Lessons Learned from European and South African Listeriosis Outbreaks

Kaarin Goodburn MBE
Chilled Food Association
AFFI 26 February 2019
• Context - UK chilled food sector
• Key terms and principles
• Why is *Listeria monocytogenes* important?
• EU regulatory requirements
• Listeriosis rates internationally
• Recent fatal outbreaks – timelines and impacts
  • South Africa 2017-18 RTE cooked meat product
  • European 2015-18 RTC frozen corn
• Conclusions
UK, 1989

CALL FOR FREEZE ON COOK-CHILL

- ‘Listeria hysteria’: fatal pâté outbreak, contaminated cooked chicken
- Department of Health demanded code of practice on ‘cook-chill’
- CFA launched May, developed HACCP-based industry guidelines, launched December together with accreditation scheme

Food body plans safety initiatives

Chilled food firms launch far-reaching code to guarantee safety

Trade association at last for chilled food manufacturers

Join CFA, urges Minister
Chilled Food Association

Our Mission
To promote and defend the reputation, sustainability and value of the professional chilled food industry through the development and communication of standards of excellence in the production and distribution of chilled food.

Membership
• Chilled food manufacturers
• Compliance with CFA Guidelines
• BRC or IFS certification
• Non-compliances + close-outs
• Resumé of person responsible for food safety
• Reference from existing member
Chilled Food

A prepared food that for reasons of safety and/or quality is designed to be stored at refrigeration temperatures (at or below *8°C) throughout its entire life.

- Ready to Eat (RTE)
- Ready to Reheat (RTRH)
- Ready to Cook (RTC)

* Legal max in England, Wales, Northern Ireland. Chilled sector operates to 5°C max on delivery to RDC.
Key Terms: RTE, RTRH, RTC

• **Ready to Eat (RTE)**
  Intended by the producer or the manufacturer for direct human consumption *without the need for cooking or other processing* effective to reduce to an acceptable level or eliminate microorganisms of concern. (cold-eating) [from EU Regulation 2073/2005]

  Manufactured in a High Care or High Risk Area

• **Ready to Reheat (RTRH)**
  Designed to be reheated by the final consumer.

  Manufactured in a High Care or High Risk Area

  Standard practice among UK major multiples to provide validated cooking instructions

• **Ready to Cook (RTC)**
  Designed to be given a heat process delivering a 6-log kill with respect to vegetative pathogens (a minimum process equivalent to 70°C/2 mins) throughout all components.

  Manufactured in a Low Risk/GMP Area
What Makes Food RTE?

- Manufacturer’s risk assessment & product design, i.e. HACCP plan:
  - Appropriate (growing &) production controls
    - Minimise potential for contamination by zoonotic organisms
  - Hygienic preparation and packing
    - Prevent re-/cross-contamination
    - (thermal) Process
  - Limited shelf life
    - Ensure peak quality
    - Minimise opportunity for microbial growth
  - Chilled distribution, sale and storage
    - Minimise potential for microbial growth
  - Appropriate usage instructions
    - E.g. Chilled storage
    - Durability date – ‘use by’ for chilled, ‘best before’ otherwise
    - No further process to reduce/eliminate hazard microorganisms
Raw RTE – Materials Assurance

- Specified suppliers
- Apply Good Agricultural Practice standards
- Agronomists on-site
- Crop protocols
  - Growing site selection
  - Organic waste use in agriculture
    - Human-derived (sewage sludge) – no use on RTE
    - Animal-derived (farmyard manures, abattoir waste) – long intervals even after composting. Not used in practice on UK retail prepared RTE
  - Irrigation water quality
  - Control animal access
  - Assure human hygiene
- Grower/processor contracts
- Grower/processor/retailer audits
Segregation

• **GMP/Low Risk Area**
  • Raw material intake / Ready to cook foods / Packaged food

• **High Care Area**
  • RTE and ready to reheat food production
  • Includes non-thermally processed (‘raw’) ingredients having been through a decontamination process
  • Separate equipment, utensils, staff and changing areas
  • Positive pressure, filtered air

• **High Risk Area**
  • RTE and ready to reheat food production
  • **Only** thermally processed foods (minimum 70°C/2 mins)
  • Separate equipment, utensils, staff and changing areas
  • Positive pressure, filtered air
**Listeria monocytogenes** (Lm)

- One of 18 *Listeria* species
- Lm is the only species legislated for - pathogenic
- Widespread in environment: soil, water, animal faeces, vegetation
- Carried by ~10% of people
- Long incubation period: up to 90 days before symptoms appear
- Grows at refrigerator temperatures (-1.4°C)
- **Survives freezing (-18°C)**
- Relatively heat resistant (70°C/2 mins for 6-log reduction)
- Grows in low O₂ environments, e.g. vacuum packed foods
- Highly salt tolerant (A_w 0.92): survives and grows even in cured foods
- Min pH for growth 4.2-4.3
- Forms persistent biofilms on surfaces
  - Resistant to cleaning and disinfection
  - Creates reservoir of contamination
  - **Must enforce rigorous hygiene schedules to manage**
- Vulnerable groups are particularly susceptible
- Transmission from infected food, the environment, mother to foetus
- **Main cause of death from foodborne illness in the EU**
**Listeria monocytogenes: Parameters**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Growth</th>
<th>Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower Limit</td>
<td>Optimum</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>-1.5 to 3.0</td>
<td>30-37</td>
</tr>
<tr>
<td>pH</td>
<td>4.2-4.3</td>
<td>7</td>
</tr>
<tr>
<td>$A_w$</td>
<td>0.90-0.93</td>
<td>0.99</td>
</tr>
<tr>
<td>NaCl (%)</td>
<td>&lt;0.5</td>
<td>0.7</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Facultative anaerobe – survives in presence or absence of oxygen</td>
<td></td>
</tr>
</tbody>
</table>
Vulnerable Groups

