Outbreak of *Bacillus cereus*
Food-poisoning with a Fatality after a Feast:
Bagli Village, Bursa City, Turkey, September 2012

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Field Epidemiology Training Program (2012)
Turkish Ministry of Health

International Night at EIS Conference
Atlanta, 24 April 2013
Bacillus cereus

- Gram positive, facultative anaerobic
- Forms endospores
- Some strains produce human toxin
  - Emetic form: Heat stable; mostly nausea and vomiting
  - Diarrheal form: Heat labile; mostly diarrhea
- Causes food-poisoning
Confirmation of *B. cereus* Food Poisoning

- Detection of $\geq 100,000$ organisms/g in food sample or
- Isolation of *B. cereus* in stool specimens of $\geq 2$ patients, but not in control patients
Outbreak reported on 12 Sept 2012

- A child died on 12 Sept, 2012 in Bagli Village
- 24 persons have been sick as of 12 Sept
- Symptoms: Diarrhea, abdominal pain, nausea, vomiting and fever
Objectives

• To determine cause of outbreak
• To identify mode of transmission
• To recommend control and prevention measures
Probable case: Onset of diarrhea (≥3/day) during 9-13 September, 2012 in a resident or visitor of Bagli Village, with ≥1 of the following symptoms:

- Nausea
- Vomiting
- Abdominal pain
- Fever (self-reported)
Case Finding

• Reviewed medical records in the two city hospitals serving residents of Bagli Village
• Interviewed key informants in village
• Asked patients to name other patients they knew
• 25 case-patients found
  – 23 Bagli Village residents; 2 visitors
  – Attack rate: 5.5% among village residents
Symptoms consistent with food intoxication of *B. cereus*, *S. aueus*, other pathogens

<table>
<thead>
<tr>
<th>Symptom</th>
<th>N*</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>Fever (self-reported)</td>
<td>23</td>
<td>92</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>21</td>
<td>84</td>
</tr>
<tr>
<td>Nausea</td>
<td>21</td>
<td>84</td>
</tr>
<tr>
<td>Vomiting</td>
<td>14</td>
<td>56</td>
</tr>
</tbody>
</table>

* 23 residents and 2 visitors
Two initial cases right after feast; followed by a large peak next day

- Village Feast
- Leftover Food Distributed
- Child that died

09 Sept 10 Sept 11 Sept 12 Sept
Cases mostly distributed on one side of main road

Family that held the feast
Hypothesis

Food-poisoning outbreak due to consumption of contaminated food during village feast

• Initial patients reported attendance at the feast

• Cases started soon after the feast, and increased sharply after distribution of leftover food

• Waterborne unlikely: Cases distributed on one side of main road, whereas entire village had same water source
Case-Control Investigation (Frequency Matched)

- **Cases:** Village residents who met probable case definition
  - 22 cases (excluding 2 visitors and 1 dead child) and 85 of 100 controls participated (1:4 matching)

- **Controls:** Randomly selected asymptomatic residents, matched by age group (0-9y, 10-17y, ≥18y)
Eating Monday meal was more strongly associated with illness than eating Sunday meal

<table>
<thead>
<tr>
<th>Meal eaten</th>
<th>Cases % (n=22)</th>
<th>Controls % (n=85)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun. (9 Sep)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ate</td>
<td>60</td>
<td>21</td>
<td>5.4 (2.0-15)</td>
</tr>
<tr>
<td>Did not eat</td>
<td>40</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>Mon. (10 Sep)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ate</td>
<td>82</td>
<td>2</td>
<td>187 (32-1099)</td>
</tr>
<tr>
<td>Did not eat</td>
<td>18</td>
<td>98</td>
<td></td>
</tr>
</tbody>
</table>

OR: Odds Ratio, CI: Confidence Interval
Preparation, storage and serving of food

- One serving: Mixed chicken and rice
- Temperature: 15.6 C (60.0 F, low) – 27.3 C (81.1 F, high)

Food preparation finished at 3:00pm
Feast
Leftover Food Distributed

Onset (Hr)

Child died
Laboratory Investigation

- \textit{B. cereus} in leftover food: $3.3 \times 10^8$
  - 3300 times higher than the concentration to confirm \textit{B. cereus} food-poisoning ($10^5$)
Investigation of 8-year old child that died

- **Consumed leftover food**
- **Started to have vomiting and diarrhea**
- **Found dead in bed; Autopsy finding non-specific**

- **10 Sept, 10:30p.m.**
- **11 Sept, 7:30a.m.**
- **12 Sept, 9:30a.m.**

- **26 hours**
Limitation

• 11 stool specimens were obtained
  – Only microscopy was done
  – No culture
Conclusions

• This was a *Bacillus cereus* food-poisoning outbreak

• Improper storage of food facilitated growth of *Bacillus cereus*
Recommendations

• Awareness campaign on food poisoning, and proper preparation and storage of food
  – Leftover food should be refrigerated (<10C/50F) promptly
  – Reheat thoroughly and rapidly before consumption

• Training and licensing of cooks for mass events
Acknowledgements

• WHO Technical Expert, Dr. Bao-Ping Zhu
• Field Epidemiology Unit, Public Health Institution of Turkey
• Public Health Directorate of Bursa City
• Mehmet Gülay, M.D., P.H.S., Public Health Unit of Osmangazi District, Bursa City
Extra slides
# Stratified Analysis by Meals Eaten

<table>
<thead>
<tr>
<th>Meals Eaten</th>
<th>Cases (n=22)</th>
<th>Controls (n=85)</th>
<th>OR (95% CI &lt;sub&gt;exact&lt;/sub&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>+</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>-</td>
<td>+</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>0</td>
<td>66</td>
</tr>
</tbody>
</table>
Eating Sunday and Monday meals were both significantly associated with illness.

<table>
<thead>
<tr>
<th>Meals Eaten</th>
<th>Cases (n=22)</th>
<th>Controls (n=85)</th>
<th>OR (95% CI&lt;sub&gt;exact&lt;/sub&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>10 (=9+1)</td>
<td>2 (=1+1)</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>5 (=4+1)</td>
<td>18 (=17+1)</td>
</tr>
<tr>
<td>-</td>
<td>+</td>
<td>10 (=9+1)</td>
<td>2 (=1+1)</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>1 (=0+1)</td>
<td>67 (=66+1)</td>
</tr>
<tr>
<td></td>
<td>Emetic Form</td>
<td>Diarrheal Form</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------------------------------------------</td>
<td>------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Mean incubation (min.-max.)</td>
<td>2-4 hours (1-6 hours)</td>
<td>10-13 hours (8-16 hours)</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>Sudden onset of severe nausea and vomiting</td>
<td>Abdominal pain, diarrhea. Vomiting less common</td>
<td></td>
</tr>
<tr>
<td>Foods</td>
<td>Rice</td>
<td>Rice, potato, meat</td>
<td></td>
</tr>
<tr>
<td>Climate condition of the region</td>
<td></td>
<td></td>
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<tr>
<td>--------------------------------</td>
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<td></td>
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<tr>
<td>The average temperature of Bursa in September (1970-2010)</td>
<td>20.1 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. and max. temperature values of Bursa in 9.9.2012</td>
<td>13.8 °C and 29.5 °C</td>
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</tbody>
</table>
### Attack rates according to gender

<p>| | |</p>
<table>
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<tr>
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<tbody>
<tr>
<td>Attack rate of females</td>
<td>%7.2</td>
</tr>
<tr>
<td>Attack rate of males</td>
<td>%3.8</td>
</tr>
</tbody>
</table>