The Report of the Outbreak Control Team of the investigations of an outbreak of *E. coli* O157 associated with Flicks Restaurant in Belfast during October 2012

March 2014

Contents

Abbreviations

BCC	Belfast City Council
CHP	Consultant in Health Protection
DHSSPS	Department of Health, Social Services and Public Safety
DPH	Director of Public Health
EHO	Environmental Health Officer
FSANI	Food Standards Agency Northern Ireland
GP	General Practitioner
HPA	Health Protection Agency (since 1st April 2013, Public Health England)
HPS	Health Protection Service (functional division within PHA)
HSC	Health & Social Care
HSCB	Health & Social Care Board
IPCN	Infection Prevention & Control Nurse
ICT	Incident Control Team
LCC	Lisburn City Council
NIFLG	Northern Ireland Food Liaison Group
OCT	Outbreak Control Team
PHA	Public Health Agency
PT	Phage Type
RoI	Republic of Ireland
VNTR	Variable Number Tandem Repeats
WGS	Whole Genome Sequencing

Definitions[1]

Presumptive / latex positive *E. coli* O157

Initial test suggests that the sample is positive for *E. coli* O157 but it still requires further biochemical testing.

Northern Ireland confirmed positive *E. coli* O157

The sample is both latex positive and biochemically confirmed (see above). This is the extent of testing that can be completed in Northern Ireland and the sample must be sent to the Reference Laboratory, Colindale for final confirmation.

Phage Typing

This method is based on the ability of specialised viruses (phages) to kill certain strains of bacteria. It has been the standard method for typing *E. coli* O157 in the UK for many years. It is undertaken by the Reference Laboratory, Colindale.

VNTR typing

This depends on the sequencing of short sections of bacterial DNA. It has been used to subtype strains of *E. coli* O157 that have similar phage types. It is undertaken by the Reference Laboratory, Colindale.

Whole Genome Sequencing

This is a recently developed method that facilitates the analysis of the entire DNA sequence of a bacterial genome. This allows a better understanding of the

[1] See section 6 for epidemiological definitions

relationship between various isolates of bacteria. It is the most accurate and discriminatory typing method currently available.

HACCP (Hazard Analysis Critical Control Point)

HACCP is a system that helps food business operators look at how they handle food and introduces procedures to make sure the food produced is safe to eat.

1. Executive Summary

1.1 *Escherichia coli* (*E. coli)* are bacteria found in the gastro-intestinal tract of humans and animals. *E. coli* O157 cause illness in humans and in some cases serious and potentially fatal complications can arise. *E. coli* O157 may be transmitted to humans through a variety of mechanisms. It is highly infectious and therefore spreads easily from one person to another in certain settings such as children's nurseries and families.

1.2 In August 2012, PHA was notified of four cases of *E. coli* O157 who had eaten at Flicks Restaurant, Belfast. Following investigation, including a food hygiene inspection, two surveillance visits and food sampling by Environmental Health, a number of recommendations were made to the premises. During this period the Food Business Operator made a number of improvements to their Food Safety Management System, and PHA and Environmental Health continued to monitor the situation with an agreement to re-investigate if further cases arose.

1.3 Between 9th October and 11th October 2012, PHA was notified about 4 other cases of *E. coli* O157 who had also eaten at Flicks restaurant. Following a multi-agency investigation and response, 141 *E. coli* O157 cases and 159 other symptomatic individuals who had an association with Flicks Restaurant during September and October 2012 were notified. This was the largest *E. coli* O157 outbreak reported in Northern Ireland to date.

1.4 An incident control team, which later became the outbreak control team (OCT), was established and met for the first time on 10th October 2012. The Public Health Agency (PHA), Belfast City Council (BCC) Environmental Health, Food Standards Agency (FSA) and Belfast Health and Care Trust Microbiology were core members of the OCT. The OCT continued to meet until November 2013.

1.5 The restaurant closed voluntarily on 11th October 2012, which successfully controlled the outbreak. PHA and BCC were involved in case management offering infection prevention and control advice, screening by faecal sampling and exclusion advice to prevent any further spread / secondary outbreaks.

1.6 Environmental Health Officers completed Food Hygiene Interventions at the restaurant and obtained food samples, water samples and environmental swabs. They completed investigations of the procedures and records at the restaurant, investigation of the suppliers and detailed interviews with the staff. Four food samples were found to be microbiologically borderline or unsatisfactory but no food, water or environmental swabs were positive for *E. coli* O157.

1.7 All staff submitted faecal samples and two were found to be positive with the same strain as the other cases in the outbreak. However, for both staff members it was not possible to confirm the date of colonisation / infection but it was noted that Food Handler 1 had enteric symptoms, including a severe episode of diarrhoea on 28th September 2012, whilst at work at the restaurant.

1.8 Descriptive and analytical epidemiological studies were undertaken. The case control study found that exposure to chopped parsley was significantly associated with illness, although there are significant caveats (exposure was attributed based upon Food Handlers' recall of general food preparation practices and this varied between interviews and also it is unclear if parsley was used continuously over the risk period). An analysis of the association between illness and the Food Handler likely to have garnished the food showed there is a statistically significant association between being a case and having had a meal garnished by 'Food Handler 1' (who had a positive faecal sample for *E. coli* O157). This association is stronger for confirmed cases. However once again there are significant caveats to this analysis.

1.9 Positive faecal samples from cases were sent to the Reference Laboratory, Colindale for further typing (phage typing and VNTR). In order to further

interpret the results, Whole Genome Sequencing (WGS) was performed on 59 strains from the August and October 2012 cases.

1.10 The four August *E. coli* O157 cases associated with Flicks were identified as phage type 8. One hundred and thirty four of the October cases were phage type 54, four were phage type 31 and one was phage type 33 *(one was NI confirmed only and one could not be typed by the Reference Laboratory).* The WGS confirmed that the PT54s and PT31s from October were closely related. The August PT8 cases were similar to the October phage types and both outbreaks derived from a common *E. coli* O157 strain. However the October cases did not derive directly from the August outbreak.

1.11 There were no other known *E. coli* O157 PT54 clusters / outbreaks related to food in Northern Ireland, the UK or Europe at the time of the October 2012 outbreak.

1.12 The OCT considered 4 main hypotheses for the cases associated with Flicks restaurant in October 2012:

- That a contaminated food was the source into the restaurant;
- That the source was a colonised / infected staff member;
- That the vehicle for spread of *E. coli* O157 was food;
- And a colonised / infected Food Handler increased the spread of the outbreak.

1.13 The OCT considered the source was either a contaminated food stuff or a colonised / infected staff member. However, the OCT could not definitively determine the source of the *E. coli* O157 into the restaurant in August or October 2012. The WGS results would suggest a greater likelihood that contaminated food was the source.

1.14 The OCT considered that food was the likely vehicle of spread of *E.coli* O157 within the restaurant, with some evidence to implicate parsley during the October outbreak but with significant caveats.

1.15 It is plausible that Food Handler 1 who tested positive for the October outbreak strain of *E. coli* O157 and had enteric symptoms, including a severe episode of diarrhoea on 28th September 2012 whilst at work at the restaurant, may have contributed to the spread of *E. coli* O157 within the restaurant. The statistically significant association between being a case and having a meal garnished by Food Handler 1 would support this hypothesis. However, due to Food Handler 1's pre-existing medical condition the date of colonisation / infection could not be definitively determined and may have occurred at any time, including after the other cases became infected.

1.16 It is likely that poor practices within the restaurant contributed to the spread of *E. coli* O157.

2. Introduction

2.1 This is the report of the interagency Outbreak Control Team (OCT) of the investigation of an outbreak of *E. coli* O157 in October 2012 associated with Flicks restaurant in Belfast. Organisations and individuals represented on the OCT are provided in Appendix 1.

2.2 The report describes the chronology of the outbreak and the outcomes of epidemiological, environmental health and microbiological investigations. The report concludes with the recommendations of the OCT.

2.3 This was the largest ever reported *E. coli* O157 outbreak in Northern Ireland and one of the largest in the UK. Three hundred affected individuals were reported to the Public Health Agency, 19 of whom were admitted to hospital (see Section 6).

3. *E. coli* O157

3.1 *Escherichia coli (E. coli)* are Gram negative bacteria which are normally found in the gastrointestinal tract of humans and animals. *E. coli* can cause a range of different infections, including urinary tract infections and intra-abdominal infection.[2]

3.2 Vero cytotoxin producing *E. coli* (VTEC) strains are a cause of gastrointestinal illness in humans. While some individuals have asymptomatic infection or mild gastroenteritis, others experience more severe infection, with bloody diarrhoea.[3]

3.3 In some cases complications can arise, including haemolytic uraemic syndrome (HUS), where individuals have haemolytic anaemia, thrombocytopenia and acute renal failure, and thrombotic thrombocytopaenic purpura (TTP), characterised by thrombocytopaenia, anaemia, renal involvement and neurological deficits.[3] Children under the age of 5 years are most at risk of developing HUS, while individuals aged over 60 years have the greatest risk of death.[4]

3.4 The incubation period for VTEC infection is usually from 1-8 days, with a median of 3-4 days.[5] The infectious dose is low and thought to be fewer than 1000 organisms.[6]

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[2] Health Protection Agency. *General Information.* Available at: http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/EscherichiaColi/GeneralInformation/ (accessed 18 December 2012).

[3] Health Protection Agency. *Vero cytotoxin-producing Escherichia coli (VTEC).* Available at: http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/EscherichiaColiO157/ (accessed 18 December 2012)

[4] Health Protection Agency. *Background evidence for the public health management of infection with Verotoxigenic Escherichia coli (VTEC).* Report number: HQSD 29.01, 2011.

[5] Hawker J *et al. Communicable Disease Control Handbook.* Massachusetts: Blackwell Publishing Ltd, 2005.

[6] Locking M, Cowden J. Escherichia coli O157. *British Medical Journal* 2009; 339: 817-818.

3.5 Individuals infected with VTEC strains of *E. coli* usually recover within 7 days.[4] Treatment is usually supportive in nature.

3.6 In most European countries, the most common strain of VTEC is *E. coli* O157:H7.[5] This has a number of different phage types, including PT54, which was implicated in the Flicks restaurant outbreak and would not be a common phage type found in Northern Ireland. Appendix 3 contains a table of the most common phage types notified in Northern Ireland from 2008.

3.7 *E. coli* and *E. coli* O157 are not notifiable diseases in Northern Ireland. However, food poisoning and gastroenteritis in children under 2 years are notifiable under the Public Health Act. Public health action is most often initiated following voluntary reporting of presumptive and confirmed cases of *E. coli* O157 by hospital laboratories.

3.8 In Northern Ireland in 2011, there were 56 NI laboratory confirmed cases of *E. coli* O157. In the last 10 years the highest number of cases in one year has been 77, which occurred in 2010. In 2012, 198 cases were reported by NI laboratories, which included the 141 cases that were associated with the October outbreak linked with Flicks restaurant in Belfast.

3.9 Infection rates normally follow a seasonal pattern, with an increase in cases in summer and early autumn.[5]

3.10 *E. coli* O157 may be transmitted to humans through a variety of mechanisms. *E. coli* O157 are naturally found in the gastrointestinal tract of animals, often ruminants, where they do not cause disease to occur.[4,5] Humans can therefore become infected via direct or indirect contact with animals, animal products and their environment.

3.11 Food-borne and water-borne transmission occurs when food or water is contaminated with the faeces of colonised animals. Inadequate cooking of food allows *E. coli* to survive and cause infection. Contamination of the surface of meat may occur during slaughter. The risk of infection is

increased with processing, for example into mince, as this surface contamination becomes mixed within the product.[4]

3.12 Other food sources include milk which is unpasteurised or pasteurised inadequately. Ready-to-eat food such as cooked meat products may be cross-contaminated through contact with contaminated raw meat or contaminated work surfaces. Food may also be contaminated by *E. coli* O157 positive Food Handlers. Consuming contaminated fruit or vegetables may also allow transmission to occur.[4]

3.13 Food which has been contaminated with *E. coli* O157 may not appear, taste or smell differently to other food products.[4]

3.14 Transmission may occur through direct contact with live animals that carry *E. coli* O157 and indirect contact through their environment. This has been responsible for previous outbreaks linked to open farms.[4]

3.15 Infected individuals may excrete *E. coli* O157 after their symptoms have resolved. This can be prolonged, especially in children (one study found excretion 62 days after symptoms started[4]). Some individuals never develop symptoms (that is they are asymptomatic), but are excreters of the bacteria. These factors raise the risk of person-to-person transmission through the faeco-oral route. Such secondary infection can be common in families and in settings with young children, for example day nurseries.[3] Occupational exposure has also been reported, including in laboratory and nursing staff.[5]

3.16 *E. coli* O157 outbreaks can occur via any of the mechanisms outlined above. In Northern Ireland from 1995-2008 there were 10 outbreaks of *E. coli* O157 infection. The largest, which was associated with an open farm, occurred in 2008 and was associated with 17 confirmed cases. None of the outbreaks were food borne.

4. Background

Cases in August 2012 associated with Flicks Restaurant

4.1 Through usual surveillance measures, the Public Health Agency (PHA) were made aware of four cases of *E. coli* O157 in August 2012, who had eaten in Flicks restaurant within the incubation period of their illness. The first case had eaten at Flicks restaurant on 9th August 2012 and the other three had eaten there on 13th August 2012. Onset of symptoms ranged from 14th August to 21st August 2012. The three who had eaten on the same day, had the same main meal (gourmet burger) with different sides. The case from 9th August 2012 had a chicken dish. All four cases had eaten at other restaurants and most had additional risk factors identified from the surveillance questionnaires, such as potential animal exposure.

4.2 Flicks Restaurant, Belfast opened in Yorkgate Shopping Centre (now known as Cityside Mall), Belfast in May 2007. The restaurant had waitress service with sit down meals and was open from 12:00 to 21:00 seven days a week. It served approximately 1000 covers a week with up to 60 at lunch and a maximum of 150 in the evening. On average ten members of staff were employed within the restaurant at any one time but there was a high turnover of Food Handlers. The menu had a variety of starters, fish, steak, pork and chicken dishes along with vegetarian dishes, pasta and burgers. There was a limited children's menu (for under 12 years).

4.3 All food businesses within Belfast are subject to regular unannounced food hygiene inspections in line with the Food Law Code of Practice (Northern Ireland) and in September 2010 Flicks Restaurant had been inspected and rated a '4' under the Food Hygiene Rating Scheme. The food hygiene rating given to a business reflects the standards of food hygiene found on the date of inspection by the local authority and a rating of 4 indicated standards were 'good'.

4.4 However, Belfast City Council (BCC) subsequently received two complaints about the standards of hygiene at Flicks Restaurant. A visit to the premises on 6th June 2012 revealed changes in staff had resulted in a decline in standards. The main issues identified were a lack of soap and / or hand drying facilities at the hand wash basins, poor cleaning of the structure and equipment, poor storage practices and there was no Hazard Analysis and Critical Control Points (HACCP) documentation on the premises.

4.5 A deep clean of the premises was undertaken during the night of 6th June 2012. When the EHO returned on 7th June 2012 a significant amount, but not all, of the cleaning had been completed. On this date the EHO therefore concentrated on discussing the practices and procedures in place at Flicks Restaurant and the record keeping (staff changes had also impacted on the documentation and record keeping). During this visit the EHO downloaded the Food Standards Agency's Guidance on *E. coli* O157[7] to the manageress's desktop and instructed the business to review its HACCP. A letter detailing the outstanding issues that had been identified on 6th and 7th June 2012 was hand delivered to Flicks Restaurant on 14th June 2012 and during this visit four microbiological food samples were taken (Appendix 2).

4.6 None of the food samples were unsatisfactory and no food poisoning organisms were detected. However, the coleslaw result was borderline for Aerobic Colony Count (ACC). A borderline result means there were higher than expected levels of bacteria but not enough to make the food unsafe to eat. A high ACC may indicate the product has been kept too long or that it has been left unrefrigerated. The lettuce was borderline for yeasts and moulds but the laboratory concluded there was no evidence of handler contamination.

[7] Food Standards Agency guidance for food business operators and enforcement authorities on *E. coli* O157 – Control of Cross-Contamination. First issued February 2011.

4.7 At the beginning of July 2012 the restaurant closed for refurbishment and a revisit on 9th July 2012 confirmed that significant improvements had taken place but some outstanding work still needed to be completed such as the new soap dispensers still had to be attached to the walls in the kitchen; all staff to be made aware of colour coding system for raw and ready to eat equipment.

4.8 The first *E. coli* O157 case associated with Flicks restaurant was notified to the PHA Duty Room as a presumptive case on 16th August 2012. An interview with this case identified several potential risk factors for *E. coli* O157 and the case had eaten a chicken dish in Flicks Restaurant on Thursday 9th August 2012.

4.9 The second presumptive *E. coli* O157 case was notified to PHA on 21st August 2012. This case initially gave incorrect details regarding the date they had eaten at Flicks restaurant to the EHO but this was corrected on 23rd August 2012 when they advised they had in fact eaten a gourmet burger in Flicks Restaurant on Monday 13th August 2012.

4.10 As this was a second presumptive *E. coli* O157 case that had eaten at Flicks Restaurant a Senior EHO (Food Safety) reviewed the BCC file on Flicks Restaurant including food safety visits made to the premises, complaints received and samples taken. A surveillance visit was undertaken by a BCC EHO on 22nd August 2012. It concentrated on the handling and preparation of the two different dishes that had been eaten by the presumptive cases. On this date there were soap and hand drying facilities at the wash hand basins and some temperature records were available. However there were still some issues with the HACCP documentation and some risks of cross contamination were identified such as raw and ready to eat boards being stored together. Advice was given to the Food Handler and manageress and it was confirmed there had been no reports of staff illness. No other allegations of food poisoning which implicated Flicks Restaurant had been made directly to the business or to Belfast City Council.

4.11 A third case was notified to the PHA on 23rd August 2012 and it was noted that this case had also eaten at Flicks Restaurant on Monday 13th August 2012.

4.12 An incident meeting of PHA, Belfast City Council Environmental Health Officers and Belfast Trust microbiology was held on Friday 24th August 2012. It was agreed this was a probable outbreak and that Environmental Health would urgently complete a full food hygiene inspection of Flicks restaurant (completed that day). Other food premises appeared in the food histories for the presumptive cases but none appeared on more than one form and none of the other premises had links to any other confirmed or alleged cases of food poisoning. It was agreed that no further action was necessary regarding these other restaurants. Other recent *E. coli* O157 cases were reviewed and no additional links to Flicks Restaurant were established.

4.13 Flicks Restaurant, Belfast was inspected by EHOs on 24th August 2012. Faecal samples were requested from all the staff and sample pots and laboratory forms, labelled with individual staff names, dates of birth etc were provided. EHOs were again advised by management that no staff members were symptomatic. A full food hygiene inspection was carried out and it included observations of the practices in place at Flicks Restaurant; an assessment of food hygiene and safety; the structure of the premises and all relevant documentation to enable the officers to determine their confidence in the management of the premises. On this date there were no hand drying facilities at the wash hand basins in the kitchen but they were replenished as soon as the EHO arrived. Some storage issues and the poor cleanliness of the staff toilets were noted. The records which were available to check were all satisfactory but the overall HACCP had still not been adequately revised to incorporate the FSA's *E. coli* Guidance. Based on the observations made by EHOs during that visit Flicks Restaurant dropped to a Food Hygiene rating of '3' which indicated standards were 'generally satisfactory'. Recommendations were made and the business started to work through these straightaway. On this date 11 food samples were taken for microbiological examination along with eight environmental swabs (Appendix

2). All of these food samples and all future food and water samples were taken formally in order to ensure they would be admissible as evidence should court proceedings be instigated at any stage in the investigation.

4.14 A second outbreak control meeting was held on Tuesday 28th August 2012. Food and environmental samples from 24th August 2012 were confirmed as negative for *E. coli* O157 (appendix 2) and no staff samples had been received. Further actions were agreed including:

- Requesting samples from staff again (after the meeting Environmental Health Officers contacted the General Manager to stress the importance of staff submitting samples);

- Further investigations into staff rotas and training records;

- Microbiological sampling of the raw burgers (subsequently found to be negative for *E. coli* O157);

- Letter to be sent to all NI GPs 28th August 2013 encouraging sampling of any individuals presenting with gastro-intestinal symptoms and blood in their stools

- Notifying FSA Incidents branch.

4.15 Surveillance questionnaires for all *E. coli* O157 cases notified in Northern Ireland from the beginning of August 2012 were reviewed by PHA and attendance at Flicks restaurant was not recorded for any other case. Ten other Belfast premises that cases had potentially eaten at during their incubation period were identified. BCC EHOs reviewed their files for each of these premises in order to determine if there was common supplier to them or with Flicks Restaurant. It was determined that there was no single common supplier and that all were using reputable suppliers most of whom were distributing widely throughout Northern Ireland.

4.16 A further trawling questionnaire (asking from which shop food was purchased; salads consumed; and attendance at any large venues or gatherings) was developed and administered by PHA and Belfast City Council staff to *E. coli* O157 cases from August / early September 2012 who had eaten in Flicks restaurant or for whom there was no obvious source. This did not identify any further cases who had eaten at Flicks restaurant during their incubation period or any other association.

4.17 EHOs reviewed all alleged food poisoning cases that had been made to BCC during July and August 2012 and were able to confirm there were no other common food premises and no common area for the home addresses of the complainants.

4.18 On 29th August 2012, PHA notified the members of the Northern Ireland Food Liaison Group (NIFLG) about the outbreak. NIFLG is made up of Environmental Health representatives from throughout NI and is used as the mechanism to disseminate information to all food safety EHOs in the 26 district councils in NI.

4.19 A further (4th) case was notified to PHA Duty Room on 30th August 2012. This case had also eaten a gourmet burger at Flicks Restaurant on Monday 13th August 2012. A further Outbreak Control Team meeting was held on 31st August 2012.

4.20 As three of the cases had eaten in Flicks Restaurant on a Monday it was decided that a further food hygiene surveillance visit would take place the following Monday. Having reviewed the staff rotas for Flicks Restaurant EHOs were already aware there was no common Food Handler who had worked on both of the dates the cases had eaten at the restaurant and one Food Handler only worked at Flicks Restaurant on Mondays. By Monday 3rd September 2012 a new HACCP pack had been completed for Flicks restaurant but the Monday Food Handler claimed he had not been shown it or been made aware of the practice and procedural changes which had taken place in the kitchen following the previous inspections by EHOs. As a

result the area which had now been designated ready to eat area was being used to prepare raw meat. There was no soap to one of the wash hand basins in the kitchen which contained a dirty cloth and a bowl. The Monday Food Handler worked the rest of the week at another Belfast restaurant and EHOs reviewed their premises file for the other restaurant and found nothing to give rise to any concerns. This other premises was rated '5' on the Food Hygiene Rating Scheme and had not been linked to any confirmed or alleged cases of food poisoning.

4.21 Seven food samples and six environmental samples were taken, which were all later confirmed as negative for *E. coli* O157 (appendix 2). Staff were again asked directly and via restaurant management, to submit faecal samples as no samples had been received.

4.22 On Monday 3rd September 2012, Environmental Health Officers visited the supplier of the gourmet burgers and completed a food hygiene surveillance visit. Three food samples of raw products were taken. All were negative for *E. coli* O157 (appendix 2).

4.23 FSANI were aware of this outbreak but Belfast City Council formally notified the FSANI on 4th September 2012 by completing an electronic Food Incident Report Form as is required by the Food Law Code of Practice (NI). BCC EHOs liaised directly with the FSA's Head of Incidents and Food Fraud in London and with the local FSA team in Northern Ireland. Some additional clarification was provided to the FSA which concluded all necessary action had already been taken and made no suggestions for further investigations by Belfast City Council at this time.

4.24 The faecal samples for all four cases associated with Flicks were sent to the Reference Laboratory, Colindale, England for further typing and were confirmed as phage type 8 (PT8) – see section 9. This is one of the most common *E. coli* O157 phage types in Northern Ireland (appendix 3).

Risk Assessment

4.25 Three of the *E. coli* O157 cases had eaten the same meal on the same day; the fourth had eaten a chicken dish. From the questionnaires a number of the cases also had other potential risk exposures for *E. coli* O157 and all had eaten with other diners who were not cases.

4.26 The Gourmet burger, eaten by three of the cases, was thicker than the usual burgers served at the restaurant and from a local supplier.

4.27 No further *E. coli* O157 cases were identified with a link to the restaurant and no other complaints of food poisoning were made which were associated with the restaurant.

