Answer Key

Part 1 [53pt]
1. [3pt] Localized, more cases than expected, occurs over specific time period
2. [1pt] Fecal-oral route
3. [1pt] Hospital acquired infection
4. 
   a. [1pt] *E. coli*
   b. [2pt] Infections by Shiga toxin-producing *E. coli* (STEC) can lead to hemolytic uremic syndrome (HUS), which can lead to decreased urination and tiredness.
5. [6pt] 1/2pt for each: signs/symptoms, people, location, and time; 2 pts per definition in total; answers may vary
   a. Confirmed: Shiga toxin found in stool samples of people who have resided in the local hospital along with bloody diarrhea within the past two weeks.
   b. Probable: Bloody diarrhea in patients of the local hospital within the past two weeks.
   c. Possible: Diarrhea and stomachache in patients of the local hospital within the past two weeks
6. [2pt] Retrospective cohort (1pt for cohort study)
7. [4pt] 1pt per correct answer; answers may vary
   a. Pros: can examine multiple outcomes for a single exposure; useful for rare exposures; temporality is easily established, supporting causation
   b. Cons: expensive in terms of time (for prospective studies) and resources; rare diseases requires a large number of subjects; less control over data (for some retrospective studies)
8. [2pt] August 10\textsuperscript{th} (Tiebreaker #1)
9. [1pt] Common source
10. [9pt] (1pt each, 2pt for showing work)

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Sandwich</td>
<td>1.79</td>
</tr>
<tr>
<td>Pasta</td>
<td>0.57</td>
</tr>
<tr>
<td>Tacos</td>
<td>0.71</td>
</tr>
<tr>
<td>Salad</td>
<td>0.58</td>
</tr>
<tr>
<td>Milk</td>
<td>1.16</td>
</tr>
<tr>
<td>Apple Juice</td>
<td>0.86</td>
</tr>
<tr>
<td>Cookies</td>
<td>0.39</td>
</tr>
</tbody>
</table>

Beef Sandwich:

<table>
<thead>
<tr>
<th></th>
<th>No. Ill</th>
<th>No. Not Ill</th>
</tr>
</thead>
<tbody>
<tr>
<td>exposed</td>
<td>26 (a)</td>
<td>32 (b)</td>
</tr>
<tr>
<td>not exposed</td>
<td>45 – 26 = 19</td>
<td>134 – 45 – 32 = 57 (d)</td>
</tr>
</tbody>
</table>

RR= \[a/(a+b)]/[c/(c+d)] = [26/(26+32)]/[19/(19+57)] = 1.79

11. 1pt per answer; answers may vary
   a. [3pt] Infected cook and improper hygiene, contamination at meat processing plant, contamination at the farm, contamination during transport
   b. [2pt] Proper cooking of raw food, avoidance of cross-contamination
12. [1pt] Recall or Response bias
13. [12pt] 1pt per correctly filled “expected deaths” cell, except for the totals; 1pt per correct age-adjusted mortality rate; accept equivalent answers

<table>
<thead>
<tr>
<th>Age</th>
<th>Age-Specific Mortality Rate</th>
<th>Expected Number of Deaths</th>
<th>Age</th>
<th>Age-Specific Mortality Rate</th>
<th>Expected Number of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-12</td>
<td>0.25</td>
<td>14.75</td>
<td>0-12</td>
<td>0.11</td>
<td>6.56</td>
</tr>
<tr>
<td>13-25</td>
<td>0.10</td>
<td>5.52</td>
<td>13-25</td>
<td>0.20</td>
<td>10.60</td>
</tr>
<tr>
<td>26-49</td>
<td>0.13</td>
<td>7.92</td>
<td>26-49</td>
<td>0.29</td>
<td>17.14</td>
</tr>
<tr>
<td>50-75</td>
<td>0.13</td>
<td>10.27</td>
<td>50-75</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>76+</td>
<td>0.27</td>
<td>18.10</td>
<td>76+</td>
<td>0.50</td>
<td>33.00</td>
</tr>
<tr>
<td>Total</td>
<td>0.17</td>
<td>56.56</td>
<td>Total</td>
<td>0.18</td>
<td>67.30</td>
</tr>
</tbody>
</table>

