Factors to Consider in Decision Making Given Variability and Uncertainty in Microbiological Risk Assessment: A Governmental Perspective

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Outline of presentation

- The Food Standards Agency
- Approach to risk
- Uncertainty in risk analysis
- Legislation and guidance
- Three examples - eggs, burgers, antimicrobial resistance
- Looking ahead - developments that will impact on variability and uncertainty in MRA
**History** Set up in April 2000 as a government department run by an independent board acting in the public interest. Food Standards Scotland from April 2015

**Purpose** To protect consumers by improving the safety of food and by giving honest, clear information. “Food is safe”

**Responsibilities** Food and feed safety; risk assessment, management and communication

**Values** consumer first/ open and transparent/ science & evidence based

**Facts** Budget: £150m/ Staff: 1,500 (1,000 in meat plants)
STRATEGIC OUTCOMES

• Food is safe
• Food is what it says it is
• Consumers can make informed choices about what to eat
• Consumers have access to an affordable healthy diet, now and in the future
What do we mean by “safe”?

“The Government does not set out to achieve zero risk, but to reduce risk to a level which should be acceptable to the reasonable consumer”

Known pathogens: bacteria cause the majority of foodborne illness in the UK

Estimate 500K cases/year known pathogens and 1M cases/year overall

*Foodborne illness caused by known pathogens, by pathogen type*

Numbers for UK, 2014.
Data source: FSA Foodborne Disease Estimation Model.
Tackling *Campylobacter* in poultry

**Campaigns**

- The 2015 Chicken Challenge
  - Spread the word, not the germs. Join the Chicken Challenge and pledge to do your bit. [Link](http://thinkit1chicken"
  - 3,250 Supporters
  - Take the Chicken Challenge. Step up to the plate. Show the world that you do the little things in the kitchen that keep your food safe.
  - Support the Chicken Challenge: Food Safety Week, 6th to 12th September

**Step Up to the Plate**

- Quick Guide to Campylobacter
- Campylobacter from Farm to Fork

**Don’t wash raw chicken**

- Campylobacter is the most common cause of food poisoning in the UK.
Vulnerable groups

Increasing life expectancies and low rate of fertility in the UK are contributing to an ageing population.
FSA Approach to Risk

- **Assess** using best scientific advice and acknowledge uncertainties: re-assess in the light of new evidence
- **Manage**: consistent, proportionate; not claim to eliminate risk
- **Communicate**: consultation, openness, honesty, role of the media
Perspective and scale of risk assessment - industry and government

- VTEC O157
  - Food
  - Water
  - Person-to-Person
  - Animal contact
  - Dairy
  - Meat
  - Fresh produce
  - Milk
  - Cheese
  - Cream
  - Process A
  - Process B
  - Process C
  - Company A
  - Company B
  - Company C
Risk Assessment – ”top down” approach

Use epidemiological data to define the scale and impact attributing to source (animals, food(s) etc.) Qualitative/quantitative depending on resources (time, data)

Hazard(s)

Non food

Food A
Food B
Food C
Risk Assessment – “bottom-up” approach

Qualitative or quantitative depending on resources (time and data availability)
May sometimes be feasible to compare/combine approaches
## Settings, timing and outputs for food safety MRA in the UK

<table>
<thead>
<tr>
<th>Setting</th>
<th>Timescale</th>
<th>Output type</th>
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<tbody>
<tr>
<td>Food hazards and incidents</td>
<td>Hours to weeks</td>
<td>Qualitative or Semi-quantitative</td>
</tr>
<tr>
<td>Expert groups, ACMSF</td>
<td>Weeks to years</td>
<td>Qualitative or semi quantitative</td>
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<tr>
<td>Strategic research</td>
<td>Months to years</td>
<td>Semi-quantitative or Quantitative</td>
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Examples of factors that impact on uncertainty in risk analysis

**Risk Assessment**
- No or limited data
- Data alignment
  - Spatial
  - Temporal
- Specificity
- Consumer behaviour
- Precision
- Time

**Risk Management**
- Point(s) of application
- Impact
- Consumer behaviour
- Tolerability of risk
- Economic
- Political
- Displacement
- Time
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<table>
<thead>
<tr>
<th>Uncertainty category</th>
<th>Interpretation</th>
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<tbody>
<tr>
<td>Low</td>
<td>There are solid and complete data available; strong evidence is provided in multiple references; authors report similar conclusions</td>
</tr>
<tr>
<td>Medium</td>
<td>There are some but no complete data available; evidence is provided in small number of references; authors report conclusions that vary from one another</td>
</tr>
<tr>
<td>High</td>
<td>There are scarce or no data available; evidence is not provided in references but rather in unpublished reports or based on observations, or personal communication; authors report conclusions that vary considerably between them</td>
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EFSA (2006)
Uncertainty in EFSA Scientific Assessments

- EFSA’s Scientific Committee developing guidance in this area

- Toolbox of approaches to analysing scientific uncertainties

- Qualitative and quantitative approaches

- Flexibility to account for time constraints, new areas where data may be limited as well as established issues.

- Public consultation June – September 2015

- Revised draft Guidance published in March 2016

- Publication anticipated at end of 2017 - currently being trialed by EFSA scientific committees
Legislation and Guidance

**Legislation**

- Microbiological criteria EC 2073/2005
- Based on risk assessment EC 178/2002

**Guidance**

- Time/temperatures e.g. 70°C for 2 minutes
- Vacuum/modified atmosphere packed foods
- Advice to vulnerable groups on runny eggs
- Boil beansprouts for 15 sec
Salmonella and eggs
FSA launches consultation on eggs report

Last updated: 22 February 2016

The Food Standards Agency has today launched a 10-week public consultation on a draft report looking at the safety of raw or lightly cooked eggs.