4.28 Visits by EHOs did identify issues with practices within the restaurant which were mostly addressed on a reactive basis. However they were considered generally satisfactory and there were no reports of any staff illness. Their HACCP documentation was satisfactory by 3rd September 2012 but not all staff had been trained in it.

4.29 Twenty microbiological food samples and 14 environmental swabs were taken from Flicks Restaurant between 24th August 2012 and 3rd September 2012. No *E. coli* O157 was detected in any of the samples. Samples were also taken at the premises which supplied the gourmet burgers and again no *E. coli* O157 was detected (appendix 2).

Conclusion

4.30 Considering the above, the OCT on 31st August 2012 considered it plausible that there may have been a breakdown of food handling procedures at this time but this could not be confirmed. The premises responded to the recommendations from the inspection visits and the PHA and EHOs continued to monitor the situation with the agreement to escalate their investigations should further *E. coli* O157 cases with an association to Flicks

Restaurant emerge. No further *E. coli* O157 cases notified to the PHA had eaten at the restaurant until 9th October 2012 with the notification of a new presumptive case of *E. coli* O157 who had eaten at Flicks Restaurant on 4th October 2012.

5. Chronology of Outbreak and Investigation

October 2012

This section of the report aims to provide an overview of the chronology of the outbreak which occurred in October.

Tuesday 9 October 2012

5.1 Afternoon - PHA is notified about a presumptive case of *E. coli* O157 and initial contact suggests that the case had eaten at Flicks restaurant within the incubation period of the illness. Environmental Health in Belfast City Council (BCC) is contacted and advised of this case and the potential link to Flicks restaurant and the *E. coli* questionnaire is completed that day. The case had eaten in Flicks restaurant on 4th October 2012 and symptoms started 6th October 2012.

5.2 Two close contacts of this case were also symptomatic and had eaten at Flicks with the presumptive case. The contacts are advised to submit faecal samples and as they were in 'at risk groups' to remain off work until they meet the return to work criteria.

5.3 A joint incident meeting arranged for 10th October 2012 between PHA and BCC Environmental Health Officers (EHOs).

Wednesday 10 October 2012

5.4 Morning - Incident meeting between PHA and Environmental Health Officers, Belfast City Council. It is agreed that PHA and Environmental Health, BCC should make a joint visit to the premises that day.

5.5 2pm - During the visit to the restaurant, PHA and BCC EHOs speak to the owner, the General Manager and the staff. The need for staff to submit faecal samples is stressed and BCC EHOs complete a food hygiene surveillance visit. Eleven food samples are taken.

Thursday 11 October 2012

5.6 The two family contacts of the known case were reported by the laboratory as presumptive *E. coli* O157 positive and had also eaten at Flicks restaurant. Additionally one other case, apparently unrelated to the family cluster, was reported as presumptively *E. coli* O157 and had also eaten at Flicks restaurant on 4th October 2012.

5.7 17.15 - A joint incident meeting is arranged between PHA and BCC Environmental Health Officers. Following in-depth discussions about the fourth new presumptive *E. coli* O157 case, the family cluster of three cases and the context of the previous cases in August 2012 it is decided to require closure of the restaurant.

5.8 The general manager is contacted by Environmental Health and advised that if the business does not agree to voluntary closure, formal closure would be pursued. At 18.10 the restaurant owner agrees to voluntary closure and the BCC EHOs visit the premises and confirm that the restaurant is closed at 18.30. All high risk food from the premises is bagged for removal by a specialist firm. The restaurant owner is instructed that before the restaurant can re-open certain criteria must be met, listed below:

- Carry out a thorough deep clean and disinfection of the premises and equipment. It is recommended that a specialist cleaning contractor is employed;

- Voluntary surrender of high risk foods, to be destroyed under supervision;

- Exclude food handling staff until microbiological clearance is obtained by two negative faecal specimens taken at intervals of not less than 24 hours;

- AND any other matter which may become apparent prior to the lifting of the undertaking which poses an imminent risk of injury to health.

5.9 The Environmental Health Manager (Food Safety and Port Health) notifies the Food Standard Agency NI, via their out of hours contact arrangements, of developments and informs them that the premises is going to close on a voluntary basis.

Friday 12 October 2012

5.10 PHA informs the Food Standards Agency (FSA) of the situation by phone.

5.11 The Outbreak Control Team meets to update members on the actions from the previous evening.

5.12 PHA out-of-hours staff are notified during the evening about two more presumptive cases of *E. coli* O157 who had eaten at Flicks restaurant on 3rd and 4th October 2012.

Saturday 13 October 2012

5.13 PHA out-of-hours staff are advised by the laboratory that four more cases are *E. coli* O157 positive (presumptive), including two staff members. There are now 10 cases of *E. coli* O157, presumptive and confirmed, associated with Flicks restaurant.

5.14 Following discussions with the Director of Public Health, it is agreed to inform GP Out-of-Hours of the link to Flicks restaurant and to hold a further Outbreak Control Team meeting that afternoon.

5.15 4pm - the Outbreak Control Team meet and agree that there is a need to start to actively find cases who may be associated with the restaurant. The OCT agrees that issuing a press statement relating to the outbreak would be most effective. The restaurant owner is contacted by phone and agrees to the PHA (on behalf of the OCT) issuing a press release naming the restaurant. The press release is issued at 6pm (appendix 4).

Monday 15 October 2012

5.16 There are 11 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant since the beginning of October 2012.

5.17 The Outbreak Control Team meets (appendix 1). The 11 cases of *E. coli* O157 associated with Flicks restaurant had eaten on 3rd and 4th October 2012. EHOs had interviewed the two positive members of staff and determined that one, a Food Handler, reported having a history of enteric symptoms over a number of months, due to a medical condition but had suffered a severe episode of diarrhoea on 28th September 2012 whilst at work. The Food Handler had not considered this out of the ordinary at the time. Results from 11 food samples taken on 10th October 2012 are negative for *E. coli* O157 but the gammon, rice and parsley show evidence of contamination with other faecal organisms (see section 9). Actions include:

- Stool samples to be sent to the Reference Laboratory, Colindale, Health Protection Agency, England for further urgent typing;

- Letter to be sent to GPs and the Joint PHA / Northern Ireland Food Liaison Group advising on the outbreak, how to report and manage cases;

- FSA to be updated;

- Environmental Health to contact Flicks staff about active case finding eg through restaurant bookings;

- PHA to develop a 'screening' questionnaire for those with symptoms but no results yet (appendix 5).

5.18 Following the meeting the FSA was contacted and agreed to investigate the parsley supplier. It is noted that parsley is 'sprinkled' or used as a dressing / garnish on most dishes.

5.19 As part of on-going control measures, PHA exclude the one Flicks Food Handler who also works in another restaurant until they have two negative samples a minimum of 24 hours apart. This Food Handler had not been excluded initially as they had not worked at Flicks Restaurant during the three weeks prior to the outbreak. Other staff members assure Environmental Health Officers that they are not working in any other food venues.

5.20 All the food for disposal is removed from the premises and disposed of by the specialist company.

5.21 PHA set up a formal internal incident structure and establishes an Emergency Operations Centre (EOC). The EOC will co-ordinate the management and follow-up of cases and results with Environmental Health, be the central point of contact within the PHA for Flicks Outbreak related enquiries from members of the public and other professionals and provide outbreak related information / updates. The PHA / HSCB / BSO Joint Response Emergency Plan is activated at level 2.

5.22 Environmental Health Officers from different areas respond to the significant numbers of notifications from PHA of 'latex positive' cases of *E. coli* O157 requiring follow up and investigation, as is usual practice in Northern Ireland.

Tuesday 16 October 2012

5.23 There are 20 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.24 The first meeting of the PHA Incident Control Team takes place. The EOC commences operations with extended opening hours to 9pm and the format of a daily Situation Report is agreed for circulation to relevant partners (PHA staff, Environmental Health Departments, DHSSPS, HSCB, and FSA).

5.25 Letters advising on the outbreak and requesting that the EOC is informed of any patients presenting with gastro-intestinal symptoms who have an association with Flicks are sent to GPs (including Out-of-Hours) and Health and Social Care Trusts (for dissemination to A&Es, microbiologists, paediatricians).

5.26 Alerts regarding the outbreak are sent to other Health Protection organisations in England, Scotland, Wales and ROI for information and asking that PHA are informed of any related cases.

5.27 PHA decides to undertake an epidemiological study to try to identify any specific food or ingredient associated with illness.

Wednesday 17 October 2012

5.28 There are 25 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.29 The Outbreak Control Team meets, including representatives from FSA who join as core members of the OCT (appendix 1).

5.30 The OCT is informed by microbiology that the first four cases from this outbreak are reported from the Reference Laboratory, Colindale to be *E. coli* O157 phage type 54 (PT54). These are different phage types to the August cases associated with Flicks which were PT8. PT54 is an uncommon phage type in Northern Ireland (see appendix 3).

5.31 At this time a case management strategy was developed to try to prevent secondary spread (that is a colonised / infected individual spreading *E. coli* O157 and causing illness in others who had not eaten at Flicks). All potential cases were initially assumed to be *E. coli* O157 positive and managed as per the HPA Operational VTEC[8] guidance until the results were

[8] HPA VTEC Operational Manual, accessed October 2012 (http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1279889252950)

available. These individuals are being followed up by PHA and Environmental Health.

5.32 OCT members are supportive of PHA plans for a case-control study.

5.33 Colleagues from the Health Protection Agency, England (HPA) confirm that PT54 is not common in England and there has been no recent rise in PT54 cases, outside of a known cluster which was not food related and has no association with travel to Northern Ireland. They agree to advise PHA if there is any change.

Thursday 18 October 2012

5.34 There are 29 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.35 The data collection for the case-control study commences.

5.36 Nine of the cases associated with Flicks are confirmed as PT54.

5.37 PHA update sent to Health Protection colleagues in England, Scotland, Wales and ROI and asking for any recent reports of *E. coli* O157 PT54 which have a potential connection with Northern Ireland.

5.38 Health Protection Scotland advises that PT54 is not common and any cases of PT54 in 2012 have no link to Belfast.

5.39 Updated press release, including numbers of cases and advice to the public issued.

Friday 19 October 2012

5.40 There are 44 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.41 The EOC is to remain operational over the weekend and a letter is sent to GP Out-of-Hours to keep them informed.

5.42 Definitions of positive results clarified with microbiology colleagues – PHA acts on latex positive cases to ensure prompt public health action (see definitions section).

5.43 The Outbreak Control Team meets. Environmental Health and FSA are following up with the restaurant food suppliers. PHA and BCC staff agree to speak to the positive Food Handler who had enteric symptoms. PHA will speak to him regarding his medical condition and the EHO will concentrate on practices and procedures within the restaurant.

Saturday 20 October 2012

5.44 There are 49 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

Sunday 21 October 2012

5.45 There are 90 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.46 The data collection for the case control study is concluded.

Monday 22 October 2012

5.47 There are 98 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.48 An update letter is sent to the Health and Social Care Trusts, Residential and Nursing Homes, General Practitioners, Education and Library Boards and Early Years Teams throughout Northern Ireland.

Tuesday 23 October 2012

5.49 There are 119 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.50 The Outbreak Control Team meets, including the Director of Public Health (DPH) and communications staff from PHA, BCC and FSA. It is reported back to the OCT that no further clarification was possible in relation to the medical discussions with the Food Handler with enteric symptoms.

5.51 The data from the case control study is being validated and preliminary analysis should be available soon.

5.52 Actions agreed include:

- Further water samples to be taken from Flicks restaurant (5 ice / water samples had already taken at the restaurant on 17th - 18th October 2012);
- representatives from FSA and BCC to attend the Assembly Health Committee with DPH;
- EHOs to interview restaurant staff again to clarify food preparation procedures.
- Update letter to be sent to the Education and Library Boards and Early Years Teams.

Wednesday 24 October 2012

5.53 There are 124 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.54 An outbreak faecal sample is sent to the Republic of Ireland (RoI) for PFGE typing (RoI use PFGE rather than phage typing) to determine if there are any associated cases in RoI.

5.55 Through the European Centre for Disease Prevention and Control (ECDC) Epidemic Intelligence Information System (EPIS) a request for information on any cases / clusters of *E. coli* O157 PT54 among the member countries is made. No recent clusters or association with Northern Ireland were identified.

Friday 26 October 2012

5.56 There are 130 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.57 The Outbreak Control Team meets, including the Director of Public Health. Actions agreed include clarifying with the restaurant IT supplier if the electronic order system could be used to provide information on meals served (current information is only total numbers of covers per day – IT supplier subsequently confirmed that information on meals served could not be extracted retrospectively) and the EHOs to meet with Drinking Water Inspectorate and engineers regarding the restaurant water supply.

5.58 Twenty six outbreak associated cases are confirmed as PT54.

5.59 Preliminary results are reported from the case control study. The results are being reviewed by the statistician at HPA who has indicated following an initial review of the results that the data does not appear to support a single food as being the vehicle of transmission. Cross contamination of many food stuffs / a ubiquitous garnish or spread by a contaminated Food Handler appear more likely than a single food at this time.

5.60 An email update is sent to out-of-hours GPs.

Sunday 28 October 2012

5.61 The EOC opens Sunday 12noon to 5pm to facilitate phoning results to patients.

Monday 29 October 2012

5.62 The EOC is officially scaled back to a Health Protection Incident Room but the EOC email and telephone number remains active. The daily Situation Report ceases.

Wednesday 31 October 2012

5.63 There are 134 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.64 PFGE analysis completed on the outbreak isolate sent to Dublin and the pattern matched one sporadic case in RoI. The RoI Public Health departments were notified and advised regarding the Belfast outbreak and to report any epidemiological links with Belfast as soon as possible. No such links were subsequently reported.

5.65 The Outbreak Control Team meets, including the Director of Public Health, to review investigations and results to date. Data analysis shows there is a statistically significant association between being a confirmed case and eating food likely to have been garnished by Food Handler 1. The multivariate analysis of the case control study, which is awaiting review by HPA, suggests a statistically significant association between being a case and eating peppercorn sauce but this would explain only a small proportion of cases. In addition peppercorn sauce was considered to be an unlikely source of *E.coli* O157 into the restaurant as the ingredients were widely distributed and an unlikely vehicle of transmission as the sauce was boiled during preparation and maintained at a high temperature.

5.66 One Northern Ireland sporadic (that is with no known link to the outbreak) case of *E. coli* O157 has returned from the Reference Laboratory, Colindale as PT54. PHA staff interview the case and confirm that the case had no association with the restaurant nor did any family members. The case had not eaten at any food premises during the incubation period. The case had

been a hospital inpatient during the incubation period and the Infection Prevention and Control Team within the hospital confirmed with staff members that there was no association with the restaurant. The OCT agrees this appears to be a sporadic case and note that historically there have been small numbers of this phage type reported – one case in 2011 (appendix 3).

November 2012

Monday 5 November 2012

5.67 As the VNTR results (see section 9) from the first cases associated with the October outbreak become available, a variation in the sequences is noted and clarification sought from the Reference laboratory, Colindale. The advice from the Reference laboratory is that variation within a single locus would not be significant i.e. would consider strains with two degrees of variation to be related to the outbreak. However there is considerable variation within a locus which is unusual.

Wednesday 7 November 2012

5.68 There are 137 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

Tuesday 13 November 2012

5.69 The Outbreak Control Team meets. One hundred and twenty one of the cases associated with Flicks are PT54 and four are PT31. The OCT is awaiting further VNTR typing from Colindale on the samples.

5.70 The OCT agrees the outbreak can be declared over, as there have been more than three incubation periods since the restaurant closed and three incubation periods since the onset of symptoms in the last primary case and no further cases have presented. However, the PHA / Environmental Health investigation and response is on-going.

Wednesday 14 November 2012

5.71 PHA issues a final press release (appendix 6) on behalf of the OCT.

Tuesday 27 November 2012

5.72 The Outbreak Control Team meets. PHA advised the OCT of the outcome of the Case Control study, which had been shared with colleagues in HPA. Consumption of parsley was identified as statistically significant in relation to having *E. coli* O157 but with substantial caveats as it relies upon the information supplied by staff, which changed upon further questioning and it was unclear whether parsley was served for the entire duration of the outbreak period. It was no longer possible to show an independent statistical association with peppercorn sauce.

5.73 Environmental Health update the OCT on the findings of the investigation of water and ventilation systems. The water system appears adequately protected from faecal contamination and the OCT agreed that *E. coli* O157 is not usually an airborne pathogen therefore the ventilation system is not likely to be the source of infection or a vehicle of transmission.

5.74 FSA advise the OCT that the parsley had been distributed to a number of catering premises in NI and there were no non Flicks clusters or cases of *E. coli* O157 associated with this product.

5.75 Initial VNTR results from the Reference Laboratory, Colindale showed although some similarities between the phage types in August and October there were also differences making interpretation difficult. The OCT agrees to await further clarification from the Reference Laboratory, Colindale.

Thursday 29 November 2012

5.76 The Reference laboratory, Colindale informed PHA of the VNTR results from six *E. coli* O157 phage type 8 cases from August 2012. The results suggest they could be related to each other if there was an epidemiological link. Four

of the cases had eaten at Flicks and two cases were not known to have any connection to Flicks at that time. However, on re-interview potential links to Flicks were subsequently determined for both of the additional cases (see 5.84).

5.77 The Reference laboratory, Colindale also advised PHA that as the number of different VNTR profiles available from the October PT54 outbreak has increased, the VNTR profiles from August PT8s which had previously differed from the PT54 outbreak, now share some typing features and cluster with the October outbreak strains.

5.78 Four of the PT31 strains associated with the Flicks outbreak VNTR profiles cluster with the PT54 outbreak strains. As the VNTR profiles and different phage types are difficult to interpret, the Reference laboratory, Colindale suggest to PHA that Whole Genome Sequencing (WGS) to clarify the relationship between the cases in August and October would be beneficial.

December 2012

Wednesday 12 December 2012

5.79 Some members of the Outbreak Control Team teleconference with HPA colleagues regarding interpretation of the VNTR results. It is agreed that whole genome sequencing is required to clarify the situation, and the Reference Laboratory, Colindale agree to arrange for the further testing.

Tuesday 18 December 2012

5.80 The Outbreak Control Team meets to discuss the results of the VNTR typing from the Reference Laboratory, Colindale and to review the August cases. The WGS results will not be available until January 2013.

January 2013

Wednesday 9 January 2013

5.81 Information explaining the outcomes of the whole genome sequencing (WGS) is received from Colindale (see section 9). Members of the OCT arrange a teleconference (15th January 2013) with HPA colleagues to clarify findings.

Friday 15 January 2013

5.82 There are 140 NI confirmed cases of *E. coli* O157 associated with Flicks restaurant.

5.83 The Outbreak Control Team meets with teleconference link to HPA colleagues. WGS results are discussed in depth (see section 9).

5.84 Following the last OCT meeting in December 2012, BCC Environmental Health had contacted the *E. coli* O157 PT8 cases from August who previously had stated they had no epidemiological link with Flicks. One of the cases now claims to have eaten at the restaurant within the incubation period, although had not advised Newtownabbey Borough Council or PHA of this when contacted twice in August 2012. The other case has no confirmed link with the restaurant but could be a secondary case as their sibling who was sick before them ate at Flicks regularly. The sibling tested negative for *E. coli* O157 but her symptoms had ceased prior to her stool sample being submitted.

April 2013

Wednesday 10th April 2013

5.85 The OCT meets to discuss the implications following the WGS results. It was agreed that this would be the last meeting of the OCT unless there was a need to meet again to discuss the report.

May 2013

Wednesday 8th May 2013

5.86 PHA host the OCT debrief.

September 2013

5.87 PHA are made aware of a mislabelling issue of a positive sample related to the outbreak. When this issue is investigated and resolved, the total numbers of confirmed cases increases to 141.

6. Descriptive Epidemiological Investigation

Methods

6.1 The following are **epidemiological** case definitions that were used in the descriptive investigation. Note they are different to the **microbiological** definitions of confirmed and probable cases.

6.2 A confirmed primary case was defined as a case of enteric illness within Northern Ireland who had eaten at Flicks restaurant on or after 24th September 2012 **AND** developed symptoms after one day but within eight days of eating at the restaurant **AND** was confirmed *E. coli* O157 by the Reference laboratory in Colindale.

6.3 A confirmed secondary case was defined as someone who had **NOT** eaten at Flicks restaurant within the incubation period but was a close contact of a primary case **AND** developed symptoms after one day but within eight days of exposure to that individual **AND** was confirmed *E. coli* O157 by the Reference laboratory in Colindale.

6.4 A Northern Ireland confirmed case was defined as a case of enteric illness within Northern Ireland who had eaten at Flicks restaurant on or after 24th September 2012 **AND** developed symptoms after one day but within eight days of eating at the restaurant **AND** was confirmed latex positive and biochemically positive *E. coli* O157 by a Northern Ireland laboratory but not by the Reference laboratory in Colindale.

6.5 A probable primary case was defined as a case of enteric illness within Northern Ireland who had eaten at Flicks restaurant on or after 24th September 2012 **AND** developed symptoms after one day and within eight days of eating at the restaurant **WITHOUT** a Northern Ireland laboratory confirmation of *E. coli* O157 (i.e. a faecal sample was not submitted or was *E. coli* O157 negative).

6.6 A probable secondary case was defined as a case of enteric illness who had **NOT** eaten at Flicks restaurant within the incubation period but was a close contact of a primary confirmed or probable case **AND** developed symptoms after one day but within eight days of exposure to that individual **WITHOUT** a Northern Ireland laboratory confirmation of *E. coli* O157 (i.e. a faecal sample was not submitted or was *E. coli* O157 negative).

6.7 A co-primary case was either a confirmed or probable primary case (as defined above) who was the second or subsequent case in a household, whose onset of symptoms was within eight days of eating at Flicks restaurant **AND** whose onset of symptoms was within 48 hours of symptoms in the first case; or

A confirmed or probable primary case who was the second or subsequent case in the household **AND** whose onset of symptoms was within four days of eating at Flicks restaurant, regardless of the onset of symptoms in the Primary case.

6.8 Confirmed or probable cases unable to be further defined as primary, co-primary or secondary were classified as non-categorisable.

6.9 Symptomatic individuals who presented who had eaten prior to 24th September 2012 were not included within the analysis as they did not meet the case definition. There were 11 such individuals none of whom were microbiologically confirmed cases of *E. coli* O157.

6.10 There was no statistically significant difference in terms of gender between the 11 symptomatic individuals not included and the probable cases but they were older with the mean age of those not included 38 years compared to 29 years for the other probable cases (P=0.036).

6.11 The restaurant did not operate a booking system so PHA / EHOs could not actively contact all those who ate at the restaurant during the period 24th September 2012 to 11th October 2012. Case finding was by the PHA issuing

a letter to GPs advising of the outbreak and the association with Flicks restaurant and a media release (appendix 4) naming the restaurant and asking those who were unwell to contact their GP. Primary Care were asked to provide details of potential cases to PHA EOC for follow up.

6.12 Potential cases were contacted by EOC staff and advised to submit two stool samples, a minimum of 24 hours apart. A short questionnaire was completed on each potential case (appendix 5) including demographic details, close contacts and what was eaten at Flicks.

6.13 Once a case was latex positive or NI confirmed by a local laboratory as *E. coli* O157, PHA advised the relevant Environmental Health Officers who contacted the case to complete the longer and more detailed surveillance questionnaire either face-to-face or by telephone (used the shorter questionnaire only from 20th October 2012 onwards, as it was quicker to complete given the large numbers and it was felt that further details on other risk factors were no longer required). On completion the questionnaire was returned to the PHA EOC for individual case management and further epidemiological analysis. Cases and contacts were managed as per usual practices (HPA Operational VTEC guidance).

6.14 Updated epidemic curves showing cases by onset date of symptoms and by date they ate at Flicks were made available for OCT meetings.

6.15 Anonymised information on food histories was regularly updated by PHA and sent to FSA. Updated information and graphs on food history analysis were provided by FSA to the OCT meetings.

6.16 If a case had eaten more than once in Flicks restaurant, the date of exposure was taken as either the one within the incubation period or if there was more than one exposure within the incubation period, the most recent exposure to the date of onset was selected.

6.17 Information was available from the restaurant on total covers per day but unfortunately not on the number of specific menu items served per day so food specific attack rates could not be calculated.

