practices with shorter length of stay contributes to the underestimation of the true SSI rate (Kent *et al* 2001). Accurate determination of SSIs required the introduction of a system of post discharge surveillance for up to 30 days. To be useful for regional or national audit the method must

be effective, inexpensive and acceptable to patients (Taylor et al 2003). A post discharge surveillance system was commenced in WGH in 2010 and continued in 2011.

PDS is conducted through a patient questionnaire survey and a follow-up telephone conversation with General Practitioners, Practice Nurses or Public Health Nurses. The method of PDS for each procedure is categorised as;

(a) **Passive:** Passive surveillance occurs when the SSI Manager checks for readmissions for SSI

(b) **Active with direct observation**: Active with direct observation occurs when there was direct observation of the surgical site by healthcare staff within 30 days of their procedure.

Formal active/passive post discharge surveillance (PDS) was introduced for C sections on 1st January 2010.

Analysis and Calculations

Full exclusions from analysis include any patients where:

- PDS was not completed (Note: not for 2009, where PDS was not yet established)

In any table, the number of procedures with missing/non recorded data is included in the last row. This indicates non-compliance with data recording.

SSI rate is calculated as No. of SSI/No. of procedures X 100.
All rates will be shown with 95% Confidence Intervals (CI) calculated using a Wilson's approximation (Wilson 1927)

The BMI recorded on form is taken at 20 weeks gestation. An adjustment is made by subtracting 2 from the '20 weeks gestation BMI figure to give a 'pre-pregnancy BMI value. The adjusted value is used in Table 6.

Data scanning and validation by Ms Leah Warren, Administrative Assistant, Wexford General Hospital

We would like to thank all the healthcare professionals who participated in all aspects of the surveillance. It would have been impossible to produce this report without their support.

This report was written by Dr Colette O' Hare, Surveillance scientist, Public Health, HSE South (SE), Dr Brian Carey, Consultant Microbiologist, Waterford Regional Hospital and Wexford General Hospital, Ms Emer Ward, IPCN, Wexford General Hospital and Ms Eithne O'Sullivan, Surveillance Manager, Wexford General Hospital.

Steering committee members are listed in Appendix B.

Section 1: Crude rates

Two annual reports for 2009 and 2010 have previously been published and are available on www.hpsc.ie. This is the first comparative report for three years of data from 2009 to 2011 covering surgical site surveillance in Caesarean Section (C-section) procedures in Wexford General Hospital (WGH).

In 2011 data were received on 302 women who had their babies delivered by C-section at WGH between 1 January and 31 December and who also had completed post discharge surveillance (PDS).

The following overview is given for 2011 data and the rest of the report will do comparative analysis with previous years. Please be aware for comparative purposes data presented for 2009 does not include post discharge sureveillance (PDS).

Table 1: Overall view of data from 2011 C section SSIS

No of in-patient forms completed	411
No of Post Discharge surveillance forms returned	302
No of valid forms used for data analysis	302
% of valid forms used for data analysis	73 %
Number of inpatient/readmission SSIs	4
Number of post discharge SSIs	31

Table 2: Crude SSI rates for C sections in WGH from 2009 to 2011

Year	Number of procedures	Number of SSI	% Crude SSI rate (95% CI)	
2009	445	10	2.2	(1.2 – 4.1)
2010	302	22	7.3	(4.9 – 11.0)
2011	302	35	11.6	(8.5 – 15.7)

Since C-sections in 2009 did not have PDS, a cumulative SSI rate was produced for 2010 and 2011 only. From 2010 to 2011 there were a total of 604 C-sections in WGH that had completed surveillance forms and PDS forms. Fifty seven SSIs were detected. This gives a cumulative SSI rate of 9.4% (95% CI; 7.4, 12.0)

Section 2: General demographics

This section gives information about the age groups, patient gestation, BMI, previous C-sections, labour details and ruptured membranes, in particular SSIs associated with each category.

