Healthcare-Associated Infections

- Contribute to ~4% of all deaths in the US
- Despite much effort, they remain stubbornly prevalent
- Dynamics of risk factors are poorly understood
- Our focus: Clostridium difficile (C. diff)

Risk Factors

- Time Invariant
  - e.g., admission complaint, previous admissions, home meds
- Time Varying
  - e.g., current meds, current procedures, current location, hospital conditions

"Medicare Shift Fails to Cut Hospital Infections" (Oct. 10th 2012)
1. **Typical Approaches in Clinical Literature**
   Calculate risk using only a snapshot of patient’s state
   
   1a. at time of admission (Tanner et al., 2009)
   1b. \( n \) days before index event (Dubberke et al., 2011)

2. **Our Approach**
   Calculate risk using the entire evolving risk profile
Step 1: Infer risk over time (I.e., extract time series)

Step 2: Stratify patients based on this time series (multiple methods presented and compared in paper)

Time Series Classification:
- Temporal Feature Extraction
- Kernel Methods
- Hidden Markov Models

Improved Estimate of Patient’s Daily Risk
Patient Risk Stratification for Hospital-Associated

C. *diff* as a Time-Series Classification Task

Jenna Wiens*, John V. Guttag and Eric Horvitz

The Data

- Electronic health records from >10,000 hospital admissions
- On average 10 days/stay, ~10,000 variables/day

Results

<table>
<thead>
<tr>
<th>Odds Ratio</th>
<th>Typical Approach</th>
<th>Our Approach</th>
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<tbody>
<tr>
<td>2.8</td>
<td></td>
<td>30.5</td>
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Taking into account the temporal aspect of risk leads to a significant improvement in risk stratification.