Epidemiological Investigation Results (Appendices 8 and 9)

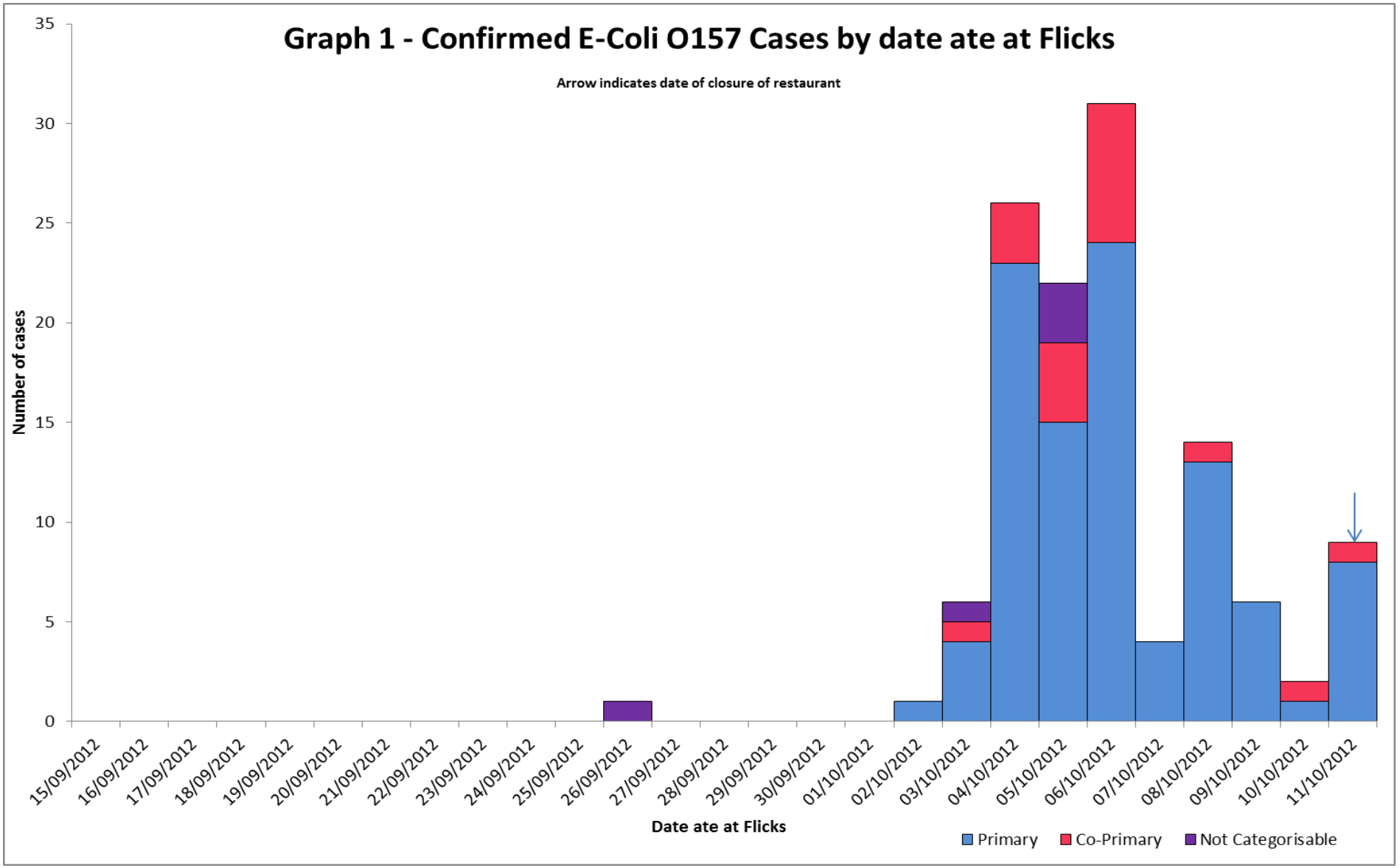
6.18 There were 140 Reference laboratory confirmed cases and one Northern Ireland confirmed case. For this analysis these 141 cases were considered together and will be referred to as 'confirmed'. One hundred were confirmed primary cases, 18 co-primary cases, 15 secondary cases and in 8 the category could not be determined (appendix 7). The 141 includes the two positive staff members.

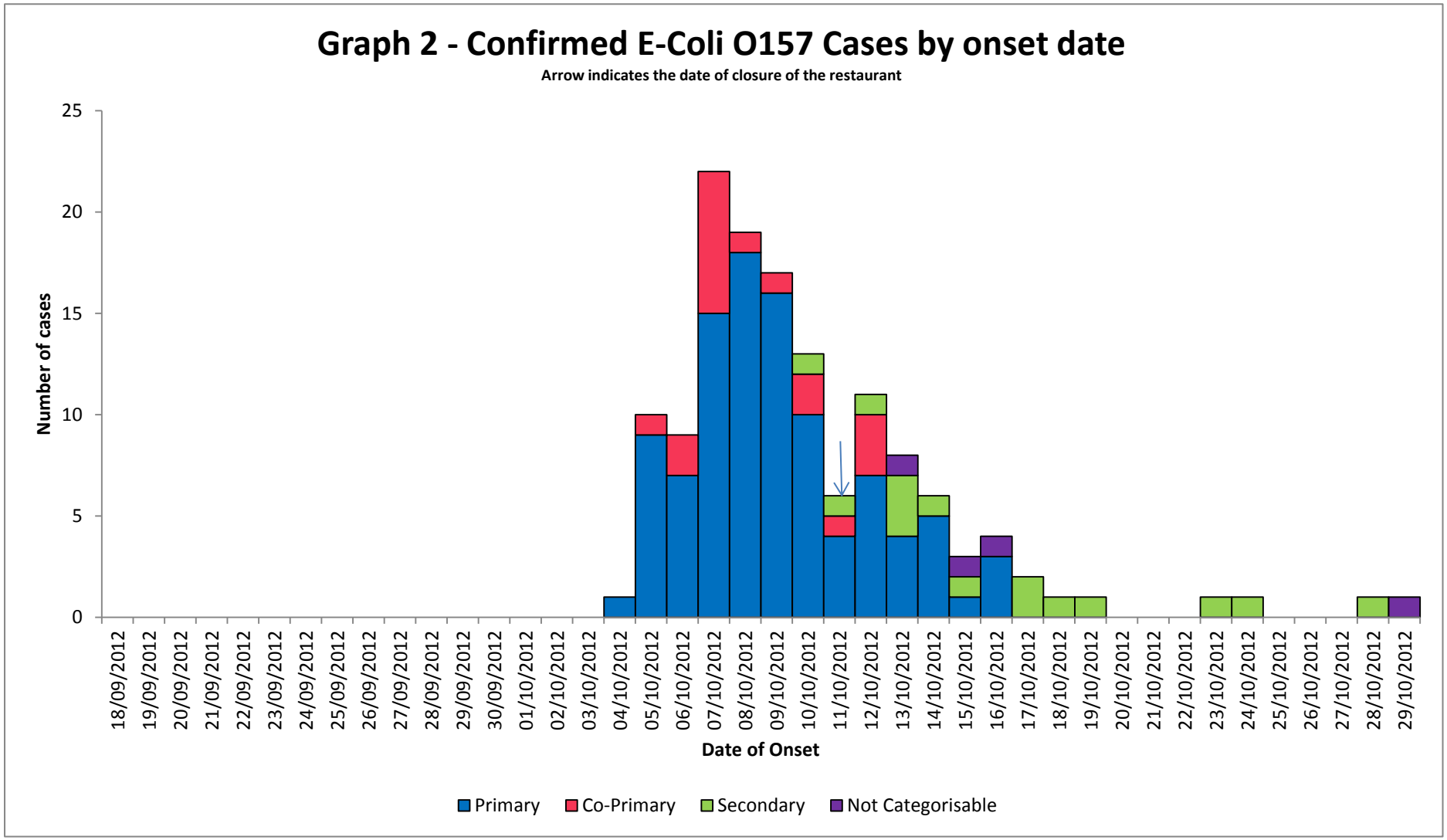
6.19 All of the confirmed primary and co-primary cases had eaten at Flicks from 2nd to 11th October 2012 (which was the date the restaurant closed). A non-categorisable confirmed case (according to the definitions in appendix 7), identified through contact screening of a case, had eaten at Flicks restaurant on 26th September 2012 but due to existing symptoms, was unable to identify an onset date.

6.20 Graph 1 shows the confirmed cases by the date they ate at Flicks restaurant. Of the 141 confirmed cases, fifteen were not included as they were categorised as secondary cases. One primary case and three non-categorisable confirmed cases could not identify the date they ate at Flicks, which includes the two staff members who tested positive for *E. coli* O157 who would have eaten over a number of days at the restaurant. The afore mentioned primary case did however eat in the restaurant within 8 days of onset of symptoms. The remaining 122 cases are shown in graph 1 by date ate at Flicks.

6.21 Dates of onset of illness in primary confirmed cases ranged from 4th October 2012 to 16th October 2012, peaking around 7th to 9th October 2012. The

onset date was not known for four of the confirmed cases (non-categorisable), including Food Handler 1 who reported having a history of enteric symptoms over a number of months due to a medical condition but had suffered a severe episode of diarrhoea on 28th September 2012 whilst at work. The other staff member did not have symptoms whilst the restaurant was open. The epi-curve (graph 2) shows that the cases with later onset of illness were mostly secondary cases, which would be expected.


Graph 1 - Confirmed E-Coli O157 Cases by date ate at Flicks
Arrow indicates date of closure of restaurant
Number of cases
35
30
25
20
15
10
5
0
15/09/2012
16/09/2012
17/09/2012
18/09/2012
19/09/2012
20/09/2012
21/09/2012
22/09/2012
23/09/2012
24/09/2012
25/09/2012
26/09/2012
27/09/2012
28/09/2012
29/09/2012
30/09/2012
01/10/2012
02/10/2012
03/10/2012
04/10/2012
05/10/2012
06/10/2012
07/10/2012
08/10/2012
09/10/2012
10/10/2012
11/10/2012
Date ate at Flicks
Primary
Co-Primary
Not Categorisable


Graph 2 - Confirmed E-Coli O157 Cases by onset date
Arrow indicates the date of closure of the restaurant
Number of cases
25
20
15
10
5
0
18/09/2012
19/09/2012
20/09/2012
21/09/2012
22/09/2012
23/09/2012
24/09/2012
25/09/2012
26/09/2012
27/09/2012
28/09/2012
29/09/2012
30/09/2012
01/10/2012
02/10/2012
03/10/2012
04/10/2012
05/10/2012
06/10/2012
07/10/2012
08/10/2012
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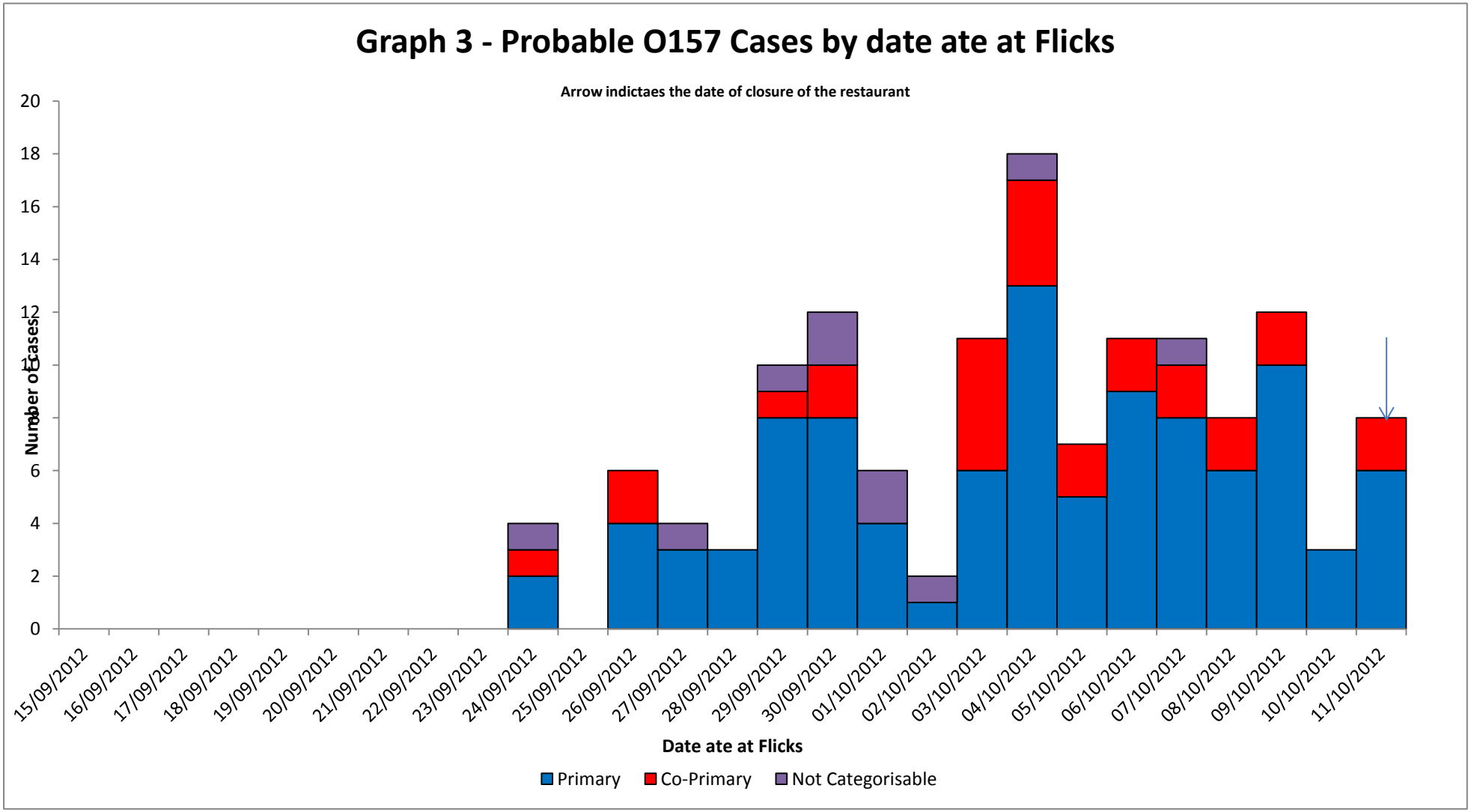
12/10/2012
13/10/2012
14/10/2012
15/10/2012
16/10/2012
17/10/2012
18/10/2012
19/10/2012
20/10/2012
21/10/2012
22/10/2012
23/10/2012
24/10/2012
25/10/2012
26/10/2012
27/10/2012
28/10/2012
29/10/2012
Date of Onset
Primary
Co-Primary
Secondary
Not Categorisable

6.22 There were 159 symptomatic individuals, who were not confirmed by microbiological testing reported to the PHA (either no faecal specimen was submitted or it was negative for *E. coli* O157). 147 symptomatic individuals met the probable case definitions and are included in the analysis.

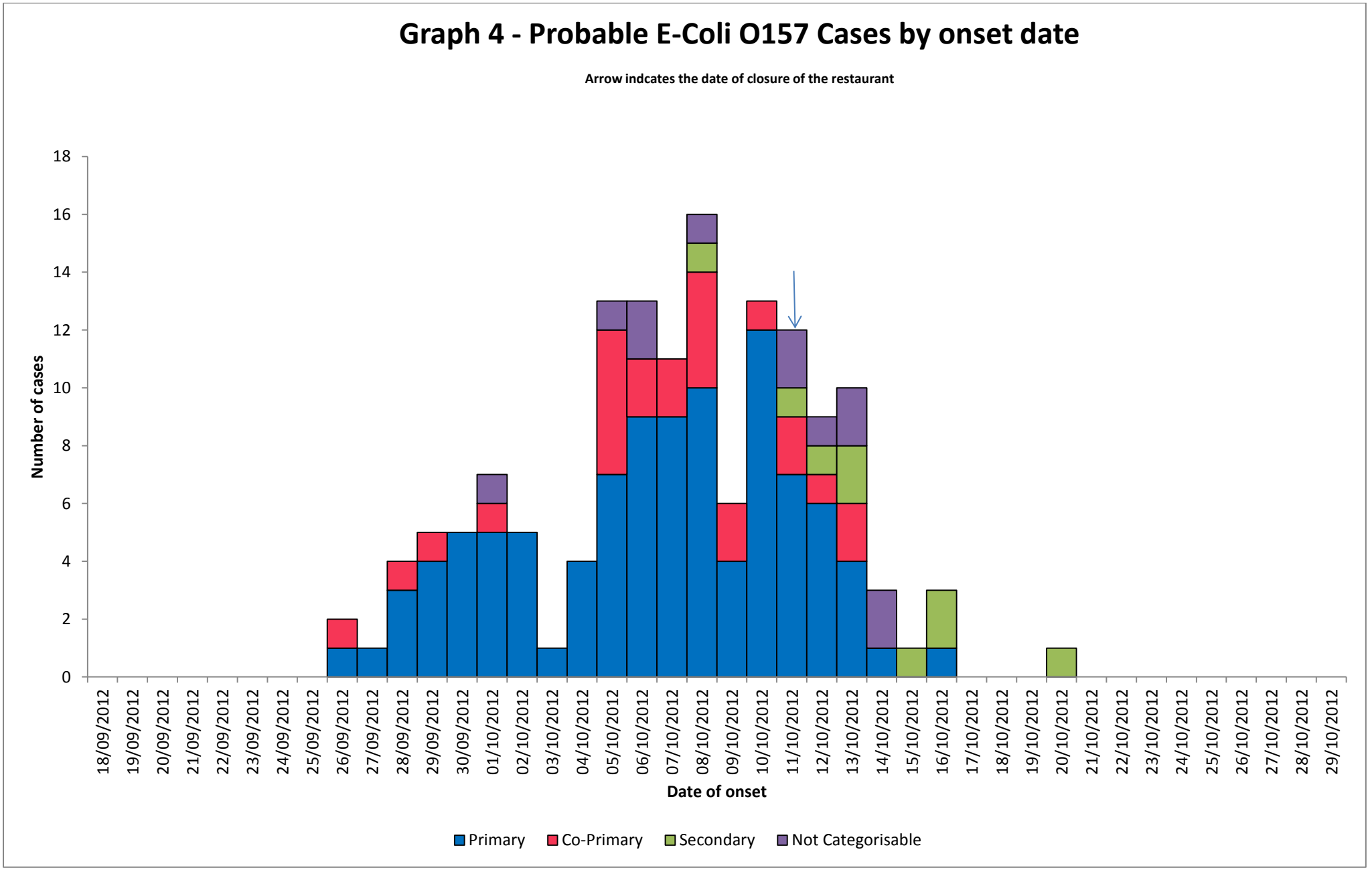
6.23 Of these 147 probable cases, 99 were primary, 27 were co-primary, 9 were secondary and 12 could not be categorised (appendix 7).

6.24 Graph 3 shows the probable cases by date they ate at Flicks. Of the 147 probable cases, nine were categorised as secondary cases and therefore were not included, one was non-categorisable and one had no date eaten recorded. The remaining 136 probable cases are represented on the graph.

6.25 Compared to the confirmed cases, probable cases reported eating at Flicks over a much longer time period and were not as tightly clustered as the confirmed cases. The modal date for probable cases eating at Flicks was 4th October 2012.


Graph 3 - Probable O157 Cases by date ate at Flicks
Arrow indictaes the date of closure of the restaurant
Number of Cases
20
18
16
14
12
10
8
6
4
2
0
15/09/2012
16/09/2012
17/09/2012
18/09/2012
19/09/2012
20/09/2012
21/09/2012
22/09/2012
23/09/2012
24/09/2012
25/09/2012
26/09/2012
27/09/2012
28/09/2012
29/09/2012
30/09/2012
01/10/2012
02/10/2012
03/10/2012
04/10/2012
05/10/2012
06/10/2012
07/10/2012
08/10/2012
09/10/2012
10/10/2012
11/10/2012
Date ate at Flicks
Primary
Co-Primary
Not Categorisable

Graph 4 - Probable E-Coli O157 Cases by onset date



6.26 Graph 4 shows the onset date of symptoms in the probable cases. Of the 147 probable cases, 2 did not have a date of onset recorded. As would be expected onset dates in the secondary cases were later than the primary cases.

6.27 There was no statistically significant difference (p=0.7) in gender between the confirmed and probable cases. Confirmed cases are 68% female and 32% males and probable cases are 66% female and 34% male (appendix 8 table 4).

6.28 There is no statistically significant difference between the mean age of the confirmed cases (31.3 years) and the probable cases (29.2 years). The majority of both confirmed (68%) and probable (78%) cases were in the 15-44 year age band, which probably reflects the clients attending the restaurant.

6.29 The mean incubation period of all confirmed cases was 3.2 days and for probable cases was 3.4 days (appendix 8 table 13).

6.30 Both confirmed and probable cases most frequently complained of diarrhoea, abdominal pain and nausea but confirmed cases were more likely to complain of bloody diarrhoea (39% compared to 17% of probable cases) and this was a statistically significant difference ($p<0.001$). Table 17 in appendix 8 shows the frequency of symptoms in the confirmed and probable cases.

6.31 Forty four (31%) of the confirmed cases and 12 (8.1%) of the probable cases had either been admitted to or attended hospital (appendix 8 table 24). Sixteen of the confirmed cases were admitted (one within the 0-14 year age band) and three of the probable cases (one in the 0-14 year age band).

6.32 There were no reported cases of serious complications of *E. coli* O157 infection such as Haemolytic Uraemic Syndrome (HUS) and no deaths associated with this outbreak.

6.33 The mean interval between symptom onset and submission of the first faecal sample was longer in the probable cases (12.9 days) than in the confirmed cases (6.6 days) and this was statistically significant (appendix 8 table 28). As *E. coli* O157 excretion is transient,

this may mean that some of the probable cases could have been positive if they had submitted samples earlier.

6.34 Of the 141 confirmed cases, 41 were excluded from school or work to reduce the risk of secondary spread as they fell within the HPA 'at risk' categories from the VTEC Operational Guidance. This does not include the probable cases excluded until negative samples were obtained or those off work due to symptoms.

6.35 Food exposure histories are available for 126 of the confirmed cases who ate at Flicks (appendix 9).

6.36 Out of 126 cases, 74 reported eating chicken. However, chicken features in 19 dishes on the menu compared to beef in 9, fish in 7 and 4 pork and 4 vegetarian dishes, so the high level of chicken dishes eaten probably reflects the large number of chicken dishes on the menu. If a case had exposure to more than one type of salad (side salad and garnish) it had been counted as one salad exposure. If there was more than one meat included in a dish then this was counted as one exposure under each type.

6.37 One hundred and thirty five exposures to potatoes were recorded (many cases had eaten different types of potatoes) and again this reflects menu choice. Only 5 main courses and 2 lunch dishes did not have a form of potatoes served with the dish.

Summary

6.38 There were 141 confirmed cases (one of whom was NI confirmed only). The peak onset of symptoms was 7th to 9th October 2012.

6.39 159 other symptomatic individuals were notified to PHA, of whom 147 met the descriptive epidemiological definition of a probable case. These people ate over a wider range of dates (24th September to 11th October 2012) than the confirmed cases.

6.40 There was no difference between confirmed and probable cases in terms of age and gender but the confirmed cases reported more bloody diarrhoea amongst their symptoms. The interval between symptom onset and submission of first faecal sample was significantly longer in the probable cases than the confirmed cases. As *E. coli* O157 excretion is transient, the longer delay in submission of samples from the probable cases could explain the lack of a positive result in some of these cases.

7. Epidemiological Analytical Investigation

Case Control Study

7.1 This is a summary of the case control study. The relevant tables and results are included in appendix 10.

Methods

7.2 The PHA undertook a case control study to investigate the hypothesis that illness was associated with eating a food item, or food items, at the restaurant. Data collection commenced at 17.00 on 18/10/12 and finished at 17.00 on 21/10/12.

Hypothesis

7.3 People with a diagnosis of *E. coli* O157 and who have attended Flicks restaurant during the period 2-11 October 2012 have become unwell through eating a food item(s) at the restaurant[9].

Case Definitions used in the Case Control Study

7.4 An individual who ate at Flicks restaurant during 2-11 October 2012, and had onset of enteric symptoms within 10 days of eating at Flicks **AND** with a microbiological isolate confirmed as *E. coli* O157, PT54[10]

Exclusions:

- Individuals with household contacts symptomatic with diarrhoea in the 10 days prior to onset of symptoms in the case.