Age

Table 3. SSI rates by age group

Age group	Year	No procedures (No. SSI)	% SSI (95% CI)	
<20	2009	9 (1)	11.0	(0.0 - 43.5)
	2010	5 (2)	40.0	(11.8 - 76.9)
	2011	3 (0)	0	(0.0 - 56.2)
20 – 24	2009	42 (0)	0	(0.0 - 83.8)
	2010	21(3)	14.3	(5.0 - 34.6)
	2011	19 (4)	21.1	(8.5 - 43.3)
25 – 29	2009	92 (1)	1.1	(0.2 - 5.9)
	2010	70 (8)	11.4	(5.9 - 20.1)
	2011	59 (7)	11.9	(5.9 - 22.5)
30 – 34	2009	167 (7)	4.3	(2.1 - 8.7)
	2010	108 (6)	5.6	(2.6 - 11.6)
	2011	113 (13)	11.5	(6.9 - 18.7)
35 – 39	2009	115 (0)	0	(0.0 - 32.3)
	2010	83 (2)	2.4	(0.6 - 8.4)
	2011	83 (9)	10.8	(5.8 - 19.3)
≥ 40	2009	26 (1)	3.8	(6.8 - 18.9)
	2010	15 (1)	6.7	(1.2 - 29.8)
	2011	25 (2)	8.0	(2.2 - 25.0)

Gestation

Table 4. SSI rates by time of gestation

Gestation	Year	No procedures (No. SSI)	% SSI (95% CI)	
< 37 weeks	2009	21 (0)	0	(0.0 - 15.5)
	2010	22 (1)	4.6	(0.8 - 21.8)
	2011	21 (4)	19.0	(7.7 - 40.0)
37 – 40 weeks	2009	299 (6)	2.0	(0.9 - 4.3)
	2010	202 (15)	7.4	(4.5 - 11.9)
	2011	207 (27)	13.0	(9.1 - 18.3)
≥ 40 weeks	2009	59 (2)	3.4	(0.9 - 11.5)
	2010	51 (3)	5.9	(2.0 - 15.9)
	2011	37 (2)	5.4	(1.5 - 17.7)
Non-recorded	2009	66 (2)		
	2010	27 (3)		
	2011	37 (2)		

Body Mass Index (BMI) category

The risk of SSI increased with increasing BMI.

Table 5. SSI rates by BMI

Body mass Index category	Year	No procedures (No. SSI)	% SSI (95% CI)	
Under weight (<18.5)	2009	6 (1)	16.7	(3.0 - 56.4)
	2010	6 (0)	0	(0.0 - 39.0)
	2011	12 (1)	8.3	(1.5 – 35.4)
Healthy weight (18.5 -24.9)	2009	150 (0)	0	(0.0 - 2.5)
	2010	99 (5)	5.0	(2.2 - 11.3)
	2011	100 (6)	6.0	(2.8 - 12.5)
Overweight (25.0 - 29.9)	2009	85 (4)	4.7	(1.9 - 11.5)
	2010	97 (7)	7.2	(3.5 - 14.2)
	2011	76 (10)	13.2	(7.3 - 22.6)
Obese (≥ 30)	2009	78 (2)	2.6	(0.7 - 8.9)
	2010	49 (6)	12.2	(5.7 - 24.2)
	2011	49 (8)	16.3	(8.5 - 29.1)
Non recorded	2009	126 (3)		
	2010	51 (4)		
	2011	65 (10)		

The values in table 5 are adjusted to pre-pregnancy BMI. The surveillance methodology (p.4) shows how this was calculated.

Previous C-sections

For both 2010 and 2011, the highest rates of SSI were in patients who had three or more previous C-sections.

Table 6. SSI rates by number of previous C-sections

Previous C-sections	Year	No procedures (No. SSI)	% SSI (95% CI)	
0	2009	233 (6)	2.6	(1.2 - 5.5)
	2010	169 (11)	6.5	(3.7 - 11.3)
	2011	154 (18)	11.7	(7.5 - 17.7)
1	2009	135 (3)	2.2	(0.8 - 6.3)
	2010	85 (7)	8.2	(4.1 - 16.0)
	2011	100 (10)	10.0	(5.5 - 17.4)
2	2009	43 (0)	0	(0.0 - 8.2)
	2010	31 (2)	6.5	(1.8 - 20.7)
	2011	27 (2)	7.4	(2.1 - 23.4)
3+	2009	6 (0)	0	(0.0 - 39.0)
	2010	7 (1)	14.3	(2.6 - 51.3)
	2011	15 (2)	13.3	(3.7 - 37.9)
Non recorded	2009	28 (1)		
	2010	10 (1)		
	2011	6 (3)		

