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NPHS Communicable Disease  
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**ALL WALES**

**Orthopaedic Surgical Site Infection Report**

**January – December 2007**

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## **All Wales Summary**

- The report covers surveillance of elective hip & knee prosthesis procedures carried out in 2007.
- 5268 questionnaires were analysed for the report, which represented nearly 70% of the mandatory surveillance procedures carried out in Wales in 2007. Compliance with the surveillance varied, with Trusts reporting between 0.5% and all of the mandatory orthopaedic procedures carried out in the Trust.
- There has been a large increase in the numbers of procedures reported compared to 2006 (40% increase for hips, 70% increase for knees).
- Overall 61 infections were detected within the hospital stay, giving a crude pre-discharge SSI rate of 1.2%. Another 88 infections were detected post discharge, giving a crude overall SSI rate of 2.8%.
- The all Wales infection rate for elective knee prosthesis procedures was higher than for elective hip prosthesis procedures (3.2% vs 2.3%), but not significantly so.
- The infection rate for hip prosthesis procedures has decreased since 2006 (2.3 vs 2.5) and increased for knee prosthesis procedures (3.2 vs 2.5). Data for 2007 is not strictly comparable with previous years, however, since surveillance is now restricted to elective primary procedures only.
- There was considerable variation in the infection rates between Trusts, ranging from 0 to 5.7% for total SSI in all orthopaedic procedures. Comparisons between Trusts should, however, be made with caution since there were differences in Trust interpretation of the procedure names as well as the degree of surveillance coverage and the amount of post-discharge surveillance.
- Overall a post discharge report was received for 60% of procedures but this varied from 6% to 100% of records by Trust. To take into account the variation in follow up, rates were calculated by 1000 days of patient follow up. The overall rate was 0.8 per 1000 days followed: 0.6 for hip prosthesis procedures and 0.9 for knee prosthesis procedures. There was less variation in rates by Trust when length of follow up was taken into account (0 – 3.0/1000 days followed up).
- 85% of infections were of the superficial type.
- The majority of procedures were carried out by consultant surgeons. There were no significant differences between the rates of infection in procedures carried out by consultants and other surgeon grades.

- Most patients were in the lowest risk category of infection (risk index=0). In general infection rates increased with increasing numbers of risk factors although there was a higher than expected SSI rate for knee prosthesis patients with no risk factors for infection, when post-discharge surveillance was included.
- In general SSI rates in Wales in 2007 for hip and knee prosthesis procedures were higher than the data available for other countries.
- Over 90% of patients were in hospital 1 day or less before they underwent an elective hip or knee prosthesis. There were no significant differences in the pre-operative lengths of stay between patients who developed an SSI and those that did not.
- Approximately 80% of hip and knee prosthesis patients were discharged from hospital within 10 days of admission. Nearly 70% of patients were discharged within a week of having their procedure. The median total length of stay for patients who developed a pre-discharge SSI was 8 days longer than for those that did not develop an SSI, for hip procedures it was 11 days longer and for knees it was 4 days longer.

## **Introduction**

In November 2002 the NHS Management Board in Wales agreed to adopt measures to reduce healthcare associated infections. The first step was to make orthopaedic surgical site infection surveillance mandatory in all Trusts in Wales performing joint replacement. A Welsh Health Circular (WHC (2003) 43) was issued to Chief Executives informing them of this.

Surgical site infections (SSI) are a substantial cause of mortality and morbidity among hospitalised patients. Studies on orthopaedic surgical site infections have shown them to result in considerable increases in lengths of stay, high re-hospitalisation rates, increased healthcare costs and significant reductions in health-related quality of life<sup>1,2</sup>. Surveillance of orthopaedic SSI and participation in national surveillance schemes have previously been shown to contribute to significant reductions in SSI rates, by allowing units to recognise whether they have a problem and monitoring the affects of interventions introduced<sup>3,4</sup>. This is the 5th national report on surgical site infections (SSI) following orthopaedic procedures in Wales, since the surveillance was made mandatory in September 2003. The data presented here is a summary of information reported by 12 Trusts in Wales in the calendar year 2007, although 1 trust has only contributed 3 valid records to the surveillance.

The surveillance incorporates data collected by clinical teams and uses internationally agreed definitions<sup>5</sup>, allowing Welsh data to be compared with and be incorporated into other international databases, such as the HELICS<sup>6</sup> European SSI database. The purpose of the surveillance is to assist Trusts in monitoring their infection rates so that risk can be assessed and communicated and variations from the expected mean recognised and investigated.

In November 2006, following discussions with the orthopaedic staff in the Welsh Trusts, it was decided to alter the surveillance to make it more relevant and less time consuming to Trust staff. From January 2007, the mandatory procedures were reduced to elective hip and knee prostheses only. This is therefore the first orthopaedic SSI report that is restricted to those 2 procedure categories. A questionnaire was issued during 2007 investigating what procedures Trusts were including under the operation titles provided on the questionnaire - 'elective hip prosthesis' and 'elective knee prosthesis'. It was found that not all Trusts interpreted these categories in the same way, with some Trusts including routine revision procedures under these headings and others not. As a result of this, the surveillance form was changed again from January 2008. The titles of the mandatory surveillance procedures on the questionnaire were changed to 'elective primary hip arthroplasty' and 'elective primary knee arthroplasty' and a list of OPCS IV codes<sup>7</sup> that should be included in the surveillance are provided on the form. Comparisons between Trusts based on the 2007 data should therefore be made with caution, since not all Trusts have included the same procedure types.

## All Wales Results

This report is restricted to the surveillance of the 2 procedures that were mandatory in 2007:

- Arthroplasty of the hip (elective hip prosthesis)
- Arthroplasty of the knee (elective knee prosthesis)

### 1. Questionnaire Return

A total of 5423 questionnaires were received for the 2 mandatory procedures with procedure dates in 2007. 3% (155) of these questionnaires were not included in the analysis because the question on whether the patient had an SSI had not been completed on either the inpatient or the post-discharge form. A valid post-discharge update was received for 60% of the questionnaires where it was expected. A breakdown of the questionnaire return for Wales is provided in Table 1.

