ACM/1014

ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

INFORMATION PAPER

OUTBREAKS OF INFECTION ASSOCIATED WITH READY-TO-EAT FOOD

At the 68th meeting of ACMSF in September 2008, the Health Protection Agency briefed the Committee on the microbiological safety of ready-to-eat foods, focusing on fruit and vegetables (paper ACM/922). Following discussion members requested for an update at a future meeting[1]. Members have previously received updates on the microbiological safety and status of ready-to-eat food in the UK focused on fresh produce.

The attached paper provides an update on outbreaks of infection associated with the consumption of ready-to-eat foods.

Secretariat
January 2011

[1] http://acmsf.food.gov.uk/acmsfmeets/acmsf2008/acmsf250908/acmsfmin250908

ADVISORY COMMITTEE OF THE MICROBIOLOGICAL SAFETY OF FOOD

OUTBREAKS OF INFECTION ASSOCIATED WITH READY-TO-EAT FOOD, JANUARY 2011

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Summary

We have presented an overview of the findings of outbreak investigations conducted in England and Wales over the period 2008 to 2010. The information given supplements and updates three reports previously submitted to the Committee.

Outbreaks of infectious intestinal disease (IID) associated with the consumption of microbiologically contaminated ready-to-eat foods continue to be identified and investigated. When the most recent data are considered alongside those presented earlier, four recurrent themes emerge. These are:

- the susceptibility of vulnerable groups to listeriosis associated with the consumption of a range of ready-to-eat foods;
- general kitchen hygiene;
- norovirus infection associated with the consumption of raw oysters;
- salmonellosis associated with the consumption of raw or lightly heat treated vegetables.

Introduction

The ACMSF has previously requested updates on the microbiological safety and status of ready-to-eat food in the United Kingdom (UK) and focused on fresh produce. This report is the fourth update on foodborne outbreaks associated with the consumption of ready-to-eat foods.

1. Foodborne outbreaks, 2008 to 2009

A review on general outbreaks of foodborne outbreaks associated with the consumption of ready-to-eat foods in England and Wales has recently been published by the Health Protection Agency (Gormley et al., 2010).

During 2008 and 2009, 132 foodborne outbreaks were reported to the Health Protection Agency (HPA) electronic foodborne and non-foodborne gastrointestinal outbreak surveillance system (eFOSS) (Table 1). *Salmonella* Enteritidis non phage type (PT) 4 accounted for the majority of outbreaks (31/132, 23.5%) with those caused by norovirus (18/132, 13.6%) and *Campylobacter* spp. (17/132, 12.9%) the next most commonly reported.

The food service sector was most frequently implicated in foodborne outbreaks (93/132, 70.5%), within which restaurants accounted for 55/93 (59.1%) (Table 2). Other than food service associated outbreaks, institutional / residential (21/132, 15.9%), community / private household (12/132, 9.1%) and retail (6/132, 4.5%) setting linked outbreaks were also recorded (Table 2).

At least one food vehicle was identified in 99/132 outbreaks (75%). Poultry meat was the most frequently implicated (29/133, 21.8%), followed by composite / mixed foods 22/133, 16.5%) (e.g. sandwiches, prepared salad dishes and multi-component ethnic dishes) (Table 3). A single food vehicle was identified in 77/132 (58.3%) of outbreaks, two in 14/132 (10.6%) and three in 8/132 (6.1%).

The evidence implicating the consumption of a particular food vehicle to being a case in an outbreak can be epidemiological and microbiological in nature. During 2008 and 2009, analytical epidemiology and microbiological evidence was used in 2/132 outbreaks (1.5%); microbiological evidence alone in 24/132 (18.2%); analytical epidemiology evidence in 17/132 (12.9%); and descriptive epidemiology evidence in 46/132 (34.8%).