Labour details

Table 7. SSI rates by labour details

Labour details	Year	No procedures (No. SSI)	% SSI (95% CI)	
No Labour	2009	280 (6)	2.1	(1.0 - 4.6)
	2010	196 (6)	8.2	(5.1 - 12.9)
	2011	217 (22)	10.4	(6.8 - 14.9)
Up to 12 hours labour	2009	132 (3)	2.3	(0.8 - 6.5)
	2010	98 (6)	6.1	(2.8 - 12.7)
	2011	77 (11)	14.3	(8.2 - 23.8)
More than 12 hours labour	2009	9 (1)	11.0	(1.2 - 43.5)
	2010	6 (0)	0	(0.0 - 39.0)
	2011	5 (0)	0	(0.0 - 43.5)
Non recorded	2009	24 (0)		
	2010	2 (0)		
	2011	3 (2)		

Rupture of membranes (ROM) before the procedure

Table 8. SSI rates by rupture of membranes

Rupture of membranes	Year	No procedures (No. SSI)	% SSI (95% CI)	
No rupture	2009	299 (7)	2.3	(1.1 - 4.8)
	2010	205 (15)	7.3	(4.5 - 11.7)
	2011	195 (20)	10.3	(6.7 - 15.3)
Yes – less than 24 hours	2009	101 (1)	1.0	(0.1 - 5.4)
	2010	79 (7)	8.9	(4.4 - 17.2)
	2011	86 (4)	16.3	(10.0 - 25.5)
Yes – more than 24 hours	2009	15 (2)	13.3	(3.7 - 37.9)
	2010	14 (0)	0	(0.0 - 21.5)
	2011	14 (0)	0	(0.0 - 21.5)
Non recorded	2009	30 (0)		
	2010	4 (0)		
	2011	7 (1)		

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 and crash), use of antibiotic prophylaxis, and skin closure type.

Elective, emergency and crash procedures

Table 9. SSI rates by type of procedure

Procedure class	Year	No procedures (No. SSI)	% SSI (95% CI)	
Elective	2009	222 (6)	2.7	(1.2 – 5.8)
	2010	145 (11)	7.6	(4.3 – 13.1)
	2011	173 (19)	11.0	(7.1 – 16.5)
Emergency	2009	200 (3)	1.5	(0.5 – 4.3)
	2010	137 (6)	4.4	(2.0 – 9.2)
	2011	100 (11)	11.0	(6.3 – 18.6)
Urgent	2009	23 (1)	4.4	(0.8 – 21.0)
	2010	20 (5)	25.0	(11.2 – 46.9)
	2011	27 (5)	18.5	(8.2 – 36.7)
Non recorded	2009	0		
	2010	0		
	2011	2 (0)		

In 2011 the SSI rate for elective and emergency surgery was the same

Antibiotic prophylaxis

Table 10. SSI rates by prophylaxis

Antibiotic prophylaxis	Year	No procedures (No. SSI)	% SSI (95% CI)	
Yes, prior to incision	2009	170 (3)	1.8	(0.6 – 5.1)
	2010	173 (11)	6.4	(3.6 – 11.0)
	2011	139 (11)	7.9	(4.5 – 13.6)
Yes, after incision	2009	235 (6)	2.6	(1.2 – 5.5)
	2010	104 (11)	10.6	(6.0 – 18.0)
	2011	149 (19)	12.8	(8.3 – 19.1)
No	2009	4 (0)	0	(0.0 – 49.0)
	2010	2 (0)	0	(0-65.8)
	2011	0		
Non recorded	2009	36 (1)		
	2010	23 (0)		
	2011	14 (5)		

The SSI rate in all patients that had prophylaxis given prior to incision was lower than those who were given prophylaxis after incision. This supports international recommendations on best practice.

Skin closure type

For both 2010 and 2011, SSI rate was highest when staples were used.