Age-Specific Mortality Rate = # deaths / # cases in a specific age group
Expected Number of Deaths = (Age-Specific Mortality Rate)*(Reference Population for the Age Group)

Age-Adjusted Mortality Rate 2015 Outbreak = 56.56 expected deaths / 315 people (from reference population) = 18 per one hundred people
Age-Adjusted Mortality Rate Hospital Outbreak = 67.30 deaths / 315 people = 21 per one hundred people

14. [2pt] 1pt per answer; answers may vary
   random error (due to small sample size); Berkson bias
15. [1pt] b. T-test

Part 2 [27pt]

1. [2pt] Pathogenicity is the capacity of a pathogen to cause disease. Virulence is the severity of the disease caused by a pathogen. Ex. TB is less pathogenic than smallpox. Smallpox is more severe than TB.
2. [1pt] (answers may vary) pandemics span countries and regions, not a neighborhoods; existence of an outbreak or a pandemic hasn’t been established yet; pathogen in question hasn’t been confirmed
3. [2pt] (answers may vary) cases who left the area, cases where patients didn’t seek medical attention in the area
4.  [6pt] 1/2pt per correctly labeled axis, 2pt for correct title (condition, “by time of onset,” location, time), 1pt for reasonably scaled x-axis (between 8hr and 1 day intervals), 1pt for a histogram, 1pt for correct frequency for each time interval.

5.  [6pt] (1pt each, 2pt for showing work; tiebreaker #3)

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visited Areas with Local Zika Transmission</td>
<td>1.20</td>
</tr>
<tr>
<td>Ate Commercially Canned Food</td>
<td>0.96</td>
</tr>
<tr>
<td>Ate Home-Canned Food</td>
<td>19.95</td>
</tr>
<tr>
<td>None of the Above</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Visited Areas with Zika:

\[
\text{OR} = \frac{(a/c)/(b/d)} = \frac{(5/19)/(9/41)} = 1.20
\]

exposed | Muscle Weakness | No Symptoms |
---------|----------------|-------------|
5 (a)    | 5 (a)          | 9 (b)       |
24 – 5 = 19 (c) | 50 – 9 = 41 (d)

6.  [1pt] contingency tables

7.  [2pt] (answers may vary) recall bias, rumination bias
8. [1pt] (answers may vary) spread information on proper canning techniques; instruct on inspection of canned goods before consumption
9. [1pt] (1/2pt each, answers may vary) cheap, easy to perform, well-defined disease/condition
10. [1pt] Type II Error (1/2pt for false negative)
11. 1pt per answer; answers may vary
   a. [2pt] test will find most cases, especially combined with evaluation of past exposures, symptoms, et cetera; people tested negative most likely do not have the disease
   b. [2pt] high incident of false positives may lead to distress in patients; false positives may lead to burden on health system due to additional testing

Part 3 [20pt]
1. [1pt] Typhoid Mary was an asymptomatic carrier (accept asymptomatic infection)
2. [1pt] arbovirus
3. [3pt] vectors, airborne, vehicular
4. [1pt] (1/2pt each) hepatitis A & hepatitis E
5. [1pt] clean, separate, cook, chill
6. [1pt] heart disease (Tiebreaker #2)
7. [2pt] (1pt for 3+ answers, 2pt for 5+ answers) sex, age, ethnicity, immunocompromised individuals, socioeconomic status, answers may vary
8. [1pt] endemic
9. [1pt] asymptomatic
10. [1pt] fomite
11. [1pt] reservoir
12. [1pt] environment
13. [1pt] spot map
14. [1pt] portal of exit
15. [1pt] herd immunity
16. [1pt] vector
17. [1pt] attack rate