[9] The period of risk was initially defined as 24 September until restaurant closure on 11 October, and data collection was undertaken using this definition. At the conclusion of the outbreak, no confirmed primary or co-primary cases whose most recent exposure had been before 2 October had been reported. For the purposes of analysis, the period of risk has been redefined as 2-11 October.

[10] VNTR typing of PT54 isolates identified a number of potentially distinguishable strain types. Genomic sequencing has confirmed all VNTR PT54 profiles as a common indistinguishable strain type.

Control Definition

7.5 Person who ate a meal with the case at Flicks restaurant from 2 – 11 October 2012 **AND** had no diarrhoea or any enteric symptoms within 10 days of eating at Flicks.

Sample Size

7.6 It was not possible to calculate a sample size estimation apriori. For pragmatic reasons it was decided to conclude the study on 21/10/12 when 67 cases and 29 controls had been recruited.

Selection of Cases

7.7 All confirmed cases on the outbreak database current during the life of the study were eligible to participate. All had been previously interviewed regarding food exposures on at least one occasion.

7.8 A file on each case, comprising any EHO administered questionnaire or case management questionnaire, was reviewed to identify any secondary cases, prior to interview for inclusion in the study.

Selection of Controls

7.9 Participating cases were asked to nominate controls who ate a meal with the case at Flicks, and who, to the best of the case's knowledge, have not had enteric symptoms or a diagnosis of *E. coli* O157 following their attendance.

Data Collection

7.10 A food exposure questionnaire was developed using a combination of the restaurant menu and interview with Food Handler 2. During this interview, the ingredients and food preparation for each dish were obtained. Follow up interviews with Food Handlers 1 and 2 were conducted, focusing on their use of garnishes including parsley.

7.11 PHA staff interviewed cases and controls by telephone using standardised scripts and a food exposure questionnaire. PHA staff were briefed at the start of each session with the standardised scripts and questionnaire as the basis for this.

7.12 Control status was verified during the control interview.

7.13 Case food exposures were elicited for all meals eaten at Flicks since 24 September, and for controls for meals eaten with the case at Flicks since 24 September. Choices of starter, main meal and dessert courses were asked as open questions (for example: what did you have for starter?). Component items for the dish reported were then explored using closed questions (based on potential component items identified from the menu).

7.14 Changes to data collection were made as the study evolved and further information became available:

- At the first session, staff were briefed to include questions on condiments, sauces, drinks and ice as these were omitted from the first version of the questionnaire. These questions were added to subsequent versions.
- Four specific questions regarding exposure to a parsley garnish were added to the questionnaire on 20/10/12.
- For sessions beginning after 13.30 on 20/10/11, staff were briefed to ask regarding exposure to the complete list of side dish choices by closed questions.

7.15 Subject responses were entered into an Epidata database. Case and control food exposures occurring within 10 days of onset of illness in the case and within the period 2-11 October were included in the final dataset.

Multiple Attendances

7.16 Multiple attendances with different food type exposures were captured using a separate questionnaire for each attendance by a case and for each attendance by a control eating with the case. Exposures were combined for all attendances occurring within 10 days of onset of illness and during the risk period 2-11 Oct for cases, as it would be unknown as to which attendance was associated with the development of illness. The same strategy was applied in the event that a control had had multiple attendances with the case.

Data Analysis

7.17 Age, gender and exposure date variables for cases included in the case control study were compared with those of all outbreak cases which were microbiologically confirmed (PT54/PT31) and classified as primary and co-primary cases, using Mann Whitney U and

Fisher's exact tests.[11] An exact logistic regression was used to compare food items reported pre and post question change adjusted for case status.

7.18 An independent statistical analysis of the possible cause of the outbreak was performed by the statistics unit, Health Protection Services, HPA Colindale. The main analysis was of 67 cases and 29 controls. A separate analysis of 'early diners' defined as those who had eaten at the restaurant between 2-6 October 2012 (50 cases and 21 controls) was also performed. This was done to explore whether there was any different association with foods eaten during the period when daily attack rates were highest.

7.19 The main outcome was the diagnosis of *E. coli* O157 PT54. A number of the exposures were grouped into combination exposures: all peppercorn, all chilli sauce, all chicken, all steak, side salad, lettuce, tomato, raw onion and coleslaw. These combination exposures have been used in the analysis in place of the individual exposures that form part of the definition of the combined exposures.

7.20 In addition, parsley_expected and salad garnish_expected exposures were coded based on whether parsley and/or salad garnish would have been expected to have been served with the meal. For both variables this was based on the nature of the main meal eaten, and the date eaten and the practice of the Food Handler who would have garnished the meal. Two Food Handlers worked at the restaurant during the outbreak period. On days where one Food Handler worked alone, that Food Handler would have garnished any food served. Where both worked together, Food Handler 1 would have garnished the food. On two days during the outbreak, Food Handler 1 started work 3-4 hours after Food Handler 2 and continued to work with Food Handler 2. Food Handler 1 then took over garnishing duties from Food Handler 2. Cases exposed during these days were coded according to the practice of Food Handler 1.

7.21 First a single variable analysis was performed, followed by a multivariable analysis. In the single variable analysis, the association between each explanatory variable and illness was determined for each variable separately.

[11] Genomic sequencing confirmed PT31 and PT54 as indistinguishable. Case status for all microbiologically confirmed outbreak cases was defined separately for the purposes of descriptive epidemiology as primary, co-primary or secondary (Appendix 7).

7.22 Those variables from the single variable analysis with raised odds ratios (ORs) having associations with p-value less than 0.2, together with age and sex, were included in the multivariable analysis. The model was simplified in a backwards stepwise procedure wherein, at each step, the variable with p-value greater than 0.05 and greatest number of missing observations was removed from the model provided it was not a substantial confounder (i.e. one whose removal results in a change in the odds ratios of the variables remaining in the model by more than 15%) and after exposures which were protective were dropped one at a time, ignoring confounding. Age and sex were retained regardless of significance or number of missing observations. This process concluded when all remaining terms in the model were either significant at the 10% level, substantial confounders or had no missing observations and were not protective.

7.23 Single and multivariable analysis was performed by logistic regression, with clustering to obtain ORs and their 95% confidence intervals (CIs), with significance of association being determined by Wald p-values. Clustering was used to allow for possible non-independence between individuals within groups engendered by the method of control selection. The form of association of age with illness on the logit scale was determined in each analysis and a linear association appeared to be adequate. Profile likelihood was used in the single variable analysis to obtain ORs and their CIs, with p-values obtained from Fisher's exact test, for those exposures with a sampling zero. No statistical analysis was possible in those instances where no one was exposed.

7.24 The sub-analysis (early diners) used the same approach as outlined above for the main analysis, but two extra steps were added once the final model was reached. First it was determined that it was reasonable in terms of inference to ignore the clustering and then exact logistic regression was performed in order to obtain median unbiased estimates for those exposures which would otherwise have been non-estimable. ORs and CIs from this model were calculated and exact score mid-p values given to indicate the statistical significance of the association of each variable with the outcome in this model.

7.25 All single and asymptotic multivariable analysis was conducted in STATA version 12.1,[12] with exact logistic regression performed using LogXact, part of the Cytel Studio version 8 software.[13]

[12] Statacorp. 2011. Stat Statistical Software: Release 12. College Station, TX: Stata corporation

[13] Cytel Inc, 2007. Cytel Studio 8. Cambridge, Massachusetts, USA

Results

Included cases and controls

7.26 Eighty-six individuals with confirmed *E. coli* O157 disease were identified during the period of the study. 67 met the case definition for the case control study. The median interval between attendance at Flicks and onset of illness for those included was 3 days (range: 1-7).

7.27 The following were excluded from the study:

- One case isolate was identified as PT 31[14], and one case isolate was unviable and therefore unable to be typed in the reference laboratory
- Six cases were identified as secondary cases from review of EHO questionnaires or as learned during the study interview
- One case was excluded as primary/secondary case status was unclear from the review of EHO questionnaires. Two controls nominated by this case were retained.
- Ten cases were un-contactable

7.28 Cases included in the study were significantly younger than those not included (median 27 years versus 36 years; Mann Whitney U test P=0.03). There was no difference in the proportion of females between cases included and not included (χ^2 test P=0.73). Included cases were representative of all cases identified during the outbreak with regard to date of attendance at Flicks (Fisher's exact P=0.74) (Appendix 10).

7.29 Thirty three controls were nominated, of whom 32 (99%) were contactable and interviewed. Twenty nine met the criteria for inclusion in the study.

[14] Although PT31 was confirmed as indistinguishable from the PT54 outbreak strain by genomic sequencing, this information was not available until after the analysis presented in this report had been performed, This case remains excluded from the analysis.

Multiple Attendances

7.30 No multiple attendances with different exposures occurring in the risk period and within ten days of onset of illness in the case were identified for either cases or controls eating with cases.

Univariate and Multivariate Analysis

7.31 Results from the single variable analysis are shown in Table E1 (Appendix 10). Those exposures with raised odds ratios (raised for decreasing years old in the case of age) and significant at the 20% level have their odds ratios and p-values shown in bold in this table. The following variables were therefore included in the initial multivariable model: age, sex, all chicken, all chilli, all peppercorn sauce, other[15] and parsley expected. The ORs, CIs and p-values from the final multivariable model are shown in Table E2 which reveals that the only exposure significantly related to illness at the 5% level is parsley_expected.

7.32 Tables E3 and E4 (appendix 10) show results for the early diners. There were seventy-one such individuals, fifty of whom were cases. The multivariable model comprised sixty-four individuals with responses to all the variables in this model. Results indicate that there were more exposures to consider. As the p-values obtained from the exact logistic regression are slightly conservative, it would be reasonable to conclude that there is some evidence that exposure to one or more of peppercorn sauce, cheese, other and parsley_expected raised the odds of illness independently of each other, with parsley_expected showing the strongest association.

7.33 Analysis of all study cases and controls shows that the parsley_expected exposure is independently and significantly associated with illness and accounts for just over 95% (61/64) of the cases. This was, however, a common exposure occurring in 83% (24/29) of controls. It was not possible to obtain an independent effect of “all peppercorn sauce” while accounting for clustering.

7.34 The low infective dose of *E. coli* O157 is an important factor in considering the plausibility of contaminated parsley as a potential vehicle in this outbreak. Overall, there is the potential that only a proportion of the parsley may have been contaminated and at a low

[15] [Other] is a composite variable describing a variety of beverages including alcoholic and non-alcoholic drinks, tea and coffee

level. This may explain the large proportion of people exposed to the parsley who were not ill.

7.35 The sub-analysis of early diners confirmed the association of parsley with illness. However, additional exposures were found with a possible association with illness raising the possibility of a more general cross-contamination issue among some other food and drink items early in the study period. These items would explain relatively few cases and the 'other' variable would be an implausible principal source of contamination due to its composite nature (see footnote 15).

7.36 The parsley_expected exposure was coded for each subject based on the main meal eaten, date eaten and the practice of the Food Handler likely to have been responsible for garnishing the food on that date. This was the most appropriate method to examine this exposure. From the initial Food Handler interview it was established that a chopped parsley garnish was used for the majority of restaurant dishes. This was included in the dish in such a way that it may not have been recognisable by the diner as a separate ingredient, may have been impossible to avoid eating, and was unlikely to be recalled if specifically asked. This latter is supported by the results of the specific question regarding parsley in which a majority reported they were unaware or unsure as to whether parsley was either served or eaten. However it may also reflect a true absence of parsley from the meal (see 7.41).

Limitations of the study methodology

Control selection

7.37 The use of case nominated controls did not allow use of day of exposure as an explanatory variable. The study was therefore unable to explore directly the effect of a particular Food Handler or other member of staff on duty. A separate analysis of the two Food Handlers has been performed to explore this.

Information Bias

7.38 Study cases had all been interviewed on at least two occasions prior to their study interview. It is possible that this introduced recall bias.

7.39 Recall bias may also have resulted from the delay time from exposure to Flicks until questionnaire administration. Delay times potentially ranged from 7-18 days.

7.40 The study used open questions to elicit the majority of food exposures. While this is unlikely to lead to recall/reporting bias for the starter, main course or pudding, this approach may lead to under-reporting of side dishes. This may be a particular issue for controls. However, a separate analysis showed no difference in the reporting of side orders before and after the interviewers had been briefed to seek a response to side order choices relevant to each section of the menu (Appendix10).

7.41 Significant caveats in interpreting the results for parsley_expected are that the use of chopped parsley was reported differently over two interviews with one of the Food Handlers and that it is unclear whether the use of parsley was continuous over the risk period examined.

7.42 Our study did not record the time at which the meal was eaten. We were therefore unable to definitively attribute diners to the Food Handler responsible for garnishing their meal with parsley on the two days when Food Handler 1 did not take over from Food Handler 2 until 14.00-15.00. While two subjects had meals where there was a difference in Food Handler practice on these dates, both were attributed to Food Handler 1 as neither meal was from the lunchtime menu.

Association between case occurrence and the Food Handler likely to have garnished the food eaten by the case at Flicks Restaurant

7.43 The restaurant employed two full time Food Handlers during this period. A faecal sample provided by Food Handler 1 was positive for *E. coli* O157 PT54. This Food Handler had enteric symptoms over several months with a severe episode of diarrhoea whilst at work on 28th September 2012. This was reported to Environmental Health during an interview on 14th October 2012. One hypothesis considered by the OCT was that Food Handler 1 may have contaminated the food being served. Inspection of the kitchen practices has shown this could have happened during preparation or while food was being plated and garnished prior to service.

7.44 The aim of this analysis is to examine the association between case occurrence and the identity of the person likely to have garnished the food eaten by the case at Flicks restaurant.

Methodology

Risk Period

7.45 The risk period (time during which eating at Flicks is associated with illness) for this analysis is taken as 2-11/10/2012.

Case Definition

7.46 An individual who ate at Flicks restaurant during 2-11 October 2012, and had onset of enteric symptoms within 1-8 days of eating at Flicks **AND**

- Confirmed: With a microbiological isolate confirmed as *E. coli* O157, PT54/31 **OR**
- Probable: Cases without microbiological confirmation.

Case status as defined for the descriptive epidemiology study (Appendix 7) was used to identify primary and co-primary cases.

Exposure Categorisation

7.47 Cases are assigned to either FOOD HANDLER1 or FOOD HANDLER2 using the following information:

- For each primary and co-primary confirmed and probable case, the date of exposure at Flicks was extracted from EHO and PHA completed questionnaires. Five confirmed primary or co-primary cases had multiple exposures to the restaurant within the incubation period (1-8 days). For these cases the date of exposure was assumed to be that closest to the date of onset of illness.

- The identity of the Food Handler responsible for garnishing food each day was derived from examination of staff rotas and Food Handler interviews

- FOOD HANDLER1 worked either as the only Food Handler on duty or, occasionally, with FOOD HANDLER2 during the period analysed in this study. Routine practice was that only the Food Handler on duty would have garnished any food served. Where FOOD HANDLER1 worked with FOOD HANDLER2, FOOD HANDLER1 would have been responsible for plating and garnishing the food. Where FOOD HANDLER1 began work after FOOD HANDLER2 and they continued to work together, FOOD HANDLER1 would have taken over the garnishing duties.

Attack Rates

7.48 Attack rates for FOOD HANDLER1 and FOOD HANDLER2 were calculated as the number of confirmed cases (and all cases separately) assigned to each Food Handler category, divided by the number of covers served by each Food Handler category by the restaurant (as derived from restaurant records and the staff rota), and expressed as a percentage.

7.49 For two days, FOOD HANDLER1 came on duty 3-4 hours after FOOD HANDLER2. For the calculation of attack rate by Food Handler, on each of these days 75% of meals served that day have been assumed to be attributable to FOOD HANDLER1 and 25% attributable to FOOD HANDLER2, based on the number of hours the food handler was likely to have garnished food on those days. The same proportions have been applied to the confirmed and total cases with exposures on those days.

Data Analysis

7.50 Assuming that a non-report of illness was a negative report, relative risk and Chi squared test were calculated for the association of illness with FOOD HANDLER1 for a theoretical cohort, using STATCALC.

Results

7.51 There is variation in the attack rate both within and between the categories of Food Handler exposure (Table 1). The variation between Food Handler exposure categories is more marked for confirmed cases compared with all cases.

7.52 There is a statistically significant association between being a case and eating food served or garnished by FOOD HANDLER1 (Table 2). This is stronger for confirmed cases compared with all cases.

Table 1[16]: Confirmed and All outbreak cases by date of exposure and Food Handler exposure: numbers and attack rates

			Confirmed cases		All cases	
				Attack rate		Attack rate
	Exposure date	Covers	Number	%	Number	%
Food Handler1	02/10/2012	42	1	2.4	2	4.8
	04/10/2012	118	26	22	43	36.4
	05/10/2012*	***75***	***14.25***	***19***	***19.5***	***26***
	06/10/2012	100	31	31	42	42
	08/10/2012	92	13	14.1	21	22.8
	10/10/2012*	***77***	***1.5***	***1.9***	***3.75***	***4.9***
	11/10/2012	63	9	14.3	17	27
	Total	567	96	16.9	148	26.1
Food Handler2	03/10/2012	70	5	7.1	16	22.9
	05/10/2012*	***25***	***4.75***	***19***	***6.5***	***26***
	07/10/2012	108	3	2.8	13	12
	09/10/2012	93	6	6.5	18	19.4
	10/10/2012*	***26***	***0.5***	***1.9***	***1.25***	***4.8***
	Total	322	19	5.9	55	17.1

*Cases and covers attributed 75:25 to Food Handler1: Food Handler2 on these dates. Total numbers have been rounded to reflect the total numbers of confirmed and probable cases.

[16] Notes re Tables 1 and 2: Confirmed cases excluded from the numerator but not the denominator: date of exposure not known for one primary case; status uncategorisable for 5; 3 confirmed case (1 PT33, 1 unable to be phage typed and 1 NI confirmed only). Probable cases excluded from the numerator but not the denominator: 5 uncategorisable).

Table 2: Univariable analysis of the association between being a case and exposure to Food Handler1, by case status

		Cases		Total covers	Attack rate	Relative risk		
		Number	%	Number	%	Estimate	95%CI	P value
Confirmed cases	**Food Handler1**	96	83.5	567	16.9	2.87	1.79-4.60	<0.001
	Food Handler2	19	16.5	322	5.9	1		
Total cases	**Food Handler1**	148	72.9	567	26.1	1.53	1.16-2.02	0.002
	Food Handler2	55	27.1	322	17.1	1		

Limitations of Study

7.53 The major limitation is that without individual follow up of all who ate at Flicks during this time, this is not a true cohort analysis.

7.54 Firstly it assumes that if individuals have not reported illness that they have not been infected. It is unlikely that people would have been unaware of the potential significance of any symptoms associated with eating at Flicks and more likely that they would have reported illness, given the large amount of publicity generated by this outbreak. This remains unknown, however.

7.55 Secondly, for the analysis of confirmed cases, it assumes that if an individual's illness has not been microbiologically confirmed, then the individual has not been infected. However, excretion of *E. coli* O157 after infection is transient and differences in the interval between onset of illness and specimen collection would need to be examined to allow further interpretation. In addition, not all individuals who complained of symptoms submitted specimens for testing.

Discussion of the Analytical Studies

7.56 The case control study found that exposure to chopped parsley was significantly associated with illness. However, there are significant caveats (exposure was attributed based upon Food Handlers' recall of general practices and this varied between interviews and it is unclear if parsley was used continuously over the risk period).

7.57 The analysis by Food Handler likely to have garnished the food showed there is a statistically significant association between being a case and having had a meal garnished by 'Food Handler 1', the colonised / infected Food Handler. This association is stronger for confirmed cases. This is plausible in that poor hand hygiene on the part of Food Handler 1 could have led to contamination of food items. However once again there are significant caveats to this analysis (see above). Furthermore, the onset of the positive Food Handler's infection is not known and they may have been infected at any point, including after the cases. This interpretation of the analysis assumes infectiousness throughout the period studied.

7.58 The temporal variation in the attack rate might also suggest that contamination of food(s) by FOOD HANDLER1 differed, possibly as a result of variation in hand hygiene carried out by FOOD HANDLER1. This, together with the low dose of VTEC required to cause illness, could explain why not all those expected to have consumed the contaminated food item became ill.

7.59 It is also not possible to understand from the case control study if parsley could have been the source of the organism into the restaurant or if it could have been contaminated by restaurant practices and subsequently acted as a vehicle for spread. Limited support for the latter is provided by the Food Handler analysis.

8. Environmental Investigation

Background

8.1 Following notification on 9th October 2012 of a new presumptive case of *E. coli* O157 with a link to Flicks Restaurant, BCC Environmental Health decided that the Principal Environmental Health Officer (PEHO) who had managed the Environmental Health investigation into the August 2012 outbreak would co-ordinate the new investigation as an urgent priority.

8.2 A Senior Environmental Health Officer (SEHO) who was familiar with the August 2012 outbreak interviewed the case. As the case had eaten with two family members, the SEHO stressed the importance of them submitting faecal samples to aid with this investigation.

8.3 Section 3 of this report details the sustained range of interventions carried out by EHOs at Flicks Restaurant in the period from June 2012 to the October 2012 outbreak. This indicates that dating back to June 2012 significant food safety issues had been identified including continued lack of provision of hand washing materials, some on-going poor practices evident, training and supervision issues and failures in documented food safety management system. Overall it would appear Food Safety was being managed in a reactive manner rather than proactively. However in response to the interventions of the Council there is clear evidence that the business took action to remedy deficiencies over that time. Improvements included closing for refurbishment in July 2012, putting staff through an external food hygiene training course on 27th September 2012 and making progress towards reviewing its HACCP in line with the *E. coli* guidance. The EHO visiting the premises on 10th October 2012 confirmed that most of the recommendations made in previous visits had now been completed in full with only minor outstanding issues reported (see section 8.6).

8.4 It was decided that for continuity purposes the same EHO who had carried out all of the recent visits to Flicks Restaurant would carry out any visits now required. The Department already had an in depth knowledge of the practices and procedures at Flicks Restaurant due to the August outbreak and this would enable the October investigation to progress quickly and without the need to bring other officers up to speed regarding the restaurant.

Action taken while Flicks Restaurant was still operating

8.5 On Wednesday 10th October 2012 the first Incident Team meeting took place and considering that staff had continually failed to provide stool samples during the August investigation it was decided that a Consultant in Health Protection, PHA would accompany the EHOs to the premises. The Incident Team felt it would be more appropriate for a doctor to emphasise to the staff members the need to submit stool samples to aid with this investigation.

8.6 During this visit EHOs assessed the overall hygiene conditions and practices. The kitchen was inspected and officers noted that most of the recommendations made on previous visits had now been completed in full. Some issues, including the poor cleanliness of the staff toilets, were identified and lack of supervision was again evident as the Food Handler had to be reminded of the Flicks HACCP requirement to use tongs when handling ready to eat foods. The manageress was advised that although their Safe Catering Pack (HACCP) had now been completed it had not been signed off by management. Food and environmental samples were also taken during this visit. EHOs were again advised that none of the members of staff at Flicks Restaurant had suffered any symptoms of food poisoning.

Voluntary Closure

8.7 By 16:30 on Thursday 11th October 2012 a total of 4 presumptive cases of *E. coli* O157 were linked to Flicks Restaurant. Based on all of the available evidence and taking into account events in August 2012 the Incident Team decided that it was likely that Flicks Restaurant presented an imminent risk to public health and should be closed with immediate effect. Council officers agreed that should the food business operator fail agree to close the premises on a voluntary basis EHOs would use their formal emergency prohibition procedures (legislation) to close the restaurant. The food business operator (FBO) was contacted and agreed to a Voluntary Closure with immediate effect. The Incident Team drew up the criteria that must be met prior to the restaurant re-opening and also decided that all potentially contaminated foodstuffs at Flicks Restaurant should be removed from the premises and disposed of in an appropriate manner. The Environmental Health Manager (Food Safety and Port Health) notified the Food Standard Agency NI, via their out of

hours contact arrangements, of developments and informed them that the premises was going to close on a voluntary basis.

8.8 EHOs visit Flicks Restaurant immediately after the Incident Team meeting and confirmed that it had already closed. The necessary paperwork for a Voluntary Closure was completed and the FBO was informed of the Incident Team's criteria that must be met prior to re-opening (see section 5.8). It was again confirmed that no staff had reported any symptoms but they were all informed that they could not work at Flicks Restaurant or any other food business until they had been cleared microbiologically and this would entail the submission of two stool samples, at least 24 hours apart, that were both free from *E. coli* O157. EHOs supervised the bagging and tagging of all foodstuffs (except unopened soft drinks which were stored in a separate drinks store) at the premises ready for removal by a licensed waste contractor. The removal of this waste was witnessed by an EHO on Monday 15th October 2012.