**Table 1. Questionnaire return for Orthopaedic SSI Surveillance in Wales in 2007**

<b>Trust</b>	<b>No of inpatient forms received</b>	<b>No of valid inpatient forms received<sup>A</sup></b>	<b>No of inpatient forms where PD update expected<sup>B</sup></b>	<b>No of expected PD forms received<sup>C</sup></b>	<b>No of valid expected PD forms received<sup>D</sup></b>	<b>No of overall valid forms<sup>E</sup></b>	<b>Proportion of forms with expected valid PD update</b>
<b>Wales</b>	5423	5221	5344	3434	3212	5268	60% (3212/5344)

- A. Where inpatient SSI field has been answered yes or no
- B. All forms where patient did not have an inpatient SSI (includes SSI=no and SSI field blank) and where outcome was not death
- C. Post discharge updates received for forms in B above
- D. Expected post discharge updates received where the post-discharge SSI field has been answered yes or no
- E. Where SSI field has been completed on either the inpatient or post-discharge form

## 2. Completion Rates

The all Wales completion rates for the data items in the orthopaedic SSI questionnaire are detailed in Table 2 below. 5423 questionnaires were extracted with a procedure date in 2007 and the procedure type field completed as one of the 2 mandatory procedure types.

**Table 2. Percentage completion of data items on the orthopaedic SSI questionnaires in Wales in 2007**

Field Name	Expected No of Fields Completed	No of Fields Completed	% Completion
Sex	5423	5415	99.9
Age	5423	5382	99.2
Admission Date	5423	5195	95.8
Procedure Date	Not applicable – all records have been extracted from database on the basis of procedure dates in 2007.		
Procedure	Not applicable – all records have been extracted from database on the basis of procedure being “elective hip prosthesis” or “elective knee prosthesis”.		
Consultant Code	5423	4613	85.1
ASA Score	5423	4938	91.1
Incision time	5423	5306	97.8
Closure time	5423	5208	96.0
Surgeon Grade	5423	5199	95.9
Thromboprophylaxis	5423	3569	65.8
Laminar Air Flow	5423	4282	79.0
Inpatient SSI	5423	5221	96.3
Inpatient SSI Type	61	52	85.2
Inpatient SSI Date	61	44	72.1
Outcome	5423	4402	81.2
Date of Death/Discharge	5423	5289	97.5
Post-Discharge SSI	3434	3212	93.5
Post-Discharge SSI Type	88	82	93.2
Post-Discharge SSI Date	88	56	63.6
Post-Discharge Assessment Date	3434	3177	92.5

### 3. Surveillance Coverage

The number of valid questionnaires received from the surveillance was compared with data reported to Health Solutions Wales on the number of procedures carried out by the different Trusts in Wales. Overall questionnaires were received for approximately 69% of the mandatory orthopaedic surveillance procedures in Wales. This however may represent an over-estimation since data requested from HSW only includes elective primary procedures whereas we are aware that some trusts have included some non-primary procedures in their surveillance.

**Table 3. Coverage of Orthopaedic SSI Surveillance compared to procedures reported to the PEDW database at HSW by Trust in Wales in 2007**

No of procedures reported to HSW <sup>A</sup>	No of valid questionnaires received <sup>B</sup>	% Coverage
7674	5268	69%

A. Procedure codes requested from HSW: hip prosthesis (W37.1, W38.1, W39.1, W58.1 (hip joint), W93.1, W94.1, W95.1), knee prosthesis (W40.1, W41.1, W42.1, W58.1 (knee joint)).

B. Only questionnaires where SSI field has been completed have been included.



## 4. General Demographics

For inclusion in the analysis:

- Procedure must be Elective Hip Prosthesis/Elective Knee Prosthesis
- Record must have a procedure date within 2007
- SSI field must have been completed on the inpatient or post-discharge form

5268 records have been included in the analysis.

This section gives information about the incidence of SSI, which is the proportion of SSIs per 100 operations. Details are given on SSI incidence by procedure type, by patient age group and gender, by grade of surgeon performing the operation and by type of SSI.

### 4.1 Incidence of SSI

There were 149 SSI recorded in the 5268 analysable procedures. 41% (61) of SSI were identified during the inpatient stay and 59% (88) after the patient was discharged from hospital. The rates of infections identified during the inpatient stay and total infection rates by procedure type are provided in sections 4.1.1 and 4.1.2.

#### 4.1.1 Incidence of Inpatient SSI

61 SSI identified during the inpatient stay were recorded in 5221 analysable procedures, giving a crude inpatient SSI rate of 1.2%. The SSI rate by procedure type is provided in Table 4.

**Table 4. Incidence of inpatient SSI by procedure type in Wales in 2007**

Procedure Type	No. of Procedures*	No. of SSI	% SSI	95% CI
All mandatory procedures	5221	61	1.2	0.9 – 1.5
Elective hip prosthesis	2229	32	1.4	1.0 – 2.0
Elective knee prosthesis	2992	29	1.0	0.6 – 1.4

\*47 procedures have been excluded because the inpatient SSI field was not completed.

#### 4.1.2 Incidence of SSI

The additional 88 SSI identified after the patient was discharged results in a crude total SSI rate of 2.8%. The total SSI rate by procedure type is provided in Table 5.

**Table 5. Incidence of total SSI by procedure type in Wales in 2007**

Procedure Type	No. of Procedures*	No. of SSI	% SSI	95% CI
All mandatory procedures	5268	149	2.8	2.4 – 3.3
Elective hip prosthesis	2246	52	2.3	1.7 – 3.0
Elective knee prosthesis	3022	97	3.2	2.6 – 3.9

### Key Summary Points

- Overall approximately 60% of the SSIs were identified post-discharge. Approximately 40% of SSI following elective hip prosthesis procedures were identified post-discharge compared to 70% of SSI following elective knee prosthesis procedures.
- During the inpatient stay, the SSI rate following hip prosthesis procedures was higher than for knees, but not significantly so.
- Overall the infection rate for knee procedures was higher than for hip procedures, but not significantly so.

