Cost Analysis of Implementing MALDI-TOF with Real-Time Antimicrobial Stewardship Intervention for Bloodstream Infections

Rola Kaakeh, PharmD; Twisha S. Patel, PharmD; Jerod Nagel, PharmD; BCPS (AQ-ID); Duane Newton, PhD; James Stevenson, PharmD
University of Michigan Health System, University of Michigan College of Pharmacy

INTRODUCTION

- Matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) uses mass spectrometry to rapidly identify species of bacteria and yeast following isolation from clinical specimens.
- Use of this technology significantly reduces time to organism identification by 24-36 hours compared to conventional techniques, which may take as long as 72 hours for final results.
- Although existing evidence has consistently demonstrated significantly improved clinical outcomes, the additional costs of implementing MALDI-TOF have not been well established.

METHODS

Study Design
- Single center retrospective cost analysis (pre/post-intervention with antimicrobial stewardship program)

Inclusion Criteria
- Adult patients (>18 years of age) with a BSI that were hospitalized at the University of Michigan Health System

Exclusion Criteria
- Transferred from an outside hospital and those with a BSI secondary to organisms not yet validated for identification by MALDI-TOF (e.g., Mycobacterium species, Nocardia species, anaerobic organisms, and filamentous fungi)
- Inability to generate incurred inpatient costs from Enterprise Performance Systems, Inc. (EPS, Alpharetta, Chicha, IL) cost accounting system

RESULTS

Table 1. Baseline Demographics of Pre-intervention vs. Post-intervention Populations

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Pre-intervention (N=247)</th>
<th>Post-intervention (N=247)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>62.2 ± 17.8</td>
<td>62.0 ± 18.6</td>
<td>0.31</td>
</tr>
<tr>
<td>Gender</td>
<td>Female: 105 (42.8%)</td>
<td>Female: 119 (47.9%)</td>
<td>0.06</td>
</tr>
<tr>
<td>Race</td>
<td>White: 198 (80.0%)</td>
<td>White: 215 (86.7%)</td>
<td>0.07</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Yes: 111 (44.5%)</td>
<td>Yes: 132 (53.3%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>Yes: 57 (23.0%)</td>
<td>Yes: 72 (29.3%)</td>
<td>0.09</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Yes: 22 (8.9%)</td>
<td>Yes: 26 (10.5%)</td>
<td>0.30</td>
</tr>
<tr>
<td>Recent Surgery</td>
<td>Yes: 34 (13.7%)</td>
<td>Yes: 33 (13.6%)</td>
<td>0.97</td>
</tr>
<tr>
<td>Type of admission</td>
<td>Acute Medical: 220 (89.0%)</td>
<td>Acute Medical: 224 (90.9%)</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>Trauma: 27 (11.0%)</td>
<td>Trauma: 3 (1.2%)</td>
<td></td>
</tr>
</tbody>
</table>

Results

- Time to organism identification: 0.81 days post-MALDI-TOF intervention compared to 1.81 days post-Laboratory test identification.

Primary Outcome
- Incurred costs from the date of BSI to the date of discharge from hospital or date of death

Secondary Outcomes
- 30-day all-cause mortality
- Length of hospitalization from the date of BSI to the date of discharge

Statistical Analysis
- Student’s t-test or Mann-Whitney U test were performed for all continuous data
- Chi-square test were performed for all dichotomous data

Cost

- Cost of MALDI-TOF: $41.30 per case
- Cost of laboratory tests (intervention period only): $42.580

CONCLUSIONS

- This analysis evaluated the financial impact of a dual intervention approach utilizing rapid diagnostic testing with MALDI-TOF in conjunction with antimicrobial stewardship. The intervention resulted in a financial savings of $2.34 million, and demonstrated an annual cost saving of $2.34 million, in addition to improving all-cause mortality.

LIMITATIONS

- MALDI-TOF costs the cost included in this analysis was estimated for blood cultures only, and therefore represents a percentage of the total costs.
- The cost estimate was based on outcomes from this single-center quasi-experimental analysis with noted differences in characteristics between groups, which may have influenced length of stay and mortality.
- There are several factors in this analysis, which ultimately represents a conservative cost savings estimate.
- This analysis was unable to differentiate the cost saving related to implementation of MALDI-TOF versus pharmacists review and intervention.

Acknowledgments
- Financial support for this project was from the University of Michigan Health System, University of Michigan College of Pharmacy.

References