Action taken after Flicks Restaurant Closed

8.9 Given that Flicks Restaurant had closed on 11th October 2012 and the imminent risk to public health from that premises had been removed EHOs spent the day after the closure concentrating on facilitating the staff in submitting stool samples; actively seeking any staff contacts who might be ill and liaising with the manageress regarding staff rotas and clarifying the roles and responsibilities of staff within the restaurant.

8.10 The Incident Team met on 12th October 2012 to review the 4 cases from August and the 4 new cases from October. No single food was implicated from the food histories. Some but not all of the cases had also visited the cinema. EHOs examined the staff rotas and determined that no common member of staff had been on duty on all of the dates the cases had eaten at Flicks Restaurant. Some of the cases had eaten in restaurants outside Belfast during their incubation period and EHOs made contact with colleagues in other District Councils but none of these other premises was linked to any other alleged or confirmed cases of food poisoning.

Documentation

8.11 Throughout this investigation EHOs continually reviewed all relevant paperwork from Flicks Restaurant including their HACCP documentation; sickness policy and training records. The findings of the documentation review were used to verify and on occasion to challenge the information given by the staff.

Practices and Procedures

8.12 The restaurant had closed so quickly that officers had limited opportunity to observe the improvements the business had put in place following previous visits to Flicks Restaurant. The only way to verify current practices and procedures was through detailed discussions with the key members of staff. By this date all of the staff had completed an external one day food hygiene training course and were fully aware of what they should be doing. EHOs therefore spent time trying to verify that what was written down as the procedure was what was happening in practice, even when the restaurant was busy or when different members of staff were on duty.

Contact with cases

8.13 EHOs in BCC's Food Safety Team were involved in completing food poisoning questionnaires with probable, presumptive and confirmed cases. Officers also delivered and collected specimen pots. Staff worked until 22:00 hours each night for the first fortnight. In order to minimise the risk of secondary cases and the risk of a secondary outbreak great emphasis was placed on getting across the importance of good personal hygiene. EHOs followed the PHA guidance on who should be excluded from work and made those who were being excluded aware of the PHA criteria to be met prior to returning to work.

8.14 When the VNTR data became available in November 2012 it identified two *E. coli* O157 cases from August 2012 with similar profiles to the August cases associated with Flicks. A SEHO re-interviewed the cases (see section 5.84).

Investigation of Specific Foods

8.15 As part of the investigation, the OCT considered if a food item could have been the source of the *E. coli* O157 into Flicks Restaurant and / or if a food item could have been the vehicle by which the organism was spread.

8.16 EHOs interviewed the Food Handlers and manageress about every food and every supplier into Flicks Restaurant and also determined what would happen if a supplier could not supply a particular food to the premises i.e. did the restaurant manage without it or obtain it from a different supplier. The Food Standards Agency took responsibility for investigating the wider food chain and reported that no issues had been identified.

8.17 Food Handlers were again interviewed at length on 17th, 19th, 23rd and 25th October 2012 and were asked to explain the preparation and handling of every dish on the menu. What the Food Handlers said was compared to determine if there were any discrepancies. Their answers did show that things varied a little depending on who was working.

8.18 As no common dish was consumed by all of the cases, it was considered that a garnish, which could have been common to many dishes, might be implicated. EHOs compiled a detailed report on the nine different garnishes used at the restaurant and a separate report on the parsley which was the most ubiquitous garnish. These reports looked at how each garnish was used within the restaurant.

Samples

8.19 Food samples and swabs (see Appendix 2) were taken from the restaurant on the day before it closed. After closure further food samples, water samples and environmental swabs were taken on six occasions up to, and including, 2nd November 2012. Samples were also taken from two of the premises that supplied food to Flicks Restaurant. No *E. coli* O157 was detected in any of the samples taken from Flicks Restaurant. The samples taken from Flicks were: 15 food samples, 65 environmental swabs (from the main kitchen, the seating area, the toilets and the delivery corridor), 22 water samples, 3 ice samples, 2 cloths and 1 apron. No *E. coli* O157 was detected in the 11 samples taken from the suppliers.

Results

8.20 Although no *E. coli* O157 or other food poisoning organisms were detected four food samples were borderline or unsatisfactory – cooked rice, cooked gammon, cooked chicken and chopped flat leaf parsley. Three were borderline or unsatisfactory for *E. coli* which is used as a faecal indicator to assess the hygiene status of a food product.

8.21 The cooked and chilled **gammon** result was borderline for *E. coli* (not *E. coli* O157). A borderline result indicates there were higher than expected levels of bacteria but not enough to make the food unsafe to eat. The low *E. coli* count in the sample is an indication of post cooking contamination. However, no *E. coli* O157 was detected and this product would have been reheated prior to use.

8.22 The cooked and chilled **chicken** was borderline for Aerobic Colony Count (ACC). A high ACC may indicate the product has been kept too long or that it has been left unrefrigerated but again this product would have been reheated prior to use.

8.23 The cooked and chilled **rice** was unsatisfactory for ACC and borderline for *E. coli*. The high ACC suggests prolonged storage and / or temperature abuse with the low *E. coli* count indicating post cooking contamination. Again this product would have been reheated prior to use.

8.24 The **chopped flat leaf parsley** was unsatisfactory for *E. coli* (not *E. coli* O157) and the high count indicated faecal contamination. The Consultant Clinical Scientist also stated in his report that the ACC and Enterobacteriaceae counts for this sample were higher than normal and suggested inadequate washing. The parsley as sampled was ready to eat and would not have undergone any further preparation prior to use as a garnish.

<u>Parsley</u>

8.25 The Case Control Study identified that parsley had a significant association with illness. Although there were many caveats to the Case Control Study the OCT agreed that based on the chopped flat leaf parsley sample result and the study findings, the parsley warranted further investigation. In particular this included determination of the country (or countries) of origin; dates and quantities delivered to

Flicks Restaurant (EHOs already had this information from the premises but needed the supplier to verify the information); the wider distribution chain; instructions for use and an assessment of the extent of additional sampling of the parsley that needed to be undertaken at the supplier. As the parsley supplier was located outside the jurisdiction of BCC, the FSA took responsibility for this aspect of the investigation. It liaised directly with Lisburn City Council (LCC) regarding the supplier and reported its findings back to the OCT.

8.26 FSA worked with LCC to determine that the parsley originated in either Western or Eastern Mediterranean (parsley from these sources was used to produce a local brand). The supplier was unable to determine from which source the parsley used to supply Flicks came, but LCC felt it probable to have originated in Eastern Mediterranean. Three samples of the parsley from the supplier on 16th October and two samples on 22nd October 2012 were satisfactory for *E. coli* and *E. coli* O157 was not detected (appendix 2). The parsley was widely distributed within Northern Ireland.

8.27 While the FSA pursued the supply of parsley, EHOs reviewed all of the information they already had about the parsley and again questioned the staff to confirm how parsley was handled at Flicks Restaurant. The Food Handlers believed the parsley to be ready to eat and did not consider thorough washing of it as a critical control to remove *E. coli* O157. The FSA subsequently confirmed the parsley was not being supplied as a ready to eat product. Although the Food Handlers were allegedly rinsing the parsley to some extent before use, they believed it was ready to eat and subsequently were not aware of the need to vigorously wash before consumption. The business had not identified vigorous washing of parsley as a critical control. Therefore the washing carried out at Flicks may not have been sufficient to reliably remove the risk of *E. coli* O157 contamination. This assertion may be supported by the result for the chopped flat leaf parsley which contained high levels of *E. coli*; however, it is also possible this result may have been due to poor personal hygiene / contamination on the premises and/or temperature abuse.

8.28 Chopped parsley is required to be kept refrigerated and it was discovered that sometimes the prepared parsley at Flicks Restaurant was not kept refrigerated but sat out at ambient temperatures for long periods.

8.29 EHOs also reviewed the supply of parsley into Flicks Restaurant and it was confirmed that a parsley delivery could last for up to a week but more typically lasted 3 – 5 days. Invoices revealed there was a 9 day period, during the identified risk period, when there had been no parsley delivered. Neither Food Handler clearly recollected running out of parsley but when presented with this information both commented that they must have run out. Therefore it is possible that some of the cases may have eaten in the restaurant on the days when there was no parsley available.

Peppercorn Sauce

8.30 The peppercorn sauce, which was served at a high temperature, was sampled and found to be satisfactory. Temperature monitoring, while the kitchen was still operational, did not find any evidence of temperature abuse of this product. The ingredients for the peppercorn sauce were from large suppliers and were widely distributed. The OCT agreed that further investigation was not required.

All Other Foods

8.31 Analysis of the food histories and the findings of the Case Control Study did not highlight any other foods that merited further investigation. EHOs carried out a detailed review of every invoice and petty cash receipt for Flicks Restaurant from August 2012 through to the date the premises closed in October 2012. Every raw and ready to eat food in use during this period was considered in order to verify that no food or ingredient had been missed. It was confirmed that all of the higher risk ready to eat products delivered to the premises were widely distributed and that Flicks was not using any small localised supplier. There had been no change in the suppliers or foods in use at Flicks and the raw product evaluation from August was still valid. This was reported back to the OCT which considered all of the available evidence and did not recommend any further investigations of the food chain or food sampling.

Air and Water

8.32 Northern Ireland Water and the Drinking Water Inspectorate were consulted about the public water supply in the area where Flicks was located and confirmed there were no issues with the general supply. Although no *E. coli* O157 was detected in

any of the water or ice samples or the environmental swabs of the ventilation grilles at Flicks Restaurant, it was recognised that there was the potential for *E. coli* O157 to be spread by water. Given the significance of the outbreak it was considered appropriate to obtain an independent report on the plumbing and ventilation systems at Flicks Restaurant. The report concluded there were no risks of contamination from *E. coli* to the water system and whilst there where issues identified with the ventilation system these were unlikely to provide an opportunity for transfer of faecal matter. The OCT considered these findings and agreed the ventilation system and water supply where not likely to be the source of the contamination.

Staff

8.33 After Flicks Restaurant closed all of the members of staff did submit stool samples. Two were confirmed as having *E. coli* O157.

8.34 Food Handler 1 was confirmed as positive for *E. coli* O157 and had been on holiday at the time of the August 2012 outbreak. During an interview with an EHO on 14th October 2012, Food Handler 1 reported having a history of enteric symptoms over a number of months but had suffered a severe episode of diarrhoea on 28th September 2012 whilst at work. Therefore Food Handler 1 did not consider this incident to be out of the ordinary or to be associated with food poisoning but did notify the manageress at the time. Neither suspected food poisoning and Food Handler 1 continued to work until relieved by a colleague later during the shift.

8.35 The other member of staff who tested positive for *E. coli* O157 claimed to have suffered no symptoms.

8.36 All of the staff subsequently submitted two negative faecal samples before they returned to work.

8.37 EHOs commenced formal interviews of the staff in November 2012.

Communication / Liaison with Colleagues

8.38 **Belfast City Council EHOs** - Given the size and complexity of the outbreak an internal BCC Incident Team (BCCIT) was quickly established. It consisted of the Environmental Health Manager (Food Safety and Port Health), the PEHO co-

ordinating the investigation, an additional PEHO, three SEHOs and a Technical Officer for administration support. The BCCIT met each morning to review what had happened the previous day and to prioritise the activities for the coming day. The PEHO then disseminated this information to the wider team. This continued on an almost daily basis until Wednesday 7th November 2012 and then on an ad hoc basis until March 2013.

8.39 **Food Standards Agency NI** – BCC Environmental Health liaised throughout this investigation with their colleagues in the FSANI who also sat on the OCT.

8.40 **FSA (Head of Incidents, London)** – at the request of BCC the Head of Incidents, FSA, London carried out a Peer Review of the Environmental Health investigation to date. He arrived on Monday 29th October 2012 and spent two days interviewing EHOs and reviewing BCC Environmental Health evidence. He concluded that the investigation had been very thorough to date and made a few recommendations which were actioned by EHOs.

8.41 **EHOs in other District Councils** - Throughout the investigation BCC EHOs liaised directly with colleagues in other district council areas who were interviewing cases that lived outside Belfast. The Northern Ireland Food Liaison Group (NIFLG) was also used to inform all 26 district councils, whether involved in interviewing cases or not, of key pieces of information regarding the outbreak.

8.42 **All food businesses in Belfast Area** – During the outbreak the FSANI requested that all 26 district councils in NI send an advisory letter to all food businesses in their area to make them aware of their legal obligations regarding symptomatic Food Handlers. BCC wrote to each of the 2959 food businesses in the Belfast area on 24th October 2012.

8.43 **Health Committee of the Assembly** – During this outbreak the Environmental Health Manager (Food Safety and Port Health) accompanied FSA and PHA representatives to a Health Committee meeting of the Assembly.

8.44 **Health and Environmental Services Committee** – During the outbreak the Director of Health and Environmental Services provided a report to BCC's Health and Environmental Services Committee.

Summary

8.45 During the period from June to October 2012 food safety within Flicks Restaurant was primarily managed on a reactive basis. It is significant that lack of hand washing facilities was a recurring theme and there was on-going evidence of inadequate supervision and instruction of staff.

8.46 Although no *E. coli* O157 was found in any of the food, water or environmental samples there was evidence of faecal contamination in three foods sampled from the kitchen – including heavy faecal contamination of the ready-to-eat parsley.

8.47 Staff assumed the parsley, which originated in the Eastern and Western Mediterranean, was supplied to the restaurant as a ready to eat product but this was not the case. Washing of the parsley to remove contamination was therefore not identified as a critical control point in their HACCP. There was evidence of failure to comply with the legal requirement to keep the prepared parsley refrigerated and this could have facilitated the growth of micro-organisms.

8.48 All food handlers had recently received food hygiene training and during subsequent in-depth interviews were generally aware of the correct practices and procedures that should have been followed. However, given the prompt closure of the restaurant on 11th October 2012 there was limited opportunity for Officers to observe or verify what was happening within the premises at the time of the outbreak.

8.49 During an interview with Food Handler 1 it was discovered that he had a history of enteric symptoms and had suffered a severe episode of diarrhoea whilst at work on 28th September 2012.

9. Microbiological Investigation

Methods

Human Stool Samples

9.1 All human stool samples submitted to each of the five hospital clinical microbiology laboratories in Northern Ireland are routinely cultured for *E. coli* O157. Laboratories notify any isolations immediately to the Public Health Agency.

9.2 All human isolates of *E. coli* O157 are sent to the Health Protection Agency Laboratory in Colindale, London for phage typing and toxin testing.

9.3 During the incidents of August and October 2012, human stool samples from cases and contacts were submitted by EHOs or via GPs to local clinical laboratories using an agreed identifier. Stool samples were initially read at 24 hours, isolates positive for the *E. coli* O157 latex test were described as "Latex positive" and reported to the PHA. Following biochemical confirmation 24 hours later these were moved into the category of "Presumptive *E. coli* O157". The Public Health Agency referred to these cases as "Northern Ireland confirmed".

9.4 The first isolate from any individual was forwarded to Colindale for phage typing and toxin testing (subsequent isolates from samples taken to check for clearance were not referred).

9.5 Samples confirmed as *E. coli* O157 by Colindale were then placed in the category of "Confirmed *E. coli* O157".

9.6 Colindale subsequently undertook Variable Number Tandem Repeat (VNTR) and Whole Genome Sequencing (WGS).

Food, Water and Environmental Samples

9.7 All food, water and environmental samples taken to investigate these incidents were submitted to the Northern Ireland Public Health Laboratory for culture.

Results

Human Stool Samples

9.8 140 individuals were confirmed as *E. coli* O157 by the Reference laboratory, Colindale. Two were Flicks staff members. One individual was 'NI Confirmed' but the Reference laboratory, Colindale was unable to complete further testing on the sample.

Phage Typing

9.9 Phage typing and VNTR revealed that the isolates from the four individuals with a history of eating at Flicks in August plus two other persons from August had *E. coli* O157 phage type 8 with similar VNTR profiles. The other samples from all of Northern Ireland during January to August 2012 were from a variety of different phage types.

9.10 The isolates from those who had eaten at Flicks in October belonged to phage types 54, 31 or 33, as did the samples from those thought to be secondary contacts connected to Flicks. There were 134 cases with phage type 54, four with phage type 31 and one with phage type 33. One case was confirmed *E. coli* O157 but did not conform to phage typing. One case was NI confirmed but was not confirmed by the Reference Laboratory, Colindale.

9.11 No samples from the October outbreak were of phage type 8.

9.12 There was one sporadic case of *E. coli* O157 notified to PHA during the October outbreak who was phage type 54 but had no connection to Flicks restaurant or the outbreak.

Variable Number Tandem Repeat (VNTR) typing method

9.13 This method was applied to all six phage type 8 strains in August and 134 Flicks related strains from October. The outbreak VNTR profile for all the Flicks associated strains isolated in August and those from cases in October was ?-8-12-4-5-2-8-3. The profile showed a high degree of variation at VNTR locus #3. This result was difficult to interpret in conjunction with the phage typing data.

Whole Genome Sequencing (WGS)

9.14 As the phage typing and VNTR results were inconclusive, microbiologists at the Reference laboratory, Colindale recommended Whole Genome Sequencing (WGS). This method is not in wide spread use but it is an emerging technique used to investigate clusters of a variety of infectious diseases when other microbiological investigations e.g. phage typing, have not been able to fully distinguish between cases. WGS allows the true genetic distance to be ascertained between bacterial isolates and therefore their relatedness. WGS is a sophisticated analytic technique requiring complex joint microbiological and epidemiological interpretation. The investigation was performed by a specialist laboratory in England.

9.15 WGS was applied to 59 strains from the August and October incidents alongside 30 other recent *E. coli* O157s from Northern Ireland and 186 *E. coli* O157 strains from England and Wales (total=275). By aligning the sequenced genomes against a common reference strain, single nucleotide polymorphisms (SNPs) could be identified to illustrate the phylogenetic relationships (that is based on the evolutionary ancestry) between the strains.

9.16 The 53 Flicks related strains from October typed as a closely related group which included both the strains phage typed as PT54s and those phage typed as PT31s. The six August strains of phage type 8 (four with a known association with Flicks and two others) typed as a separate but very closely related group. Phylogenetically the October strains were not derived from the August group but the two groups share a common ancestor which may have differentiated along two different lines within a few months prior to August 2012. No August or August-derived strains were seen in the October incident.

9.17 The 59 strains were very different from the other sporadic NI strains. The strains in the Colindale collection typing most closely to the Flicks strains came from travel-related cases following visits to North Africa or Eastern Mediterranean. This related to only a few cases and the European Centre for Disease Prevention and Control (ECDC) were not aware of any PT54 problems in member states.

Food, Water and Environmental Samples (Appendix 2)

9.18 There were a total of 20 food samples and 14 environmental swabs taken from Flicks during the August investigation (some were taken in September 2012).

9.19 There were a total of 15 food samples, 25 water samples and 77 environmental swabs taken during the October investigation from Flicks restaurant. In addition a kitchen porter's apron and two samples of cleaning clothes were also taken (some taken in November).

9.20 None of the samples of the food, water, environment, apron or clothes yielded an isolate of *E. coli* O157.

9.21 The examination results from a sample of **cooked rice** from 10th October 2012 showed the following unsatisfactory or borderline results:

- Aerobic colony count (at 30^{o}C/48hrs) >$1.0X10^{8}$ cfu/g (unsatisfactory)
- *E. coli* $4.0x10^{1}$ cfu/g (borderline)
- Enterobacteriaceae $6.7x10^{4}$ cfu/g (unsatisfactory)
- Salmonella*, E. coli* O157 not detected
- *Bacillus cereus, Bacillus* species, *Clostridium perfringens, Listeria* species, *Staphylococcus aureus* within satisfactory limits.

The Food Examiner's Certificate of Examination stated 'High ACC suggests prolonged storage and/or temperature abuse. Low *E. coli* count indicates post-cooking contamination. Not *E. coli* O157'.

9.22 A sample of **cooked gammon** from 10th October 2012 showed:

- *E. coli* $2.0x10^{1}$ cfu/g (Borderline)
- Salmonella, *E. coli* O157 not detected

- Aerobic colony count (at 30^{o}C/48hrs), *Bacillus cereus, Bacillus* species, *Clostridium perfringens*, Enterobacteriaceae, *Listeria* species, *Staphylococcus aureus* within satisfactory limits.

The Food Examiner's Certificate of Examination stated 'Low *E. coli* count indicating post-cooking contamination. Not *E. coli* O157'.

9.23 A sample of **chopped flat leaf parsley** from 10th October 2012 showed:

- *E. coli* 1.2x10^{5} cfu/g (unsatisfactory)
- Salmonella, *E. coli* O157 not detected
- Aerobic colony count (at 30^{o}C/48hrs), *Bacillus cereus, Bacillus* species, *Clostridium perfringens*, Enterobacteriaceae, *Listeria* species, *Staphylococcus aureus* within satisfactory limits.

The Food Examiner's Certificate of Examination stated 'High *E. coli* result indicates recent faecal contamination. Not *E. coli* O157. ACC and enterobacteriaceae counts are higher than normal and suggest inadequate washing'.

9.24 A sample of **cooked chicken** from 10th October 2012 showed:

- Aerobic colony count (at 30^{o}C/48hrs) >1.9X10^{6} cfu/g (borderline)
- Salmonella, *E. coli* O157 not detected
- *Bacillus cereus, Bacillus* species, *Clostridium perfringens*, Enterobacteriaceae, *Listeria* species, *Staphylococcus aureus* within satisfactory limits.

The Food Examiner's Certificate of Examination stated 'Borderline – raised ACC'.

9.25 Three samples of parsley from the distributor / supplier on 16th October and two samples from 22nd October 2012 were found to be satisfactory with *E. coli* O157 not detected.

Discussion

9.26 Two of the Flicks staff members had positive results for *E. coli* O157. The OCT was unable to determine when and how these individuals became colonised / infected and therefore could not definitively determine what contribution the positive staff members had in the October outbreak.

9.27 There were 4 PT8s in August associated with the restaurant and the outbreak in October associated with the restaurant was mainly PT54. Initial interpretation of this was that they were two separate events. However, when the VNTR results became available there was a high degree of similarity between the August and October cases, despite the different phage types. This result was difficult to interpret and HPA expert advice was that Whole Genome Sequencing could possibly clarify the typing results.

9.28 WGS clarified that the October strains were not derived from the August group but the two groups share a common ancestor. As no August or August-derived strains were seen in the October incident it is likely that the actions taken to control the August outbreak were successful but emergence of a second (related) strain in October suggests that both incidents shared a common ultimate source for the introduction of the *E. coli* O157 strain onto the Flicks premises.

9.29 The strains from August and October are very different from usual Northern Ireland *E. coli* O157 strains on WGS. The strains in the Reference laboratory, Colindale collection typing most closely to the Flicks strains came from a small number of travel-related cases following visits to North Africa or Eastern Mediterranean. This raises the possibility that a foodstuff deriving from North Africa or the Eastern Mediterranean area could have been the initial source of the *E. coli* O157 introduced to the restaurant. During the outbreak investigation it was determined that the parsley supplied to Flicks originated in Eastern or Western Mediterranean.

9.30 The high ACC result from the cooked rice sample suggests prolonged storage or temperature abuse and the *E. coli* indicates post cooking contamination. The results from the gammon also showed post cooking contamination. The *E. coli* result from the chopped flat leaf parsley indicates heavy faecal contamination and the ACC and enterobacteriaceae counts suggested inadequate washing.

9.31 The parsley was used as a garnish for many of the dishes and was sprinkled onto dishes by a staff member as the dish left the kitchen. The samples from the supplier / distributor did not show *E. coli* O157 in the samples taken on 16th October 2012 and 22nd October 2012. However, the unsatisfactory result from the sample from the restaurant suggests that the parsley was contaminated either prior to arrival at the restaurant and not adequately washed or at the restaurant, either through poor hand hygiene practices or cross contamination from another foodstuff. The parsley from this supplier was distributed elsewhere in Northern Ireland and there were no other clusters / outbreaks of *E. coli* O157 associated with any other food premises.

Conclusion

9.32 All staff members submitted faecal samples and two were positive for *E. coli* O157.

9.33 140 cases were confirmed by the Reference laboratory, Colindale and one was 'NI confirmed'.