• People with weakened immune systems are particularly susceptible to listeriosis, and likely to suffer more severe symptoms

• Vulnerable groups include:
  • immunosuppressed people
  • patients undergoing immunosuppressive or cytotoxic treatment
  • cancer patients
  • unborn and newly delivered infants
  • pregnant women
  • people with diabetes
  • alcoholics (including those with alcoholic liver disease)
  • the elderly
  • people using gastric acid inhibitors*

• Proportion of population in a vulnerable group?
  • USA** and UK *** ~ 20%

*** The Occurrence and Prevention of Foodborne Disease in Vulnerable People. Foodborne Path & Disease. 2011; 8 (9), 961-973
Foods of Particular Risk to Vulnerable Groups

**Fish**
- Smoked fish
- Cooked shellfish
- Pâté

**Meat**
- Cooked (sliced) meats/poultry
- Pâté
- Cured meats

**Pasteurised/unpasteurised cheeses**
- Soft blue veined
- Mould ripened soft

**Prepared foods**
- Pre-packed sandwiches
- Prepared salad veg
- Some cut fruits e.g. melon

**Generally high risk:**
- Chilled, and
- Able to support the growth of Lm, and
- Ready to eat
EU General Food Law 178/2002

- **Art 14.1:** Food shall not be placed on the market if it is unsafe
- **Art 14.2:** Food shall be deemed to be unsafe if it is considered to be:
  - (a) injurious to health;
  - (b) unfit for human consumption.
- **Art 14.5:** In determining whether any food is unfit for human consumption, regard shall be had to whether the food is unacceptable for human consumption according to its intended use...
- **Art 14.8:** Conformity of a food with specific provisions applicable to that food shall not bar the competent authorities from taking appropriate measures to impose restrictions on it being placed on the market or to require its withdrawal from the market where there are reasons to suspect that, despite such conformity, the food is unsafe.

https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32002R0178
EU General Food Hygiene Law 852/2004

- **Art 1.1:**
  
  (a) primary responsibility for food safety rests with the food business operator (FBO)
  
  (b) it is necessary to ensure food safety throughout the food chain,
  
  (c) it is important, for food that cannot be stored safely at ambient temperatures, particularly frozen food, to maintain the cold chain;
  
  (d) general implementation of procedures based on the HACCP principles, together with the application of good hygiene practice, should reinforce FBOs’ responsibility

- **Chapter V, 1:** All articles, fittings and equipment with which food comes into contact are to:
  
  (a) be effectively cleaned & where necessary, disinfected. Cleaning and disinfection are to take place at a frequency sufficient to avoid any risk of contamination...

EU Food Information to Consumers Law 1169/2011

• Chapter IV, Section 1, Art 9.1 1: In accordance with Articles 10 to 35 and subject to the exceptions contained in this Chapter, indication of the following particulars shall be mandatory....

(j) instructions for use where it would be difficult to make appropriate use of the food in the absence of such instructions;

• Art 27.1: The instructions for use of a food shall be indicated in such a way as to enable appropriate use to be made of the food.

https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32011R1169
**L. monocytogenes EU Legislation**

**EU Microbiological Criteria for Foodstuffs 2073/2005**

<table>
<thead>
<tr>
<th>Criterion number</th>
<th>Food category</th>
<th>Sampling plan</th>
<th>Limits</th>
<th>Analytical reference method</th>
<th>Stage where the criterion applies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 (a and b)</td>
<td>Ready-to-eat foods able to support the growth of <em>L. monocytogenes</em>, other than those intended for <em>infants</em> and for special medical purposes</td>
<td>5 0</td>
<td>100 cfu/g</td>
<td>EN/ISO 11290-2</td>
<td>Products placed on the market during their shelf-life</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 0</td>
<td>Absence in 25 g applies before food has left the immediate control of the initial FBO if the manufacturer is NOT able to demonstrate that growth will not exceed 100cfu/g throughout the shelf life</td>
<td>EN/ISO 11290-1</td>
<td>Before the food has left the immediate control of the food business operator, who has produced it</td>
</tr>
<tr>
<td>1.3</td>
<td>Ready-to-eat foods unable to support the growth of <em>L. monocytogenes</em>, other than those intended for <strong>infants</strong> and for special medical purposes</td>
<td>5 0</td>
<td>100 cfu/g</td>
<td>EN/ISO 11290-2</td>
<td>Products placed on the market during their shelf-life</td>
</tr>
</tbody>
</table>

* Shelf life <5 days (P+4): food ‘automatically considered’ not to support growth

** EU Reg 609/2013 on Food for Specific Groups (FSG), i.e. food for infants and young children (infant formula, follow-on formula and weaning foods), food for specific medical purposes, and total diet replacement for weight control. Limit of 0 cfu/g in 25g sample, n=10, c=0

EU Regulation 2073/2005
Environmental Sampling

- Art 3.2 of 2073/2005:

- Samples shall be taken from processing areas and equipment used in food production, when such sampling is necessary for ensuring that the criteria are met. In that sampling the ISO standard 18593 shall be used as a reference method. **Food business operators manufacturing ready-to-eat foods, which may pose a *Listeria monocytogenes* risk for public health, shall sample the processing areas and equipment for *Listeria monocytogenes* as part of their sampling scheme.**
Trending Sampling Results