Table 11. SSI rates by skin closure type

Skin closure type	Year	No procedures (No. SSI)	% SSI (95% CI)	
Continuous suture	2009	224 (3)	1.3	(0.5 – 3.9)
	2010	149 (10)	6.7	(3.7 – 11.9)
	2011	215 (23)	10.7	(7.2 – 15.5)
Interrupted suture	2009	61 (3)	4.9	(1.7 – 13.5)
	2010	53 (2)	3.8	(1.0 – 12.8)
	2011	26 (3)	11.5	(4.0 – 29.0)
Staples	2009	132 (4)	3.0	(1.2 – 7.5)
	2010	70 (8)	11.4	(5.9 – 21.0)
	2011	27 (6)	22.2	(10.6 – 40.8)
Non recorded	2009	28 (0)		
	2010	30 (2)		
	2011	35 (3)		

One procedure in 2011 had both continuous and interrupted sutures (not an SSI case).

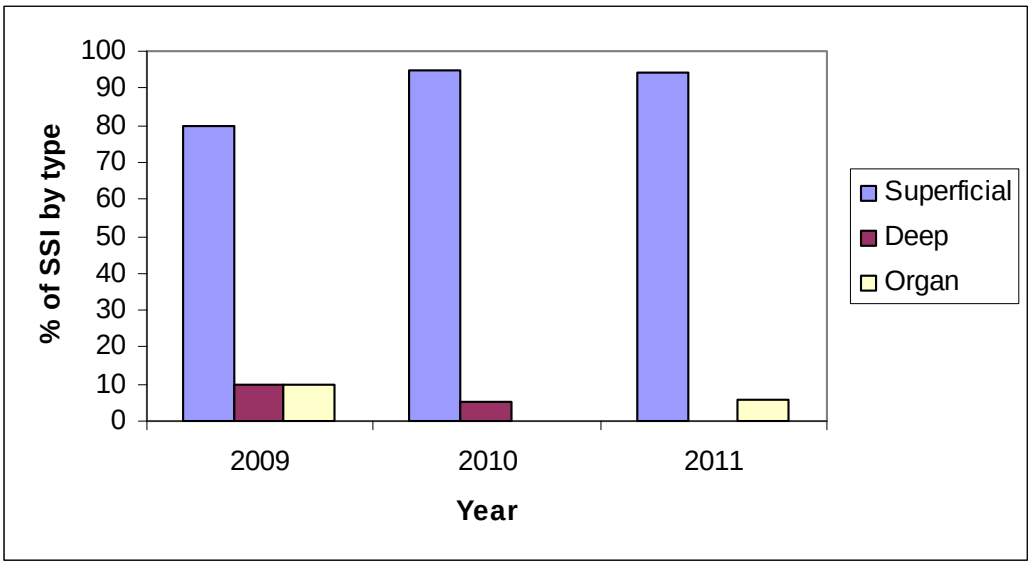
SSI Infection type

Table 12. SSI rates by Infection type

Skin closure type	Year	Number of SSI	% SSI
Superficial	2009	8	80%
	2010	21	95%
	2011	33	94%
Deep	2009	1	10%
	2010	1	5%
	2011	0	0
Organ	2009	1	10%
	2010	0	0
	2011	2	6%
Non recorded	2009	0	
	2010	0	
	2011	0	

For all years, the vast majority of infections were superficial (Figure 1).

Figure 1: Percentage of infection type from 2009-2011



Section 4: Timelines

The following section provides details on the pre, post and total length of hospital stay. In addition, data are provided on onset of infection.

Length of stay

Table 13 provides the average pre-operative, post-operative and total hospital length of stay for C-section procedures.

Table 13. C section pre-operative, post-operative and total length of stay from 2009-2011

Year	**Pre-operative LOS**		**Post-operative LOS with SSI**		**Post-operative LOS without SSI**		**Total LOS**	
	Mean (days)	Range (days)	Mean (days)	Range (days)	Mean (days)	Range (days)	Mean (days)	Range (days)
2009	1	0 – 32	5.5	3 – 12	4	0 – 10	5	1 – 36
2010	1	0 – 11	3.5	2 – 7	3.7	0 – 12	4.7	2 – 16
2011	1	0 - 18	3.8	3 - 10	3.8	1 - 34	5	2 - 35

No of SSI per year: 2009 (10), 2010 (22), 2011 (35)
Pre-operative stay = procedure date – admission date
Post-operative stay = discharge from hospital date – procedure date
Total hospital stay = discharge from hospital date – admission date