9.34 Cooked rice, gammon and parsley showed evidence of varying levels of faecal contamination.

9.35 Initially as the two outbreaks were different phage types (PT8 and PT54) the OCT had considered that the two events were not directly related. However, Whole Genome Sequencing of 59 outbreak strains (PT8/PT31/PT54) revealed :

- The outbreak strains are genetically distinct from the usual Northern Irish strains;
- The August PT8 (four associated with Flicks and two others – see 5.84) strains are identical and distinct from the October PT54 strains;
- The October PT54 strain did not arise from the August PT8 strains but they both share a common recent ancestor;
- There is no difference between PT54/PT31 in the October 2012 cluster.

10. Control Measures

Structure

10.1 The OCT was chaired by PHA with representatives from Belfast City Council, Belfast Trust Microbiology and Food Standards Agency. Membership is listed in Appendix 1.

10.2 There was extensive liaison between members of the OCT and HPA colleagues outside the formal OCT meetings.

Prevention

10.3 The Food Business Operator voluntarily closed on the recommendation of the OCT at 18.10 on 11th October 2012. All high risk food from the restaurant was disposed of by a licensed company.

10.4 All staff members submitted faecal samples and were advised not to work at any other food premises until they had provided two consecutive negative faecal samples taken a minimum of 24 hours apart. When screening requirements were met, PHA wrote to the staff advising such.

10.5 The PHA established an EOC to co-ordinate and manage the response to cases. Case finding was through media releases. Those who contacted the EOC, had symptoms and had eaten at Flicks were advised to submit samples via their GP. Questionnaires were completed on these cases by PHA staff and EHOs. The cases and their contacts were advised and excluded according to the HPA VTEC Operational Guidance pending faecal sample results. Positive cases and their contacts who required clearance samples were followed up by PHA staff within the EOC.

10.6 The OCT reviewed information on food history and the outcomes of the case-control study analysis at each OCT meeting to identify food items which may require more extensive follow up.

Information

10.7 On Saturday 13th October 2012, the PHA issued a press statement on behalf of the OCT and with the agreement of the Food Business Operator, naming the restaurant and asking

anyone with symptoms who had eaten at the restaurant since the 24th September 2012 to contact their GP. The PHA, on behalf of the OCT, issued a further 16 press statements in relation to the outbreak.

10.8 The EOC circulated a daily situation report to update on the response.

10.9 PHA sent information on the outbreak to GPs and Out-of-Hours, other Environmental Health colleagues, Health and Social Care Trusts, Residential and Nursing Homes, Education and Library Boards, Early Years Teams. PHA kept DHSSPS updated on the outbreak and the Director of Public Health attended the Health Committee along with representatives from Belfast City Council and Food Standards Agency.

10.10 FSA in NI actions:

- On 22/10/12 the FSA in NI held a scoping group meeting with members of the Food Industry trade organisations in Northern Ireland. During this meeting the FSA requested that trade organisations contact their members to remind them of the FSA's guidance document 'Food Handlers: Fitness to Work'.

- On 22/10/12 the FSA in NI requested that all 26 district councils in NI send an advisory letter to all food businesses in their area to make them aware of their legal obligations regarding symptomatic Food Handlers.

- On 23/10/12 the FSA in NI contacted all approved slaughterhouses, cutting plants and game handling establishments in Northern Ireland reminding Food Business Operators of the FSA's guidance document 'Food Handlers: Fitness to Work'.

- On this date the FSA web page was also updated to include a 'Reminder to food handlers with food poisoning'. The web page also highlighted the Agency's guidance for 'Food Handlers: Fitness to Work'.

11. Discussion

11.1 This report describes an outbreak of *E. coli* O157 associated with Flicks restaurant in Belfast in October 2012.

11.2 This was the largest *E. coli* O157 outbreak ever reported in Northern Ireland with 141 cases of *E. coli* O157 (PT54 / PT31 / PT33) and 159 other symptomatic individuals. Two of the confirmed cases were staff members of Flicks restaurant. All confirmed and probable cases had either eaten at Flicks restaurant within the incubation period or been close contacts of cases who had eaten at Flicks. There was no other association identified between the confirmed and probable cases other than eating at Flicks restaurant.

11.3 The primary and co-primary confirmed cases had eaten at Flicks restaurant during the period 2nd October 2012 until 11th October 2012, when the restaurant closed. However, the period of risk may extend further back than this as some symptomatic individuals reported eating at Flicks restaurant from 15th September 2012. The probable and confirmed cases are similar in terms of age, gender and incubation periods although the probable cases were less likely to complain of bloody diarrhoea and less likely to have attended or been admitted to hospital.

11.4 All isolates from confirmed cases were *E. coli* O157 phage type 54, 31 or 33. The PT54 and PT31 types that were sequenced were shown to be indistinguishable by WGS. *E. coli* O157 was not isolated from food, water or environmental samples although a small number of food samples had faecal contamination indicator organisms.

11.5 During September to December 2012 there were 15 sporadic cases of *E. coli* O157 (i.e. not associated with an outbreak) notified to PHA and only one of these cases was PT54. This case had no obvious epidemiological link to the outbreak. There were no other concurrent *E. coli* O157 PT54 clusters linked with food reported within the UK, Ireland or Europe. Further evidence that this outbreak appears to have been confined to Flicks restaurant is provided by the outbreak being brought rapidly under control by voluntary closure of the restaurant.

11.6 The systems supplying water and air to the restaurant were investigated and on consideration of the findings the OCT agreed that they were not likely to be the source or vehicle of spread of the contamination (see section 8.32). The OCT therefore considered

2 main hypotheses for the **source** of the outbreak– that the source of the outbreak was a contaminated food or the source was a colonised / infected staff member.

Hypothesis 1 – contaminated food was the source of the outbreak

11.7 This is plausible as there are recorded outbreaks of *E. coli* O157 associated with different food types. The WGS results show that the strains from the August cases and the October cases have a similar genetic ancestor but that October cases did not derive directly from the August cases and the October cases are not typical of the Northern Ireland strains on the WGS database. This appears to support the hypothesis that a contaminated food, either delivered into the restaurant from the same supply but separated by a period of time or a long shelf life product containing both strains, could be the source. None of the food or water samples from the premises were positive for *E. coli* O157 so there was no confirmed microbiological link. However it is not unusual in food borne outbreaks that the organism is not detected in food and water samples.

11.8 With the exception of a few raw meat items, all the foods supplied into the restaurant were from large suppliers with a wide distribution and yet there were no other concurrent *E. coli* O157 PT54 outbreaks reported. Even the smaller raw meat supplier supplied to several other local businesses. Therefore the two episodes in the one restaurant with no other cases or clusters in NI or the UK, would reduce the likelihood that a contaminated food introduced to the restaurant could have been the source in both outbreaks. However it is still plausible that the low level intermittent contamination of a widely distributed food item(s) could potentially be the source. Poor handling practices, including inadequate hand washing, lack of temperature control and inadequate product washing, may have increased the risk in this restaurant.

11.9 The case control study identified the serving / consumption of chopped parsley, served on many of the dishes as a garnish, as having a statistically significant association with illness. This could potentially mean that parsley was the source of *E. coli* O157 into the restaurant or that parsley acted as a vehicle for spread as a result of contamination within the restaurant. Although no *E. coli* O157 was isolated, the parsley did show evidence of contamination with other faecal indicator organisms (appendix 2). As this sample was taken after preparation in the restaurant, it is not clear whether contamination occurred before or after arrival into the restaurant. This association is potentially supported by the findings of WGS and investigations into the possible source of the parsley. The parsley

supplied to the restaurant was from either Western or Eastern Mediterranean regions and the results of the WGS did indicate that the outbreak strains typed most closely to a small number of isolates of *E. coli* O157 on the HPA database associated with travel to North Africa or the Eastern Mediterranean. On the other hand, the parsley was widely distributed and again, as discussed above, two episodes in the one restaurant with no cases or clusters in NI or the UK would seem to reduce the plausibility that a contaminated food introduced to the restaurant could have been the source of both outbreaks but does not rule it out. Finally, a significant caveat to the association with parsley is that it is unclear whether the use of parsley was continuous over the entire period of the outbreak.

Hypothesis 2 – a colonised / infected staff member was the source of the outbreak

11.10 All staff members submitted faecal samples in October 2012 and two tested positive for the October outbreak strain. One staff member was asymptomatic whilst the restaurant was open and the other (Food Handler 1) had on-going enteric symptoms. It is plausible that a positive staff member could be the source of *E. coli* O157 into the restaurant and the absence of any outbreaks elsewhere is consistent with this hypothesis. However, it was not possible to define the date from which the staff members began to excrete the organism. Food Handler 1 who had on-going enteric symptoms did suffer an episode of severe diarrhoea whilst at work on 28th September 2012 but it was also noted that this staff member was not working in the restaurant at the time of the August outbreak.

11.11 The evidence that the PT8 strains have unique SNPs (see 9.15) not identified in any strains of the October PT54/31 cluster indicated that the October PT54/31 cluster did not evolve from the August PT8 strain. The WGS analysis suggests that the strains from cases in August and October were introduced in to the restaurant by two different events but shared a common genetic ancestor. Alternatively a single source introduced into the restaurant in August, for example a food or an asymptomatic carrier, comprising or carrying strains belonging to PT8, PT31 and PT54, remained in the restaurant but that, by co-incidence different phage types were involved in August and October outbreaks. The latter option seems less likely as strains belonging to the PT8 would be expected to be detected in the cases associated with the October outbreak. Furthermore the WGS results indicated that the strains associated with the outbreak were different from other NI strains. This makes it unlikely that two such closely related, non-typical NI strains were introduced to the restaurant by different individuals on two separate occasions.

11.12 The OCT, having considered the above hypotheses, could not definitively conclude if the source of *E. coli* O157 into the restaurant was food or a colonised / infected staff member. However the WGS results would suggest a greater likelihood that contaminated food was the source.

11.13 The OCT also considered two further hypotheses: that the vehicle for spread of *E. coli* O157 was food; and a colonised / infected Food Handler increased the spread of the organism.

Hypothesis 3 – vehicle for spread of the organism was food

11.14 Food as a vehicle of spread is plausible and the case control study identified the serving / consumption of parsley as being significantly associated with illness. While the multivariate analysis of all diners showed no independent statistically significant link to any other food stuff, from the analysis of early diners it would be reasonable to conclude there is some evidence of contamination of other foods. However, as already discussed there are important limitations to the case control study (see section 7) including whether the parsley was available during the entire duration of the outbreak. Nevertheless it was noted that the parsley was a widely used garnish in the restaurant, it was handled extensively and there was inadequate temperature control and the washing carried out at Flicks may not have been sufficient to reliably remove the risk of E. coli O157 contamination. Although *E. coli* O157 was not identified in any of the food or environmental samples, four food samples (see section 9) were found to be microbiologically unsatisfactory or borderline. This included the chopped parsley which had faecal indicator organisms at an unsatisfactory level.

Hypothesis 4 – a colonised / infected Food Handler could have increased the spread of the organism

11.15 Two staff members tested positive for *E. coli* O157 PT54 and Food Handler 1 had a pre-existing medical condition with a history of enteric symptoms over several months with a severe episode of diarrhoea whilst at work on 28th September 2012. The analysis by Food Handler likely to have garnished the food showed there is a statistically significant association between being a case and having a meal garnished by the colonised / infected Food Handler 1, supporting the hypothesis. In addition from the analysis of early diners there is some evidence to suggest a statistical association with other foods. This was

supported by observed deficiencies in staff hand washing facilities that may have increased this risk. However, as noted in section 7, there are significant limitations to these analyses. Furthermore, the dates of acquisition of the organism by the positive staff members are not known and acquisition may have been at any point, including after the other cases became infected.

11.16 Considering the above hypotheses, the OCT concluded that food was the likely vehicle of spread of the organism within the restaurant with some evidence to implicate parsley. A colonised / infected Food Handler may have contributed to the spread of the organism.

Conclusion

11.17 The OCT considered the source was either a contaminated food stuff or a colonised / infected staff member. However, the OCT could not definitively determine the source of the *E. coli* O157 into the restaurant in August or October 2012. The WGS results would suggest a greater likelihood that contaminated food was the source.

11.18 The OCT considered that food was the vehicle of spread of E. coli O157 within the restaurant, with some evidence to implicate parsley during the October outbreak but with significant caveats.

11.19 It is plausible that Food Handler 1 who tested positive for the October outbreak strain of *E. coli* O157 and had enteric symptoms, including a severe episode of diarrhoea on 28th September 2012 whilst at work at the restaurant, may have contributed to the spread. The statistically significant association between being a case and having a meal garnished by Food Handler 1 would support this hypothesis. However, due to Food Handler 1's pre-existing medical condition the date of colonisation / infection could not be definitively determined and may have occurred at any time including after the other cases became infected.

11.20 It is likely that poor practices within the restaurant contributed to the spread of E. coli O157.

12. Recommendations

12.1 Food business operators should put in place and implement the FSA's *E. coli* O157 Guidance – E. coli O157 Control of Cross-Contamination - Guidance for Food Business Operators and Enforcement Authorities.

12.2 Food business operators should retain reliable, easily retrievable records to aid traceability of batches of food handled.

12.3 Manufacturers, packers and suppliers must clearly label pre-packed vegetables as ready to eat or raw with instructions for adequate washing to remove contamination.

12.4 Caterers should have awareness that unless vegetables are supplied to them as ready-to-eat, it should be assumed that they are not. Pre-packed vegetables that are labelled as ready to eat should not be re-washed as this may introduce contamination.

12.5 Unwashed vegetables, particularly those which are visibly contaminated by soil should be considered as potential sources of E. coli O157. Washing will help to remove bacteria including E.coli and can be done effectively by rubbing the vegetables vigorously in clean water and then rinsing.

12.6 Cut ready to eat vegetables should be kept refrigerated.

12.7 These recommendations should be re-enforced through targeted advice by the FSA to food businesses and consumers.

12.8 In future outbreaks the need for whole genome sequencing should be considered as early as possible.

12.9 Consideration should be given to the introduction of legislation to make it compulsory for food handlers to submit faecal samples on request by an appropriate authority.

12.10 Consideration should be given to a UK co-ordinated survey of imported fresh parsley and other fresh garnishes.

Appendix 1: Organisations and Individuals on the Outbreak Control Team (OCT) and the Incident Control Teams

Dr Louise Herron	Chair, Consultant in Health Protection, PHA
Dr Brian Smyth	Acting Assistant Director of Health Protection, PHA
Dr Neil Irvine	Consultant in Health Protection, PHA
Dr Lourda Geoghegan	Consultant in Health Protection, PH A
Mr Damian Connolly	Environmental Health Manager (Food Safety and Port Health) Belfast City Council
Mr Ian Lee	Principal EHO, Belfast City Council
Ms Helen Morrissey	Senior EHO, Belfast City Council
Dr Paul Rooney	Consultant Microbiologist Belfast Health and Social Care Trust
Dr Martin Brown	Microbiology SpR, Belfast Health and Social Care Trust
Dr Fadwa Elsanousi	Microbiology SpR, Belfast Health and Social Care Trust
Mrs Maria Jennings	Food Standards Agency
Dr Susanne Boyd	Food Standards Agency
Mr Craig Leeman	Food Standards Agency

The following individuals also represented the core OCT organisations at some OCT meetings:

Dr Carolyn Harper	Director of Public Health, PHA
Ms Hilary Byrne	Senior EHO, Belfast City Council
Ms Kara McMillan	Senior EHO, Belfast City Council
Mr Tom Crossan	Principal EHO, Belfast City Council
Mr Drew McClennaghan	Principal EHO, Belfast City Council
Ms Nora Largey	Solicitor, Belfast City Council

The OCT gratefully acknowledges the support of colleagues from the Health Protection Agency in England:

Dr Bob Adak, Dr Claire Jenkins, Dr Tim Dallman, Andre Charlett, Neville Verlander

Appendix 2: Food, Water and Environmental Samples

DATE in 2012	SAMPLE	SAMPLE DESCRIPTION	RESULT
Thursday 14th June	807/E/43852	Coleslaw	Borderline
Thursday 14th June	807/E/43853	Lettuce	Borderline
Thursday 14th June	807/E/43854	Cooked Long Grain Rice	Satisfactory
Thursday 14th June	807/E/43855	Sweet Chilli Chicken Stir Fry	Satisfactory
Friday 24th August	807/E/44166	Coleslaw	Satisfactory*
Friday 24th August	807/E/44167	Cooked Chicken	Satisfactory*
Friday 24th August	807/E/44168	Cooked Deli Ham	Satisfactory*
Friday 24th August	807/E/44169	Sour Cream	Satisfactory*
Friday 24th August	807/E/44170	Cooked Beef Burger	Satisfactory*
Friday 24th August	807/E/44171	Cajun Chicken	Satisfactory*
Friday 24th August	807/E/44172	Cooked Chicken fillet Burger	Satisfactory*
Friday 24th August	807/E/44173	Sautee Garlic Potatoes	Satisfactory*
Friday 24th August	807/E/44174	Lettuce	Satisfactory*
Friday 24th August	807/E/44175	Chicken fillet (Plain)	Satisfactory*
Friday 24th August	807/E/44176	Grated Cheese	Satisfactory*
Friday 24th August	807/E/44177	Swab - WHB taps @ Double Sink	Satisfactory*
Friday 24th August	807/E/44178	Swab - Handle door of walk in Chill	Satisfactory*
Friday 24th August	807/E/44179	Swab - Handle door of Raw bench Chill	Satisfactory*
Friday 24th August	807/E/44180	Swab - Ready To Eat service counter bench	Satisfactory*
Friday 24th August	807/E/44181	Swab - Mixer	Satisfactory*
Friday 24th August	807/E/44182	Swab - Handles to the Serve Over Counter Chill	Satisfactory*
Friday 24th August	807/E/44183	Swab - Handle door of Microwave	Satisfactory*
Friday 24th August	807/E/44184	Swab - Probe Thermometer	Satisfactory*
Wednesday 29th August	807/E/44194	Raw Gourmet Burger	Satisfactory*
Wednesday 29th August	807/E/44195	Frozen Burger	Satisfactory*
Monday 3rd Sept Burger supplier	**807/E/44259**	**Processed Beef Burger**	**Satisfactory***
Monday 3rd Sept Burger supplier	**807/E/44260**	**Raw Steak Pieces**	**Satisfactory***
Monday 3rd Sept Burger supplier	**807/E/44261**	**Processed Mince Steak**	**Satisfactory***
Monday 3rd September	807/E/44245	Beef Burger	Satisfactory*
Monday 3rd September	807/E/44246	Cooked Mushrooms	Satisfactory*
Monday 3rd September	807/E/44247	Onion	Satisfactory*
Monday 3rd September	807/E/44248	Mixed Salad	Satisfactory*
Monday 3rd September	807/E/44249	Mayonnaise	Satisfactory*
Monday 3rd September	807/E/44250	Grated Cheese	Satisfactory*
Monday 3rd September	807/E/44251	Raw Mushrooms	Satisfactory*
Monday 3rd September	807/E/44252	Swab - WHB taps @ Servery	Satisfactory*
Monday 3rd September	807/E/44253	Swab - Meat Tongs	Satisfactory*
Monday 3rd September	807/E/44254	Swab - Ready To Eat Preparation Bench	Satisfactory*
Monday 3rd September	807/E/44255	Swab - Door Handle to Walk in Chill	Satisfactory*
Monday 3rd September	807/E/44256	Swab - Yellow Ready to Eat Board	Satisfactory*
Monday 3rd September	807/E/44257	Swab - Raw Bench Chill Door Handles	Satisfactory*

DATE in 2012	SAMPLE	SAMPLE DESCRIPTION	RESULT
Wednesday 10th October	807/E/44448	Coleslaw	Satisfactory
Wednesday 10th October	807/E/44449	Garlic Mayonnaise	Satisfactory
Wednesday 10th October	807/E/44450	Mixed Salad	Satisfactory
Wednesday 10th October	807/E/44451	Chopped Flat leaf Parsley	Unsatisfactory
Wednesday 10th October	807/E/44452	Grated Cheese	Satisfactory
Wednesday 10th October	807/E/44453	Peppered Sauce	Satisfactory
Wednesday 10th October	807/E/44454	Gravy	Satisfactory
Wednesday 10th October	807/E/44455	Cooked Chicken	Borderline
Wednesday 10th October	807/E/44456	Cooked Rice	Unsatisfactory
Wednesday 10th October	807/E/44457	Baby Boiled Potatoes	Satisfactory
Wednesday 10th October	807/E/44458	Cooked Gammon	Borderline
Tuesday 16th October Parsley supplier	**819/E/12/316**	**E.F.K. (Flat Leaf Parsley)**	**Satisfactory****
Tuesday 16th October Parsley supplier	**819/E/12/317**	**K.H.I. (Flat Leaf Parsley)**	**Satisfactory****
Tuesday 16th October Parsley supplier	**819/E/12/318**	**T.P. (Flat Leaf Parsley)**	**Satisfactory****
Wednesday 17th October	807/E/44488	Pepper	Satisfactory*
Wednesday 17th October	807/E/44489	Table Salt	Satisfactory*
Wednesday 17th October	807/E/44490	Water Sample - Tap Water from Sink behind Bar (Mains)	Satisfactory*
Wednesday 17th October	807/E/44491	HP Sauce (Brown)	Satisfactory*
Wednesday 17th October	807/E/44492	Ice from Ice Machine	Satisfactory*
Wednesday 17th October	807/E/44493	Water Sample - Hot Water from WHB in Kitchen	Satisfactory*
Wednesday 17th October	807/E/44494	Water Sample - Vegetable Sink in Kitchen	Satisfactory*
Thursday 18th October	807/E/44499	Swab - Inside door handle & lock of Staff WC 1	Satisfactory*
Thursday 18th October	807/E/44500	Swab - WHB taps of Staff WC 1	Satisfactory*
Thursday 18th October	807/E/44501	Swab - WC handle of Staff WC 1	Satisfactory*
Thursday 18th October	807/E/44502	Swab - Inside door handle & lock of Staff WC 2	Satisfactory*
Thursday 18th October	807/E/44503	Swab - WHB taps of Staff WC 2	Satisfactory*
Thursday 18th October	807/E/44504	Swab - WC handle of Staff WC 2	Satisfactory*
Thursday 18th October	807/E/44505	Swab - Staff WC light Switch	Satisfactory*
Thursday 18th October	807/E/44506	Swab - Staff WC door handle (inside)	Satisfactory*
Thursday 18th October	807/E/44507	Swab - Outside door handle of Dry Goods Store	Satisfactory*
Thursday 18th October	807/E/44508	Swab - Corridor Door	Satisfactory*
Thursday 18th October	807/E/44509	Swab - Kitchen Door	Satisfactory*
Thursday 18th October	807/E/44510	Swab - WHB 1	Satisfactory*
Thursday 18th October	807/E/44511	Swab - WHB 2	Satisfactory*
Thursday 18th October	807/E/44512	Swab - Vegetable Sink taps	Satisfactory*
Thursday 18th October	807/E/44513	Swab - Walk in Chill handle	Satisfactory*
Thursday 18th October	807/E/44514	Swab - Grill Handles	Satisfactory*
Thursday 18th October	807/E/44515	Swab - Front of House WHB taps	Satisfactory*
Thursday 18th October	807/E/44516	Swab - Condiments fridge handle	Satisfactory*
Thursday 18th October	807/E/44517	Swab - Ice Machine handle	Satisfactory*
Thursday 18th October	807/E/44518	Swab - WHB taps in drinks room	Satisfactory*

