Salmonella with the focus on Europe

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I don’t believe in Salmonella
I don’t believe in Salmonella

Dr. Bruno Garin-Bastuji,
Belgrado, October 16th, 2013, lunchtime
Outline

- *Salmonella* - examples
- Two chapters in the Terrestrial Code
- *Salmonella* in Europe
- Take home messages
Salmonella
A national outbreak of *Salmonella* Enteritidis infection from ice cream in the US

*ice cream concentrate* → *non-pasteurised liquid eggs*

224,000 with *Salmonella* gastroenteritis
Attack rate 6.6%
Ice cream consumed by 3½ million people

Hennessy et al 1996
The fall and rise of reported *Salmonella* infections in the United States, 1920-2000

CDC, National surveillance data

- Typhoid Fever
- Non-typhoid salmonellosis

Pasteurization of milk
Chlorination of water
Safe canning
1985: Salmonellosis outbreak US

- S. Typhimurium in milk from the Hillfarm Dairy in Melorose Park, Illinois
- 16,284 lab confirmed cases
- Two people died and the infection was a contributing factor in the deaths of "four, possibly five, others".
Large outbreak of *Salmonella* Thompson related to smoked salmon
Dutch laboratory surveillance network

- Since 1987

- 16 regional public health laboratories
  - Coverage +/- 64%

- Confirmation and typing at RIVM

- Number of isolates per year:

- Algoritme
Start

● Wednesday 15 August 2012 (week 33):
  – 14 cases of Salmonella Thompson
    › 4 cases in week 31
    › 10 cases in week 33
  – Normal: 0-7 cases per year

● 16 August:
  – First outbreak meeting

● 17 August:
  – Start case-control study
  – 15 cases
Food traceback

- Monday 24 September (week 39): smoked fish (result case-control study)
- Tuesday 25 September: one producer
- Wednesday 26 September: visit (Dutch) production site
- Thursday 27 September: salmon positive for Salmonella
- Friday 28 September: start of recall
- Sunday 30 September: confirmation Salmonella Thompson
- Monday 1 October: RASFF-alert (2012.1382)
Production site

- Production site in Greece
  - Several production lines
  - Reused dishes for transportation
  - Delivery to production site in the Netherlands

- Further distribution:
  - The Netherlands
  - Europe
  - North and Central America
## Symptoms

<table>
<thead>
<tr>
<th>Symptom</th>
<th>n/N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>108/112</td>
<td>96</td>
</tr>
<tr>
<td>Blood in stool</td>
<td>29/104</td>
<td>28</td>
</tr>
<tr>
<td>Nausea</td>
<td>67/112</td>
<td>60</td>
</tr>
<tr>
<td>Vomiting</td>
<td>44/111</td>
<td>40</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>88/111</td>
<td>79</td>
</tr>
<tr>
<td>Fever</td>
<td>63/101</td>
<td>62</td>
</tr>
<tr>
<td>Tremors</td>
<td>58/101</td>
<td>57</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>39/112</td>
<td>35</td>
</tr>
</tbody>
</table>
The outbreak

- 1149 confirmed cases
  - 696 women (64.5%), 383 men (35.5%), 70 unknown
  - median age 45 years (0-95 year)

- 4 reported deaths
  - 2 men + 2 women, 76-91 years of age
Composition of isolates at RIVM

- other Salmonella
- cases (conf)
- supplement

Number of cases

Week nr
Impact

● 4-6 million Dutch citizens were possible exposed per month Assuming:
  ➢ 47% of the population eats smoked salmon in four weeks
  ➢ the incriminated producer has a market share of 50-80%

● 812 confirmed cases within Dutch laboratory surveillance network
  Estimated number of cases:
  ✓ 23,000 persons infected
    ✓ 3,500 cases consulting a general practitioner
    ✓ 650 hospitalized
    ✓ 24 died

● To compare:
  an estimated 35,000 cases of salmonellosis occurred in 2009
Previous outbreaks