An expert group, set up by the Advisory Committee on the Microbiological Safety of Food (ACMSF), to look at egg safety, found there has been a reduction in the risk from salmonella in UK shell eggs since its last report on this issue 15 years ago.

The group found that UK eggs produced under the Lion Code scheme have a very low risk in comparison to other eggs. The report recommends that Lion Code eggs, or eggs produced under equivalent schemes, can be served raw or lightly cooked to those in most vulnerable groups, including pregnant women, the young and the elderly. The FSA currently advises vulnerable groups against this for all eggs.

Professor John Coia, Chair of the expert group on eggs, said: ‘The committee has acknowledged that there has been a reduction in the risk from salmonella in UK eggs since 2001. This is especially the case for eggs produced under the Lion Code, or equivalent, schemes.’

Once the comments from the consultation are considered, and the report finalised by the ACMSF, the FSA will review its advice to vulnerable groups taking into account the independent committee’s conclusions.
Prevalence of target *Salmonella* serovars in laying flocks detected during National Control Plan sampling in the main egg producing Member States (2011-2014)

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<td>2.8%</td>
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<tr>
<td>UK</td>
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<td>0.07%</td>
<td>&lt;0.1%</td>
<td>0.2%</td>
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Salmonella outbreaks in humans linked to eggs/egg products, England & Wales

26 outbreaks in 2009-14 with confirmed or suspected link to eggs/egg products.

- 5 with potential link to UK eggs (4 chicken, 1 duck)
- none linked to UK Lion code eggs in last 7 years
- 9 outbreaks definitively linked to non-UK eggs
- 3 outbreaks linked to non-UK pasteurised egg products (caterers/bodybuilders)
- Several investigations unable to identify a specific source.

Growth in the peer reviewed literature 1993-2015

To what extent does increasing knowledge help to reduce uncertainty and clarify variability?

Source: PubMed accessed 8/5/16
Rare Burgers
Serving of rare burgers in catering

- Sept 15 FSA board approved serving of rare burgers in catering
- Source control
  - QMRA modelling the impact of interventions in burger production
- Time/temperatures to achieve a 4 log reduction in STEC
- Epidemiological indicators that would prompt revisiting the issue
- Development of a framework for “risky foods”
A risk assessment model for *Escherichia coli* O157:H7 in ground beef and beef cuts in Canada: Evaluating the effects of interventions

- Use of QMRA model to assess the efficacy of intervention measures on the production chain – singularly and in combinations

- Average probability of illness per serving ranged from no intervention ($1.78 \times 10^{-4}$) to most effective combination ($6.7 \times 10^{-7}$)

- Used systematic reviews and meta-analyses to critically assess the results of intervention studies

Source: Smith *et al* (2013), Food Control 29:364-381
QMRA for burger production chain*

- UK QMRA model – adapted to focus on catering rather than the home
- Reviewed available interventions, feasibility, data sources
- To examine outputs under different cooking scenarios intended to deliver a 4 log reduction
- Look at the extent and sources of uncertainty and variability
- Review by ACMSF – previous work on safe cooking of burgers

ACMSF Report on Safe Cooking of Burgers

Source: ACMSF 2007
Antimicrobial resistance
“More information is needed on the prevalence of AMR in bacteria of animal origin and its impact on human health, on the quantity of antibiotics used for different indications and on the classes of antibiotics used”.

“Risk assessments and risk management are impeded by a lack of data and/or inability to access available data”

**CODEX has produced guidelines for risk analysis of foodborne antimicrobial resistance CAC/GL77-2011**
AMR - Plasmid-mediated colistin resistance (mcr-1 gene) – Nov 2015

- Plasmid-mediated colistin resistance reported from *E. coli* in pigs, raw meat and human infections in China.
- Resistance previously thought to be chromosomal
- Now becoming an antibiotic of last resort for certain infections in human medicine
- Animal and Plant Health Agency find *mcr-1* gene in *E. coli* in UK pigs.
- Public Health England screened WGS archive of 24,000 bacterial isolates for *mcr-1* gene (24 hours) – found 12 *Salmonella* and 3 *E. coli* isolates with *mcr-1*
- Denmark (DTU) reported 6 positives from screening ~3000 WGS
AMR - Plasmid-mediated colistin resistance (*mcr-1* gene)

- In China 0.7-1.4% of inpatient isolates of *E.coli* and *Klebsiella pneumoniae* with the *mcr-1* gene - much lower than in animals (21%) or pork, chicken (15%).
- Frequency of the *mcr-1* gene in clinical isolates in the UK much lower
- Qualitative assessment that the direct and indirect risk was very low - medium to high uncertainty - supported by ACMSF
- Jan 16 - screening of *E.coli* from retail meat for the *mcr-1* gene as an add on to EU antimicrobial resistance monitoring - more data needed!
- *mcr-1* gene now reported from many countries
Looking ahead – implications for variability and uncertainty in risk assessment

• Whole genome sequencing – what impact will this have on defining a hazard?
• Impact on other areas of risk assessment?
• Implications for previous MRAs?
• Wider adoption of systematic reviews and meta-analysis
• Better alignment of data to inform/support MRA rather than using what is available
• Consistency in the approach to assessing and communicating uncertainty and variability
THANK YOU