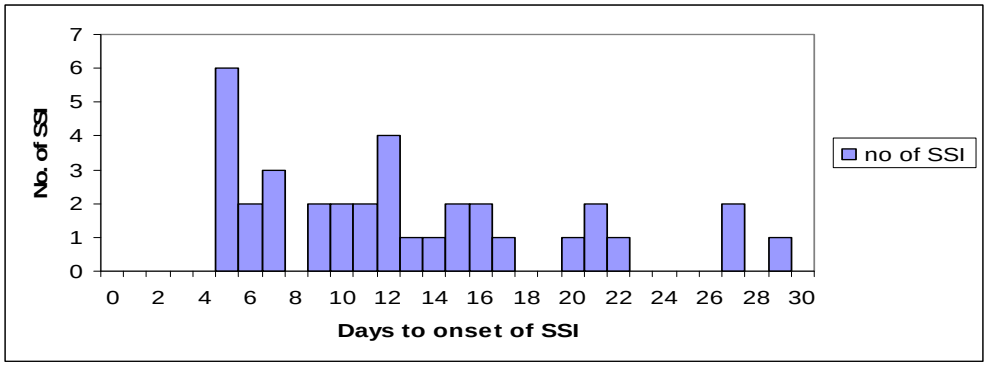
The average length of stay (LOS) for patients post-operatively, and the percentage of SSIs which developed after patient discharge are shown in Table 14.

Table 14: Post operative LOS and development of SSIs after patient discharge

Year	Post-op LOS (days, mean)	Percentage of identified SSIs that developed <u>after</u> patient discharge
2009	4.0	60%
2010	3.7	91%
2011	3.8	88%

Onset of infection

Figure 2. Length of time (days) from C section procedure date to onset of surgical site infection



Twenty three SSIs developed between 0-14 days after procedure. Thirty one of the thirty five SSIs were noted after discharge.

Duration of Procedure

Table 15 provides details of the mean duration of C-section procedures for all patients and provides a comparison of procedure duration with patients who developed an SSI post surgery compared to those without an SSI. Only those procedures with a recorded start and end time to the procedure could be utilised in calculations.

Table 15. Duration of procedure

	Duration of procedure					
Year	**All patients with an SSI**		**All patients without an SSI**		**All patients**	
	Number of procedures with calculable time	Mean time (mins)	Number of procedures with calculable time	Mean time (mins)	Number of procedures with calculable time	Mean time (mins)
2009	10	28	419	31	429	31
2010	21	32	268	32	289	32
2011	34	31	255	30	290	31

T-values are calculated as the 75th percentile of duration of the surgical procedure, based on surgeon performance in the United States (NNIS, 1999). For C-section procedures, the T-value is 1 hour. It would be expected that 25% of the procedures should lie above the T-value. In WGH in 2009 1% of procedures took longer than the T value set by the USA, for 2010 it was 1.4% and for 2011 it was 0.7%.

We calculated our own T values for Wexford General Hospital C-section procedures (Table 16) and found that for all years the T values are lower than those found in the distribution of operations in European hospitals with a published T time (75th percentile) of 48 min (HELICS, 2004).

Table 16.

Year	75th percentile of WGH data	% of procedures exceeding a T value of 36 minutes*
2009	35 mins	20%
2010	38 mins	27%
2011	35 mins	23%

*average of T values 2009-2011

Section 5: Incidence of SSI by patient risk

Wound classification

The following tables provide the number of SSI and % SSI associated with each wound class and ASA scoring category for C-section procedures.

Table 17. SSI rates by wound class

Wound Classification	Year	No procedures (No. SSI)	% SSI (95% CI)	
Clean contaminated	2009	414 (9)	2.2	(1.2 – 4.1)
	2010	287 (21)	7.3	(4.8 – 10.9)
	2011	270 (27)	10.0	(7.0 – 14.2)
Dirty or Infected	2009	0	0	
	2010	4 (0)	0	(0.0 - 49.0)
	2011	5 (2)	40.0	(11.8 – 76.9)
Non recorded	2009	31 (1)		
	2010	11 (1)		
	2011	27 (6)		

Education sessions will be addessing the area of non compliance in the recording of wound class.

