Prioritization of Food Borne Pathogens

M.J.J. MANGEN
Y.T.H.P. van DUYNHOVEN
W. van PELT
J. KEMMEREN
A.H. HAVELAAR

American Agricultural Economics Association - 2006
Pre-Conference Workshop: New Food Safety
Incentives and Regulatory, Technological, and
Organizational Innovations
July 22, 2006, Long Beach, CA
AAEA 21 July 2006

Prioritization of food borne pathogens

M.-J.J. Mangen, Y.T.H.P. van Duynhoven, W. van Pelt, J. Kemmeren, A.H. Havelaar

National Institute for Public Health and the Environment
Introduction

- There are many foodborne and zoonotic pathogens
- Evidence-based food safety policy requires focusing on the most relevant ones
- *This study aims to support Dutch decision makers in establishing the priority of pathogens that can (also) be transmitted by food*

- It is the basis for a study at the European level in Med-Vet-Net
- It has been strengthened by a fruitful collaboration with the US Food Safety Research Consortium
Criteria for priority setting

- Incidence (severity grade)
- Disease burden
- Cost-of-illness
  - DHC
  - Total costs
- Involved food products (food attribution)
- Prevention measures
- Trends
- Risk perception
Selected pathogens (2005)

- **Most frequent pathogens of community-acquired GE:**
  - Norovirus
  - Rotavirus
- **Most frequently observed bacterial pathogens**
  - Campylobacter
  - Salmonella
- **Other pathogens considered were:**
  - *Escherichia coli* O157
  - *Listeria monocytogenes*
  - *Toxoplasma gondii*

- **All routes considered**
Gastro-enteritis and sequel

- Laboratory-confirmed cases
  - Sequel

- Cases consulting GP*
  - Sequel

- Community-acquired cases*
  - Sequel

- Hospitalization
  - Sequel

- Death

* Correcting for trend
Outcome tree:
Disease burden

- **DALYs (Disability Adjusted Life Years)**
- **Conceptually simple:**
  - disease burden is a function of
    - the number of affected persons
    - the duration of the adverse health effect
    - and the severity of the effect

- **DALY = YLL + YLD**
  - mortality: years of life lost
    \[ YLL = \sum_{\text{all diseases}} (D \times e) \]
  - morbidity: years lived with disability, weighted for severity of illness
    \[ YLD = \sum_{\text{all diseases}} (N \times t \times w) \]
Cost-of-illness

- **Direct health care costs**
  - Consultation of general practitioners and specialists
  - Hospitalization
  - Drugs
  - Rehabilitation
  - etc.

- **Indirect non-health care costs (not considered)**
- **Direct non-health care costs**
  - Travel costs by patients
  - Co-payments by patients

- **Indirect non-health care costs**
  - Productivity losses of patients or care-givers
    - Friction method
Friction cost method vs Human capital approach

• Friction period
  - Period that is needed to replace sick, invalid or deceased worker.
  - Assuming 154 days at maximum/episode
    ➔ changing over the years!

• Friction vs human capital method
  - Short sickness leave:
    • Hardly any difference
  - Chronic and long-lasting diseases
    • Lower productivity losses than with e.g. human capital method
    • e.g. 30 year old invalid or deceased worker: productivity losses:
      13,300 € ➔ Friction period
      1,519,500 € ➔ Remaining working life years
### What are the priorities?

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Norovirus</th>
<th>Rotavirus</th>
<th>Campylobacter</th>
<th>Salmonella</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastro-enteritis</td>
<td>470,000</td>
<td>190,000</td>
<td>59,000</td>
<td>35,000</td>
</tr>
<tr>
<td>GE – visit to GP</td>
<td>10,000</td>
<td>11,000</td>
<td>14,000</td>
<td>5,400</td>
</tr>
<tr>
<td>GE – hospital</td>
<td>1,000</td>
<td>3,000</td>
<td>570</td>
<td>640</td>
</tr>
<tr>
<td>GE – death</td>
<td>5</td>
<td>1</td>
<td>25</td>
<td>39</td>
</tr>
<tr>
<td>Reactive arthritis</td>
<td>-</td>
<td>-</td>
<td>1,000</td>
<td>460</td>
</tr>
<tr>
<td>Guillain-Barré syndr.</td>
<td>-</td>
<td>-</td>
<td>59</td>
<td>-</td>
</tr>
<tr>
<td>Infl. Bowel Disease</td>
<td>-</td>
<td>-</td>
<td>22</td>
<td>9</td>
</tr>
</tbody>
</table>

*the Netherlands, 2004*
Disease burden - results

DALYs per year

- Campylobacter
- E-coli
- Salmonella
- Norovirus
- Rotavirus
- Listeria
- Toxoplasma

Undiscounted vs. Discounted (4%)
Disease burden – results

- Campylobacter
- Salmonella
- Norovirus
- Rotavirus

DALYs per year

Undiscounted vs Discounted (4%)
DALYs per 1000 cases
Cost-of-illness - results

![Bar chart showing total costs in € million per year for different infections: Campylobacter, Salmonella, Norovirus, and Rotavirus. The chart compares undiscounted and discounted costs (4%).](chart.png)
Cost-of-illness – results II

Total costs in € million per year

- Campylobacter
- Salmonella
- Norovirus
- Rotavirus

Legend:
- DHC
- DNHC
- INHC
Cost-of-illness (€) per case

- **Campylobacter**: 378
- **Salmonella**: 252
- **Norovirus**: 53
- **Rotavirus**: 116

Costs (€) per case:
- Not discounted
- Discounted (4%)
Conclusion and future perspective

• Priority setting is a multidimensional problem
• Ranking depends on the criterium used
• A quantitative and systematic approach is necessary
• Current data are not complete, but data needs can be prioritised
• International collaboration will speed up the process
QUESTIONS?