DATE in 2012	SAMPLE	SAMPLE DESCRIPTION	RESULT
Thursday 18th October	807/E/44519	Water Sample - Staff WHB in WC	Satisfactory*
Thursday 18th October Burger supplier	**807/E/44524**	**Raw Chicken Fillet**	**Satisfactory***
Thursday 18th October Burger supplier	**807/E/44525**	**Raw Minced Beef**	**Satisfactory***
Thursday 18th October Burger supplier	**807/E/44526**	**Raw Chump Steak**	**Satisfactory***
Friday 19th October	807/E/44527	Swab - Floor outside Service lift	Satisfactory*
Friday 19th October	807/E/44528	Swab - Inside door handles to Smoking exit door	Satisfactory*
Friday 19th October	807/E/44529	Swab - Outside door handle of Flicks rear exit door	Satisfactory*
Friday 19th October	807/E/44530	Swab - Lip & Side of green bin	Satisfactory*
Friday 19th October	807/E/44531	Swab - Roll cage outside Flicks rear exit door (Coke bottles)	Satisfactory*
Monday 22nd October Parsley supplier	**819/E/12/324**	**T.P. (Flat Leaf Parsley)**	**Satisfactory****
Monday 22nd October Parsley supplier	**819/E/12/325**	**K.H.I. (Flat Leaf Parsley)**	**Satisfactory****
Wednesday 24th October	807/E/44536	Swab - Raw Shelves in Walk in Chill	Satisfactory*
Wednesday 24th October	807/E/44537	Swab - Grey Container used to store Parsley(at dishwash area)	Satisfactory*
Wednesday 24th October	807/E/44538	Swab - Shelves in Walk in Chill @ Raw Storage Area	Satisfactory*
Wednesday 24th October	807/E/44539	Swab - Shelves in Walk in Freezer	Satisfactory*
Wednesday 24th October	807/E/44540	Swab - Walls in Walk in Freezer	Satisfactory*
Wednesday 24th October	807/E/44541	Swab - Stainless steel bench for Raw Prep	Satisfactory*
Wednesday 24th October	807/E/44542	Swab - Raw Veg Prep Bench (s/s)	Satisfactory*
Wednesday 24th October	807/E/44543	Swab - Chopping Boards Rack	Satisfactory*
Wednesday 24th October	807/E/44544	Swab - Back step at Smoking Area	Satisfactory*
Wednesday 24th October	807/E/44545	Swab - Red Chopping Board on Rack	Satisfactory*
Wednesday 24th October	807/E/44546	Swab - Brown Chopping Board on Rack	Satisfactory*
Wednesday 24th October	807/E/44547	Swab - Shelves & Walls of fridge 2 below microwaves	Satisfactory*
Wednesday 24th October	807/E/44548	Swab - Shelves & Walls of fridge below Serve Over	Satisfactory*
Wednesday 24th October	807/E/44549	Swab - Liquid in base of Bain Marie @ Service Hatch	Satisfactory*
Wednesday 24th October	807/E/44550	Swab - Surface along lights at the Service Hatch (Top)	Satisfactory*
Wednesday 24th October	807/E/44551	Swab - Stainless steel area beside Bain Marie	Satisfactory*
Wednesday 24th October	807/E/44552	Swab - Door Handle & door to plate hot Cupboard	Satisfactory*
Wednesday 24th October	807/E/44553	Swab - Switches and base of Bain Marie	Satisfactory*
Wednesday 24th October	807/E/44554	Swab - Order Printer in Kitchen	Satisfactory*
Wednesday 24th October	807/E/44555	Swab - Kitchen light	Satisfactory*
Wednesday 24th October	807/E/44556	Water Sample - WHB behind bar	Satisfactory*
Wednesday 24th October	807/E/44557	Water Sample - WHB in womens WC	Satisfactory*
Wednesday 24th October	807/E/44558	Water Sample - WHB in mens WC	Satisfactory*

DATE in 2012	SAMPLE	SAMPLE DESCRIPTION	RESULT
Wednesday 24th October	807/E/44559	Water Sample - WHB in disabled WC	Satisfactory*
Wednesday 24th October	807/E/44560	Water Sample - WHB in staff WC 1	Satisfactory*
Wednesday 24th October	807/E/44561	Water Sample - WHB in staff WC 2	Satisfactory*
Wednesday 24th October	807/E/44562	Water Sample - WHB in kitchen beside hatch	Satisfactory*
Wednesday 24th October	807/E/44563	Water Sample - Veg Sink in Kitchen	Satisfactory*
Wednesday 24th October	807/E/44564	Water Sample - WHB in dishwash area	Satisfactory*
Wednesday 24th October	807/E/44565	Ice Machine	Satisfactory*
Wednesday 24th October	807/E/44566	Water Sample - WHB in drinks store	Satisfactory*
Wednesday 24th October	807/E/44567	Water Sample - Mop Sink	Satisfactory*
Wednesday 24th October	807/E/44568	Water Sample - WHB beside equipment sink in Kitchen	Satisfactory*
Wednesday 24th October	807/E/44569	Food sample - Seasame Seeds	Satisfactory*
Friday 26th October	807/E/44615	Water Sample - WHB @ hatch in Kitchen	Satisfactory*
Friday 26th October	807/E/44616	Water Sample - Veg Sink in Kitchen	Satisfactory*
Friday 26th October	807/E/44617	Water Sample - WHB in ladies WCs	Satisfactory*
Friday 26th October	807/E/44618	Water Sample - WHB behind Bar	Satisfactory*
Friday 26th October	807/E/44619	Water Sample - WHB in staff WC 1	Satisfactory*
Friday 26th October	807/E/44620	Water Sample - WHB in staff WC 2	Satisfactory*
Friday 26th October	807/E/44621	Ice Machine	Satisfactory*
Friday 2nd November	807/E/44625	Swab - Air Vent above bar area	Satisfactory*
Friday 2nd November	807/E/44626	Swab - Vent in 1	Satisfactory*
Friday 2nd November	807/E/44627	Swab - Vent in 2	Satisfactory*
Friday 2nd November	807/E/44628	Swab - Vent in 3	Satisfactory*
Friday 2nd November	807/E/44629	Swab - Air Con 8A	Satisfactory*
Friday 2nd November	807/E/44630	Swab - Air Con 8B	Satisfactory*
Friday 2nd November	807/E/44631	Swab - Air Vent in Ice Machine Room	Satisfactory*
Friday 2nd November	807/E/44632	Swab - Air Con in Kitchen	Satisfactory*
Friday 2nd November	807/E/44633	Swab - Vents in female WC	Satisfactory*
Friday 2nd November	807/E/44634	Swab - Vents in male WC (Customer)	Satisfactory*
Friday 2nd November	807/E/44635	Swab - Vents in disabled WC (Customer)	Satisfactory*
Friday 2nd November	807/E/44636	Swab - Vent in staff WCs	Satisfactory*
Friday 2nd November	807/E/44637	Swab - Vent in dishwash area	Satisfactory*
Friday 2nd November	807/E/44638	Swab - Mop Bucket	Satisfactory*
Friday 2nd November	807/E/44639	Swab - Kitchen Vents	Satisfactory*
Friday 2nd November	807/E/44640	KP Apron	Satisfactory*
Friday 2nd November	807/E/44641	Cloth hanging in staff changing area	Satisfactory*
Friday 2nd November	807/E/44642	Cloths from black bin liners	Satisfactory*
Friday 2nd November	807/E/44643	Swab - Mop Handle	Satisfactory*
Friday 2nd November	807/E/44644	Swab - Mop & Handle Service Sink Area	Satisfactory*
Friday 2nd November	807/E/44645	Swab - Mop bucket under coffee machine	Satisfactory*

Total number of samples - 155

See over page for key.

Sample Key:

Total number of samples - 155

Satisfactory – when tested for range of organisms.
Satisfactory* - satisfactory but only tested for *E. coli* O157.
Satisfactory** - satisfactory but only tested for *E. coli* O157 and *E. coli.*
Borderline and unsatisfactory results are discussed in the body of the report (See 8.20 & 9.19)

50 - Food samples
- 4 (June)
- 20 (August/September)
- 15 (October),
- 6 (Burger Supplier)
- 5 (Parsley Supplier)

77 - Swabs
25 - Water and Ice
2 – Clothes
1 - Apron

Appendix 3: Table of Northern Ireland *E. coli* O157 Phage types from 2008 to 2012

Phage type	2008	2009	2010	2011	2012	Total
PT 1	0	0	1	0	1	2
PT 14	0	0	0	0	1	1
PT 2	1	0	0	0	1	2
PT 21/28	4	1	2	6	3	16
PT 31	21	9	2	3	14	49
PT 32	10	11	14	11	20	66
PT 33	3	0	0	0	1	4
PT 34	0	0	6	0	0	6
PT 4	0	0	0	1	0	1
PT 43	2	0	0	0	0	2
PT 51	0	1	0	4	0	5
PT 54	0	0	0	1	135	135
PT 8	8	8	34	19	14	83
PT 89	0	0	0	0	1	1
RDNC	0	1	2	2	1	6
Untyped	10	17	16	9	6	58
Total	**59**	**48**	**77**	**56**	**198**	**438**

RDNC = reacts but does not conform

Appendix 4: Initial Press Release

Saturday, 13 October 2012 - 6:09pm – Health Protection

The Public Health Agency (PHA) is investigating an outbreak of E. coli O157 linked to Flicks restaurant in Cityside Mall, 100-150 York Street, Belfast.

Health Protection staff from the PHA are currently working with Environmental Health Officers from Belfast City Council to investigate the outbreak. At this stage, ten confirmed or suspected cases have been identified.

The management of Flicks have voluntarily closed the premises and are cooperating with the investigation.

The PHA has advised that anyone who ate at Flicks restaurant since 24 September and has symptoms of diarrhoea (especially bloody diarrhoea) and/ or abdominal pain should contact their GP urgently for medical advice.

Dr Michael Devine, Public Health Consultant, PHA, said: “The Escherichia coli bacteria is commonly found in the intestines of humans and animals. There are many different types of E. coli, and while some live in the intestine quite harmlessly, others may cause a variety of diseases. The bacterium is found in faeces and can survive in the environment.

“Symptoms caused by E. coli O157 can include diarrhoea, which can range from mild to profuse watery or bloody diarrhoea, tummy cramps, nausea or vomiting.”

Ends

For further information, contact PHA Communications on (028) 9055 3663

Appendix 5: Short Screening Questionnaire

E coli O157 Investigation Form

District Council _____ Group Reference Number (if applicable) _____

Health & Social Care Trust _____

Date of Notification: ___/___/____ (dd/mm/yyyy)

Date Completed: ___/___/____ (dd/mm/yyyy) Time Completed: ___:___ (24 hour clock)

Interview type:
Face to Face ☐
Telephone ☐
Other ☐
If other please specify_____

Interview location:
Home ☐
Hospital ☐
Other ☐
If other please specify _____

Attempts to Contact

Unable to contact? (1) Date ___/___/____ Time ___:___ Telephone ☐ Visit ☐
Unable to contact? (2) Date ___/___/____ Time ___:___ Telephone ☐ Visit ☐
Unable to contact? (3) Date ___/___/____ Time ___:___ Telephone ☐ Visit ☐

Section 1: CASE DETAILS

1.1 Forename(s): _____

1.2 Surname: _____

1.3 Address: _____

_____

_____

1.4 Postcode: _____

1.5 Telephone Number: (Home) _____
(Mobile) _____
(Work) _____
(email) _____

1.6 Gender: Male ☐ Female ☐

1.7 Date of Birth: ___/___/____ (dd/mm/yyyy)

1.8 Age (*if child*): _____ Years _____ Months

1.9 GP's name: _____

1.10 Surgery Address: _____

(IF CASE IS A CHILD)

1.11 Name of Parent / Guardian: _____

Section 2: OCCUPATION

2.1 Occupation of Case: (*if adult*) _____

2.2 *If case is a child*: Occupation of Father: _____

Occupation of Mother: _____

2.3 Risk Groups: Does anyone in the household **(including the case)**

- ☐ *work as a food handler*
- ☐ *handle raw meat in a professional capacity (e.g. butcher, chef, abattoir worker)*
- ☐ *work in or attend a childcare setting (e.g. nursery, playgroup)*
- ☐ *work in healthcare setting (e.g. nurse, doctor, care assistant)*
- ☐ *have difficulty maintaining personal hygiene*
- ☐ *undertake work which involves contact with farm animals*
- ☐ *undertake work which involves contact with faeces (e.g. sewage work, laboratory work)*

If yes, please provide details:

2.4 Name, address, telephone number of workplace/school/nursery/playgroup (as applicable)

2.5 Date last attended work/school/nursery/playgroup: ___/___/____ (dd/mm/yyyy)

2.6 Date returned to work/school/nursery/playgroup: ___/___/____ (dd/mm/yyyy)

Section 3: ILLNESS

3.1 Onset of symptoms: date ___/___/____ (dd/mm/yyyy) Time: ___:___ (24 hour clock)

3.2 Were any of the following symptoms experienced due to illness?

Symptom	Yes	No	Ongoing	Date ended (dd/mm/yyyy)
Diarrhoea (3 or more loose stools in 24)	☐	☐	☐	___/___/____
Nausea	☐	☐	☐	___/___/____
Vomiting	☐	☐	☐	___/___/____
Abdominal pain (cramps)	☐	☐	☐	___/___/____
Fever (feeling hot & cold)	☐	☐	☐	___/___/____
Blood in Stools	☐	☐	☐	___/___/____
Other (please specify)				

3.3 Visited GP as a result of this illness? Yes ☐ No ☐

3.4 Did you submit a sample? Yes ☐ No ☐

If so what date?

3.5 Attended hospital or casualty department as a result of this illness? Yes ☐ No ☐

3.6 Admission to hospital as a result of this illness? Yes ☐ No ☐

If 'yes': Date & time of admission: ___/___/____ (dd/mm/yyyy) ___:___ (24 hour clock)

Date of discharge: ___/___/____ (dd/mm/yyyy)

Hospital name: _____ Ward: _____

Section 4: ENVIRONMENTAL FACTORS

4.1 Water source: Mains ☐ Private ☐ Other ☐

If 'Other' please specify: _____

4.2 Milk supply in past 8 days:

	Yes	No	*If 'yes' please provide details and where it was bought / supplied from*
Pasteurised milk (delivered)	☐	☐	_____
Pasteurised milk (shop bought)	☐	☐	_____
Non-pasteurised milk	☐	☐	_____
Goat's milk	☐	☐	_____

4.3 Contact with any **pets / animals / environmental exposure**?

Yes ☐ No ☐ Not sure ☐

If 'yes' please give details:

4.4 If answered 'yes' to 4.3 were any of the animals unwell?

Yes ☐ No ☐ Not sure ☐

If 'yes' please provide details:

Section 5: FOOD HISTORY

5.1 Did you eat at Flicks Restaurant, Yorkgate?

5.2 If yes what date(s) and time?

5.3 What did you eat (including salads / dressings / desserts etc)?

5.5 How many were in your party whilst eating at Flicks?

5.6 Names and contact details of any who are unwell

Section 6: MANAGEMENT

Follow up Actions for <u>Index Case</u>

	Yes	No	
Faecal samples recommended:	☐	☐	
Infection control advice given:	☐	☐	
Exclusion recommended:	☐	☐	

Follow up Actions for <u>Contacts</u>

If yes to any of the following, please provide details below

Screening recommended Yes ☐ No ☐

Exclusion recommended Yes ☐ No ☐

Infection control advice given Yes ☐ No ☐

Discussion with PHA

Details of Follow up Actions

Screening recommended:

Infection control advice given:

Exclusion recommended:

APPENDIX 1

Can you list all your contacts including those with gastro-intestinal symptoms?

Name and Address (including phone number and email)	**Date of Birth**	**Sex**	**Relationship to Patient** (*e.g.* relative, travel companion)	**Occupation/school**	**Symptoms / Onset**

Appendix 6: Final Press Release

Thursday, 13 December 2012 – Health Protection

The Public Health Agency (PHA) and Environmental Health Officers from Belfast City Council declared the outbreak of Escherichia coli (E. coli) O157 linked to Flicks restaurant in Cityside Mall, 100-150 York Street, Belfast over on the 14 November 2012. However, the multi-agency investigation has not yet concluded. As with all outbreaks, a full report will be made publicly available when the investigation and analysis is complete. As such, it would not be appropriate to comment further at this stage on any potential cause of the outbreak.

This is a complex and detailed investigation with all aspects of the outbreak being examined thoroughly and in line with existing guidance. It is therefore anticipated that it will be some time before the investigation is complete and the outbreak report can be finalised.

In relation to learning from this outbreak, the information to date has not highlighted any new issues. Rather, it reinforces the need to observe established guidance on the prevention and spread of E.coli infection, as emphasised consistently in previous press releases. Namely, raw and cooked food should be kept separately, vegetables and other ready to eat food should be washed thoroughly, everyone should wash their hands after using the toilet and before eating or preparing food, and people with vomiting or diarrhoea should remain at home and not prepare food – this is good advice at all times, not just when there is an outbreak.

Appendix 7: Case Definitions

Primary Case

Someone who ate at Flicks, had onset of symptoms within 8 days of eating there and was the first case in the household.

Co-Primary Case

1) Someone who ate at Flicks, was the second (or subsequent) case in the household, whose onset of symptoms was within 8 days of eating at Flicks AND whose onset of symptoms was within 48 hours of symptoms in the first case.

OR

2) Someone who ate at Flicks, was the second (or subsequent) case in the household and whose onset of symptoms was within 4 days of eating at Flicks, regardless of the onset of symptoms in the Primary Case.

Secondary Case

1) Someone who did not eat at Flicks, lives in the same household as a "Primary Case" and develops symptoms after onset of symptoms in the primary case.

OR

2) Someone who ate at Flicks whose symptoms started more than 4 days after eating at Flicks AND more than 48 hours after onset of symptoms in the Primary Case.

Important Note

Confirmed or probable cases unable to be further defined as primary, co-primary or secondary were classified as non-categorisable.

Given the wide variation in incubation period for E. coli the above are just a working guide as to what is the most likely situation for each case. There will always be uncertainty between co-primary and secondary cases, and even some apparently Primary cases can be secondary, following an asymptomatic primary. The definitions definite, probable etc can also be applied to all of these, and have been defined elsewhere.

Appendix 8: Descriptive Study

The number in the dataset for analysis is 288 (141 confirmed cases and 147 probable cases).

Table 1:

Status of Cases		
	Frequency	Percent
Confirmed	141	49
Probable	147	51
Total	288	100

Table 2:

Category of Cases		
	Frequency	Percent
Primary	199	69
Co-primary	45	16
Secondary	24	8
No category	20	7
Total	288	100

Table 3:

Frequency of cases by Status and Category						
	Confirmed		Probable		Total	
	N	%	N	%	N	%
Primary	100	71	99	67	200	69
Co-primary	18	13	27	19	45	16
Secondary	15	10	9	6	24	8
No Category*	8	6	12	8	19	7
Total	141	100	147	100	288	100

*Category not able to be determined

Table 4:

Frequency of cases by Status and Gender						
	Confirmed		Probable		Total	
	N	%	N	%	N	%
Male	45	32	50	34	95	33
Female	96	68	97	66	193	67
Total	141	100	147	100	288	100

Table 5:

Age profile of all cases							
	N	Mean	Median	Min	Max	Range	IQR
Confirmed	141	31.3	28	1	84	83	23
Probable	147	29.2	27	1	73	72	14
Total	288	30.2	27	1	84	83	17

Table 6:

Age profile of Confirmed cases by category							
	N	Mean	Median	Min	Max	Range	IQR
Primary/CP	118	31.63	28.5	1	70	69	22
Secondary	15	25.20	24	1	70	69	45
Total Conf	141	31.3	28	1	84	83	23

*6 Confirmed cases were not categorisable

Table 7:

Age profile of Probable cases by category							
	N	Mean	Median	Min	Max	Range	IQR
Primary/CP	126	29.8	27	2	73	71	14
Secondary	9	23.8	28	1	48	47	15
Total	147	29.2	27	1	73	72	14

*13 Probable cases were not categorisable

Table 8:

Age profile of Primary/Co-Primary Confirmed cases by Gender							
	N	Mean	Median	Min	Max	Range	IQR
Male	34	30.9	30.5	1	60	59	16
Female	84	31.9	27.5	1	70	69	23
Total	118	31.6	28.5	1	70	69	22

Table 9:

Age-groups of all Cases						
	All		Confirmed		Probable	
	N	%	N	%	N	%
0-4	13	4.5	8	6	5	3
5-14	13	4.5	4	3	9	6
15-44	210	73	96	68	114	78
45-64	44	15	29	20	15	10
65+	8	3	4	3	4	3
Total	288	100	141	100	147	100

Table 10:

Age-groups of all Cases by Gender						
	Male		Female		Total	
	N	%	N	%	N	%
0-4	7	7	6	3	13	4.5
5-14	7	7	6	3	13	4.5
15-44	67	71	143	74	210	73
45-64	14	15	30	16	44	15
65+	0	0	8	4	8	0
Total	95	100	193	100	288	100

Table 11:

Age Groups by Category										
	Primary		Co-Primary		Secondary		No Category		Total	
	N	%	N	%	N	%	N	%	N	%
0-4	3	1.5	4	9	6	25	0	0	13	4.5
5-14	6	3	2	4	3	12	2	10	13	4.5
15-44	155	78	31	69	10	42	14	70	210	73
45-64	29	14.5	8	18	4	17	3	15	44	15
65+	6	3	0	0	1	4	1	5	8	0
Total	199	100	45	100	24	100	20	100	288	100

Table 12:

Age-groups of Cases by Status and Category								
	Primary/CP Confirmed		Secondary Confirmed		Primary/CP Probable		Secondary Probable	
	N	%	N	%	N	%	N	%
0-4	3	2	5	33	4	3	1	11
5-14	2	2	1	7	6	5	2	22
15-44	87	74	5	33	99	79	5	56
45-64	24	20	3	20	13	10	1	11
65+	2	2	1	7	4	3	0	0
Total	118	100	15	100	126	100	9	100

Table 13:

Incubation period (days)						
	Mean	Median	Min	Max	Range	IQR
Confirmed	3.21	3	1	11	10	2
Probable	3.43	2	1	17	16	2
Total	3.33	2	1	17	16	2

Table 14:

Incubation period (days) of All Cases by Category						
	Mean	Median	Min	Max	Range	IQR
Primary	2.72	2	1	8	7	2
Co-primary	2.59	2	1	7	6	1
Secondary	9.31	9	5	13	8	3
No Category	9.17	10	1	17	16	5.5
Total	3.33	2	1	17	16	2

Table 15:

Incubation period (days) of Confirmed Cases by Category						
	Mean	Median	Min	Max	Range	IQR
Primary	2.86	3	1	7	6	2
Co-primary	2.44	2	1	7	6	2
Secondary	8.14	8	5	11	6	4
No Category	10.5	10.5	10	11	1	1
Total	3.21	3	1	11	10	2

Table 16:

Incubation period (days) of Probable Cases by Category						
	Mean	Median	Min	Max	Range	IQR
Primary	2.57	2	1	8	7	2
Co-primary	2.71	2	1	6	5	1.5
Secondary	10.66	11	8	13	5	4
No Category	8.9	11	1	17	16	8
Total	3.43	2	1	17	16	2

Table 17:

Frequency of Symptoms by Status						
	All (n=288)		Confirmed (n=140)		Probable (n=148)	
	N	%	N	%	N	%
Diarrhoea	261	90.6	131	92.9	130	88
Vomiting	129	44.8	65	46.0	64	43
Ab. Pain	242	84	124	87.9	118	80
Nausea	202	70	105	74.5	97	66
Fever	149	51.8	78	55.3	71	48
B. Diarrhoea	80	27.8	55	39.0	25	17

Table 18:

Frequency of Symptoms by Status and Category				
	Primary/Co-Primary Confirmed (n=118)	Secondary Confirmed (n=15)	Primary/Co-Primary Probable (n=127)	Secondary Probable (n=9)
Diarrhoea	113	14	111	8
Vomiting	59	4	56	4
Ab. Pain	110	12	101	9
Nausea	93	8	81	6
Fever	72	5	58	6
B. Diarrhoea	50	5	22	3

Table 19:

Frequency of Symptoms by Age						
	All (n=288)		0-14 (n= 26)		15+ (n= 262)	
	N	%	N	%	N	%
Diarrhoea	261	91	25	96	236	90
Vomiting	129	45	12	46	117	45
Ab. Pain	242	84	18	69	224	85
Nausea	202	70	15	58	187	71
Fever	149	52	9	35	140	53
B. Diarrhoea	80	28	3	12	77	29

Table 20:

Frequency of B. Diarrhoea by Status			
	Yes	No	Total
Confirmed	55	86	141
Probable	25	122	147
Total	80	208	288

Table 21:

Frequency of B. Diarrhoea by Status and Category			
	Yes	No	Total
Primary/CP Confirmed	50	69	119
Secondary Confirmed	5	10	15
Primary/CP Probable	22	104	126
Secondary Probable	3	6	9

Table 22:

B. Diarrhoea by Status and Age						
	All (n=288)		Confirmed (n=140)		Probable (n=148)	
	0-14	15+	0-14	15+	0-14	15+
Yes	3	77	1	54	2	23
No	23	185	11	75	12	110
Total	26	262	12	129	14	133

Table 23:

B. Diarrhoea by Status/Category and Age								
	Primary/CP Conf (n=118)		Secondary Conf (n=15)		Primary/CP Prob (n=127)		Secondary Prob (n=9)	
	0-14	15+	0-14	15+	0-14	15+	0-14	15+
Yes	0	50	1	4	1	21	1	2
No	5	63	5	5	9	95	2	4
Total	5	113	6	9	10	116	3	6

