Incidence of *Staphylococcus aureus* Infection after Elective Surgeries among Adults in U.S. Hospitals

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**Poster No: 1228**

### Introduction
- Despite antimicrobial prophylaxis and other preventive measures, *Staphylococcus aureus* (*S. aureus*) remains a major pathogen for postsurgical infections.
- National estimates of *S. aureus* infections across a comprehensive list of elective surgeries based on microbiology data in real-world hospital settings are limited.

### Objectives
- To assess the 180-day incidence of postsurgical *S. aureus* infections among patients who underwent elective surgeries and project the number of infections to the U.S. population.

### Methods
- **Study design:** A retrospective, observational study using inpatient and hospital-based outpatient discharge and microbiology data from geographically diverse U.S. hospitals included in the Premier Healthcare Database (PHD).
- **Inclusion criteria:**
  - Adult patients (≥ 18 years) discharged between 07/01/2010 – 06/30/2015 from a qualifying hospital that continuously submitted microbiology data to the PHD (n=181) during the study period.
  - Elective admission for a surgical procedure.
  - Elective surgery performed within 2 days after the admission.
- **Exclusion criteria:**
  - Patients with a diagnosis of *S. aureus* infection present on admission, or with a positive culture from a normally sterile site on day of elective surgery or on day after surgery.
  - Patients transferred from another facility or with emergency department charges.
- **Exposure:** Elective surgeries falling in one of 87 surgical categories defined by National Hospital Surveillance Network (NHSN) and determined by ICD-9-CM and CPT procedure codes. If more than one surgery was performed in the same anatomic region, the procedure was assigned to the discharge according to highest expected NHSN infection risk.
- **Outcome variables:** *S. aureus* infection was defined using an algorithm that included non-surveillance culture results and ICD diagnosis codes indicating BSI, SSI, or other (e.g. UTI, respiratory, all others) within 180 days post index surgery. Incidence was calculated as number of *S. aureus* infections per 100 surgical discharges.
- **U.S. national infection volumes (inpatient surgeries):** To estimate the national annual number of infections following inpatient surgeries, surgery-specific *S. aureus* infection incidences were multiplied by the number of nationally projected inpatient elective surgeries (overall and by surgical category), calculated using surgical discharge counts in the entire PHD (n=665 hospitals) and established weights based on hospital characteristics such as geographic region, urban/rural location, teaching status, and bed size.

### Results
- A total of 1,116,994 hospital outpatient and 884,803 inpatient elective surgical discharges were included.
- Patients with any *S. aureus* infection within 180-days post-surgery were older, more likely male, African-American, had inpatient index surgery, Medicare as payer, and a higher comorbidity index than patients without *S. aureus* infection (Table 1).
- By 180 days after surgery, *S. aureus* was cultured from 1.19% of patients who had outpatient elective surgery, and 1.35% of patients who had inpatient elective surgery (Figure 1).

### Study Limitations
- Hospital charge masters may be insufficiently detailed to capture all criteria used in our algorithm to determine infection type, possibly resulting in BSIs and SSIs being misclassification as other *S. aureus* infections.
- Ability to ascertain post-surgical *S. aureus* infections is also limited to those patients who had a culture performed and who consistently return to the same hospital for care, thus the incidence rates might be underestimated.

### Conclusions
- A high burden of *S. aureus* infections was observed following surgical procedures, and close to half of these infections were due to MRSA.
- Results highlight the much larger burden of disease of *S. aureus* infections in the U.S. beyond inpatient surgeries, warranting special attention.
- Underscores the need for additional targeted infection prevention efforts at US hospitals and these results may help guide such prevention efforts.

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**Table 1. Patient and Hospital Characteristics**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Any <em>S. aureus</em> Infection (N=25,240)</th>
<th>No <em>S. aureus</em> Infection (N=1,976,557)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in yrs, mean±SD</td>
<td>60 ± 16</td>
<td>55 ± 17</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Female Sex, %</td>
<td>50</td>
<td>61</td>
<td>&lt;.0001</td>
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<tr>
<td>Race, %</td>
<td>75</td>
<td>77</td>
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</tr>
<tr>
<td>White</td>
<td>14</td>
<td>10</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>African-American</td>
<td>11</td>
<td>13</td>
<td>&lt;.0001</td>
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<tr>
<td>Other</td>
<td>47</td>
<td>44</td>
<td>&lt;.0001</td>
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<tr>
<td>Inpatient Surgery, %</td>
<td>27</td>
<td>47</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Primary Payer, %</td>
<td>13</td>
<td>10</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Commercial Medicare</td>
<td>13</td>
<td>10</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Medicaid</td>
<td>55</td>
<td>36</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>8</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

**Figure 1. *S. aureus* Incidence by Follow-Up Time after Elective Surgery**

**Figure 2. *S. aureus* Incidence by Infection Type at 180 Days after Elective Surgery**

**Study Disclosure:** This project was funded by Pfizer Inc.