## 4.2 Incidence of SSI by Patient Age Group

**Table 6. Incidence of total SSI by Patient Age Group by Procedure Type in Wales in 2007**

Procedure Type	Age Group	No. of Procedures*	No. of SSI	% SSI	95% CI
<b>All mandatory procedures</b>	<56	390	16	4.1	2.3 – 6.7
	56-65	1309	37	2.8	2.0 – 3.9
	66-75	2034	61	3.0	2.3 – 3.9
	76+	1507	33	2.2	1.5 – 3.1
<b>Elective hip prosthesis</b>	<56	189	5	2.6	0.9 – 6.2
	56-65	510	13	2.5	1.4 – 4.4
	66-75	856	23	2.7	1.7 – 4.0
	76+	677	9	1.3	0.6 – 2.5
<b>Elective knee prosthesis</b>	<56	201	11	5.5	2.7 – 9.8
	56-65	799	24	3.0	1.9 – 4.5
	66-75	1178	38	3.2	2.3 – 4.4
	76+	830	24	2.9	1.9 – 4.3

\*28 procedures have been excluded because patient age was not completed

### Key Summary Points

- The majority (68%) of procedures were carried out on patients aged over 65.
- Although overall and for elective knee prosthesis procedures, rates were highest in the youngest age group (under 56), there were no significant differences in SSI rates between different age groups.

### 4.3 Incidence of SSI by Patient Gender

**Table 7. Incidence of total SSI by Patient Gender in Wales in 2007**

Procedure Type	Gender	No. of Procedures*	No. of SSI	% SSI	95% CI
<b>All mandatory procedures</b>	Male	2255	68	3.0	2.3 – 3.8
	Female	3006	80	2.7	2.1 – 3.3
<b>Elective hip prosthesis</b>	Male	910	26	2.9	1.9 – 4.2
	Female	1334	25	1.9	1.2 – 2.8
<b>Elective knee prosthesis</b>	Male	1345	42	3.1	2.3 – 4.2
	Female	1672	55	3.3	2.5 – 4.3

\*7 procedures have been excluded because patient gender was not completed

#### Key Summary Points

- The majority of procedures are carried out on female patients, overall (57%) and within each procedure type.
- There are no significant differences in rates by gender, overall or within procedure types.

### 4.4 Incidence of SSI by Grade of Surgeon

The grade of the surgeon performing the surgery was recorded in 96% (5062/5268) of questionnaires. 78% (3952/5062) of procedures were carried out by a substantive consultant. Table 8 provides the SSI incidence by grade of surgeon.

**Table 8. Incidence of total SSI by Grade of Surgeon in Wales in 2007**

Procedure Type	Surgeon Grade	Procedures*	SSI	% SSI (95% CI)
<b>All mandatory procedures</b>	Substantive consultant	3952	106	2.7 (2.2 – 3.2)
	Other	1110	35	3.2 (2.2 – 4.4)
<b>Elective hip prosthesis</b>	Substantive consultant	1672	38	2.3 (1.6 – 3.1)
	Other	476	11	2.3 (1.1 – 4.1)
<b>Elective knee prosthesis</b>	Substantive consultant	2280	68	3.0 (2.3 – 3.8)
	Other	634	24	3.8 (2.4 – 5.6)

\*206 procedures have been excluded because surgeon grade was not provided.

#### Key Summary Points

- The majority (78%) of procedures were carried out by substantive consultants.
- Infection rates are higher surgeon grades other than consultants, but not significantly so.

#### 4.5 Incidence of SSI by Type of SSI

Three types of surgical site infection have been defined depending on whether the incisional site (superficial and deep infections) or other structures (organ/space infections) are involved. 135 of the 149 infections reported in Wales in 2007 had an infection type identified. Table 9 gives details of the different SSI types recorded. Deep incisional and organ/space infections have been combined into the category of 'Deep Seated SSI'. The incidence of SSI by SSI type is given in Table 10.

**Table 9. Type of Surgical Site Infection by procedure category in Wales in 2007**

Procedure Type	% Superficial (N)	% Deep Seated* (N)	% Not stated (N)
All mandatory procedures	85% (126)	6% (9)	9% (14)
Elective hip prosthesis	75% (39)	10% (5)	15% (8)
Elective knee prosthesis	90% (87)	4% (4)	6% (6)

\*Deep seated include deep incisional and organ/space infections combined.

**Table 10. Incidence of total SSI by type of SSI in Wales in 2007**

Procedure Type	No. of Procedures*	SSI Type	No. of SSI	% SSI	95% CI
All mandatory procedures	5254	Superficial	126	2.4	2.0 – 2.9
		Deep seated	9	0.2	0.1 – 0.3
Elective hip prosthesis	2238	Superficial	39	1.7	1.2 – 2.4
		Deep seated	5	0.2	0.1 – 0.5
Elective knee prosthesis	3016	Superficial	87	2.9	2.3 – 3.6
		Deep seated	4	0.1	0.03 – 0.3

\*The 14 procedures where SSI type was unknown have been excluded

#### Key Summary Points

- 85% of SSI reported following orthopaedic procedures were of the superficial type.
- A higher proportion of infections were deep seated following hip prosthesis procedures than knee prosthesis procedures (10% vs 4%).
- There were no significant differences in the rates of superficial or deep infections between hip and knee procedures.

## 5. SSI Incidence Density

The infection rates based on the number of SSI per 100 procedures provided in section 4, do not take into account the length of time the patients are followed up. The CDC definitions for SSI state that a patient with an implant should be followed up for 1 year from the procedure date<sup>5</sup>. Inpatient lengths of stay vary between trusts as does the degree of post-discharge follow up. This section therefore provides an incidence density rate, based on a denominator of 1000 days followed up.

Tables 11 and 12 detail the number of inpatient days followed up and the inpatient SSI incidence density by procedure type for Wales in 2007. Tables 13 and 14 detail the total days followed up (inpatient and post-discharge) and the total SSI incidence density by procedure type.

**Table 11. Inpatient Days followed up by Procedure Type in Wales in 2007**

Procedure Type	Valid Records	Total IP days followed	Mean IP days followed	Median IP days followed	Mode IP days followed
All mandatory procedures	5184	37868	7	6	5
Elective hip prosthesis	2207	17359	8	6	5
Elective knee prosthesis	2977	20509	7	6	5

**Table 12. Inpatient SSI rate/1000 days followed up by procedure type in Wales in 2007**

Procedure Type	Valid Records	IP SSI	IP Days followed up	IPSSI/1000 days followed	95% CI
All mandatory procedures	5184	59	37868	1.6	1.2 – 2.0
Elective hip prosthesis	2207	31	17359	1.8	1.2 – 2.5
Elective knee prosthesis	2977	28	20509	1.4	0.9 – 2.0

**Table 13. Total Days followed up by Procedure Type in Wales in 2007**

Procedure Type	Valid Records	Total days followed	Mean days followed	Median days followed	Mode days followed
All mandatory procedures	5251	183623	35	38	5
Elective hip prosthesis	2237	82295	37	39	5
Elective knee prosthesis	3014	101328	34	38	5