S. Thompson outbreaks
- Egg albumen; UK, 1956
- Cow’s milk; UK, 1956
- Roast beef; USA, 1996
- Cilantro; USA, 1999
- Bread contaminated by an ill food handler; USA, 2000
- Rucola lettuce; Norway, 2004

Salmon
- *Salmonella* Montevideo, hygiene food handlers; UK, 1984
- *Salmonella* Enteritidis, salmon dish contained eggs; Denmark, 1999
- *Salmonella* Enteritidis, salmon dish contained eggs; USA, 2000
Conclusion

- Large outbreak
- Rare *Salmonella* serovar
- Unexpected source
- Not international

- Surveillance
- Collaboration

- Recall bias
- Product versus ingredients
Acknowledgments

● RIVM:
  – EPI
  – IDS (LIS)
  – LCI
  – Z&O (LZO)
  – Communication

● Dutch laboratory surveillance network

● Other laboratories

● Regional public health services

● NVWA

● Cases
● Controls
Edwina Currie ("eggwina") junior health minister UK
1988....

- ‘most of the egg production in this country, sadly, is now affected with salmonella’

- "most eggs produced“ vs. ‘egg producing flocks”

- 60% drop in egg sales

British Lion Quality Code of Practice:

- Registration and traceability
- Breeding flock controls
- Pullet farms/vaccination programme
- A full hygiene monitoring programme including hygiene swabbing
- Time and temperature controls on-farm
- Controls on egg packs
- Strict controls on feed
- Packing centre hygiene
- 'Best before' date and Lion Quality mark on shell
- Advice to retailers, consumers and caterers
- Environment policy
- Animal welfare
- Ban of 'farm' descriptions of cage-produced eggs
- Independent auditing
Key: (a) S. Enteritidis phage typing began; (b) CMO issued advice to vulnerable groups; (c) Compulsory slaughter began; (d) Compulsory slaughter revoked; (e) Vaccination of broiler-breeder flocks began; (f) Vaccination of laying flocks began; (g) "Lion Flock" fully vaccinated.

*Salmonella* data sources: Health Protection Agency; Health Protection Scotland; Public Health Agency of Northern Ireland

* Shiga toxin-producing *Escherichia coli*.
† The position of each line indicates the relative change in the incidence of that pathogen compared with 1996–1998. The actual incidences of these infections cannot be determined from this graph. Data for 2012 are preliminary.
<table>
<thead>
<tr>
<th>Disease Agents</th>
<th>Percentage change in 2012 compared with 2006–2008</th>
<th>2012 rate per 100,000 Population</th>
<th>2020 target rate per 100,000 Population</th>
<th>CDC estimates that...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td>😞 14% increase</td>
<td>14.30</td>
<td>8.5</td>
<td>For every Campylobacter case reported, there are 30 cases not diagnosed</td>
</tr>
<tr>
<td>Escherichia coli O157</td>
<td>😞 No change</td>
<td>1.12</td>
<td>0.8</td>
<td>For every E. coli O157 case reported, there are 26 cases not diagnosed</td>
</tr>
<tr>
<td>Listeria</td>
<td>😞 No change</td>
<td>0.25</td>
<td>0.2</td>
<td>For every Listeria case reported, there are 2 cases not diagnosed</td>
</tr>
<tr>
<td>Salmonella</td>
<td>😞 No change</td>
<td>16.42</td>
<td>11.4</td>
<td>For every Salmonella case reported, there are 29 cases not diagnosed</td>
</tr>
<tr>
<td>Vibrio</td>
<td>😞 43% increase</td>
<td>0.41</td>
<td>0.2</td>
<td>For every Vibrio parahaemolyticus case reported, there are 142 cases not diagnosed</td>
</tr>
<tr>
<td>Yersinia</td>
<td>😞 No change</td>
<td>0.33</td>
<td>0.3</td>
<td>For every Yersinia case reported, there are 123 cases not diagnosed</td>
</tr>
</tbody>
</table>

For more information, see [http://www.cdc.gov/foodnet/](http://www.cdc.gov/foodnet/)
Two chapters in Veterinary Public Health Section of the Terrestrial Code

- Prevention, detection and control of Salmonella in poultry
  - country freedom not feasible in the short term for many OIE Members.
  - to encourage Members to undertake control programmes as appropriate to their circumstances.
  - ensure that international trade does not pose risks to animal or human health.