• Recital 25 of 2073/2005 – generally applicable:

• Trends in test results should be analysed, as they are able to reveal unwanted developments in the manufacturing process enabling the FBO to take corrective actions before the process is out of control.
EU Regulation 2073/2005
Annex II - Shelf Life Studies

• The studies shall include:

  • specifications for physico-chemical characteristics of the product, such as pH, $a_w$, salt content, concentration of preservatives and the type of packaging system, taking into account the storage and processing conditions, the possibilities for contamination and the foreseen shelf-life....
## Expected Storage Temperature: Domestic Fridges

<table>
<thead>
<tr>
<th>Temperature reported (°C)</th>
<th>Number of fridges at specified temperature</th>
<th>% fridges at specified temperature</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4°C</td>
<td>143</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4.0-4.9°C</td>
<td>1,255</td>
<td>34.8</td>
<td>38.8</td>
</tr>
<tr>
<td>5.0-5.9°C</td>
<td>120</td>
<td>3.3</td>
<td>42.1</td>
</tr>
<tr>
<td>6.0-6.9°C</td>
<td>24</td>
<td>0.7</td>
<td>42.8</td>
</tr>
<tr>
<td>7.0-7.9°C</td>
<td>1,356</td>
<td>37.6</td>
<td>80.4</td>
</tr>
<tr>
<td>8.0-8.9°C</td>
<td>68</td>
<td>1.9</td>
<td>82.3</td>
</tr>
<tr>
<td>9.0-9.9°C</td>
<td>633</td>
<td>17.5</td>
<td>99.8</td>
</tr>
<tr>
<td>≥10°C</td>
<td>8</td>
<td>0.2</td>
<td>100</td>
</tr>
</tbody>
</table>

Of 3,607 domestic refrigerators (consolidated surveys) worldwide 39% were <5°C, 80% were <8°C. Mean European and UK temperature 6.6°C

Source: *Cl botulinum* in vacuum and modified atmosphere packed (MAP) chilled foods (FSA Project B13006)
What Good Control Looks Like (UK Chill): Validation & Monitoring

• Regular environmental swabbing and food sampling
  • Target environmental sampling: try to find Lm, address with hygiene
  • Trend results (EU Reg 2073/2005) and act on adverse trends (hygiene)

• Environmental swabbing (presence/absence)
  • Validate cleaning method efficacy
  • Verify ongoing efficacy

• Food sampling
  • Day of Production (DOP) hygiene indicator
  • End of Life (EOL) shelf life appropriateness

• RTE food prevalence (835624 samples):
  • <1% Lm at any point during shelf life, of which
  • 0.04% present at quantifiable levels, i.e. >20 cfu/g LOQ

• Production environment prevalence (1356031 samples):
  • Food contact surfaces <0.5% Lm (~663k samples)
  • Non-Food contact surfaces ~2% Lm (~693k samples)
**Fatal Listeriosis Outbreaks – Why the Repeats?**

<table>
<thead>
<tr>
<th>Country</th>
<th>Year(s)</th>
<th>Outcomes</th>
<th>Description</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>1981</td>
<td>18 dead, 41 cases</td>
<td>Coleslaw</td>
<td>Field contamination of cabbage (sheep)</td>
</tr>
<tr>
<td>USA</td>
<td>1985</td>
<td>48 dead, 142 cases</td>
<td>Queso fresco (raw milk cheese)</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>1987-9</td>
<td>&gt;17 dead, 200+ cases</td>
<td>Pâté imported from Belgium</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>1992</td>
<td>92 dead, 272 cases</td>
<td>Jellied pork tongue</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>1997*</td>
<td>0 dead, 1556 cases</td>
<td>Corn and tuna salad</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>1998-9</td>
<td>17 dead, 4 miscarriages/stillbirths, 101 cases</td>
<td>Cooked meat. Contaminated air filtration unit</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>2007</td>
<td>1 dead</td>
<td>Catered sandwiches</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>2008</td>
<td>22 dead, 57 cases</td>
<td>CAD 27m. Cooked sliced meat. Retirement homes &amp; hospitals. Dirty slicer</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>2009</td>
<td>3 dead, 36 cases</td>
<td>Chicken wrap</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>2010-15</td>
<td>3 dead, 10 cases</td>
<td>Ice cream (served to patients as milkshake). [WGS]</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>2011</td>
<td>33 dead, 147 cases</td>
<td>USD 50m. Cantaloupes. Equipment &amp; water</td>
<td></td>
</tr>
<tr>
<td>UK (N. Ireland)</td>
<td>2012</td>
<td>3 dead</td>
<td>Hospital-catered sandwiches</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>2013-16</td>
<td>3 dead, 9 cases</td>
<td>Frozen vegetables</td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>2014</td>
<td>17 dead, 41 cases</td>
<td>Cooked meat (rullepølse). [WGS]</td>
<td></td>
</tr>
<tr>
<td>Canada &amp; USA</td>
<td>2015-16</td>
<td>4 dead, 33 cases</td>
<td>Leafy salad</td>
<td></td>
</tr>
<tr>
<td>EU (AT, DK, FI, SE, UK)</td>
<td>2015-18</td>
<td>6 dead, 32 cases</td>
<td>Frozen corn [WGS]</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>2017-18</td>
<td>216 dead, 1060 cases</td>
<td>Cooked RTE meat products</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>2018</td>
<td>7 dead, 19 cases</td>
<td>Cantaloupes</td>
<td></td>
</tr>
</tbody>
</table>
## European Listeriosis Rates