Between 2008 and 2009, there was a 122.0% increase in foodborne outbreaks (41 to 91) (Table 1) reflecting the increase in outbreaks caused by particular pathogens. The increase in *S*. Enteritidis non-PT4 outbreaks from nine to 22 was the result of the 16 *S*. Enteritidis PT14b outbreaks concurrent with a national increase of this pathogen linked to consumption of eggs from restaurants (Tables 2 and 3) (described in section 2). The upsurge of norovirus outbreaks from two to 16 (Table 1) resulted from the increase in outbreaks linked to contaminated oysters (Table 3) from restaurants (described in section 5). The increase in *Campylobacter* outbreaks from four to 13 was linked to the increase in poultry liver pate/parfait outbreaks (Table 3) from restaurants and hotels (Table 2) (described in section 3).

Information on foodborne outbreaks that occurred in England and Wales during 2010 will be published on the HPA website in April 2011.

2. Human salmonellosis linked to raw shell eggs

2.1 *Salmonella* Enteritidis non-Phage Type 4 infection in England & Wales

Eggs have continued to be implicated as a source or vehicle of infection in outbreaks associated with catering premises despite almost 20 years of national guidance on the safe handling and use of eggs. *Salmonella* Enteritidis PT4 has been the dominant phage type since 1987 but since the introduction of specific control measures by the UK poultry industry in the 1990s, isolation of this PT has declined. At the same time increases in other PTs (mainly PT1 and PT14b), causing human infection have been seen. These major resurgences were associated with substantive changes in market supply with the sourcing of eggs from other egg producers in member states, where there was a lack of vaccination of layer flocks against *Salmonella* or controlled assurance (Gillespie and Elson, 2005; Little et al., 2007). This continues to be a public health concern with 16 outbreaks concurrent with an upsurge in cases of *S.* Enteritidis PT 14b reported during the latter part of 2009 and associated with non-UK eggs linked to food service establishments (HPA, 2010a).

Investigations in 2009 provided evidence of point source outbreaks of infection from examination of foods and environmental samples at implicated food service premises and a care home and their supply of raw shell eggs (RSE). Most of the food service premises were restaurants and take-aways serving Chinese and Thai cuisine. Eleven of the 16 outbreaks had links to RSE sourced from Spain, and eggs collected from food service premises in seven of the outbreaks had the same origin (same approved establishment in Spain) as indicated by the egg stamp mark on the egg shells. RSE produced by this Spanish establishment were found to be contaminated with the outbreak strain. The outbreak investigations also revealed poor hygienic practices in food service premises as shown by cross contamination of ready-to-eat foods, food preparation surfaces and utensils with the outbreak strain within the kitchen environment. Caterers should heed advice on the safe use of eggs.

The results of the national analytical epidemiology study supported the hypothesis that infection with *S.* Enteritidis PT 14b was associated with eating out, particularly foods from restaurants and takeaways serving Chinese and Thai cuisine, with additional supportive evidence from consumption of eggs away from home (HPA, 2010a).

The Spanish Authorities were notified via the Rapid Alert System for Food and Feeds (RASFF) of RSE contaminated with *S.* Enteritidis PT 14b sourced from an establishment in Spain. RSE from the affected flock were prohibited from entering the

RSE market and sent for heat processing. The European removal of the implicated eggs from the market resulted in the outbreak being contained.

2.2 *Salmonella* Typhimurium Definitive Phage Type 8 infection linked to duck eggs

Salmonella Typhimurium definitive phage type (DT) 8 is uncommon in humans in the UK. In July 2010, the HPA reported an excess isolation rate of pan-susceptible *S.* Typhimurium DT 8 in England and Northern Ireland (HPA, 2010b). By the end of October, this had amounted to 81 laboratory confirmed human cases for all regions of England and Northern Ireland in 2010, an increase of 26% and 41% on 2009 and 2008, respectively. The descriptive epidemiological investigation found a strong association with infection and consumption of duck eggs. Duck eggs contaminated with *S.* Typhimurium DT 8 were collected from a patient's home and also at farms in the duck egg supply chain (HPA, 2010b). At the same time, a nationwide outbreak of pan-susceptible *S*. Typhimurium DT 8 also occurred in Ireland (McKeown, 2010). The descriptive epidemiological investigation in Ireland also demonstrated a link with duck eggs.