- Biosecurity procedures in poultry production (formerly: Hygiene and disease security procedures in poultry breeding flocks and hatcheries)
  - General recommendations (establishment location, construction, operation).
  - Prevention of dissemination of infectious agents.
  - Recommendations for live bird markets.

CHAPTER 6.5.

PREVENTION, DETECTION AND CONTROL OF SALMONELLA IN POULTRY

CHAPTER 6.4.

BIOSECURITY PROCEDURES IN POULTRY PRODUCTION
Challenges in writing the chapter on “Prevention, Detection and Control of *Salmonella* in Poultry”

1. The chapter has to be applicable to all members of the OIE, developing and developed countries.
2. The chapter has to be relevant to large industrial production and small family farms.
3. The chapter has to be appropriate for all poultry species and types.
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Salmonella in Europe

EU-data
EFSA-ECDC Zoonoses report 2011

Figure SU1. Reported notification rates of zoonoses in confirmed human cases in the EU, 2011

- Campylobacteriosis (N = 220,209)
- Salmonellosis (N = 95,548)
- VTEC (N = 9,485)
- Yersiniosis (N = 7,017)
- Listeriosis (N = 1,475)
- Echinococcosis (N = 781)
- Brucellosis (N = 330)
- Trichinellosis (N = 266)
- Tuberculosis caused by M. bovis (N = 132)
- Rabies (N = 1)
Figure SU2. Distribution of food-borne outbreaks (weak and strong evidence - excluding strong evidence waterborne outbreaks) per causative agent in the EU, 2010. 

- Unknown
- Salmonella
- Viruses
- Campylobacter
- Bacterial toxins
- Other causative agents
- Other bacterial agents
- Parasites
- *Escherichia coli* pathogenic

Legend:
- Strong evidence outbreaks
- Weak evidence outbreaks
Figure SA1. Trend in reported confirmed cases of human salmonellosis in the EU, 2008–2011

- Observed data
- Linear trend
Figure SA1. Trend in reported confirmed cases per 100,000 population of human salmonellosis in the EU, 2006-2010

Source: TESSy data for 27 EU MSs.
Table SA16. Distribution of reported confirmed cases of human salmonellosis by serovar (10 most frequent serovars) in the EU, 2010–2011