ASA classification

Table 18. SSI rates by ASA classification

ASA Classification	Year	No procedures (No. SSI)	% SSI (95% CI)	
Normally healthy	2009	402 (10)	2.5	(1.4 – 4.5)
	2010	286 (22)	7.7	(5.1 – 11.4)
	2011	292 (34)	11.6	(8.5 – 15.8)
Mild systemic disease	2009	6 (0)	0	(0.0 – 39.0)
	2010	11 (0)	0	(0.0 – 25.9)
	2011	5 (0)	0	(0.0 – 43.5)
Severe systemic disease not incapacitating	2009	1 (0)	0	(0.0 – 79.4)
	2010	1 (0)	0	(0.0 – 79.4)
	2011	2 (0)	0	(0.0 – 65.8)
Incapacitating systemic disease with threat to life	2009	0	0	
	2010	1 (0)	0	(0.0 – 79.4)
	2011	0	0	
Moribund	2009	0	0	
	2010	0	0	
	2011	0	0	
Non-recorded	2009	36 (0)		
	2010	3 (0)		
	2011	3 (1)		

Table 19 shows factors that may influence the risk of infection. The American National Nosocomial Infections Surveillance (NNIS) system risk index is the most widely used method internationally of risk adjusting surgical patients (Culver *et al* 1991; NNIS system report, 2004). The risk index uses three risk factors to score each patient from 0 to 3, namely the American Society of Anaesthesiologists (ASA) pre-operative assessment score, the wound classification and the duration of surgery. The procedure is scored from 0 to 3 according to how many of the factors were present at the time of surgery.

Risk index

Table 19. Patient risk factors

	Patient risk factors (NNIS)					
Year	**ASA of 3, 4 or 5**		**Wound class Dirty or infected**		**Duration of surgery > 60 mins**	
	No	Yes	No	Yes	No	Yes
2009	408	1	414	0	424	5
2010	297	2	287	4	286	4
2011	297	2	270	5	286	4

Table 20. Patient Risk Index (NNIS)

	NNIS Risk Index			
Year	**RI 0**	**RI 1**	**RI 2**	**RI 3**
	Number of patients (No. SSI)	**Number of patients (No. SSI)**	**Number of patients (No. SSI)**	**Number of patients (No. SSI)**
2009	360 (9)	5 (0)	0	0
2010	269 (19)	9 (1)	0	0
2011	252 (26)	11 (2)	0	0

Conclusion

The caesarean section SSI rate in the UK has more than doubled during the last two decades and is continuing to rise (Ward *et al* 2008). The majority of SSIS systems are restricted to in patient stay, which may give misleading results. The time it takes for an infection to develop is an important factor of any disease surveillance system and can influence which surveillance methods are most effective for detecting infection. Unless surgical site surveillance includes a post discharge component, infection rates and associated human and economic costs will continue to be grossly underestimated (Creedy & Noy 2001). The introduction of formal post discharge surveillance in 2010 at Wexford General Hospital has contributed to the accurate determination of SSI rates. C-Sections are one of the most commonly performed operative procedures (Opoien *et al* 2007).This system provides an opportunity for a collaborative surveillance approach between hospital and community staff. The introduction of our surveillance system in 2009 showed an SSI rate of 2.2%, for that year. With the introduction of post discharge surveillance in 2010 our SSI rates rose to 7.3% in 2010 and to 11.6% in 2011. This data compares favourably with the findings of the Pan Celtic Collaborative SSIS report published in December 2010 (HPS 2010). In that report, overall SSI rates, including infections detected following discharge, ranged from 6.2% in Scotland to 15.1% in Northern Ireland. Our report contains data collected by clinical teams utilising internationally agreed definitions and therefore is internationally comparable. Interpretation or comparison of rates between countries should be treated with caution as there are several factors which can influence the rate of SSI. These factors include when the surveillance process was first implemented, the number of patients that are included in PDS and compliance within an organisation/country.

The risk of developing a SSI after C-section is multi-factorial and has been found to most commonly influenced by the following factors: body mass index (BMI), age, blood loss, method of wound closure and type of procedure (Ward *et al* 2008). The rates of SSI increase with the number of risk factors present. We have found that the SSI rate in the BMI category of obese has varied from 2.6 % (no PDS) in 2009 to 12.2% in 2010 and 16.3% in 2011. However, taking low numbers into account the overall view is that the risk of SSI increased with increasing BMI. We could not determine any consistent trend of SSI in relation to patient age group. Blood loss was not measured as part of our surveillance process. The type of skin closure associated with our highest rate of SSI is in skin closed with staples. This SSI rate has increased from 3.0% in 2009, to 11.4% in 2010 and 22.2 % in 2011. The lowest SSI rate has been found in patients where a continuous suture has been used, 1.3% in 2009, to 6.7% in 2010 and 10.7% in 2011.

