Zoonoses in food and feed

Jaap Wagenaar, DVM PhD

Faculty of Veterinary Medicine, Utrecht University, the Netherlands
Central Veterinary Institute, Lelystad, the Netherlands
j.wagenaar@uu.nl
Outline

- Zoonoses and food borne zoonoses
- Current trends
- Control of food borne zoonoses
- Future aspects - challenges
Zoonoses and re-emerging zoonoses

**Zoonoses:**
Diseases and infections that are transmitted between vertebrate animals and humans – WHO 1959

**(re-)emerging zoonoses:**
Diseases whose incidence in humans has increased in the past 2 decades or threatens to increase in the near future – Emerging Infectious Diseases
Importance of zoonoses

- More than 200 infectious diseases can be transmitted from animals to humans.
- The last 20 years, 73% of all emerging human infections are zoonotic.
- Many zoonoses are (potentially) food borne.
Deaths Due to Selected Infectious Diseases

Total deaths (51.9 million)

Other causes 67%
(34.6 million)

Infectious diseases 33%
(17.3 million)

By main mode of transmission

Person-to-person 65%
(11.2 million)

Food, water- and soil-borne 22%
(3.7 million)

Animal-borne 0.3%
(0.06 million)

Insect-borne 13%
(2.3 million)
Old `fellows`…..

- Non typhoid Salmonella (S. Enteritidis, S. Typhimurium)
- Brucella
- Anthrax
Figure 1. Observed prevalence of *Salmonella*-positive holdings of laying hens, with 95% confidence intervals, in the EU, 2004-2005

- Portugal: 79.5%
- Poland: 76.2%
- Spain: 73.2%
- Czech Republic: 65.6%
- Greece: 49.3%
- Lithuania: 44.4%
- Hungary: 43.8%
- Belgium: 37.6%
- EU: 30.8%
- Italy: 29.2%
- Germany: 28.9%
- Cyprus: 28.0%
- Slovenia: 19.4%
- Estonia: 18.2%
- France: 17.2%
- Latvia: 16.7%
- Austria: 15.4%
- The Netherlands: 15.4%
- The United Kingdom: 11.9%
- Denmark: 2.7%
- Ireland: 1.4%
- Finland: 0.4%
- Sweden: 0.0%
- Luxembourg: 0.0%
- Norway: 0.0%

95% confidence interval for the observed holding prevalence
New age....

- Campylobacter
- *E. coli* O157
- Norwalk/Noro virus
- Transmissible Spongiform Encephalopathies
- Antimicrobial resistance
The good news..... (US)

- The 5 major pathogens <1900:
  - Brucella
  - *Clostridium botulinum*
  - *Salmonella* Typhi
  - Trichinella
  - *Vibrio cholerae*

Account for 0.01% of the cases in 1999
<table>
<thead>
<tr>
<th>Position</th>
<th>Pathogen</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Norwalk like viruses</td>
<td>9,200,000</td>
</tr>
<tr>
<td>2</td>
<td>Campylobacter</td>
<td>1,963,000</td>
</tr>
<tr>
<td>3</td>
<td>Salmonella (non-typhoid)</td>
<td>1,342,000</td>
</tr>
<tr>
<td>4</td>
<td><em>Clostridium perfringens</em></td>
<td>249,000</td>
</tr>
<tr>
<td>5</td>
<td>Giardia lamblia</td>
<td>200,000</td>
</tr>
<tr>
<td>6</td>
<td>Staphylococcus</td>
<td>185,000</td>
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<tr>
<td>7</td>
<td>Toxoplasma gondii</td>
<td>112,000</td>
</tr>
<tr>
<td>8</td>
<td>VTEC (E. coli)</td>
<td>92,000</td>
</tr>
<tr>
<td>9</td>
<td>Shigella</td>
<td>90,000</td>
</tr>
<tr>
<td>10</td>
<td>Enterotoxigenic E. coli</td>
<td>56,000</td>
</tr>
</tbody>
</table>
Changing microbes in a changing world....(1)