<table>
<thead>
<tr>
<th>Serovars</th>
<th>2011 N</th>
<th>2010 N</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Enteritidis</td>
<td>34,385</td>
<td>36,466</td>
</tr>
<tr>
<td>S. Typhimurium</td>
<td>19,250</td>
<td>21,223</td>
</tr>
<tr>
<td>S. Typhimurium, monophasic 1,4,[5],12:i:-</td>
<td>3,666</td>
<td>1,793</td>
</tr>
<tr>
<td>S. Infantis</td>
<td>1,676</td>
<td>1,426</td>
</tr>
<tr>
<td>S. Newport</td>
<td>771</td>
<td>839</td>
</tr>
<tr>
<td>S. Derby</td>
<td>704</td>
<td>783</td>
</tr>
<tr>
<td>S. Kentucky</td>
<td>559</td>
<td>689</td>
</tr>
<tr>
<td>S. Poona</td>
<td>548</td>
<td>665</td>
</tr>
<tr>
<td>S. Virchow</td>
<td>467</td>
<td>471</td>
</tr>
<tr>
<td>S. Agona</td>
<td>459</td>
<td>445</td>
</tr>
<tr>
<td>Other</td>
<td>14,936</td>
<td>17,657</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>77,421</strong></td>
<td><strong>82,457</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serovars</th>
<th>2011 %</th>
<th>2010 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Enteritidis</td>
<td>44.4</td>
<td>44.2</td>
</tr>
<tr>
<td>S. Typhimurium</td>
<td>24.9</td>
<td>25.7</td>
</tr>
<tr>
<td>S. Typhimurium, monophasic 1,4,[5],12:i:-</td>
<td>4.7</td>
<td>2.2</td>
</tr>
<tr>
<td>S. Infantis</td>
<td>2.2</td>
<td>1.7</td>
</tr>
<tr>
<td>S. Newport</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>S. Kentucky</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>S. Poona</td>
<td>0.7</td>
<td>0.8</td>
</tr>
<tr>
<td>S. Derby</td>
<td>0.7</td>
<td>0.8</td>
</tr>
<tr>
<td>S. Virchow</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>S. Agona</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Other</td>
<td>19.3</td>
<td>21.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Figure SA22. Trend in reported confirmed cases of human salmonellosis in the EU by selected serovars, 2008–2011
Figure 1. Observed prevalence of *Salmonella*-positive holdings of laying hens, with 95% confidence intervals, in the EU, 2004-2005
Figure 2. Observed prevalence of *Salmonella* Enteritidis/Typhimurium-positive holdings of laying hens, with 95% confidence intervals, in the EU, 2004-2005

Czech Republic 62.5
Poland 55.5
Spain 51.5
Portugal 47.7
Lithuania 44.4
Hungary 33.7
Belgium 27.7
Greece 25.7
Germany 24.2
EU 20.4
Austria 10.7
Slovenia 9.2
Estonia 9.1
France 8.0
Cyprus 8.0
The United Kingdom 7.9
Italy 7.9
The Netherlands 7.8
Denmark 1.6
Finland 0.4
Latvia 0.0
Sweden 0.0
Ireland 0.0
Luxembourg 0.0
Norway 0.0

95% confidence interval for the observed holding prevalence
Figure SA10. Prevalence of S. Enteritidis and/or S. Typhimurium-positive laying hen flocks of Gallus gallus during the production period and targets for Member States, Iceland, Norway and Switzerland, 2011
Figure SA9. Prevalence of *S. Enteritidis* and *S. Typhimurium*-positive laying hen flocks of Gallus gallus during the production period in Member States, Norway and Switzerland,¹ 2008–2011
Figure SA9. Prevalence of *S. Enteritidis* and *S. Typhimurium*-positive laying hen flocks of *Gallus gallus* during the production period in Member States, Norway and Switzerland, \(^1\) 2008–2011
Table SA10. Salmonella in laying hen flocks of Gallus gallus during the production period (flock-based data) in countries running control programmes, 2011