The choice of subcuticular suture rather than staples to close the surgical site is associated with a significantly lower incidence of infection (Johnson *et al* 2006; Gould 2007).
SSI types are divided into three categories, superficial incisional, deep incisional and organ space infections. In 2011 the vast majority of SSI's (94%) were superficial, none were recorded as deep (5% in 2010) and 6% reported as organ space. The rate of SSIs increased significantly in 2011 from 2010 rates. Going forward, a multi-disciplinary approach to clinical interpretation of our data will be adopted to identify the contributing factors and to improve the delivery of patient care.

The principles of clinical governance apply to all who provide or manage patient care services in the HSE. Strategies to prevent or at least decrease, the risk of infection are needed. There is evidence to suggest that infection rates can be reduced when routine surveillance with feedback of rates to staff is included in infection control programmes. The publication of the 2011 report now provides the staff of Wexford General Hospital with three years of comparative, meaningful data which can be used to underpin and influence infection control programmes. The choice of wound closure method varies, and may be influenced by individual preference, speed of insertion and surgeon experience (Ward *et al* 2008). However, the provision of the data contained within this report may influence changes in certain practices where SSI rates are highlighting areas of potential concern, along with highlighting areas of good practice. The surveillance process and its findings will help our efforts to reduce adverse outcomes following surgery, by lowering SSI rates and avoiding the impact that these infections have on patient morbidity and mortality.

References

Creedy DK, Noy DL(2001) Post-discharge Surveillance After Caesarean Section. *BIRTH*. 28 (4) 264-269.

Culver DH, Horan TC, Gaynes RP, Martne WJ, Jarvis WR, Emori TG, Banergee JR, Tolson JS, Henderson TS et al. (1991) Surgical wound infection rates by wound class, operative procedure and patient risk index. *American Journal of Medicine*; 91 (Suppl B): 3B-152S-157S.

Gaynes RP, Solomon S. (1996) Improving hospital acquired infection rates: the CDC experience. *Journal on Quality Improvement*. 22(7): 457-467

Gould D. (2007) Caesarean section, surgical site infection and would management. *Nursing Standard*,. **21** (32) 57-58.

Health Protection Scotland (HPS), 2010. Pan Celtic collaborative surgical site infection surveillance report: Surveillance of surgical site infection for caesarean section procedures performed in Northern Ireland, Scotland and Wales in 2008.

Health Protection Surveillance Centre, Point Prevalence Survey of Hospital Acquired Infection and Antimicrobial use in European Acute Care Hospitals. May 2012. Ireland National Report. November 2012.

Hillan EM. (1995) Postoperative morbidity following Caesarean delivery. *Journal of Advanced Nursing*. **22** (6) 1035-1042

HIQA Infection Prevention and Control Standards 2009 – Standards 2.2 & 11. http://www.hiqa.ie/standards/health/healthcare-associated-infections

Horan T, Andrus M, Dudeck M. (2008) CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. *American Journal Infection Control*; 36:309-32

Hospitals in Europe Link for Infection Control through Surveillance (HELICS). Surveillance of surgical site infections. Surgical site infections 2004. HELICS, March 2006. Available at: http://helics.univ-lyon1.fr/helicshome.htm

Infection Control Action Plan – Say No to Infection. Health Services Executive, 2007 http://www.hse.ie/eng/services/Publications/HealthProtection/Health_Care_Associated_Infection/Say_No_to_Infection_A_National_Strategy_Nov_2007.html

Johnson A, Young D, Reilly J. (2006) Caesarean section surgical site infection surveillance. *Journal of Hospital Infection*. 64; 30-35.

Kent P, McDonald M, Harris O, Mason T, Spelman D. (2001) Post-discharge surgical wound infection surveillance in a provincial hospital: follow up rates, validity of data and review of the literature. *ANZ Journal of Surgery*; 71, 583-589

National Nosocomial Infections Surveillance (NNIS) Manual. U.S Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention (CDC), 1999.