**Table 14. Total SSI rate/1000 days followed up by procedure type in Wales in 2007**

Procedure Type	Valid Records	SSI	Days followed up	SSI/1000 days followed	95% CI
All mandatory procedures	5251	147	183623	0.8	0.7 – 0.9
Elective hip prosthesis	2237	51	82295	0.6	0.5 – 0.8
Elective knee prosthesis	3014	96	101328	0.9	0.8 – 1.2

### **Key Summary Points**

- The median length of inpatient follow up is 6 days.
- The incidence of inpatient SSI was higher for elective hip prosthesis procedures than elective knee prosthesis procedures, when length of inpatient follow up was taken into account, but not significantly higher.
- The median length of total follow up was 38 days, reflecting approximately 6 weeks to the outpatient follow-up appointment for elective hip and knee prosthesis procedures.
- The total SSI incidence for elective knee prosthesis procedures was significantly higher than for hip prosthesis procedures (0.9 vs 0.6 per 1000 days followed up), when length of follow up was taken into account.

## 6. Incidence of SSI by Patient Risk Index

Although the results are grouped by category of clinically similar procedures, they do not take into account factors that may influence the risk of infection. The American National Nosocomial Infections Surveillance (NNIS) system risk index<sup>8</sup> is the most widely used method internationally of risk adjusting surgical patients. The risk index uses three risk factors to score each patient, namely the American Society of Anaesthesiologists (ASA) pre-operative assessment score, the wound classification and the duration of surgery. If a patient has an ASA score of 3 or more, a wound class of contaminated or dirty/infected or surgery duration of over 2 hours, 1 point is assigned to the risk factor calculation for each. This results in each patient receiving a score of 0 to 3. Since January 2007, wound class has no longer been collected in the surveillance scheme. The assumption has been made that all elective hip and knee prostheses are 'clean', therefore the risk index classification allocates a score of 0 to 2 to each patient. Table 15 gives the proportion of records scoring 1 for each of the components of the risk index.

580 procedures have been excluded from the risk index analysis because one or more of the risk index component fields have not been completed and the risk index therefore could not be calculated.

**Table 15. Proportion of procedures scoring 1 for each of the components making up the NNIS system risk index in Wales in 2007**

Risk Factor	Proportion of Procedures scoring 1
ASA of 3,4,5	22.4
Duration of surgery over T value	8.3

### 6.1 Incidence of SSI by Patient Risk Index

Table 16 shows the numbers of records falling into each risk index category and inpatient SSI rate by patient risk index by procedure type. Table 17 gives the total SSI rate by patient risk index by procedure type.

**Table 16. Inpatient Surgical Site Infections by Patient Risk Index for mandatory orthopaedic procedures in Wales in 2007**

Procedure Type	Patient Risk Index	Procedures*	IP SSI	% SSI (95% CI)
All mandatory procedures	0	3337	28	0.8 (0.6 – 1.2)
	1	1195	21	1.8 (1.1 – 2.7)
	2	116	4	3.4 (0.9 – 8.8)
Elective hip prosthesis	0	1362	15	1.1 (0.6 – 1.8)
	1	567	12	2.1 (1.1 – 3.7)
	2	74	2	2.7 (0.3 – 9.8)
Elective knee prosthesis	0	1975	13	0.7 (0.4 – 1.1)
	1	628	9	1.4 (0.7 – 2.7)
	2	42	2	4.8 (0.6 – 17.2)

\*An extra 40 records have been excluded because the inpatient SSI field was not completed

**Table 17. Total Surgical Site Infections by Patient Risk Index for mandatory orthopaedic procedures in Wales in 2007**

Procedure Type	Patient Risk Index	Procedures	SSI	% SSI (95% CI)
All mandatory procedures	0	3360	84	2.5 (2.0 – 3.1)
	1	1210	33	2.7 (1.9 – 3.8)
	2	118	8	6.8 (2.9 – 13.4)
Elective hip prosthesis	0	1367	25	1.8 (1.2 – 2.7)
	1	574	19	3.3 (2.0 – 5.2)
	2	76	4	5.3 (1.4 – 13.5)
Elective knee prosthesis	0	1993	59	3.0 (2.3 – 3.8)
	1	636	14	2.2 (1.2 – 3.7)
	2	42	4	9.5 (2.6 – 24.4)

#### Key Summary Points

- The majority of patients were in the lowest risk category for infection: 72% of all procedures, 75% of knee prosthesis patients and 68% of hip prosthesis patients.
- The incidence of inpatient SSI increased with increasing risk index overall and for hip and knee prosthesis procedures, although there were no significant differences in rates between risk index groups.
- The incidence of total SSI increased with increasing risk index for hip prosthesis procedures but for knee prosthesis procedures there was a higher than expected total SSI rate for patients with risk index 0.

#### 6.2 SSI Incidence Density by Patient Risk Index

Table 18 shows rates of inpatient SSI per 1000 days followed up by patient risk index by procedure type. Table 19 gives the total SSI rate per 1000 days followed up by patient risk index by procedure type.



**Table 18. Inpatient Surgical Site Infections per 1000 inpatient days followed up by Patient Risk Index for orthopaedic procedures in Wales in 2007**

Procedure Type	Patient Risk Index	Procedures	No. of inpatient days followed up	IPSSI	IPSSI/1000 days followed (95% CI)
All mandatory procedures	0	3313	22694	27	1.2 (0.8 – 1.7)
	1	1185	9749	20	2.1 (1.3 – 3.2)
	2	114	1202	4	3.3 (0.9 – 8.5)
Elective hip prosthesis	0	1348	9803	14	1.4 (0.8 – 2.4)
	1	561	4848	12	2.5 (1.3 – 4.3)
	2	73	813	2	2.5 (0.3 – 8.9)
Elective knee prosthesis	0	1965	12891	13	1.0 (0.5 – 1.7)
	1	624	4901	8	1.6 (0.7 – 3.2)
	2	41	389	2	5.1 (0.6 – 18.6)

**Table 19. Total Surgical Site Infections per 1000 days followed up by Patient Risk Index for orthopaedic procedures in Wales in 2007**