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>Target (production period)</th>
<th>% positive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>pos (all)</td>
</tr>
<tr>
<td>Austria</td>
<td>2,843</td>
<td>2.0</td>
<td>2.3</td>
</tr>
<tr>
<td>Belgium</td>
<td>750</td>
<td>2.9</td>
<td>5.2</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>228</td>
<td>2.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Cyprus</td>
<td>69</td>
<td>4.3</td>
<td>23.2</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>444</td>
<td>2.1</td>
<td>3.2</td>
</tr>
<tr>
<td>Denmark</td>
<td>410</td>
<td>2.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Estonia</td>
<td>35</td>
<td>2.0</td>
<td>8.6</td>
</tr>
<tr>
<td>Finland</td>
<td>818</td>
<td>2.0</td>
<td>0</td>
</tr>
<tr>
<td>France</td>
<td>4,000</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Germany</td>
<td>4,993</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Greece</td>
<td>578</td>
<td>2.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Hungary</td>
<td>867</td>
<td>2.0</td>
<td>15.7</td>
</tr>
<tr>
<td>Ireland</td>
<td>193</td>
<td>2.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Italy</td>
<td>1,122</td>
<td>2.3</td>
<td>9.7</td>
</tr>
<tr>
<td>Latvia</td>
<td>370</td>
<td>2.6</td>
<td>2.4</td>
</tr>
<tr>
<td>Lithuania</td>
<td>127</td>
<td>5.7</td>
<td>0.8</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>226</td>
<td>2.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Malta</td>
<td>102</td>
<td>10.6</td>
<td>8.8</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1,839</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Poland</td>
<td>2,235</td>
<td>4.1</td>
<td>5.5</td>
</tr>
<tr>
<td>Portugal</td>
<td>332</td>
<td>2.1</td>
<td>9.3</td>
</tr>
<tr>
<td>Romania</td>
<td>411</td>
<td>2.0</td>
<td>29.2</td>
</tr>
<tr>
<td>Slovakia</td>
<td>290</td>
<td>2.0</td>
<td>0</td>
</tr>
<tr>
<td>Slovenia</td>
<td>185</td>
<td>2.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Spain</td>
<td>2,500</td>
<td>5.3</td>
<td>13.6</td>
</tr>
<tr>
<td>Sweden</td>
<td>629</td>
<td>2.0</td>
<td>0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>4,195</td>
<td>2.0</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>EU Total</strong></td>
<td><strong>30,791</strong></td>
<td><strong>4.2</strong></td>
<td><strong>1.5</strong></td>
</tr>
<tr>
<td>Iceland</td>
<td>22</td>
<td>2.0</td>
<td>0</td>
</tr>
<tr>
<td>Norway</td>
<td>828</td>
<td>2.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Switzerland</td>
<td>841</td>
<td>2.0</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Figure SA20. Salmonella in human cases, eggs and laying hens and the number of Salmonella outbreaks caused by eggs within the EU, 2007–2011.
Figure SA14. Prevalence of *S. Enteritidis* and/or *S. Typhimurium*-positive broiler flocks of *Gallus gallus* before slaughter for Member States, Iceland, Norway and Switzerland, 2011
Galanis et al, EID 2006 (results of GFN)

Human data: Europe, Asia, Latin America, Caribbean, N-America, Africa

- Enteritidis
- Typhimurium
- Newport
- Heidelberg
- Infantis
- Hader
- Virchow

Year
2000
2001
2002
Number of isolates
1000
2000
3000
4000
5000
12500
13000
13500
60000
70000
80000
Enteritidis
Typhimurium
Newport
Heidelberg
Infantis
Hader
Virchow
Prevention and control measures (OIE-Chapter)

- Good Agricultural Practices
- Hazard Analysis Critical Control Point (HACCP)
- Hygiene and Biosecurity Procedures in Poultry Production
- Specific *Salmonella* practices
Specific *Salmonella* practices (OIE-Chapter)

- “Clean” sources of chicks and pullets
- Control of *Salmonella* contamination of feed
- Competitive exclusion
- Vaccination
- Culling
- Antimicrobials ??
Specific *Salmonella* practices (OIE-Chapter)

- “Clean” sources of chicks and pullets
- Control of *Salmonella* contamination of feed
- Competitive exclusion
- Vaccination
- Culling
- Antimicrobials
It is estimated that 2.6 % (95 % CI: 1.2-5.2) of all human salmonellosis cases in the EU in 2010 were attributed to turkeys. For the other Salmonella food-animal reservoirs, it is estimated that 17.0 % (95 % CI: 11.3-24.0), 56.8 % (95 % CI: 48.2-65.8) and 10.6 % (95 % CI: 5.1-18.3) of the estimated number of human salmonellosis cases could be attributed to laying hens (eggs), pigs and broilers, respectively.

Concluding remarks

- *Salmonella* is still one of the most important causes of bacterial food borne disease in humans
- Worldwide S. Enteritidis is No 1 and poultry derived
- In the poultry sector top-down strategy is essential
- *Salmonella* infections are preventable
- *ad hoc* approach (not well structured) does not work
- Reduction in human cases follows measures in primary production: One Health!
- Future: control of *Salmonella* in pig production?!