Bacterial Food Poisoning (BFP) Forecasting and Early Warning System Based on Meteorological Factors of Shanghai

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BFP Forecasting and Early Warning System

Shanghai Food and Drug Administration

Shanghai Meteorological Bureau
Most of Foodborne Disease Caused by Pathogen

- **WHO**
  - Every year, billions of cases of foodborne illness (food poisoning is most important kind of this disease) occurred. 70% caused by pathogen.
  - In developing countries, every year approximately 1.8 million children died from diarrhea, which caused by pathogen from food and water.

- **Shanghai**
  - During 1992～2006, food safety authorities received 608 outbreaks, 19433 cases of food poisoning.
  - 75% of the outbreaks (458) and 78% of the cases (15225) were BFP, which caused by pathogen.
Significance of Developing Forecasting and Early Warning System

- Food Safety Law of China: If indicate high degree of food safety risk, food authorities shall give warning of these risk in a timely manner.

- In the high-risk days of BFP, reminding food industry and consumers to take appropriate measures to eliminate the hazards and prevent the occurrence of food poisoning.

- Providing quantitative basis to the food safety authorities to strengthen the supervision and take further measures in the high-risk days.

- World EXPO will be held in Shanghai from May to Oct 2010, just high-risk days of BFP. Warning ahead is very important to ensure the food safety.
Feasibility of Developing the Forecasting and Early Warning System

- Food science has clarified that BFP has closely relationship with factors that influence the fate of pathogens in food:
  - Meteorological factors
  - Pathogen in the foods
  - Sanitation of food industry
  - Practice of consumers, etc.

- Experience indicates there should be some regularity between BFP and the above-mentioned factors

- The forecasting model of epidemic trend of infective disease has been developed, BFP is very similar to the infective disease
Objective

Outbreak data of BFP in past 15 years

Meteorology, pathogen in food & sanitation of food industry at the same time

Researching the relationship between occurrence of BFP and relevant factors

Analysing the regularity of BFP in the near future

Establishing the forecasting model & warning in high-risk days

First Step: based on meteorological factors
Monthly & Daily Distribution of BFP

Averaged monthly amount of BFP

Averaged daily amount of BFP

Remarkable regularity was showed in averaged monthly and daily distribution
Positive relationship was showed between BFP and averaged temperature, as well as relative humidity.
### Forecasting Model

#### Probability distribution of BFP occurrence

| 13 | -10 | -8 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 |
|----|-----|----|----|----|----|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|    |     |    |    |    |    | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 9 | 5 | 0 |     |     |     |     |     |     |     |
| 44 |     |    |    |    |    | 0 | 2 | 2 | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 8 | 10 | 10 | 10 | 8 |     |     |     |     |     |     |     |
| 48 |     |    |    |    |    | 0 | 0 | 2 | 1 | 0 | 2 | 2 | 4 | 2 | 2 | 7 | 10 | 10 | 8 | 9 |     |     |     |     |     |     |     |
| 52 |     |    |    |    |    | 0 | 0 | 2 | 1 | 1 | 0 | 2 | 1 | 4 | 2 | 3 | 12 | 10 | 10 | 12 | 20 |     |     |     |     |     |     |     |
| 56 |     |    |    |    |    | 0 | 0 | 2 | 1 | 1 | 0 | 2 | 1 | 4 | 2 | 3 | 12 | 10 | 10 | 12 | 20 |     |     |     |     |     |     |     |
| 60 | 2 | 1 | 3 | 1 | 1 | 0 | 1 | 3 | 4 | 2 | 5 | 8 | 11 | 13 | 25 | 34 | 23 | 19 | 33 |     |     |     |     |     |     |     |
| 64 | 0 | 0 | 1 | 0 | 2 | 2 | 1 | 1 | 2 | 5 | 4 | 4 | 8 | 10 | 12 | 29 | 25 | 31 | 39 |     |     |     |     |     |     |     |
| 68 | 0 | 0 | 1 | 2 | 2 | 1 | 2 | 4 | 3 | 4 | 5 | 9 | 13 | 16 | 21 | 22 | 21 | 19 |     |     |     |     |     |     |     |
| 72 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 4 | 5 | 2 | 5 | 8 | 16 | 17 | 24 | 21 | 18 | 18 |     |     |     |     |     |     |     |
| 76 | 12 | 0 | 1 | 1 | 1 | 3 | 5 | 5 | 5 | 9 | 12 | 21 | 22 | 19 | 12 |     |     |     |     |     |     |     |     |     |
| 80 | 12 | 11 | 1 | 1 | 1 | 1 | 4 | 4 | 5 | 9 | 7 | 12 | 14 | 21 | 13 | 11 |     |     |     |     |     |     |     |     |
| 84 | 12 | 0 | 1 | 0 | 1 | 2 | 2 | 3 | 12 | 9 | 10 | 13 | 18 | 16 | 13 |     |     |     |     |     |     |     |     |
| 88 | 0 | 0 | 0 | 2 | 1 | 1 | 2 | 8 | 9 | 16 | 12 | 18 | 22 | 13 | 8 |     |     |     |     |     |     |     |     |
| 92 | 0 | 2 | 3 | 3 | 1 | 1 | 0 | 13 | 11 | 13 | 21 | 25 | 13 |     |     |     |     |     |     |     |     |     |
| 96 | 0 | 2 | 1 | 0 | 0 | 4 | 8 | 12 | 9 | 15 | 18 | 11 |     |     |     |     |     |     |     |     |     |     |     |

#### Averaged temperature

- **Relative humidity**
- **Averaged temperature**
## BFP Early Warning Category

<table>
<thead>
<tr>
<th>Category</th>
<th>Meanings</th>
<th>Measures</th>
<th>Guideline (to Industry)</th>
<th>Guideline (to Consumer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>High-risk weather conditions, can easily cause BFP</td>
<td>1) Strengthen the supervision and the examination of high-risk food business units 2) Disseminate the early warnings to high-risk food business units and demand them to focus on food safety management 3) Strengthen the education of consumers, particularly the health in food processing operations</td>
<td>On the basis of yellow, it adds: Not to provide high-risk food such as raw food, uncooked fish and sea food.</td>
<td>On the basis of yellow, it adds: No eating of high-risk food such as raw food, uncooked fish and sea food.</td>
</tr>
<tr>
<td>YELLOW</td>
<td>Mid-risk weather conditions, BFP is possible</td>
<td>Strictly limit the time between cooking and eating to 2 hours. Separate raw food from cooked food. Only touch cooked food with disinfected hands.</td>
<td>Determine if food stored in the refrigerator has gone bad; If not, re-cook the food completely. Before processing raw food, disinfect your hands first. Separate raw and cooked food in the refrigerator. Dishes for raw food should be disinfected before processing. Fast food should be consumed in time.</td>
<td></td>
</tr>
</tbody>
</table>
Procedure of Forecasting and Warning

Temperature and humidity in the next three days → Calculating the possibility of the BFP → Forecasting the BFP risk in the next three days → Warning in the high-risk days
The system and platform has been put into operation since June 2009.
Provide guideline to the consumer & industry to prevent the BFP
As a result, the BFP reported in 2009 reached a lowest level in the past 17 years!
Further Work

- Amending and improving forecasting model
- Considering the other factors (pathogen in food & sanitation of food industry, etc)
- Using diarrhea monitoring data (initiative) instead of BFP reporting data (passive)
Thanks for your attention!

Any question?