Procedure Type	Patient Risk Index	Procedures	No. of Days Followed up	SSI	SSI/1000 days followed (95% CI)
All mandatory procedures	0	3351	119975	83	0.7 (0.6 – 0.9)
	1	1204	39079	32	0.8 (0.6 – 1.2)
	2	117	4098	8	1.9 (0.8 – 3.8)
Elective hip prosthesis	0	1361	51092	24	0.5 (0.3 – 0.7)
	1	572	20325	19	0.9 (0.6 – 1.5)
	2	76	3069	4	1.3 (0.4 – 3.3)
Elective knee prosthesis	0	1990	68883	59	0.9 (0.7 – 1.1)
	1	632	18754	13	0.7 (0.4 – 1.3)
	2	41	1029	4	3.9 (1.1 – 10.0)

#### Key Summary Points

- The incidence of inpatient SSI increased with increasing risk index, although there were no significant differences in rates between risk index groups.
- The incidence of total SSI increased with increasing risk index for hip prosthesis procedures but for knee prosthesis procedures there was a higher than expected total SSI rate for patients with risk index 0.
- The incidence of total SSI was significantly higher for patients with a risk index of 0 who had elective knee prosthesis procedures compared to elective hip prosthesis procedures.

### 6.3 Duration of Procedure

The duration of surgery is used to calculate the patient risk index. Each surgical category has been assigned a T-value; procedures that take longer than the T-value for that procedure are assigned a point towards their risk index total. The T-values are calculated as the 75<sup>th</sup> percentile of duration of the surgical procedure, based on surgeon performance in the United States<sup>8</sup>. For the 2 mandatory orthopaedic procedures, the T-value is 2 hours. It would be expected that 25% of the procedures should lie above the T-value, but in Wales only 8% of procedures took longer than the T value (See Table 15). The durations of procedure categories in Wales are given in Table 20.

**Table 20. Duration of Procedure Categories in Minutes and proportion over T value**

Procedure Category	Number with Procedure start and end times	Mean	Median	Range	Proportion > T-value	75 <sup>th</sup> Percentile of Welsh data (minutes)
Elective hip prosthesis	2140	93	89	5-460	12 %	105
Elective knee prosthesis	2933	81	78	8-303	6 %	93

Table 21 gives the proportion of records scoring 1 for the procedure duration in the risk index calculation, using 105 minutes as the T value for hip prosthesis procedures and 93 minutes as the T value for knee prosthesis procedures.

**Table 21. Proportion of procedures scoring 1 for each of the components making up the NNIS system risk index in Wales in 2007 using revised procedure T values**

Risk Factor	Proportion of Procedures scoring 1
ASA of 3,4,5	22.4
Duration of surgery over T value	17.1 (796/4662)

#### 6.3.1 Incidence of SSI by Revised Patient Risk Index

A revised patient risk index was calculated using T values based on the Welsh data for 2007. Table 22 shows the numbers of records falling into each risk index category and inpatient SSI rate by revised patient risk index by procedure type. Table 23 gives the total SSI rate by revised patient risk index by procedure type.

**Table 22. Inpatient Surgical Site Infections by Revised Patient Risk Index for orthopaedic procedures in Wales in 2007**

Procedure Type	Revised Patient Risk Index	Procedures	IP SSI	% SSI (95% CI)
All mandatory procedures	0	2783	25	0.9 (0.6 – 1.3)
	1	1577	20	1.3 (0.8 – 2.0)
	2	288	8	2.8 (1.2 – 5.5)
Elective hip prosthesis	0	1199	14	1.2 (0.6 – 2.0)
	1	676	11	1.6 (0.8 – 2.9)
	2	128	4	3.1 (0.9 – 8.0)
Elective knee prosthesis	0	1584	11	0.7 (0.3 – 1.2)
	1	901	9	1.0 (0.5 – 1.9)
	2	160	4	2.5 (0.7 – 6.4)

**Table 23. Total Surgical Site Infections by Revised Patient Risk Index for mandatory orthopaedic procedures in Wales in 2007**

Procedure Type	Revised Patient Risk Index	Procedures	SSI	% SSI (95% CI)
All mandatory procedures	0	2803	74	2.6 (2.1 – 3.3)
	1	1593	37	2.3 (1.6 – 3.2)
	2	292	14	4.8 (2.6 – 8.0)
Elective hip prosthesis	0	1203	23	1.9 (1.2 – 2.9)
	1	683	19	2.8 (1.7 – 4.3)
	2	131	6	4.6 (1.7 – 10.0)
Elective knee prosthesis	0	1600	51	3.2 (2.4 – 4.2)
	1	910	18	2.0 (1.2 – 3.1)
	2	161	8	5.0 (2.1 – 9.8)

### 6.3.2 SSI Incidence Density by Revised Patient Risk Index

Table 24 shows rates of inpatient SSI per 1000 days followed up by revised patient risk index by procedure type. Table 25 gives the total SSI rate per 1000 days followed up by revised patient risk index by procedure type.

**Table 24. Inpatient Surgical Site Infections per 1000 inpatient days followed up by Revised Patient Risk Index for orthopaedic procedures in Wales in 2007**

Procedure Type	Revised Patient Risk Index	Procedures	Inpatient days followed up	IPSSI	IPSSI/1000 days followed (95% CI)
All mandatory procedures	0	2768	18875	25	1.3 (0.9 – 2.0)
	1	1560	12186	18	1.5 (0.9 – 2.3)
	2	284	2584	8	3.1 (1.3 – 6.1)
Elective hip prosthesis	0	1188	8639	14	1.6 (0.9 – 2.7)
	1	668	5564	10	1.8 (1.9 – 3.3)
	2	126	1261	4	3.2 (0.9 – 8.1)
Elective knee prosthesis	0	1580	10236	11	1.1 (0.5 – 1.9)
	1	892	6622	8	1.2 (0.5 – 2.4)
	2	158	1323	4	3.0 (0.8 – 7.7)

**Table 25. Total Surgical Site Infections per 1000 days followed up by Revised Patient Risk Index for mandatory orthopaedic procedures in Wales in 2007**

Procedure Type	Revised Patient Risk Index	Procedures	Days Followed up	SSI	SSI/1000 days followed (95% CI)
All mandatory procedures	0	2799	101779	74	0.7 (0.6 – 0.9)
	1	1584	51984	35	0.7 (0.5 – 0.9)
	2	289	9389	14	1.5 (0.8 – 2.5)
Elective hip prosthesis	0	1199	45034	23	0.5 (0.3 – 0.8)
	1	680	24411	18	0.7 (0.4 – 1.2)
	2	130	5041	6	1.2 (0.4 – 2.6)
Elective knee prosthesis	0	1600	56745	51	0.9 (0.7 – 1.2)
	1	904	27573	17	0.6 (0.4 – 1.0)
	2	159	4348	8	1.8 (0.8 – 3.6)

