Validating the Surgical Instrument Cleanability Index

Abhi Bukkapatnam, Lauren Hirth, Malcolm Hudson, Michael Kalmus, Jakob Kiel-Locey, Emily Krebs, Caroline Owens, Wesley Chen BSE, Hannah Strat BSE, William Pozehl MSE, Joseph DeRosier PE, CSP, James Bagian MD, PE

Introduction

Motivation

Each surgical instrument may have a variety of features, ranging from teeth to grooves to hinges. The types and number of these features contribute to how difficult the instrument is to clean. By quantifying the cleaning difficulty of each instrument, we provide the ability to:

- Quantify the cleaning difficulty of an instrument tray/set
- Balance decontamination technician workload
- Measure decontamination technician efficiency
- Inform future surgical instrument purchasing decisions

Our goal is to validate the existing cleanability index (CI) scores and measure cleaning time of each instrument feature.

Previous Work

The CHEPS team previously identified ten instrument features found in sets comprised of the most commonly-used instruments for General Surgery, Neurosurgery, and Otolaryngology.

Interviews conducted with Central Sterile Processing Department (CSPD) technicians identified difficult-to-clean features, leading to the development of the following scoring system. These scores indicate staff perception of the relative cleaning difficulty of the feature; higher numbers are more difficult. A weighting factor (i.e., multiplier) was applied to the score to account for bioburden visibility and accessibility.

<table>
<thead>
<tr>
<th>Feature Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blades/Sharp Tip</td>
<td>5.65</td>
</tr>
<tr>
<td>Incurvated/V-Hinged</td>
<td>9.65</td>
</tr>
<tr>
<td>Jaws*</td>
<td>3.33</td>
</tr>
<tr>
<td>Moving Parts</td>
<td>4.25</td>
</tr>
<tr>
<td>Teeth</td>
<td>1.60</td>
</tr>
</tbody>
</table>

Table 1: Original instrument feature category raw scores

Example: Kerrison Rongeur

Jaws (V and SA) = (3.35 × 2) + (1.15 × 3) + (0.50 × 1) = 13.65

Feature Testing

30 instrument test set (3 instruments per feature group)
- Soiled one feature per instrument
- Soil dried for 24 hours
- Recruited experienced technicians to clean the instruments
- Video recorded and timed cleaning process

Approach

Feature Categories

- Cannulated
- Grounded/Textured
- Hinged
- Incurvated/V-Hinged
- Jaws*
- Micro
- Moving Parts
- Teeth

Table 2: Instrument feature multipliers

Instrument Soiling

- Healthmark Artificial Test Soil (ATS)
- Powder reconstituted with 100 mL sterile water
- Ingredients: purified bovine proteins (hemoglobin, albumin), amino acids, vitamins, carbohydrates, lipids, cellulose and mucin

Future Work

- Modify feature cleanability scores based on validation results
- Conduct time trials of technicians cleaning entire instruments with multiple features
- Modify cleanability index to include new feature categories

Acknowledgements

The team would like to thank Shawn Murphy, Jania Torreblanca, Ryan DiStefano, and the CSPD decontamination and assembly staff. We also thank all CHEPS Surgical Instrument project team members since 2013.