

# Surgical Site Surveillance in Orthopedic Surgery Using NNIS Thresholds and Standardized Infection Ratio as a Benchmarking Tool

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**Background:** SSI surveillance data is an essential part of infection control programs. Benchmarking data against the NNIS system has been used since 1999 to evaluate SSI in an orthopedic specialty hospital. The presentation of this data is intended to demonstrate trends and risk factors associated within this patient population. The standardized infection ratio is an indirect standardization method endorsed by NNIS since 1997 as a valid risk-adjusted summary measure for comparing SSI rates. This method involves the pooled mean NNIS infection rates for procedure-risk categories to calculate “expected” infection rates. The observed rate can then be compared to the expected by calculating a ratio. If the ratio is greater than 1 and exceeds the expected rate, a statistical analysis can be applied to assess its significance (p value). Generally, the SIR is used to perform comparisons when the denominator of each risk category is at least 20 or when the denominator of the SIR (the expected number of SSIs) is at least 1.

**Methods:** NNIS criteria were used to classify SSI in orthopedic surgery as superficial, deep and organ/space. The infection rates were benchmarked with the NNIS report by stratifying total hips, total knees, spinal fusions and laminectomies by risk groups 0,1,2&3 (ASA score,duration of operation and degree of wound contamination). The expected versus the actual number of infections, the infection rate, the standardized infection ratio and p value (Poisson distribution) were calculated.

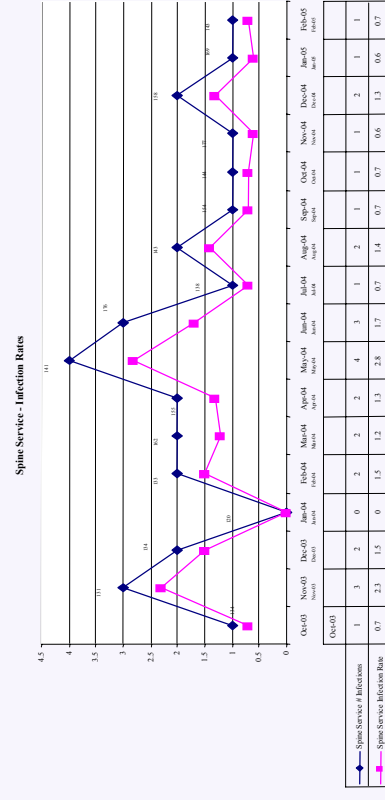
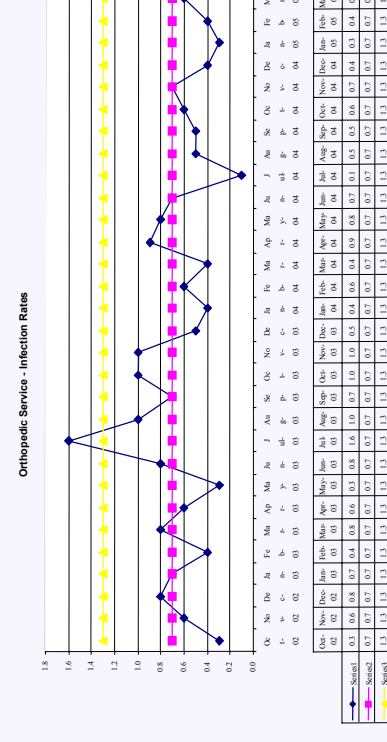
**Results:** From FY99 - FY04 there were 26,202 orthopedic cases with 229 SSI (0.9%). In FY04, data was stratified by type of surgery and showed the following infection rates: total hips 0.3; total knees 1.0; laminectomies 0.9; and spinal fusions 2.0. The standardized infection ratio (the number of infections divided by the expected number of infections) for each group was 0.2, 0.7, 0.8 and 0.9 respectively. Stratification by risk factors for each category demonstrated an increased rate in spinal fusions in patients with >2&3 risk factors (9.3) as compared to the NNIS threshold (6.3). An investigation revealed additional risk factors in this group: obesity, diabetes and allograft implantation. Control measures were implemented and infection rates were reduced. These included:

- Use of laminar flow rooms for spinal fusions and laminectomies
- Enforce and monitor compliance with OR procedures for traffic control, between room cleaning, terminal room cleaning, removal of extraneous items from the OR rooms (e.g. briefcases, cell phones) and improve hand hygiene practices.
- Enforce and monitor routine cleaning of intake and exhaust grills in OR rooms.
- Limit the number of people allowed in and out of the OR rooms during surgery.
- Present an Orthopedic Grand Rounds on the Prevention of Surgical Site Infections – M.Spencer gave one in October, 2004 and Dr. Charles Edmiston presented in Jan, 2005 – highlighting data on antimicrobial impregnated suture material and CHG/alcohol based surgical prep.

- Purchase covered tape containers to prevent contamination to the sides of rolls of tape and purchase smaller rolls of tape for more frequent discard.
- Purchase keyboard covers or one piece computer keyboards to prevent contamination.
- Assure routine cleaning of the computer screens in the OR
- Institute the use of a silver impregnated dressing covered by a transparent dressing over cervical and lumbar incisions to prevent exogenous contamination to incisions, especially in obese patients.

