Future Microbiological Trends

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Food Microbiology- we know all about that!

- We can often be lead to believe we know all there is to know about food microbiology
- The microbiological hazards are well known
- The controls are well known
- Its old science
- We know it all!
So:

- Why do an estimated 25% of the UK population suffer from food poisoning every year?
- Why was the estimated number of cases of food poisoning 43% higher in 2008/9 than 1993/6?
- And it's not just in the UK:
  - Annually in the USA foodborne illness causes
    - 1 in 6 Americans to be ill,
    - 128,000 to be hospitalized,
    - 3,000 to die.

Ref: UK FSA- IID 2 Study 2012
Ref: USA CDC- [http://www.cdc.gov/foodborneburden/index.html](http://www.cdc.gov/foodborneburden/index.html)
## FSA Incidents Report 2013

<table>
<thead>
<tr>
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<th>2006</th>
<th>2013</th>
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<tbody>
<tr>
<td>Total Food Incidents</td>
<td>1344</td>
<td>1562</td>
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<tr>
<td>Microbiological Incidents</td>
<td>147 (11%)</td>
<td>322 (21%)</td>
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- Microbiology is the only category where the number of incidents has increased every year since 2006.
Food Microbiology - there's lots to learn

• Changing Microorganisms of concern
• About external factors that effect the microbiology of our food
• About the processes and procedures we use to control microbiological hazards
• About the people who eat our food
Do we have emerging pathogens?

• Campylobacter
  – Until 1972- only 12 cases of Campylobacter infections had been reported

• Listeria
  – 1982- First conclusive evidence Listeriosis could be caused by consuming contaminated foods- Canada

• E.coli O157
  – 1982- first isolation from a foodborne outbreak- USA, (1983, UK)
Why do they emerge?

• Why don’t we know about them, where do they come from
• Campylobacter - caused foodborne infections continuously - no methods to detect it.
• Listeria - caused foodborne infections continuously - no methods to detect it
• E.coli O157 - PHLS retrospective survey of 15000 - E.coli isolates 1978-1982, 1 isolate. Not found in any diarrhoea outbreaks 1973 to 1983*
  – O157 recently evolved from an E.coli O55:H7 by gaining and losing genes

* Pennington. Infect Drug Resist 2014, 7, 211-222
So why do new organisms appear?

- They are always there and we just can’t see them or their effects - a test method issue
- Organisms evolve over time
The Trends

- Firstly—beware statistics without interpretation

Campylobacter UK

E.coli O157 Sweden
Microbial Issues

- Campylobacter
- Listeria monocytogenes
- E.coli O157 and VTEC/STEC
- Foodborne Viruses
  - Norovirus
  - Hepatitis A and E
Listeria monocytogenes

- UK - 2014 illness figures 5.5% greater than 2013
- 87% non-pregnancy associated
- 65% cases >60yrs old, 41% were 70 to 79 yr old
- Change in epidemiology and clinical effect
Listeria

• They like cold wet conditions
• Can grow at fridge temperatures
• Are killed easily by heating
• But can be hard to eliminate in chilled production areas
• Chilled Ready To Eat foods pose a risk and must be tested for Listeria-- its an EU Regulation
Verocytotoxin Producing E.coli

- VTEC or STEC (Shiga Toxin Producing E.coli)
- We know all about O157:H7
- There are hundreds of other serotypes of VTEC
- E.g. O104:H4—2011 sprouted seeds Germany
- Until recently we’ve had no methods to test for these
enteropathogenic Escherichia coli (O26H1, eae +, stx -) in raw milk cheese
shigatoxin-producing Escherichia coli (O125-H1; stx2+ /25g) in frozen kangaroo meat
shigatoxin-producing Escherichia coli (O26H11 serotype with eae and stx1 genes) in raw milk camembert
shigatoxin-producing Escherichia coli (O26, O103, O145 stx1+, stx2+, eae+) in frozen deer goulash meat
shigatoxin-producing Escherichia coli (stx1+, stx2+, eae+, O128 /25g) in frozen lamb
shigatoxin-producing Escherichia coli (O-26H-11 stx+ eae+) in raw milk cheese
shigatoxin-producing Escherichia coli (stx2+, eae+, O8) in chilled lamb
shigatoxin-producing Escherichia coli (O104, O128 & O159; stx1+, stx2-, eae-) in frozen lamb meat
shigatoxin-producing Escherichia coli (O26H11 stx+, eae+) in raw goat milk cheese
shigatoxin-producing Escherichia coli (O26-H11 eae+ stx+) in goat cheese made from raw milk
shigatoxin-producing Escherichia coli (O26 H11 eae+ stx1+) in cow's milk cheese made with raw milk
enteropathogenic Escherichia coli (O26 H11; eae positive) in raw goat milk cheese
shigatoxin-producing Escherichia coli (O123 stx1+ stx2 eae- /25g) in boneless lamb meat (Ovis aries)
shigatoxin-producing Escherichia coli (stx1, stx2, eae, O145) in chilled deer meat
shigatoxin-producing Escherichia coli in frozen lamb meat
shigatoxin-producing Escherichia coli (positive) in frozen sheep meat
shigatoxin-producing Escherichia coli in frozen lamb meat (Ovis aries)
shigatoxin-producing Escherichia coli in frozen lamb from
shigatoxin-producing Escherichia coli (STEC 0103:H2 stx1 eae) in frozen minced
shigatoxin-producing Escherichia coli (STEC O26) in chilled beef
Viruses

- Norovirus
- Hepatitis A-
- Hepatitis E-

- Viruses: cannot grow in or on foods organisms, they are just carried by them
- Difficult to detect in foods
- Limited understanding of how food processing affects them
  - Hep E has reported to have a high heat resistance
Viruses

- 2014 there were 5734 reported cases Norovirus in England & Wales
- But under-reported by 1 to 300 ratio
- But is it foodborne or person to person?
- Issue in soft fruits- a problem
  - Frozen raspberries & strawberries (Germany 10000 cases norovirus 2012- Frozen strawberries)
  - Frozen Berries and Hepatitis A around the world 2013 (USA, Italy Ireland etc.)
Other things to consider

• Recipe change/process change
  – Low salt, low sugar, low fat, preservative free

• Process change will affect microbial survival
  – Broth  Aw 0.99  10 fold reduction  62°C  24 sec
  – Wheat flour  Aw 0.6  10 fold reduction  62°C  14.6 h

• Low temperature cooking - fresher result
  – 70°C for 2 min – kills a million Listeria
  – 65°C for 9.3 min
  – 60°C for 43.5 min
Consumers

- Aging population
- Effects of prescribed drugs
- A greater proportion of the population more susceptible to infection
The changing base of analytical methods

- Microbiologists grow cultures on agar
- If it grows it’s there and it’s alive
- What if it’s there and it can’t grow?

- New DNA/RNA based methods make unculturable organisms visible.
- But if they are unculturable, are they infective

- What does the presence of “genomic material” mean
  - How would you interpret that result
Conclusions

• There are emerging infectious organisms
• It is likely that changes to analytical methods will highlight more organisms of concern in the future
• We need to rapidly develop test methods and understand the effects of food production controls on them
• We need to understand that changes to production methods can affect survival & growth of microorganisms
• The consumer is changing and will continue to do so
• Our test methods are going through a quantum change-we will have a great challenge in understanding and interpreting the results of new methods.