National Nosocomial Infections Surveillance (NNIS) System report, data January 1992 to October 2004. *American Journal of Infection Control* 2004; 32: 470-485

Opoien HK, Valbo A, Grinde-Anderson A, Walberg M. (2007) Post-caesarean surgical site infections according to CDC standards: rates and risk factors. A prospective cohort study. *Acta Obstetricia et Gynecologica*. 86; 1097-1102.

Strategy for the control of antibiotic resistance in Ireland (SARI), 2001. http://www.hpsc.ie/hpsc/A-Z/MicrobiologyAntimicrobialResistance/StrategyforthecontrolofAntimicrobialResistanceinIrelandSARI/

Taylor EW, Duffy K, Lee K, Noone A Leonard A, King PM, O'Dwyer P. (2003) Telephone call contact for post-discharge surveillance of surgical site infections. A pilot, methodological study. *The Journal of Hospital Infection*.. 55 (1) 8-13.

Ward VP, Chorlett A, Fagan J, Crawshaw SC (2008) Enhanced surgical site infection surveillance following caesarean section: experience of a multicentre collaborative post-discharge system. *The journal of Hospital Infection*. 70 (2) 166-173.

Wilson, E.B. (1927) Probable inference, the law of succession, and the statistical inference. *Journal of the American Statistical Association*; 22, 209-212

Appendix A

CDC Definitions for Surgical Site Infection Surveillance following General Surgery

Superficial Incisional Infection

SSI that occurs within 30 days of CSD surgery, involves only the skin or subcutaneous tissue of the incision & meets **one** of the following criteria:

1. Purulent drainage from superficial incision
2. Culture of organisms **and** pus cells present :
   fluid / tissue from superficial incision
   wound swab from superficial incision
3. At least 2 symptoms of inflammation :
   pain, tenderness, localised swelling, redness, heat

and either: 1) *incision deliberately opened to manage infection*
OR 2) *clinicians diagnosis of superficial SSI*

Deep Incisional Infection

SSI involving the deep tissues (i.e. fascial & muscle layers), within 30 days of surgery and the infection appears to be related to the surgical procedure & meets one of the following criteria:

1. Purulent drainage from deep incision (not organ space)
2. Organisms from culture **and** pus cells present in:
   fluid / tissue from deep incision…..or
   wound swab from deep incision
3. Deep incision dehisces or deliberately opened **and** patient has at least 1 symptom of:
   Fever or localised pain/tenderness
4. Abscess or other evidence of infection in deep incision:
   re-operation / histopathology / radiology
5. Clinicians diagnosis of deep incisional SSI

Organ/space Infection

SSI involving the organ/space (other than the incision) opened or manipulated during the surgical procedure, that occurs within 30 days of surgery and the infection appears to be related to the surgical procedure & meets one of the following criteria:

1. Purulent drainage from drain (through stab wound) into organ space
2. Organisms from culture and pus cells present:
   Fluid or tissue from organ/space or
   Swab from organ/space
3. Abscess or other evidence of infection in organ/space:
   Re-operation / histopathology / radiology
4. Clinicians diagnosis of organ/space infection

If the SSI meets the organ/space definition then identify the specific site such for example Endometritis.

Note: If infection drains through incision = deep incisional

Appendix B

Steering Committee Members

Ms Lily Byrne	General Manager (Chairperson)
Mr Seamus Butler	Director of Information Systems
Dr Brian Carey	Consultant Microbiologist
Dr Danielle Collins	Specialist Surgical Registrar
Ms Margaret Curran	Quality Manager
Mr Bernard Finnegan	Director of Nursing
Dr Francois Gardeil	Consultant Obstetrician
Ms Deirdre Lambert	Pharmacist
Mr Ken Mealy	Consultant Surgeon
Dr Colette O'Hare	Surveillance Scientist, Public Health
Ms Eithne O'Sullivan	Surveillance Manager
Ms Rebecca Pierce	Surgical Nurse Manager
Mr Nicky Power	ICT Systems Analyst
Ms Niamh Purcell	Surveillance Scientist, Microbiology Laboratory
Ms Patricia Stack	Theatre Manager
Ms Emer Ward	Clinical Nurse Specialist, Infection, Prevention & Control