Table 24:

Hospitalisation by Status						
	All (n=288)		Confirmed (n=140)		Probable (n=148)	
	N	%	N	%	N	%
Attended	37		28		9	
Admitted	19		16		3	

Table 25:

Hospitalisation by Status/Category				
	P/CP Confirmed (n=118)	Sec. Confirmed (n=15)	P/CP Probable (n=127)	Sec. Probable (n=9)
Attended	22	4	8	1
Admitted	13	2	3	0

Table 26:

Attended Hospital by Status/Category and Age						
	Con	P/CP Conf	2nd Conf	Prob	P/CP Prob	2nd Prob
0-14	3	0	2	2	1	1
15+	25	22	2	7	7	0
Total	28	22	2	9	8	1

*2 Confirmed cases were not categorised

Table 27:

Admitted to Hospital by Status/Category and Age						
	Con	P/CP Conf	2nd Conf	Prob	P/CP Prob	2nd Prob
0-14	1	0	0	1	1	0
15+	15	13	2	2	2	0
Total	16	13	2	3	3	0

*1 Confirmed case was not categorised

Table 28:

Interval (days) between onset and 1st faecal specimen							
	N	Mean	Median	Min	Max	Range	IQR
Confirmed	135	6.56	6	1	28	27	6
Probable	93	12.85	12	2	32	30	11
Total	228	9.13	8	1	32	31	7

Table 29:

Confirmed Cases Interval (days) between onset and 1st faecal specimen by Category							
	N	Mean	Median	Min	Max	Range	IQR
Primary/CP	117	7.13	7	1	28	27	5
Secondary	15	3.13	2	1	11	10	3
Total Conf	135	6.56	6	1	28	27	7

Table 30:

Probable Cases Interval (days) between onset and 1st faecal specimen by Category							
	N	Mean	Median	Min	Max	Range	IQR
Primary/CP	80	13.63	13	2	32	30	10
Secondary	6	6.33	6	3	11	8	6
Total Prob	93	12.85	12	2	32	30	11

Table 31:

Lab Results by Status				
	Positive	Negative	No Result	Total
Confirmed	141	-	-	141
Probable	-	96	51	147
Total	141	96	51	288

Table 32:

Probable Lab Results by Status/Category				
	Positive	Negative	No Result	Total
Primary/CP	-	81	45	126
Secondary	-	7	2	9
Total	-	96	51	147

* 12 Probable cases were not categorisable

Appendix 9- Summary of Food Histories for 126 of the confirmed *E. coli* O157 cases who had eaten at Flicks

FOODS	NO.
Beef and Lasagne	41
Chicken	74
Pork	9
Vegetarian	1
Fish	4
Dessert	6
Starters*	6
Potatoes* (Garlic, Sautee, Boiled, Mashed, Champ, Sweet chilli, Peppered and chilli garlic	68
Other Potatoes* (Chips, Wedges, Roasties)	67
Rice	4
Bread	9
Cooked Onion Rings/Onions	36
Mixed vegetables	18
Salads** (includes salads with Side orders)	47
Sauces***	46
Coleslaw	7

* Each individual may contribute to one or more exposures

**Total number who consumed one or more salad items

***Total includes all sauces

Appendix 10: Case Control Study

Comparison of study and non-study primary and co-primary confirmed cases

Table D1: A comparison of age and gender distribution between cases included and not included in the case control study (PT54 only)

	Included in case control study	Not included in case control study	P - value
Total number	67	47	
Age			
median	27	36	0.03
min, max	1, 70	1, 84	
IQR	21, 33	21, 48	
Gender			
Male (n(%))	18 (26.9)	14 (29.8)	0.73
Female (n(%))	49 (73.1)	33 (70.2)	

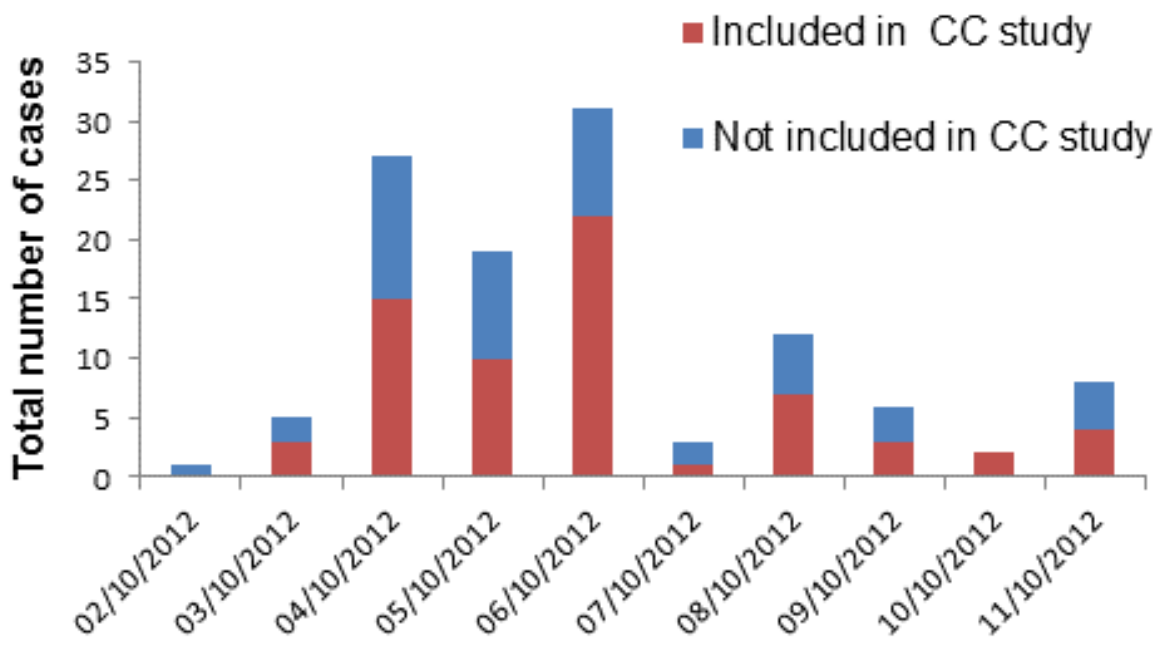


Figure D1: Epi-curve of latex confirmed and local confirmed primary and co-primary cases[17] stratified by inclusion in the case control study (n=114; P=0.74)

[17] Includes one primary case where date of exposure was recorded through case control study but not when initially questioned through descriptive epidemiology study

Results of statistical analysis by Statistics Unit, Health Protection Services, HPA

Table E1: Single variable analysis

Variable		Cases	Controls	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age		Minimum: 1 25th centile: 21 Median: 27 75th centile: 33 Maximum: 70	Minimum: 3 25th centile: 24 Median: 35.5 75th centile: 53.5 Maximum: 72	**0.96** per year	0.94, 0.99	**0.004**
Sex	Male Female	19 48	12 16	1.00 1.89	 0.71, 5.07	0.20
Battered cod	Yes No	1 66	1 28	0.42 1.00	0.29, 0.61	<0.001
Expected salad garnish	Yes No	34 33	19 10	0.54 1.00	0.24, 1.25	0.15
All chicken	Yes No	40 27	12 17	**2.10** 1.00	0.79, 5.59	**0.14**
Bacon	Yes No	4 63	0 29	Not estimable	0.72, ∞	0.3
Lettuce	Yes No	28 39	8 20	1.79 1.00	0.69, 4.68	0.23
Tomato	Yes No	12 55	3 26	1.89 1.00	0.47, 7.61	0.4
Mayonnaise	Yes No	3 64	0 29	Not estimable	0.49, ∞	0.6
All chilli	Yes No	33 34	9 18	**1.94** 1.00	0.71, 5.28	**0.19**
Red Onion	Yes No	18 48	5 23	1.73 1.00	0.53, 5.66	0.4
Rice	Yes No	5 62	0 29	Not estimable	0.96, ∞	0.3
Sweet chilli chicken & cheese panini	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Ham & cheese panini	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Mushrooms	Yes No	12 53	6 23	0.87 1.00	0.32, 2.35	0.8
Fried onions	Yes No	13 54	5 24	1.16 1.00	0.39, 3.43	0.8
All steak	Yes No	17 50	13 16	0.42 1.00	0.15, 1.16	0.1
Pork & leek sausages	Yes No	1 66	0 29	Not estimable	0.07, ∞	>0.999
All gravy	Yes No	3 64	1 28	1.31 1.00	0.24, 7.17	0.8
All garlic	Yes No	29 38	15 14	0.71 1.00	0.32, 1.61	0.4
Pasta	Yes No	2 65	1 28	0.86 1.00	0.08, 9.63	0.9
Soup	Yes No	0 67	1 28	0.00 1.00	Not estimable	0.3
Crusty Bread	Yes	2	2	0.42	0.09, 1.90	0.3

	No	65	27	1.00		
Cheese	Yes No	8 59	2 27	1.83 1.00	0.34, 9.73	0.5
Spring Onion	Yes No	3 63	0 29	Not estimable	0.50, ∞	0.6
Classic Caesar salad	Yes No	1 66	0 29	Not estimable	0.07, ∞	>0.999
Croutons	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Caesar dressing	Yes No	1 66	0 29	Not estimable	0.07, ∞	>0.999
Mussels	Yes No	0 67	1 28	0.00 1.00	Not estimable	0.3
Onion rings	Yes No	13 54	3 26	2.09 1.00	0.53, 8.18	0.3
Spicy wedges	Yes No	1 66	2 27	0.20 1.00	0.14, 0.29	<0.001
All barbecue sauce	Yes No	1 66	2 27	0.20 1.00	0.14, 0.29	<0.001
Stir fry noodles	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Noodles	Yes No	2 65	0 29	Not estimable	0.27, ∞	>0.999
Peppers	Yes No	8 59	3 26	1.18 1.00	0.31, 4.41	0.8
Oriental sauce	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Tartare sauce	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Tortilla basket	Yes No	1 66	0 29	Not estimable	0.07, ∞	>0.999
Pitta bread	Yes No	2 65	1 28	0.86 1.00	0.07, 10.22	0.9
All peppercorn sauce	Yes No	17 50	1 28	**9.52** 1.00	1.33, 67.97	**0.03**
White wine, mushroom & bacon sauce	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Tortilla bread	Yes No	3 64	2 27	0.63 1.00	0.10, 4.06	0.6
Sour cream	Yes No	5 62	2 27	1.09 1.00	0.20, 5.94	0.9
Salsa	Yes No	4 63	2 27	0.86 1.00	0.15, 4.98	0.9
Coleslaw	Yes No	7 58	1 27	3.26 1.00	0.36, 29.89	0.3
Oriental vegetable stir fry	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Fresh vegetable	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Oriental sauce	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Tomato sauce	Yes No	5 62	2 27	1.09 1.00	0.18, 6.76	0.9
Bolognese sauce	Yes No	3 64	0 29	Not estimable	0.49, ∞	0.6
Cheese sauce	Yes	2	0	Not	0.27, ∞	>0.999

	No	65	29	estimable		
Burger	Yes No	1 66	3 26	0.13 1.00	0.01, 1.44	0.1
Burger bun	Yes No	13 54	6 23	0.92 1.00	0.28, 3.01	0.9
Pineapple (option)	Yes No	3 64	0 29	Not estimable	0.49, ∞	0.6
Chips	Yes No	31 36	15 14	0.80 1.00	0.29, 2.22	0.7
Wedges	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Baby boiled potatoes	Yes No	2 65	1 28	0.86 1.00	0.05, 13.71	0.92
Mashed potato	Yes No	7 60	1 28	3.27 1.00	0.34, 31.53	0.3
Champ potato	Yes No	2 65	2 27	0.42 1.00	0.10, 1.80	0.24
Sautéed mushrooms	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Sautéed onions	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Tobacco onions	Yes No	5 62	1 28	2.26 1.00	0.29, 17.49	0.4
Chef's vegetables	Yes No	3 64	1 28	1.31 1.00	0.13, 13.35	0.8
Raw onion	Yes No	3 64	1 28	1.31 1.00	0.13, 13.35	0.8
Apple crumble	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Banoffee pie	Yes No	3 64	0 29	Not estimable	0.49, ∞	0.6
Sticky toffee pudding	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Pavlova	Yes No	1 66	1 28	0.42 1.00	0.29, 0.61	<0.001
Chocolate brownies	Yes No	1 66	0 29	Not estimable	0.07, ∞	>0.999
Cheesecake	Yes No	1 66	0 29	Not estimable	0.07, ∞	>0.999
Cream	Yes No	1 66	0 29	Not estimable	0.07, ∞	>0.999
Ice cream	Yes No	4 63	0 29	Not estimable	0.72, ∞	0.3
Sunday roast	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Roast gammon	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Beer	Yes No	3 64	2 27	0.63 1.00	0.09, 4.32	0.6
Wine	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Spirits	Yes No	0 67	1 28	0.00 1.00	Not estimable	0.3
Tap water	Yes No	14 53	8 21	0.69 1.00	0.27, 1.75	0.4
Bottled water	Yes No	2 65	1 28	0.86 1.00	0.07, 9.96	0.9
Ice	Yes No	35 24	13 16	**1.79** 1.00	0.81, 3.98	**0.15**

Other	Yes No	50 17	17 12	**2.08** 1.00	0.90, 4.78	**0.09**
Salt	Yes No	22 43	8 21	1.34 1.00	0.50, 3.58	0.6
Pepper	Yes No	6 60	3 26	0.87 1.00	0.21, 3.63	0.8
Mayo sachets	Yes No	3 64	1 28	1.31 1.00	0.24, 7.17	0.8
Hamburger	Yes No	0 67	1 28	0.00 1.00	Not estimable	0.3
Cheeseburger	Yes No	0 67	1 28	0.00 1.00	Not estimable	0.3
Fish fingers	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Chicken fillet bites	Yes No	2 65	0 29	Not estimable	0.27, ∞	>0.999
Sausage	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Baked beans	Yes No	1 66	1 28	0.42 1.00	0.03, 7.11	0.6
Roast potatoes	Yes No	0 67	0 29	Not estimable	Not estimable	Not estimable
Gammon Special	Yes No	3 64	0 29	Not estimable	0.49, ∞	0.6
Parsley expected	Yes No	61 3	24 5	**4.24** 1.00	1.01, 17.75	**0.048**

Table E2: Multivariable analysis (based on 79 observations)

Variable		OR	95% CI	p-value
Age		0.96 per year	0.94, 0.99	0.002
Sex	Male Female	1.00 2.87	 0.78, 10.58	0.11
Other	Yes No	1.78 1.00	0.54, 5.89	0.3
Parsley expected	Yes No	9.82 1.00	1.55, 62.06	0.02
All chicken	Yes No	1.64 1.00	0.44, 6.13	0.5
Ice	Yes No	1.53 1.00	0.46, 5.11	0.5

Table E3: Single variable analysis for early diners

Variable		Cases	Controls	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age		Minimum: 1 25th centile: 20 Median: 27 75th centile: 32 Maximum: 70	Minimum: 3 25th centile: 21 Median: 41.5 75th centile: 54 Maximum: 72	**0.96** per year	0.94, 0.99	**0.009**
Sex	Male Female	15 35	10 10	1.00 **2.33**	 0.77, 7.08	**0.14**
Battered cod	Yes No	1 49	1 20	0.41 1.00	0.26, 0.63	<0.001
Expected salad garnish	Yes No	23 27	12 9	0.64 1.00	0.25, 1.61	0.3
All chicken	Yes No	28 22	7 14	**2.55** 1.00	0.76, 8.52	**0.13**
Bacon	Yes No	3 47	0 21	Not estimable	0.47, ∞	0.5
Lettuce	Yes No	19 31	3 17	**3.47** 1.00	0.89, 13.54	**0.07**
Tomato	Yes No	8 42	0 21	**Not estimable**	1.73, ∞	**0.09**
Mayonnaise	Yes No	2 48	0 21	Not estimable	0.26, ∞	>0.999
All chilli	Yes No	23 27	4 15	**3.19** 1.00	0.88, 11.56	**0.08**
Red Onion	Yes No	12 37	3 17	1.84 1.00	0.44, 7.71	0.4
Rice	Yes No	5 45	0 21	Not estimable	0.94, ∞	0.3
Sweet chilli chicken & cheese panini	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Ham & cheese panini	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Mushrooms	Yes No	8 40	4 17	0.85 1.00	0.26, 2.81	0.8
Fried onions	Yes No	9 41	3 18	1.32 1.00	0.34, 5.11	0.7
All steak	Yes No	11 39	10 11	0.31 1.00	0.09, 1.06	0.06
Pork & leek sausages	Yes No	1 49	0 21	Not estimable	0.07, ∞	>0.999
All gravy	Yes No	3 47	1 20	1.28 1.00	0.23, 7.23	0.8
All garlic	Yes No	18 32	9 12	0.75 1.00	0.29, 1.94	0.6
Pasta	Yes No	2 48	0 21	Not estimable	0.26, ∞	>0.999
Soup	Yes No	0 50	1 20	0.00 1.00	Not estimable	0.3
Crusty Bread	Yes No	2 48	2 19	0.40 1.00	0.08, 1.91	0.25
Cheese	Yes No	7 43	0 21	**Not estimable**	1.46, ∞	**0.10**
Spring Onion	Yes No	2 47	0 21	Not estimable	0.27, ∞	>0.999

Classic Caesar salad	Yes No	1 49	0 21	Not estimable	0.07, ∞	>0.999
Croutons	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Caesar dressing	Yes No	1 49	0 21	Not estimable	0.07, ∞	>0.999
Mussels	Yes No	0 50	1 20	0.00 1.00	Not estimable	0.3
Onion rings	Yes No	9 41	1 20	**4.39** 1.00	0.76, 25.21	**0.10**
Spicy wedges	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
All barbecue sauce	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Stir fry noodles	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Noodles	Yes No	1 49	0 21	Not estimable	0.07, ∞	>0.999
Peppers	Yes No	7 43	2 19	1.55 1.00	0.34, 7.11	0.6
Oriental sauce	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Tartare sauce	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Tortilla basket	Yes No	1 49	0 21	Not estimable	0.07, ∞	>0.999
Pitta bread	Yes No	1 49	1 20	0.41 1.00	0.02, 7.18	0.5
All peppercorn sauce	Yes No	11 39	1 20	**5.64** 1.00	0.80, 39.62	**0.08**
White wine, mushroom & bacon sauce	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Tortilla bread	Yes No	3 47	1 20	1.28 1.00	0.12, 13.07	0.8
Sour cream	Yes No	4 46	1 20	1.74 1.00	0.18, 16.40	0.6
Salsa	Yes No	4 46	1 20	1.74 1.00	0.18, 16.40	0.6
Coleslaw	Yes No	6 43	1 19	2.65 1.00	0.27, 25.83	0.4
Oriental vegetable stir fry	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Fresh vegetable	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Oriental sauce	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Tomato sauce	Yes No	3 47	1 20	1.28 1.00	0.10, 16.35	0.9
Bolognese sauce	Yes No	3 47	0 21	Not estimable	0.47, ∞	0.5
Cheese sauce	Yes No	2 48	0 21	Not estimable	0.26, ∞	>0.999
Burger	Yes No	1 49	2 19	0.19 1.00	0.01, 2.53	0.21
Burger bun	Yes No	9 41	4 17	0.93 1.00	0.22, 3.92	0.9

Pineapple (option)	Yes No	3 47	0 21	Not estimable	0.47, ∞	0.5
Chips	Yes No	25 25	8 13	0.62 1.00	0.17, 2.28	0.5
Wedges	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Baby boiled potatoes	Yes No	2 48	1 20	0.83 1.00	0.05, 13.21	0.9
Mashed potato	Yes No	7 43	1 20	3.26 1.00	0.32, 33.15	0.3
Champ potato	Yes No	1 49	2 19	0.19 1.00	0.04, 0.87	0.03
Sautéed mushrooms	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Sautéed onions	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Tobacco onions	Yes No	4 46	1 20	1.74 1.00	0.20, 14.87	0.6
Chef's vegetables	Yes No	2 48	1 20	0.83 1.00	0.07, 9.82	0.9
Raw onion	Yes No	1 49	0 21	Not estimable	0.07, ∞	>0.999
Apple crumble	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Banoffee pie	Yes No	2 48	0 21	Not estimable	0.26, ∞	>0.999
Sticky toffee pudding	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Pavlova	Yes No	1 49	1 20	0.41 1.00	0.26, 0.63	<0.001
Chocolate brownies	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Cheesecake	Yes No	1 49	0 21	Not estimable	0.07, ∞	>0.999
Cream	Yes No	1 49	0 21	Not estimable	0.07, ∞	>0.999
Ice cream	Yes No	2 48	0 21	Not estimable	0.26, ∞	>0.999
Sunday roast	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Roast gammon	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Beer	Yes No	2 48	2 19	0.40 1.00	0.05, 3.19	0.4
Wine	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Spirits	Yes No	0 50	1 20	0.00 1.00	Not estimable	0.3
Tap water	Yes No	11 39	8 13	0.46 1.00	0.17, 1.25	0.13
Bottled water	Yes No	0 50	1 20	0.00 1.00	Not estimable	0.3
Ice	Yes No	26 19	10 11	1.51 1.00	0.61, 3.71	0.4
Other	Yes No	39 11	11 10	**3.22** 1.00	1.29, 8.07	**0.01**
Salt	Yes No	17 31	7 14	1.10 1.00	0.35, 3.49	0.9
Pepper	Yes	4	3	0.53	0.11, 2.50	0.4

	No	45	18	1.00		
Mayo sachets	Yes No	3 47	1 20	1.28 1.00	0.23, 7.23	0.8
Hamburger	Yes No	0 50	1 20	0.00 1.00	Not estimable	0.3
Cheeseburger	Yes No	0 50	1 20	0.00 1.00	Not estimable	0.3
Fish fingers	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Chicken fillet bites	Yes No	2 48	0 21	Not estimable	0.26, ∞	>0.999
Sausage	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Baked beans	Yes No	1 49	1 20	0.41 1.00	0.02, 6.98	0.5
Roast potatoes	Yes No	0 50	0 21	Not estimable	Not estimable	Not estimable
Gammon Special	Yes No	3 47	0 21	Not estimable	0.47, ∞	0.5
Parsley expected	Yes No	45 2	17 4	**5.29** 1.00	1.02, 27.42	**0.047**

Table E4: Multivariable analysis for early diners (based on 64 observations)

Variable		OR	95% CI	p-value
Age		0.96 per year	0.91, 1.01	0.11
Sex	Male Female	1.00 4.14	 0.68, 36.83	0.09
All chicken	Yes No	2.21 1.00	0.36, 18.08	0.4
Tomato	Yes No	2.91* 1.00	0.32, ∞	0.17
Cheese	Yes No	4.60* 1.00	0.56, ∞	0.1
Onion rings	Yes No	3.58 1.00	0.16, 340.49	0.4
All peppercorn sauce	Yes No	3.58* 1.00	0.43, ∞	0.09
Other	Yes No	4.07 1.00	0.60, 46.54	0.08
Parsley expected	Yes No	15.74 1.00	0.50, 1831.61	0.05

*Median Unbiased Estimate

Statistical analysis of reporting of side order exposures after change to closed questioning

Table F1: Comparison of reporting of side orders before and after questionnaire change to use of closed questions

	Cases		Controls		Before/After
	Before (n = 49)	After (n=18)	Before (n=23)	After (n=6)	P-value* (adj for case status)
Onion rings	11	2	3	0	0.31
Sautéed mushrooms	0	0	0	0	-
Sautéed onions	0	0	0	0	-
Tobacco onions	4	1	1	0	1.00
Chef's Veg	1	2	1	0	0.53
Side salad	2	3	1	0	0.35
Peppercorn sauce	14	3	1	0	0.44
White wine, mush/bacon sauce	0	0	0	0	-
Garlic butter	0	1	0	0	0.54
Chips	21	10	12	3	0.61
Wedges	0	0	0	0	-
Mashed	6	1	1	0	0.66
Garlic sautéed potatoes	19	7	6	3	0.74
Chilli sautéed potatoes	7	1	2	0	0.43
Baby boiled	2	0	1	0	0.84
Sweet chilli	1	1	0	0	0.94
Garlic mayo	2	1	1	0	1.00
Salsa	3	1	1	1	0.93
BBQ	1	0	2	0	0.91

*Median unbiased estimates