*2017 EFSA/ECDC Data*

<table>
<thead>
<tr>
<th>Disease</th>
<th>No. confirmed human cases</th>
<th>Status available (%)</th>
<th>Number of reporting countries</th>
<th>Reported hospitalised cases</th>
<th>Proportion hospitalised (%)</th>
<th>Outcome available (%)</th>
<th>No. reporting Member States</th>
<th>Reported Deaths</th>
<th>Case Fatality (%)</th>
<th>Fatality Rate cf Lm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacteriosis</td>
<td>246,158</td>
<td>27.6</td>
<td>17</td>
<td>20,810</td>
<td>30.5</td>
<td>72.8</td>
<td>16</td>
<td>45</td>
<td>0.04</td>
<td>345</td>
</tr>
<tr>
<td>Salmonellosis</td>
<td>91,662</td>
<td>43.1</td>
<td>14</td>
<td>16,796</td>
<td>42.5</td>
<td>67.8</td>
<td>17</td>
<td>156</td>
<td>0.25</td>
<td>56</td>
</tr>
<tr>
<td>Yersiniosis</td>
<td>6,823</td>
<td>27.1</td>
<td>14</td>
<td>616</td>
<td>33.4</td>
<td>65.5</td>
<td>15</td>
<td>3</td>
<td>0.07</td>
<td>20</td>
</tr>
<tr>
<td>STEC infections</td>
<td>6,073</td>
<td>41.0</td>
<td>18</td>
<td>933</td>
<td>37.5</td>
<td>66.1</td>
<td>21</td>
<td>20</td>
<td>0.50</td>
<td>28</td>
</tr>
<tr>
<td>Listeriosis</td>
<td>2,480</td>
<td>40.4</td>
<td>16</td>
<td>988</td>
<td>98.6</td>
<td>65.8</td>
<td>18</td>
<td>225</td>
<td>13.8</td>
<td></td>
</tr>
</tbody>
</table>

**2016: Listeriosis death rate 540x Campylobacteriosis, 60x STEC**

***2015: Listeriosis death rate 590x Campylobacteriosis, 74x STEC***

† Not all countries observed cases for all diseases


Comparing Countries’ Listeriosis Rates (per 100k people)

2014-2017
(Spain: 2017 sentinel system covers 7% population)

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Cases</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>Italy</td>
<td>52</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Portugal</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
<td>92</td>
<td>1.64</td>
</tr>
<tr>
<td></td>
<td>Sweden</td>
<td>125</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td>Iceland</td>
<td>4</td>
<td>1.23</td>
</tr>
<tr>
<td></td>
<td>Switzerland  + Liechtenstein</td>
<td>98</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>Finland</td>
<td>65</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>Spain</td>
<td>161</td>
<td>1.15</td>
</tr>
<tr>
<td></td>
<td>Luxembourg</td>
<td>5</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>Slovenia</td>
<td>18</td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td>Belgium</td>
<td>84</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Germany</td>
<td>597</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>Austria</td>
<td>49</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td>374</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Norway</td>
<td>29</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Netherlands</td>
<td>90</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>Slovakia</td>
<td>29</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>EU</td>
<td>2,161</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Hungary</td>
<td>39</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>Czech Republic</td>
<td>38</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Ireland</td>
<td>15</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>201</td>
<td>0.31</td>
</tr>
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<td></td>
<td>Lithuania</td>
<td>7</td>
<td>0.24</td>
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<td></td>
<td>Malta</td>
<td>1</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>Poland</td>
<td>86</td>
<td>0.23</td>
</tr>
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<td></td>
<td>Latvia</td>
<td>3</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Bulgaria</td>
<td>10</td>
<td>0.14</td>
</tr>
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<td></td>
<td>Greece</td>
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<td>0.09</td>
</tr>
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<tr>
<td></td>
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USA rate: 0.3
Australia rate: 0.3*
New Zealand rate: 0.6

2017-18 SA outbreak: 1.84
* incomplete data
European Listeriosis Trends 2008-2017

UK Listeriosis Trends 2007-2016

Source: ACMSF, ACM/1258 January 2018
Listeriosis Risk Factors (UK study 2001-2008)

• More likely to report consumption of:
  • Cooked meats (beef and ham/pork, not poultry)
  • Cooked fish, i.e. (cold?) smoked salmon & shellfish (prawns)
  • Dairy products (i.e. milk but also certain cheeses)
  • ‘Mixed salads’ (including protein)

• More likely to be bought from:
  • Convenience stores & local shops (bakers, butchers, fishmongers and greengrocers)

• Incidence higher in most deprived areas
  • Observed in patients aged 60+
  • More marked for pregnancy-associated cases

• Pregnancy-associated cases increasingly ‘ethnic’
  • 16.7% to 57.9% from 2001-8, most marked 2006-8
  • 12.7% from 2008-2013

https://www.eurosurveillance.org/content/10.2807/ese.15.27.19610-en
Example structure of food distribution channels

- **Production**
  - Primary Consolidation Centre
  - Primary UK own label

- **Brands**
  - Secondary Regional Distribution Centre (large wholesaler)
  - Tertiary Local Wholesale/cash & carry warehouse
    - Independent retail outlet
    - Catering outlet
South African RTE Cooked Meat and EU RTC Frozen Maize
Lessons learned from European and South African listeriosis outbreaks