- Open borders: trade of food and travelling to exotic regions (vector, immunity)

- Changing consumer lifestyles, habits and demands (ready to eat foods, fresh food, minimal processed food)

- Susceptibility of hosts
  - Immunocompromised (children, elderly people, chronic diseases)
Herb Butter: Salted butter - Ireland
Garlic puree - China, USA, Spain
Garlic salt - China, USA, Spain
Lemon - USA
Parsley - France, UK
Pepper - Indonesia
Water - Ireland

Chicken Breast: Chicken - Ireland, Belgium
UK, France etc.

Batter: Flour - Belgium, France
Water - Ireland

Bread Crumb: Bread crumb - Ireland, UK
Rape-seed oil - EU, Australia
Eastern Europe

Courtesy A. Reilly, FSAI, Ireland
Changing microbes in a changing world….(1)

- Open borders: trade of food and travelling to exotic regions (vector, immunity)

- Changing consumer lifestyles, habits and demands (ready to eat foods, fresh food, minimal processed food)

- Susceptibility of hosts
  - Immunocompromised (children, elderly people, chronic diseases)
Changing microbes in a changing world....(2)

- Animal production systems (focus on animal welfare and extensive farming, organic production)
- Improved diagnostics
- Changing microbes (resistance!!!!!, virulence factors, adaptation to new processing techniques)
- Climate change (floodings, spread of vectors)
Food borne zoonoses are a burden for public health

Some ‘old’ food borne zoonoses have been controlled effectively in some parts of the world

Some ‘old’ food borne zoonoses are a continuous problem around the world

Food borne zoonoses are (re)emerging and a continuous threat due to a changing world and a changing environment (new and old zoonoses)

Antimicrobial resistance is increasing rapidly
Challenges in the control of food borne pathogens and disease
Control of foodborne diseases (1)

**Information needed**
- The source(s)
- The route(s) of transmission
- Efficient control strategies
- Public health burden

**Tools needed**
- Diagnostic tools
- Epidemiological tools
- Mathematical modelling tools
- Decision support tools

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**Predict forward**
- Feed
- Pre-harvest
- Harvest
- Processing

**Trace-back**
- Retail
- Consumers
Risk assessment to inform risk management
  - Prior to (major) changes in production
  - Extrapolating trends & development in production
  - Use of new substances
  - Effects of political decisions
  - Consequences of consumer preferences

Simulation and scenario testing
Control of foodborne diseases (3)

International cooperation and communication

National
  Human Disease - Food contamination - Animal Disease

International
  Human Disease (IHR/INFOSAN) - Food contamination (INFOSAN) - Animal Disease (GLEWS)
Control of foodborne diseases (4)

Surveillance, integration and capacity building

- Animal Food chain = veterinary + food + public health

- Collaboration between disciplines needed (e.g. intervention) thanks to AI, Q-fever, MRSA

- Surveillance needed to detect new trends

- Capacity building needed to develop and support a surveillance system
An example: WHO Global Salm-Surv

- WHO support program
- Integration of vet, food and public health
- Capacity building for microbiologists and epidemiologists
Location of WHO-GSS Training Sites
59 international training courses have been conducted.

- Argentina
- Mexico
- Poland
- Thailand
- Trinidad
- Cameroon
- Egypt
- Russia, St. Petersburg
- Russia, Moscow
- Kazakhstan
- China
- Kenya
- Western/Southern Europe
- South Africa
- India
- Madagascar
- India
- Malaysia
- Mozambique
- Australia
- Pacific

Training Site
Proposed Training Site
Conclusions

Food borne zoonoses (including resistance) are a global issue and they will continuously pop up – old and new

Risk assessment and mathematical modelling may predict trends and support risk management

Surveillance systems, rapid communication and tracking & tracing systems need to be in place to detect and report (new) pathogens, and implement interventions

Special attention has to be given to developing countries

Research is needed to detect (and predict?) microbiological changes and update detection methods
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