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STEC O157 outbreak associated with frozen burgers

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Background

- Increase in STEC O157 PT2 cases in England identified by PHE in November 2017
- 12 cases were reported in total - 8 required hospitalisation including 4 who developed HUS
- WGS results suggested that the cases were likely to be linked (< 5 SNPs)
- No common exposures were identified from the routine STEC enhanced surveillance questionnaires

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Background

- Further questionnaires, case-case study and investigation of supermarket purchases using loyalty card details identified possible common exposure
- Remnants of frozen burger from 2 case households were tested - outbreak strain was isolated from both
- Trace-back investigations suggested that a specific batch of raw burgers sold frozen as likely common vehicle

- Incident management team advised a product recall

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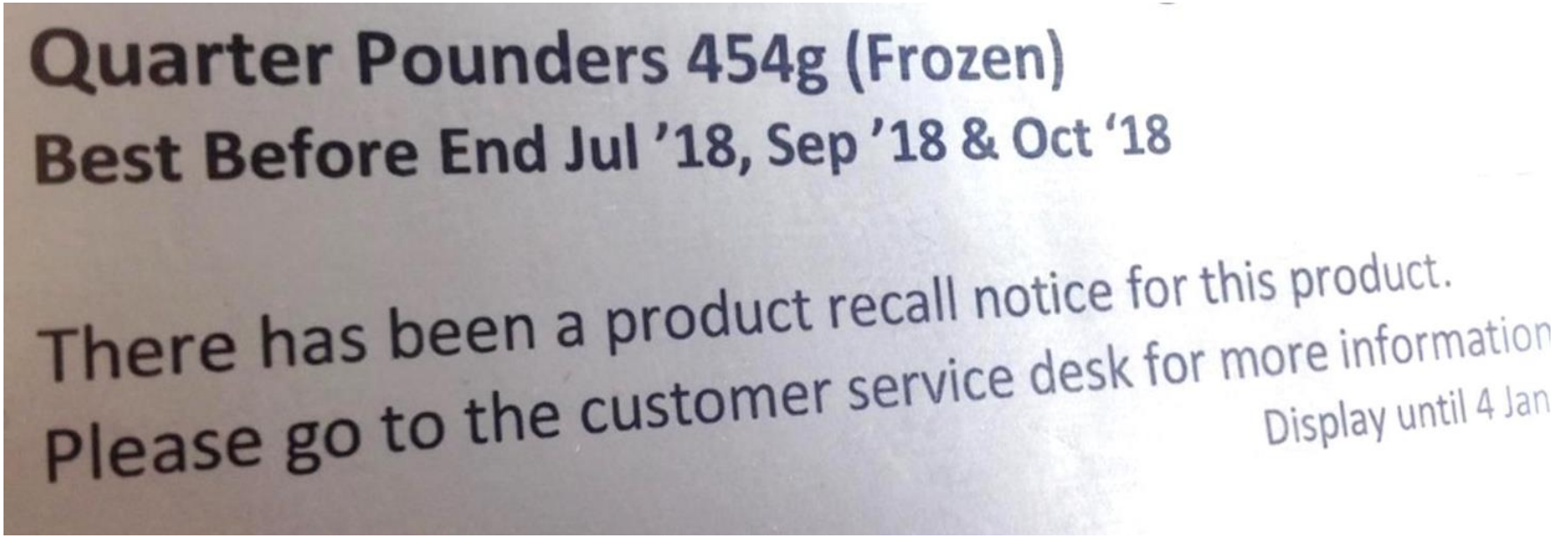
Background

Prompt voluntary recall by the affected retailers by 22 December

Customers contacted if they had bought affected batch of burgers (loyalty card history)