AFFI Food Safety Conference
February 2019, San Diego

Phil Voysey, Roy Betts
Campden BRI, Chipping Campden, UK
Andras Sebok
Campden BRI, Budapest, Hungary
Talk content

• South African ‘polony’ outbreak 2017-8
• Actions following European ‘quick-frozen vegetable’ outbreak 2018
Talk content

• South African ‘polony’ outbreak 2017-8
• Actions following European ‘quick-frozen vegetable’ outbreak 2018
The South African Listeriosis Outbreak

• The largest outbreak of Listeriosis ever recorded
• Up until Sept 2018
  – 1060 laboratory confirmed cases
  – 216 dead
  – Note: these are only the recorded cases
• Before 2017: Number of cases per year in South Africa
  – 60 to 80
Outbreak Profile

NB, cases started beginning of 2017, no recall until early 2018

Figure 1: Epidemic curve of laboratory-confirmed listeriosis cases by date of clinical specimen collection (n=1 052) and sequence type (ST) (n=597), South Africa, 01 January 2017 to 20 June 2018 (n=1053)
Some Background of Listeriosis in South Africa

- Low numbers of reported cases per year – approx. 1 per week
- But not a notifiable illness
  No understanding of real numbers
Outbreak timeline (1)

- 7\textsuperscript{th} Nov 2017 (week 45) - Letter from the National Institute for Communicable Diseases (NICD)
- To the S.A. Association for Food Science & Technology
- Requesting assistance because of a 10 fold increase in Listeria meningitis cases
- Noting vast majority of isolates are genetically identical
Outbreak Timeline (2)

• 4\textsuperscript{th} December- NICD-situation report
  – 557 cases since Jan 1\textsuperscript{st} 2017

• 5\textsuperscript{th} December- ministerial announcement
  – Health minister- noted outbreak publicly
  – 557 cases reported, 36 dead

• 15\textsuperscript{th} December
  – Listeriosis made a notifiable disease under the National Health Act (2003)
Outbreak Timeline 3

• **30th December**
  – News report- an poultry abattoir prohibited from selling meat (Sovereign foods)
  – Positive Listeria tests in factory

• **31st December**
  – News Report
  – Sovereign said move by Department of Health “premature and unfounded.”
  – Claimed they sent 14 food samples to the Department for tests and that the Department found 8 of these to contain *Listeria monocytogenes*.
  – it says it also sent a duplicate set of samples for independent analysis - no *Listeria* were found.

• **9th Jan (Sunday Times)**
  – Sovereign Foods’ poultry abattoir in Hartbeespoort back in operation following closure on December 22 by the government.
  – Sovereign media release quoting Health Minister Aaron Motsoaledi saying: "*At this juncture, we cannot conclude that the abattoir is the source of the present outbreak.*“
  – The ST6 strain was not found at Sovereign.
Update on Numbers

• 31st December
  – NICD 704 cases
  – Source of Listeriosis not confirmed
Outbreak Timeline (4)

- **4th March** - Health Minister makes statement
  - Source declared as Polony (Enterprise Foods)

---

Figure 1: Epidemic curve of laboratory-confirmed listeriosis cases by date of clinical specimen collection (n=1,052) and sequence type (ST) (n=597), South Africa, 01 January 2017 to 20 June 2018 (n=1,053)
4th March Statement by Minister for Health

• The Minister also said:

• “We advise members of the public to avoid all processed meat products that are sold as ready-to-eat. While we know that polony is definitely implicated, there is a risk of cross-contamination of other ready-to-eat processed meat products, either at production, distribution or retail.”
How was the source found?

• 12th January, nine children under the age of 5 yr. from one creche went to hospital with febrile gastro-enteritis.

• Listeriosis suspected as a possible cause.

• Environmental Health visited the crèche, obtained samples from two unrelated polony brands (manufactured by Enterprise and Rainbow Chicken Limited (RCL) respectively) and submitted these to the laboratory for testing.

• *Listeria monocytogenes* was isolated from stool collected from one of the ill children, and both of the polony specimens collected from the crèche.

• Isolates sent to the NICD and were whole genome sequenced.

• The ST6 type confirmed on all three isolates on 27th January.

• As 91% were of outbreak illness due to ST6. They concluded that this was outbreak source
What about the Rainbow Chicken?

- **18/3/18** - Health Ministry confirmed Rainbow Chicken Limited’s Wolwehoek plant found to be contaminated with *Listeria*, in line with the announcement made earlier this month.

- Rainbow said tests at a lab in France, show plant is clear of the *Listeria* strain.

- **29/3/18** - Health Department confirmed Rainbow Chicken polony factory **not** the ST6 strain that caused 91% of cases.

- "*This corroborates the results reported by RCL Foods at a French laboratory,*" a health ministry statement noted.
Outbreak Timeline (5)

• 3\textsuperscript{rd} September 18 - Health minister announces:
  – *Listeria* outbreak over
  – Polony can be eaten again
The Strain

• In January 18
  – 72% of all isolates were noted as strain ST6
  – The others were other types of
    \( L. \ monocyto\text{gen}es \)
Age Distribution Profile

- Note the unusual age profile at the 15-49 age group
- It’s been noted that people with AIDS are 500 time more likely to contract Listeriosis
Outcomes (1)

• 1060 ill, 216 dead
  – These are only the reported figures
  – Keep in mind Listeriosis was not reportable until 15th December
  – Also the rural nature of parts of the country could make reporting more difficult
  – It has been noted that there was probably massive under-reporting

• Meat industry hit badly before outbreak source finalised

• Enterprise Foods (Tiger Brands) recall virtually all product

• Cost:
  Tiger Brands said the potential losses, which it estimated at R28-33 million, were for March.