#### Key Summary Points

- As found in the Pan Celtic aggregate data<sup>9</sup>, Welsh surgeons performed operations in a shorter time than their US counterparts, therefore US derived T-values are not representative of surgery here.
- Using a Welsh T time puts more patients in risk categories 1 and 2.
- The incidence of inpatient SSI increased with increasing revised risk index, although there were no significant differences in rates between risk index groups.
- The incidence of total SSI increased with increasing revised risk index for hip prosthesis procedures but for knee prosthesis procedures there was a higher than expected total SSI rate for patients with risk index 0.
- When length of follow up was taken into account, using the revised risk index, the SSI rate was not significantly higher for elective knee prosthesis procedures in risk index category 0.

## 7. Durations of Stay

The durations of stay data are derived from the questions on admission date, procedure date and date of death/discharge. Although some of the results look unlikely to be correct, they are a representation of what has been provided on the questionnaires.

### 7.1 Pre-operative length of stay

The pre-operative length of stay is the number of days from date of admission to hospital to the date of procedure. 96% (5066/5268) of questionnaires had both the patient admission date and procedure date completed. Pre-procedure length of stay ranged from 0 days (ie admitted on the day of procedure) to 50 days. In 91% (4621/5066) of records, the pre-procedure length of stay was 1 day. The mean pre-procedure length of stay was 1 day, as was the median. This was the same for patients with hip or knee prosthesis procedures and for patients who went on to develop an SSI and those that did not.

### 7.2 Total length of stay

The total length of stay is the number of days from date of admission to hospital to the date of discharge or death. A comparison of the total lengths of stay for procedures that resulted in an SSI and those that did not by procedure type, is given in Table 26.

**Table 26. Total length of stay for patients with and without an inpatient SSI following orthopaedic procedures in Wales in 2007**

Procedure	IPSSI	Admission to Discharge (days)			
		Mean	Median	Mode	Range
All mandatory procedures	All patients* (n = 4991)	8	7	6	1-140
	Patients with inpatient SSI (n=53)	17	15	8	3 – 57
	Patients without inpatient SSI (n=4938)	8	7	6	1 – 140
Elective hip prosthesis	All patients (n=2119)	9	7	6	1 – 140
	Patients with inpatient SSI (n=28)	19	18	15	7 -37
	Patients without inpatient SSI (n=2091)	9	7	6	1 – 140
Elective knee prosthesis	All patients (n=2872)	8	7	6	1 – 61
	Patients with inpatient SSI (n=25)	15	11	8	3 – 57
	Patients without inpatient SSI (n=2847)	8	7	6	1 – 61

\* Records where the inpatient SSI field has not been completed have not been included.

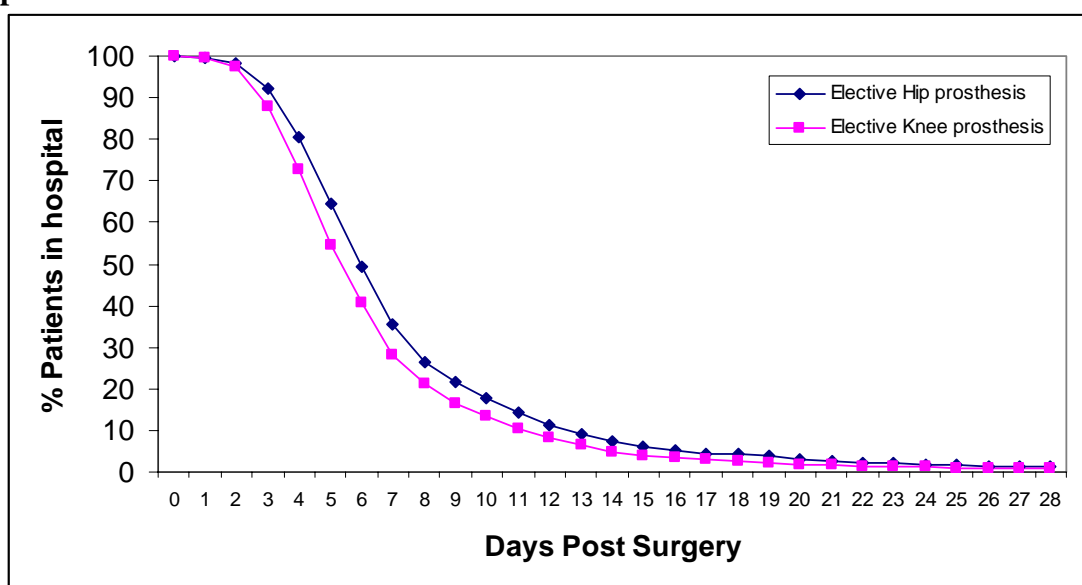
### Key Summary Points

- Approximately 80% of hip/knee arthroplasty patients in Wales in 2007 were discharged from hospital within 10 days or less of admission.
- The median total length of stay for patients who developed a pre-discharge SSI was 8 days longer than for those that did not develop an SSI (7 vs 15 days). For hip prosthesis procedures the median total length of stay for patients who developed a pre-discharge SSI was 11 days longer than for those that did not (7 vs 18 days) and for knee prosthesis procedures it was 4 days longer (7 vs 11 days).

### 7.3 Post-operative length of stay

The post-operative length of stay is the number of days from the date of procedure to the date of discharge or death. 99% (5217/5268) of questionnaires had a procedure date and date of death/discharge recorded. The post-operative lengths of stay by procedure category are given in Figure 1. The post-operative lengths of stay for procedures that resulted in an SSI and those that did not by procedure type are given in Table 27.