## Other Areas of Research for 2005

- Blood glucose control prospective study in the prescreening unit
- Evaluate CHG/alcohol surgical prep
- Implement Antibacterial sutures
- Evaluate the silver dressing for total joints



| NNIS Procedure      | NEBH# SSI | NEBH Operations | Pooled NNIS    |                | NEBH Rate  | SIR                | P value |
|---------------------|-----------|-----------------|----------------|----------------|------------|--------------------|---------|
|                     |           |                 | Mean NNIS Rate | Expected # SSI |            |                    |         |
| Spinal Fusion 0     | 2         | 410             | 1.1            | 4.5            | 0.5        |                    |         |
| Spinal Fusion 1     | 8         | 316             | 2.76           | 8.7            | 2.5        |                    |         |
| Spinal Fusion 2,3   | 5         | 54              | 6.3            | 3.4            | 9.3        |                    |         |
| <b>TOTAL</b>        | <b>15</b> | <b>780</b>      | <b>16.6</b>    | <b>16.6</b>    | <b>0.9</b> | <b>0.46542932</b>  |         |
| Laminectomy 0       | 4         | 617             | 0.92           | 5.7            | 0.6        |                    |         |
| Laminectomy 1       | 4         | 267             | 1.39           | 3.7            | 1.5        |                    |         |
| Laminectomy 2,3     | 1         | 56              | 2.49           | 1.4            | 1.8        |                    |         |
| <b>TOTAL</b>        | <b>9</b>  | <b>940</b>      | <b>10.8</b>    | <b>10.8</b>    | <b>0.8</b> | <b>0.364818653</b> |         |
| Hip Prosthesis 0    | 1         | 601             | 0.88           | 5.3            | 0.2        |                    |         |
| Hip Prosthesis 1    | 2         | 837             | 1.61           | 13.5           | 0.2        |                    |         |
| Hip Prosthesis 2,3  | 2         | 211             | 2.49           | 5.3            | 0.9        |                    |         |
| <b>TOTAL</b>        | <b>5</b>  | <b>1649</b>     | <b>24.0</b>    | <b>24.0</b>    | <b>0.2</b> | <b>3.07991E-06</b> |         |
| Knee Prosthesis 0   | 3         | 588             | 0.87           | 4.9            | 0.5        |                    |         |
| Knee Prosthesis 1   | 5         | 709             | 1.26           | 8.9            | 0.7        |                    |         |
| Knee Prosthesis 2,3 | 6         | 220             | 2.22           | 4.9            | 2.7        |                    |         |
| <b>TOTAL</b>        | <b>14</b> | <b>1487</b>     | <b>18.7</b>    | <b>18.7</b>    | <b>0.7</b> | <b>0.167328275</b> |         |

| Spine Service Rates | FY 99 | FY 00 | FY 01 | FY 02 | FY 03 | FY 04 |
|---------------------|-------|-------|-------|-------|-------|-------|
|                     |       |       |       |       |       |       |
| Spine Index 1       | 2.1   | 2.4   | 1.6   | 1.2   | 0.7   | 2.5   |
| Spine Index 2       | 0     | 5.4   | 3.4   | 1.6   | 0     | 9.3   |
| Spine Index 3       | 0     | 0     | 0     | 0     | 0     | 0     |
| Total # Operations  | 284   | 292   | 259   | 304   | 343   | 410   |
| Spine Index 0       | 14.0  | 21.1  | 24.2  | 25.5  | 27.7  | 31.6  |
| Spine Index 1       | 12    | 37    | 29    | 64    | 37    | 54    |
| Spine Index 2       | 1     | 0     | 0     | 0     | 0     | 0     |
| Spine Index 3       | 437   | 540   | 530   | 623   | 657   | 780   |
| Spinal Fusions      | 4     | 11    | 6     | 7     | 5     | 15    |
| Infections          | 0.9   | 2.0   | 1.1   | 1.1   | 0.8   | 1.9   |
| Rate                |       |       |       |       |       |       |
| Laminectomy Rates   | FY 99 | FY 00 | FY 01 | FY 02 | FY 03 | FY 04 |
| Lami Index 0        | 1.1   | 1     | 0.8   | 0.2   | 0.4   | 0.6   |
| Lami Index 1        | 0.6   | 0.6   | 0     | 1.6   | 0.4   | 1.5   |
| Lami Index 2        | 0     | 0     | 2.9   | 0     | 7.1   | 1.8   |
| Lami Index 3        | 0     | 0     | 0     | 0     | 0     | 0     |
| Total # Operations  | 433   | 478   | 474   | 436   | 567   | 617   |
| Lami Index 0        | 178   | 155   | 184   | 254   | 226   | 267   |
| Lami Index 1        | 35    | 23    | 34    | 49    | 42    | 56    |
| Lami Index 2        | 1     | 0     | 1     | 0     | 0     | 0     |
| Laminectomy         | 647   | 660   | 693   | 739   | 835   | 940   |
| Infections          | 8     | 6     | 5     | 5     | 6     | 9     |
| Rate                | 13.6  | 0.9   | 0.7   | 0.7   | 0.7   | 0.9   |

**Conclusion:** SSI surveillance in an orthopedic specialty hospital analyzed over a six-year period has demonstrated rates below NNIS benchmarking using SIR and p values. The analysis of data in this manner is useful to detect specific problems and focus investigative activities. It helped us to confirm an actual increase in observed cases of infection on the Spine Service in 2004.