  In addition, the food producer said it was taking a R337-377 million rand pre-tax hit due to the costs of a product recall and suspension of production at its Polokwane, Germiston, Pretoria and Clayville sites.

  • Recall: £1.8 million ($2.35 million)
  • Pre tax –£ 21.1 million ($27.55 million)
  • Just for recall, & suspension of sales
Outcomes (2)

• The producer shipped product to 15 different regional countries
  – Angola, Botswana, Democratic Republic of the Congo, Ghana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Swaziland, Uganda, Zambia, and Zimbabwe.

• All recalled the product
  – WHO concerns that there may be outbreaks in these other countries
End Points

• SA now have a “zero tolerance” policy on *Listeria*
• Its reportable in South Africa
• There was confusion in risk communication
  – Good risk communication with correct information is critical, and almost never achieved in outbreaks
• Large losses to many companies
• Good tracking is essential to both limit illness and minimise economic effects
Talk content

• South African ‘polony’ outbreak 2017-8

• Actions following European ‘quick-frozen vegetable’ outbreak 2018
Multinational outbreak of listeriosis linked to frozen vegetables

- Nov 2017 Finland reported in Epidemic Intelligence Information System (EPIS) a national cluster of cases of listeriosis since 2016, caused by same type of *L. monocytogenes* by whole genome sequencing (WGS).

- WGS data shared with other countries to compare it with those in own databases – member states used different comparison methods and all shared their data with each other via ECDC.
Situation in Nov 2017

- EU Teleconference held to discuss responses from EU MS
- Total of 29 cases with same WGS type in Austria (2), Denmark (2), Finland (14), Sweden (6) and UK (5)
- 2 isolates from France with same WGS type from environmental sample from FBO processing frozen foods - flat-leaved parsley, soft corn grains, potato cubes, green peas
Food consumption data

• 23 cases with food consumption data:
  • 9 reported consumption of sweetcorn and 1 reported possible consumption
  • 6 reported consumption of frozen sweetcorn and 4 non-frozen sweetcorn products (3/4 canned sweetcorn)
  • 3 reported consumption of mixed vegetables; 2 stating frozen vegetables and one non frozen
  • Sweetcorn consumption not part of food questionnaire for all MS — UK cases re-interviewed 4 cases, 3 report sweetcorn consumption
Jan and Feb 2018

• *L. monocytogenes* detected in batches of frozen sweetcorn from Finnish trader (50-140 cfu/g) - same WGS as outbreak strain
  – Sweetcorn produced in Hungary and packed in Poland
  – Recent Finnish case reported eating frozen mixed veg containing sweetcorn of same brand as above
• Swedish case reports eating frozen sweetcorn - brand unknown
• Isolate with outbreak WGS profile detected at unacceptable levels in frozen sweetcorn from home of a consumer in Sweden – trace back shows packed in Poland and produced in Hungary
• Austria reports isolates from 2 different types of frozen mixed vegetables including sweetcorn that originates same company in Hungary
Frozen sweetcorn investigations

- Large company supplying frozen sweetcorn as well as fresh and frozen vegetables + other products to major retailers, food service companies and industry across Europe and elsewhere
- Finland and Sweden: outbreak isolates from frozen corn that was produced and frozen in Hungary and packed in Poland
- Complex production and distribution network
- 10 production sites in EU
Figure 3. Graphical representation of traceability and testing information available in RASFF or provided to EFSA by Member States, as of 29 June 2018.
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<th>Match outbreak strain by WGS</th>
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<td>4 isolates from frozen corn originating from Hungarian company</td>
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<td>Isolate from batch frozen corn that came from Hungarian company</td>
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<tr>
<td>Hungary</td>
<td>11 isolates from frozen corn, frozen mixed vegetables, frozen spinach, frozen green beans, frozen creamy spinach – production 2017 and 2018</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Control measures

• Implicated frozen sweetcorn products originating in Hungary and supplied via Polish packers were withdrawn and recalled in Estonia, Finland, Poland and Sweden have withdrawn and recalled.

• Identified that frozen sweetcorn was being thawed and consumed without further cooking

• Advice to cook frozen sweetcorn before eating or adding to salads

• Need to establish the root source of contamination and implement control measures

• New cases could occur due to the long incubation period (1–70 days), long shelf-life of frozen sweetcorn products and potential consumption of frozen corn bought by the customers before the recalls and eaten without being cooked.
Figure 1. *Listeria monocytogenes* PCR serogroup IVb, ST6 confirmed outbreak cases by month of symptom onset*, European Union 2015–2018 (n=47)

*If month of onset missing: month of sampling or month of receipt at reference laboratory*
### Number of listeriosis cases July 2018

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of cases (No deaths)</th>
<th>Total number of cases</th>
<th>Total number of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2015</td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td><strong>Austria</strong></td>
<td>0</td>
<td>2 (1)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Denmark</strong></td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Finland</strong></td>
<td>0</td>
<td>4</td>
<td>10 (2)</td>
</tr>
<tr>
<td><strong>Sweden</strong></td>
<td>0</td>
<td>3 (1)</td>
<td>3</td>
</tr>
<tr>
<td><strong>The United Kingdom</strong></td>
<td>1</td>
<td>2</td>
<td>2 (2)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1</td>
<td>11 (2)</td>
<td>17 (3)</td>
</tr>
</tbody>
</table>
Summary of listeriosis outbreak