**Figure 1. Proportion of patients in hospital by days post surgery for orthopaedic procedures in Wales in 2007**



**Table 27. Post-operative length of stay for patients with and without an SSI following orthopaedic procedures in Wales in 2007**

Procedure	Records	Procedure to Discharge (days)			
		Mean	Median	Mode	Range
<b>All mandatory procedures</b>	All patients* (n=5189)	7	6	5	0 – 139
	Patients with inpatient SSI (n=57)	17	14	7	2 – 56
	Patients without inpatient SSI (n=5132)	7	6	5	0-139
<b>Elective hip prosthesis</b>	All patients (n=2209)	8	6	5	0 – 139
	Patients with inpatient SSI (n=30)	18	17	10	5 – 56
	Patients without inpatient SSI (n=2179)	8	6	5	0 – 139
<b>Elective knee prosthesis</b>	All patients (n=2980)	7	6	5	0 – 56
	Patients with inpatient SSI (n=27)	15	10	6	2 – 56
	Patients without inpatient SSI (n=2953)	7	6	5	0 – 47

\* Records where the inpatient SSI field has not been completed have not been included.

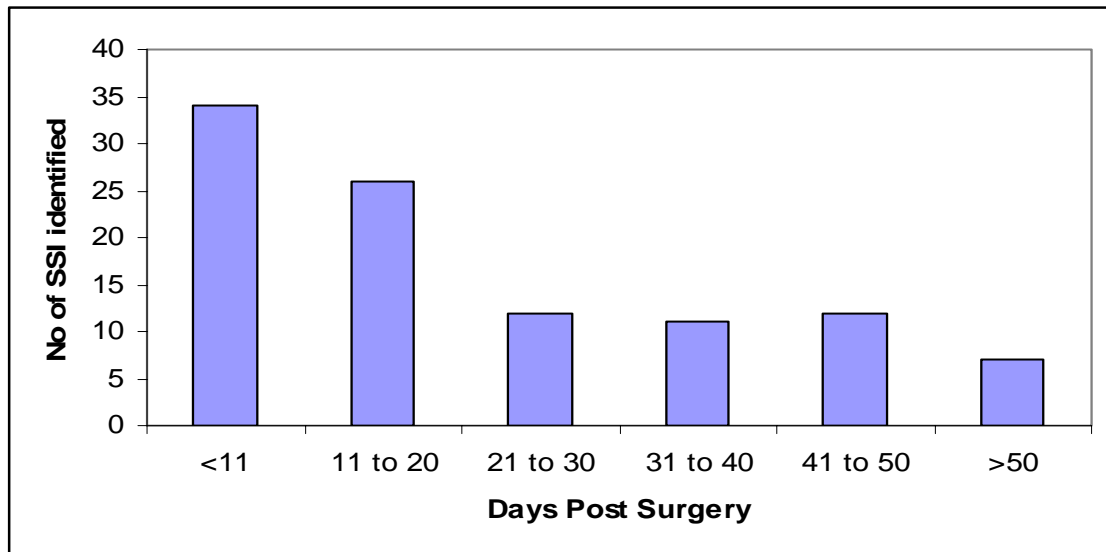
#### **Key Summary Points**

- Approximately 85% of patients were discharged within 10 days or less of having their operation; nearly 70% were discharged within a week.
- For all procedures, the median length of post-operative stay for patients who developed a SSI during the hospital admission was 8 days longer than for those that did not. For hip prosthesis procedures, the median length of stay was 11 days longer for patients who developed an inpatient SSI than for those who did not; for knee prosthesis procedures the median was 4 days longer.

#### **7.4 Onset of Infection**

An infection date was provided for two thirds (100/149) of the SSI. Figure 2 details the number of days from the date of the orthopaedic procedure to the onset of infection. Table 28 gives the numbers of days from procedure date to onset of inpatient SSI by procedure type. Table 29 gives the numbers of days from procedure date to onset of all SSI by procedure type.

**Figure 2. Number of days from procedure date to onset of surgical site infection following orthopaedic procedures in Wales in 2007**



**Table 28. Number of days from date of procedure to onset of inpatient surgical site infection in patients with an SSI following orthopaedic procedures in Wales in 2007**

Procedure Type	Procedure to Infection (days)		
	Mean	Median	Range
All mandatory procedures (n=44)	10	8	2 – 46
Elective hip prosthesis (n=23)	10	8	3 – 25
Elective knee prosthesis (n=21)	9	6	2 – 46

**Table 29. Number of days from date of procedure to onset of all surgical site infection in patients with an SSI following orthopaedic procedures in Wales in 2007**

Procedure Type	Procedure to Infection (days)		
	Mean	Median	Range
All mandatory procedures (n=100)	23	15	2 – 130
Elective hip prosthesis (n=39)	19	13	3 – 130
Elective knee prosthesis (n=61)	25	21	2 – 78

#### Key Summary Points

- The onset of over 70% of the infections was within a month of surgery, with the median number of days to onset of 15.
- The median number of days to onset of knee infections was 8 days longer than for hip infections.



## 8. Incidence of SSI over time

Data on orthopaedic SSI surveillance have been collected since 2003. In 2007 the mandatory surveillance procedures were reduced to elective hip and knee prostheses only. Table 30 compares the numbers of reports by procedure category for 2003 to 2007 and the infection rates. These data, however, should be interpreted with caution, since data for hip and knee prostheses from 2007 are not strictly comparable with data collected in previous years. Emergency procedures were included in 2003 to 2006 whereas in 2007 only elective procedures were included. Additionally revision procedures were included in the surveillance from 2003 to 2006, whereas in 2007 some Trusts have included them and others have not. There is also a much higher compliance with post-discharge surveillance in 2007 than there has been in previous years.

**Table 30. Procedures, SSIs and % SSI (95% CI) by procedure category in Wales, 2003 – 2007**

Procedure Category	Year	No. Procedures	No. SSI	% SSI (95% CI)
Hip prosthesis	2007	2246	52	2.3 (1.7 – 3.0)
	2006	1608	41	2.5 (1.8 – 3.5)
	2005	1488	49	3.3 (2.4 – 4.4)
	2004	744	20	2.7 (1.6 – 4.2)
	2003	472	17	3.6 (2.1 – 5.8)
Knee prosthesis	<b>2007</b>	<b>3022</b>	<b>97</b>	<b>3.2 (2.6 – 3.9)</b>
	<b>2006</b>	<b>1790</b>	<b>45</b>	<b>2.5 (1.8 – 3.4)</b>
	<b>2005</b>	<b>1440</b>	<b>69</b>	<b>4.8 (3.7 – 6.1)</b>
	<b>2004</b>	<b>624</b>	<b>28</b>	<b>4.5 (3.0 – 6.5)</b>
	<b>2003</b>	<b>370</b>	<b>11</b>	<b>3.0 (1.5 – 5.3)</b>

### Key Summary Points

- There was a 40% increase in the number of hip prosthesis procedures reported and an almost 70% increase in the number of knee prosthesis procedures reported between 2006 and 2007.
- The infection rate of hip prosthesis decreased in 2007 compared to 2006 whereas the rate for knees increased. Rates of infection for 2007, however, are not strictly comparable with rates for previous years since the procedures included have changed.