Thank you for your attention
Plans for 2006

- Disease burden and costs for:
  - Clostridium perfringens
  - Staphylococcus aureus
  - Bacillus cereus
  - Cryptosporidium parvum
  - Giardia lamblia

- Costs associated with STEC O157
- Outbreaks: associated costs (info)

- Food attribution

- IBS
Marie-Josée J. Mangen is researcher at the National Institute for Public Health and the Environment (NL). She holds an MSc degree in animal science (Dipl.-Ing. agr., equivalent to MSc from the University of Bonn (D)) and in Agricultural Economics and Marketing (Wageningen Agricultural University (NL)). Her PhD is from Wageningen University (NL), and was entitled ‘Economic welfare analysis of simulated control strategies for Classical Swine Fever epidemics’. She then moved for a short-term project to the Livestock Information and Policy Branch at the Food and Agricultural Organization in Rome (I). From 2003 to 2004 she held a post-doc at the Agricultural Economic Research Institute (NL) and at RIVM for which she conducted an economic evaluation on the control of *Campylobacters* in the chicken meat chain. Since March 2005 she works now at RIVM, where she conducts economic evaluations in the field of public health and infectious diseases.

[Marie-Josee.Mangen@rivm.nl](mailto:Marie-Josee.Mangen@rivm.nl)
Industry perspectives on incentives for food safety innovation
Continuous food safety innovation as a management strategy
  Dave Theno, Jack in the Box, US
Economic incentives for food safety in their supply chain
  Susan Ajeska, Fresh Express, US
Innovative food safety training systems
  Gary Fread, Guelph Food Technology Centre, Canada

Organizational and technological food safety innovations
Is co-regulation more efficient and effective in supplying safer food?
  Marian Garcia, Dept. of Agricultural Sciences, Imperial College London
  Andrew Fearne, Centre for Supply Chain Research, University of Kent, UK
Chain level dairy innovation and changes in expected recall costs
  Annet Velthuis, Cyriel van Erve, Miranda Meuwissen, & Ruud Huirne
  Business Economics & Institute for Risk Management in Agriculture, Wageningen University, the Netherlands
Regulatory food safety innovations
Prioritization of foodborne pathogens
Marie-Josée Mangen, J. Kemmeren, Y. van Duynhoven, A.H. and Havelaar, National Institute for Public Health & Environment (RIVM), the Netherlands

Risk-based inspection: US Hazard Coefficients for meat and poultry
Don Anderson, Food Safety and Inspection Service, USDA

UK HAS scores and impact on economic incentives
Wenjing Shang and Neal H. Hooker, Department of Agricultural, Environmental & Development Economics, Ohio State University

Private market mechanisms and food safety insurance
Sweden’s decade of success with private insurance for Salmonella in broilers
Tanya Roberts, ERS, USDA and Hans Andersson, SLU, Sweden

Are product recalls insurable in the Netherlands dairy supply chain?
Miranda Meuwissen, Natasha Valeeva, Annet Velthuis & Ruud Huirne, Institute for Risk Management in Agriculture; Business Economics & Animal Sciences Group, Wageningen University, the Netherlands

Recapturing value from food safety certification: incentives and firm strategy
Suzanne Thornsbury, Mollie Woods and Kellie Raper
Department of Agricultural Economics, Michigan State University
Applications evaluating innovation and incentives for food safety
Impact of new US food safety standards on produce exporters in northern Mexico
   Belem Avendaño, Department of Economics, Universidad Autónoma de Baja California, Mexico and Linda Calvin, ERS, USDA
EU food safety standards and impact on Kenyan exports of green beans and fish
   Julius Okello, University of Nairobi, Kenya
Danish *Salmonella* control: benefits, costs, and distributional impacts
   Lill Andersen, Food and Resource Economics Institute, and Tove Christensen, Royal Danish Veterinary and Agricultural University, Denmark

Wrap up panel discussion of conference
   FSN section rep. – Tanya Roberts, ERS, USDA
   AEM section rep. – Randy Westgren, University of Illinois
   INT section rep. – Julie Caswell, University of Massachusetts
   FAMPS section rep. – Jean Kinsey, University of Minnesota
   Discussion of everyone attending conference

Note: speaker is either the 1st person named or the person underlined.

Thanks to RTI International for co-sponsoring the workshop.
Workshop objectives
- Analyze how new public policies and private strategies are changing economic incentives for food safety,
- Showcase frontier research and the array of new analytical tools and methods that economists are applying to food safety research questions,
- Evaluate the economic impact of new food safety public policies and private strategies on the national and international marketplace,
- Demonstrate how new public polices and private strategies in one country can force technological change and influence markets and regulations in other countries, and
- Encourage cross-fertilization of ideas between the four sponsoring sections.

Workshop organizing committee
Tanya Roberts, ERS/USDA, Washington, DC - Chair
Julie Caswell, University of Massachusetts, MA
Helen Jensen, Iowa State University, IA
Drew Starbird, Santa Clara University, CA
Ruud Huirne, Wageningen University, the Netherlands
Andrew Fearne, University of Kent, UK
Mogens Lund, FOI, Denmark
Mary Muth, Research Triangle Institute Foundation, NC
Jayson Lusk, Oklahoma State University, OK
Randy Westgren, University of Illinois, IL
Darren Hudson, Mississippi State University, MI