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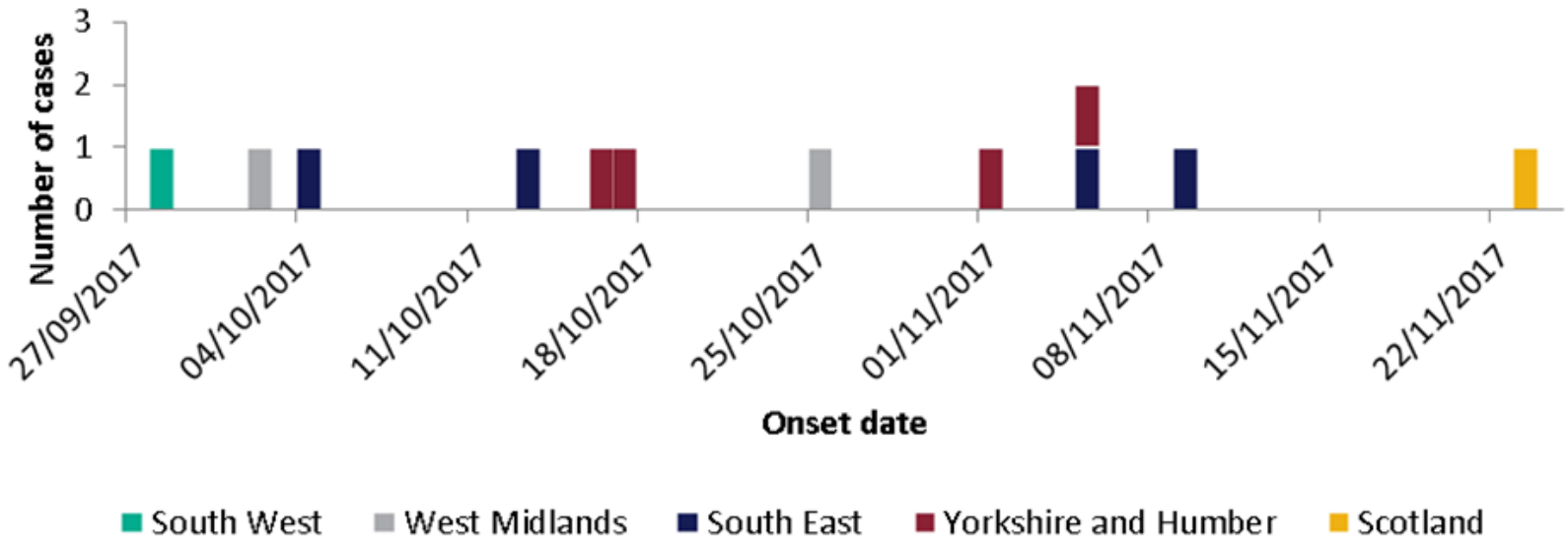
Epidemic curve



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Testing of frozen burger meat

- Original 2 samples that were retrieved from case homes (from same batch)
- Tested by the ISO standard method for detection of *E. coli* O157 and by ISO/TS STEC method
- 2/2 samples from case homes were positive using the *E. coli* O157 method but no isolation achieved using the STEC isolation method

- 4 additional samples suspected to originate from same batch also tested – all 4 were negative by both methods

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Hypotheses

- Recommended cooking procedure not adequate to ensure 6-log reduction
- Burgers not cooked according to instruction by consumer
- Burgers contaminated with a highly heat resistant strain
- Burgers heavily contaminated (either resulting in survivors after cooking or infection as a result of cross contamination in the kitchen)

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Enumeration of *E. coli* O157 in frozen burger meat using MPN

- MPN method using the E. coli O157 ISO method of enrichment (*i.e.* mTSB20 and 41.5 ^{o}C)
- Enhanced sensitivity as 20 replicates of initial 10^{-1} dilution (1 g each) were set up and 5 replicates of a further 3 dilutions (0.1 g, 0.01 g and 0.001 g).
- Real-time PCR used to screen enriched tubes before attempting isolation.
- IMS used for isolation from PCR positive tubes.

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Results

Burger sample	MPN/g	95% confidence limits	
		Lower	Upper
1	0.051	0.007	0.380
2	0.220	0.082	0.610

- Result calculated from 1/20 and 4/20 positive tubes (extended MPN calculation) from initial dilution.
- Isolates from both samples < 5 SNPs from outbreak strain

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Hypotheses review

- Recommended cooking procedure not adequate to eradicate STEC
  - Validated and revalidated
- Burgers not cooked adequately by consumer
  - Cases interviewed again - they reported they followed cooking guidelines and that burgers did not show evidence of pink meat after cooking.
- Burgers contaminated with a highly heat resistant strain that was not killed by the recommended cooking procedure
  - Strain tested and considered within expected D & Z values for E. coli O157
- Burgers heavily contaminated
  - MPN showed low levels of contamination