## 9. Comparative Results

Table 31 displays the pre-discharge and total orthopaedic SSI incidence (per 100 procedures) following hip arthroplasties and knee arthroplasties in Wales for patients in risk index categories 0 and 1, compared to rates reported from Scotland, Northern Ireland, England and the USA. Table 32 compares the SSI incidence density by risk index for England and Wales in 2007.

**Table 31. Incidence of SSI following orthopaedic procedures in patients with a risk index of 0 or 1 in Wales and other countries**

Procedure Type	Risk Index	Wales Pre – Dis rate 2007	Wales Total rate 2007	Scotland Pre – Dis rate <sup>10</sup>	Northern Ireland Total rate <sup>11</sup>	English Pre-Dis SSI rate <sup>12</sup>	American Pre-Dis SSI rate <sup>13*</sup>
Hip arthroplasty	0	1.1	1.8	0.3	0.6	0.3	0.9
	1	2.1	3.3	0.8	1.7	0.8	1.7
Knee arthroplasty	0	0.7	3.0	0.3	1.3	0.2	0.9
	1	1.4	2.2	0.3	3.0	0.4	1.3

\*Rate for hip arthroplasty and hemiarthroplasty combined

**Table 32. Incidence density of inpatient SSI following orthopaedic procedures by risk index in Wales and England in 2007**

Procedure Type	Risk Index	Wales Inpatient Rate 2007	England Inpatient Rate 2007 <sup>14</sup>
Hip arthroplasty	0	1.5	0.9
	1	2.5	1.4
	2/3	2.5	2.4
Knee arthroplasty	0	1.0	0.5
	1	1.8	0.9
	2/3	5.1	1.3

### Key Summary Point

- There are differences between the surveillance programmes for orthopaedic procedures conducted in different countries, so comparisons should be made with caution. In general, SSI rates for Wales in 2007 for hip and knee arthroplasties were higher than the data available for other countries.

## 10. Conclusions

The Welsh orthopaedic surgical site infection surveillance scheme provides surgical teams with risk-adjusted measures of performance over time for the two mandatory surveillance procedures.

The incidence of SSI per 100 operations for elective hip and knee prostheses combined was 2.8%. The rate by trust varied between 0 and 5.7%. Comparisons between trusts, however, should only be made with caution because of a number of differences identified.

A questionnaire issued in 2007 identified that there was a difference in interpretation between trusts in the terms “elective hip prosthesis” and “elective knee prosthesis”, resulting in some trusts including revision procedures and others not, which may influence the rate. This has been addressed in the new surveillance form issued from January 2008.

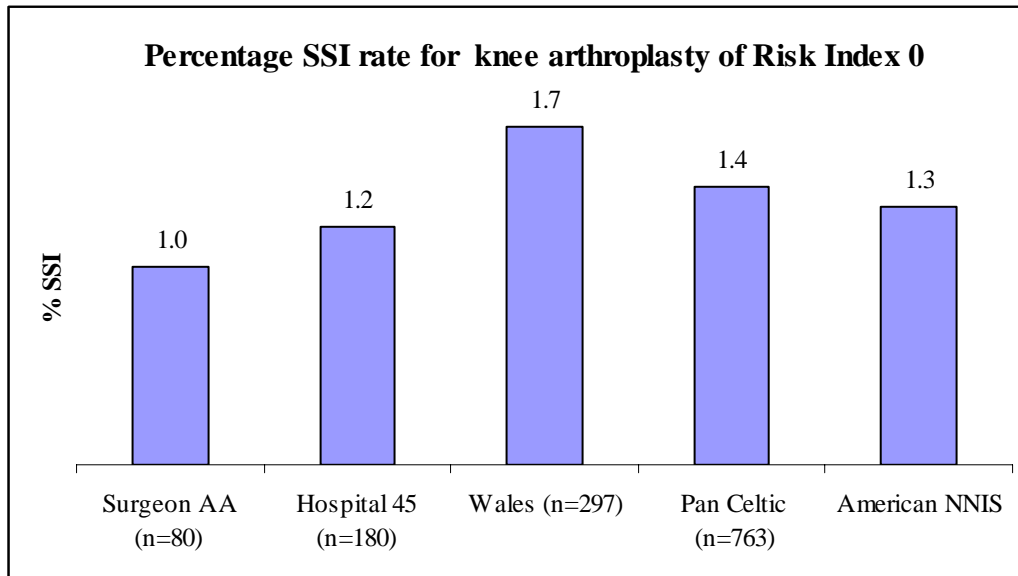
There are also still concerns about the reliability of the surveillance in some Trusts, in terms of completing and returning data for all the required procedures. Although overall surveillance coverage improved considerably in 2007 compared to 2006 (45%), with a total coverage of nearly 70% of the procedures that took place, the coverage by Trust varied considerably, ranging from less than 1% to complete compliance.

There are also differences between sites in the degree of post-discharge surveillance undertaken, which has a major impact on infection rates. Overall a post-discharge follow-up questionnaire was received for 60% of reported procedures, but this varied considerably by trust, ranging from 6% of procedures to all procedures. Calculating infection rates which take into account the length of patient follow up does reduce the influence of this and the SSI incidence density rates by Trust reflect this, ranging from 0 to 2.5 infections per 10000 days followed up.

This all-Wales report should be used in conjunction with surgeon specific reports, hospital/Trust specific reports, as well as alongside the Pan Celtic report and reports from SSI schemes in other countries. Although data from surveillance schemes in other countries are not directly comparable because of differences in methodologies, definitions and procedures covered, comparisons with data currently available for other UK countries and the United States suggest that the risk adjusted rates for Wales are higher than for other countries.

The WHAIP team can provide surgeons with individual surgeon rates and hospital specific rates. An example of how an individual surgeon may use comparative data is given below:

**Figure X. Surgeon AA SSI rates for knee prosthesis with risk index of 0, compared to rates for hospital, country, Pan Celtic collaboration and American NNIS (Example rates)**



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