- First multicounty outbreak of listeriosis identified by WGS
- WGS provides unequivocal evidence that isolates are related and are from a common source and have been present in food chain since at least 2015
- Isolates from frozen sweetcorn originating in Hungary from along the food chain have same WGS profile as isolates from cases
- Need to implement effective control measures to prevent more cases – worldwide recall of contaminated products July 2018 – >100 countries, including 43 products recalled in UK – no more cases
- Improve communication on preventing consumption of uncooked frozen sweetcorn
Response by the Hungarian frozen vegetable and fruit manufacturers (1)

• After reviewing the situation and consultations with the national food control authorities the members of the Hungarian Freezing and Canning Industry Association (MHKSZ) have taken a systematic approach to assess the level of control of L. monocytogenes at their sites to identify the necessary measures to reduce the risk of contamination of their products.

• An agreement on improving the standard of the L. monocytogenes control of Hungarian IQF sweet corn and other frozen vegetable and fruit products.

• Hosting a targeted audit on L. monocytogenes to assess the standard of the controls at the participating sites in the sweet corn processing season in 2018.
Response by the Hungarian frozen vegetable and fruit manufacturers (2)

• Development of a voluntary product certification scheme on Listeria monocytogenes control in IQF vegetables and fruits with particular focus to IQF sweet corn.
Position of the Campden BRI Hungary proposed to the Hungarian frozen food manufacturers (1)

3 parallel actions are necessary and possible to strengthen food safety and to serve the needs of those consumers who prefer to consume (frozen) vegetables and fruits without further cooking:

1. Informing the consumers clearly, effectively and repeatedly that the currently available frozen vegetable products are not ready to eat, they must be cooked before the consumption as it is described in the cooking instruction.

*This communication shall be unambiguous and consistent!*
Position of the Campden BRI Hungary proposed to the Hungarian frozen food manufacturers (2)

2.

Implementing preventive actions to reduce the level of risk of *Listeria monocytogenes* significantly in frozen vegetables processed and packed with the conventional technology without meeting high risk/high care requirements to improve the protection of the consumer (this activity has been started).
Position of the Campden BRI Hungary proposed to the Hungarian frozen food manufacturers (3)

Potential establishment of an additional new ready-to-eat frozen vegetable (sweet corn) product category – for this building of new or redesigning and rebuilding of some of the existing factories is necessary to meet high risk requirements – high costs of construction and operation – reflected in the price of the product.

*It is a complementary alternative only, - should not be applied as a mandatory requirement for all existing factories.*

*These ready-to-eat products shall be clearly differentiated, with easily distinguishable labelling from the current ready-to-cook products.*
Control measures (1)

A systematic review and redesign to improve:

- the HACCP system;
- the factory layout, flow of processes, zone segregation, movement of personnel;
- the measures to prevent cross-contamination of the products after blanching;
- hygienic design of machinery and construction of production areas, smoothness and cleanability of surfaces;
- hygiene, cleaning and disinfection;
- maintenance procedures and practices and their efficiency;
- water and air supply and quality;
- personal hygiene practices.
Control measures (2)

• Strengthening the control of:
  - blanching;
  - condensation.

• Identification of potential locations of biofilm formation and mitigation of the biofilm formation.
Expected outcomes

• A significant reduction of the risk of L. monocytogenes in ready to cook frozen vegetables processed and packed in low risk factory environment - consumers will be exposed to a significantly lower risk even if they do not follow the cooking instruction.

• Systematic elimination of potential sources of L. monocytogenes contamination in the factory environment before it reaches the finished product – continuous improvement of the controls at the site.

• Regular review of the results and exchange the experiences at national level including consultations with the food control authorities – continuous extension of the knowledge.
South African RTE Meat Products: End Points

• Contaminated high risk long shelf life chilled food eaten as a staple in a country with a 20% HIV positive adult population – and exported

• All 157 processed meat factories inspected
  • By WHO and environmental health inspectors

• 900 health inspectors retrained
  • In taking samples from food factories

• New SA legislation (R638) brought in 14 June 2018
  • Requires HACCP/FSMS for meat and poultry products
  • Lm absence requirement
  • Implementation by 14 March 2019
South African RTE Meat Products: End Points

• Tiger Brands relaunched polony Jan 2019
  • Increased price
  • Safety seal and stamp implies each polony has “passed” a “7 step quality check process” that provides “improved food safety”:
    • Sourced right
    • Quality at the gate
    • Food safe environment
    • Trained and safety skilled staff
    • Quality production
    • Delivered safely
    • Fully traceable
South African RTE Meat Products: End Points

• Industry and national infrastructure (including training and chill chain) sufficient to support consistent food safety assurance for high risk food?

• Ongoing programme of verification in place?
  • Industry?
  • Enforcers?

• CODEX/WTO role?