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Food safety procedures during production of burgers

- Manufacturer approved by competent authority
- Authorities found no failures in food safety processes in the meat preparation premises
- All statutory 2073 testing for indicator *E. coli* and *Salmonella* was compliant for batch
- Manufacturer was undertaking customer specified *E. coli* O157 testing of every batch (testing a 25 g sample). Review test data (> 3 years) showed no sample to be positive for *E. coli* O157. Samples were retained from every batch (frozen).
- Testing such stored samples, the manufacturer lab found one further sample positive for E. coli O157. The isolate was confirmed as the outbreak strain

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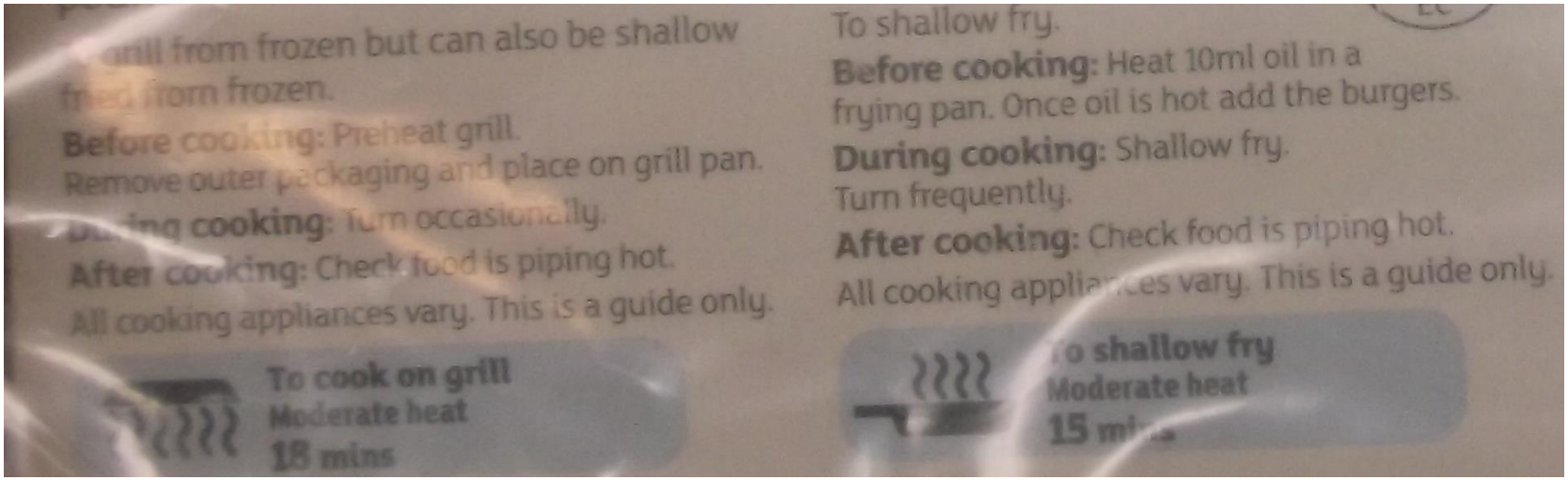
Follow up

- Inadequate cooking….?



- The cooking guidance on the product pack appeared to provide an adequate safety margin

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Follow up

- Uneven, high levels of STEC O157 in affected batch of burgers?

(production failures and/or highly colonised animals?)

- *E. coli* O157 herd prevalence 0.21 (0.16-0.28) for E&W (n = 160)/ STEC O157 herd prevalence 0.18
- *E. coli* O157 herd prevalence 0.24 (0.17-0.33) for Scotland (n = 110)/ STEC O157 herd prevalence 0.23
- Evidence for high-shedders (> 10000/g) in a proportion of these
- Majority of isolates stx2 alone; stx1 detected only together with stx2 (Henry *et al.* 2017 Epidemiol. Infect.)

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Summary

- Outbreaks associated with frozen burgers are rare; first in the UK
- Robust surveillance and multi-disciplinary investigation were key in identifying the vehicle
- Confirming outbreak strain in food sample was perhaps the most crucial evidence
- No legal requirement that raw burgers should be free of STEC
- Outbreak likely occurred due to a combination of reasons
- Adequate cooking and avoiding cross-contamination at home are critical controls

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Acknowledgements

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