Education & Experience

• 2008 PhD in Food Technology
  • Polytechnic University of Valencia (Spain)
  • Institute of Agrochemistry and Food Technology (IATA-CSIC)

• 2009-2011 Postdoctoral fellow
  • ERRC, ARS, USDA (Philadelphia, PA)

• 2011 Assistant Professor
  • University of Minnesota
Foodborne illness

• Each year 1 in 6 Americans (or 48 million people) gets sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases

• **Way way way underestimated****

• Difficult to estimate:
  • Not all sick people go to the doctor
  • Not all the diseases are reportable
  • Not all the samples are tested

• Usually the number of cases reported should be multiply by **2-150x** to get the exact number

• Direct medical costs and indirect costs
  • Work absenteeism
Foodborne illnesses notification pyramid

- People get sick
- People seek medical attention
- Hospital takes a sample
- Sample analyzed and reported
- Outbreak investigation
Factors contributing to foodborne outbreaks

- They may occur by:
  - poor personal hygiene
  - cross-contamination
  - poor storage practices
  - poor cleaning & disinfection
  - mistake during processing

- Often exist in the raw material before it is processed
- Does not include yeast or mold; primarily spoilage organisms unlikely to cause illness or death if consumed
Foodborne illness outbreak

- More than 250 foodborne diseases have been identified.
- Most of them will produce:
  - Vomiting
  - Diarrhea
  - Fever
  - Stomach pain
- Some of them will produce:
  - Uremic syndrome
  - Severe illness
  - Death
What is Risk?

- **Food safety Risk** = likelihood x severity of a hazard to be present in the food
What is food safety risk analysis?

• Set of tools to aid decision-makers to provide with more science-based decisions
• It takes into account the food safety risks among the whole food chain
Food Safety Risk Analysis-(CODEX)

Risk assessment
- Hazard identification
- Hazard characterization
- Exposure assessment
- Risk characterization

Risk management
- Weigh policy alternatives
- Select and implement control measures

Risk communication
- Interactive exchange of information concerning risks
What RA can do?

- Prioritize risks (impact and probability)
- Identify gaps of information
- Estimate the risk of my process based on the presence of a hazard
- Evaluate different control measures to reduce the risk
In other words....

• How likely is to have Salmonella/allergen/chemical in the final product?
• If present, how likely is Salmonella/allergen/chemical would be in such quantity to produce an outbreak/recall?
How risks are assessed?

- Decision matrices
- Decision trees
- Quantitative models
Decision matrices

- Tables that allow to estimate the risk based on a qualitative/semi-quantitative scale
- Define the levels for probability and severity
- Assign numbers/letters to each one
- Establish the ranges to be considered a risk
  - Negligible
  - Low
  - Medium
  - High
FDA-Approach for designating High Risk Foods

- Identify the high risk foods by assigning scores
- 7 criterion
  1. Frequency of outbreaks
  2. Severity of illness
  3. Likelihood of contamination
  4. Growth potential
  5. Manufacturing process intervention
  6. Consumption
  7. Economic impact

http://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm380210.htm
Risk ranking of local foods

• List of all local foods
• For each of the foods list all possible pathogens
• Characterize the main steps during manufacturing
• Estimate the risk for each food/process by assigning scores
Factors that affect food safety of local foods

- Contamination of raw material
- Killing step during process (raw vs. cooked)
- Shelf-life
- Cross-contamination
- Training and education
- GAP, GMP, HACCP
- Contamination of raw material

<table>
<thead>
<tr>
<th>Contamination of raw materials</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very likely (&gt;50%)</td>
<td>4</td>
</tr>
<tr>
<td>Likely (&gt;10%)</td>
<td>3</td>
</tr>
<tr>
<td>Rare (&lt;1%)</td>
<td>2</td>
</tr>
<tr>
<td>Very rare (&lt;0.1%)</td>
<td>1</td>
</tr>
</tbody>
</table>

- Manufacturing steps

<table>
<thead>
<tr>
<th>Killing step</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>The production process eliminates the hazard</td>
<td>1</td>
</tr>
<tr>
<td>The step eliminates the hazard only partially</td>
<td>2</td>
</tr>
<tr>
<td>The step only eliminates the pathogen slightly</td>
<td>3</td>
</tr>
<tr>
<td>There is no killing step</td>
<td>4</td>
</tr>
</tbody>
</table>
• **Severity**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pathogen can cause death</td>
<td>4</td>
</tr>
<tr>
<td>The pathogen can cause life disabilities</td>
<td>3</td>
</tr>
<tr>
<td>The pathogen can cause hospitalization</td>
<td>2</td>
</tr>
<tr>
<td>The pathogen causes mild symptoms (vomit and diarrhea)</td>
<td>1</td>
</tr>
</tbody>
</table>
To assess the overall risk we will use the following equation:

\[ \text{Risk} = \text{likelihood} \times \text{severity} \]

For example:

<table>
<thead>
<tr>
<th>Pathogen-Food combination</th>
<th>Risk score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken</td>
<td>12</td>
</tr>
<tr>
<td>Lettuce</td>
<td>10</td>
</tr>
</tbody>
</table>

Identify the high risk foods and apply additional risk mitigation measures
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