Compulsory standards needed to avoid another listeriosis outbreak
EU RTC Frozen Maize: Key Points

- Frozen maize
  - High sugar, cut surface
  - Blanching typically 90°C/90 secs – deals with surface contamination – core?
  - Post-process recontamination potential
  - ...But not RTE, so ‘low risk’, and no Lm criteria apply by (EU) law

- *EFSA risk management recommendation:
  "consumers should consider adequately heat treating frozen vegetable products that are not ‘RTE products’ before consumption’

EU RTC Frozen Maize: End Points

- Company applying <10 cfu/g criterion on imports into UK
- Hygiene and sampling
  - Equipment (freezer tunnel) decommissioned/replaced (conveyors, flooring) - capex
  - Systems reviewed and improved - capex
    - New zoning approaches implemented: Separation between pre- and post-blanch areas
    - Sanitation improved with new monitoring
  - Post-hygiene environment for Lm now routine
  - In-process and final product sampling for Lm now routine (previously *E. coli*)
  - Product sampling dependent on customer requirements
    - e.g. 1-5 samples end product tested/batch
  - European industry organisation suggesting <10 cfu/g on RTC frozen??
- Methods: EN ISO11290 -1 (detection) and -2 (enumeration) cf 2073/2005

Zones: red lower risk, blue higher Care
Improved cleaning programmes where belts are removed every time the kit is cleaned
New epoxy resin floor in higher care area
New conveyor with identified swabbing locations
Hand over area between higher care and lower care area. Fork lift 1 drives bin in to square and second takes out and off to storage
Scrubber drier dries floors of excess water
New boot wash and hand sanitiser station on entrance to zoned area
Marked segregation between red low risk and blue higher care. In this case bulk hoppers crossing to a packing area.
EU RTC Frozen Maize: End Points

• **User instructions**
  - **Specifications for professional users state must be cooked before use**
    - But what is compliance particularly in RTE products?
  - **Cooking statement/instructions previously often absent in Continental EU market, although required by law – industry activity to address this**
  - **Cooking instructions validated to achieve 70°C/2mins (UK)**
  - **Changed labelling to enhance the messaging that requires cooking prior to consumption**

EU RTC Frozen Maize: UK Consumer Instructions

**Cook from Frozen**

- **BOIL**
  - Add product to boiling water. Return to boil, cover and simmer.
  - 2-3 min

- **MICROWAVE**
  - Empty 250g of contents into a microwaveable container. Add a small amount of water. Cover with a microwaveable plate.
  - 750W: 5 min
  - 850W: 4 min

- **Cautions**
  - Do not remove from microwave until after 1 min stand time.
  - Larger quantities of product will require longer cooking.
  - Drain well. Season to taste.
  - Do not reheat.

**Important**

This product is not to be cooked according to instructions.

**WARNING:** Do not eat raw.

**Directions for Use: Cook from Frozen**

- **MICROWAVE**
  - oven Wattage: 750W
  - total cooking time: 2.5 minutes, stir and re-cover, 2.5 minutes

- **BOIL**
  - place the required amount of frozen sweetcorn into a non-metallic microwaveable container and add 2 tablespoons of water. Cover with a microwaveable film or saucer. Cook on full power for the time specified above, stir and re-cover as directed. Stand for 1 minute and drain before serving. Caution: Beware of escaping steam when removing film or saucer. Handle carefully to avoid scalding.

- **Cooking Guidelines from Frozen:**
  - This is a raw product. Cook thoroughly until piping hot throughout.

- **Boil**
  - place the required quantity of frozen sweetcorn into a saucepan with sufficient boiling water to cover. Bring back to the boil and simmer for 4-5 minutes. Drain and serve.

**Cooking Instructions**

- **For best results boil from frozen**
  - Remove all packaging.
  - Place in boiling water and bring back to the boil. Cover and simmer for 4-5 minutes.
  - Drain well before serving.

- **800W / 900W**
  - Place in a microwavable bowl and add 2-3 tablespoons (30-45mL) water.
  - Cover and heat on full power for 2 minutes 30 seconds (800W) / 2 minutes 30 seconds (900W).
  - Stir, re-cover and heat on full power for a further 2 minutes 30 seconds (800W) / 2 minutes (900W).
  - Leave to stand for 1 minute after cooking.
  - Drain well before serving.

- **Check food is piping hot throughout before serving**

- **All appliances vary these are guidelines only**

- **Caution**
  - Do not eat raw,
The truth is rarely pure, and never simple

Oscar Wilde, The Importance of Being Earnest
## Effective Risk Management?

<table>
<thead>
<tr>
<th>Lm management demonstrably in place?</th>
<th>SA RTE cooked meat products</th>
<th>EU frozen maize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing hygiene managed to prevent (re)contamination</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Product does not support growth</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Product does not support survival</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Not a chilled product</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Short shelf life (&lt;5 days)</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Chill chain integrity assured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Commercial</td>
<td>?</td>
<td>Y</td>
</tr>
<tr>
<td>- Domestic</td>
<td>?</td>
<td>Y</td>
</tr>
<tr>
<td>Consumer population/behaviour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Not eaten by vulnerable groups</td>
<td>N</td>
<td>?</td>
</tr>
<tr>
<td>- Usage instructions complied with</td>
<td>?</td>
<td>N</td>
</tr>
</tbody>
</table>

Total (Y =+1, N =-1, ?=0) out of +9 max

<table>
<thead>
<tr>
<th></th>
<th>-6</th>
<th>0</th>
</tr>
</thead>
</table>

General Issues

• Are HACCP plans, sanitation and their monitoring systems consistently effective?
• Is legislation a barrier to effective monitoring?
• Laboratories
  • What methods are stipulated by law?
    • Methods must appropriate not only to the microorganism but also the food matrix
  • What lab accreditations/other measures are required to assure good practice?
• Is enforcement effective consistently?
  • Commercial
  • National
• Are product usage instructions labelled correctly?
• What does effective consumer/end product user education look like?
• Why are previous lessons not being cascaded more effectively?
  • Within industry – trade associations/professional bodies?
  • By and to customers (e.g. manufacturers, retailers)
The centre of excellence for the chilled food industry

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www.chillededucation.org
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