Consumption of duck eggs in the UK plummeted in the 1950s when large scale hen egg production methods took control of the market. However, promotion on use of duck eggs in recent years has seen sales significantly increase. Outbreaks like the one described may therefore happen again. This is the first known outbreak of salmonellosis linked to duck eggs in the UK since 1949 and highlighted the continuing need to remind the public and commercial caterers of the potential high risks of contracting salmonellosis from duck eggs.

The commercial UK hen egg sector has had industry assurance schemes in place and has used vaccination of layer hen flocks against *Salmonella* for over a decade. To improve public health, i.e. by reducing the number of infections from eggborne *Salmonella,* the duck industry is planning to implement a similar assurance scheme, including mandatory vaccination of flocks.

3. Human campylobacterioisis linked to poultry liver pâté/parfait

An increase in the number of outbreaks of campylobacteriosis associated with consumption of poultry liver pâté/parfait prepared and served at hotels and restaurants was reported in 2009 and 2010 (Little et al., 2010; Inns et al., 2010; HPA, 2010c). Similarly, cases of infection with *Campylobacter* in England and Wales have also continued to increase in 2010, with 10% more cases reported up to week 47 compared to the same period in 2009.

Campylobacter is the principle cause of bacterial gastroenteritis in the UK and control in poultry meat is a major public health strategy for the prevention of campylobacteriosis. Poultry livers carry a high risk of *Campylobacter* contamination as the bacteria can be present throughout the liver, and may remain as a source of infection if insufficiently cooked. Evidence gained from outbreaks during 2009 and 2010 revealed that livers used to make the parfait or pâté were deliberately undercooked allowing the liver dish to remain pink in the centre. Poor practice regarding handling and cooking of liver and other offal presents an unacceptable level of risk to the consumer. Chefs and other caterers can reduce the risk of their customers becoming infected by ensuring that *Campylobacter* is killed through proper cooking and avoiding contamination of ready-to-eat foods from raw poultry and liver and other offal. Advice to caterers on the safe handling and cooking of chicken liver products such as pâté and parfait has been recently updated and reissued (FSA, July & December 2010).

4. Human listeriosis linked to ready-to-eat food

4.1 Human listeriosis linked to retail sliced meats

In July 2010, national surveillance of human listeriosis highlighted three cases of *Listeria monocytogenes* serotype 1/2a, Amplified Fragment Length Polymorphism (AFLP) type XIV, fluorescent AFLP type 6a infection (henceforth Lm 1/2a XIV.6a) clustered in time (April and May) but not geography. All three patients reported the consumption of tongue (purchased from two national supermarket chains) and various sliced meats. A subsequent review of *L. monocytogenes* food isolates typed in 2010 found that three meat products, all originating from a single cooked meat manufacturer, were also contaminated with Lm 1/2a XIV.6a. This manufacturer was subject to a recall of chicken roll products in late February after *L. monocytogenes* was detected in these foods. In July, *L. monocytogenes* was again detected at unsatisfactory levels (1.7×10^3 cfu/g) in a retail pack of cooked sliced corned beef produced by the manufacturer. The corresponding *L. monocytogenes* isolates were subsequently confirmed as Lm 1/2a XIV.6a. In total, ten human cases of Lm 1/2a XIV.6a infection were reported in England between October 2009 and October 2010. Eight reported the consumption of tongue and all reported consuming sliced meats – a level of reporting far higher than observed in patients infected with other subtypes.

4.2 Cluster of cases of *Listeria monocytogenes* in patients at a North East Hospital

Six incidents/outbreaks of *L. monocytogenes* infection associated with sandwiches purchased from or provided in hospitals in England and Wales has been previously reported to the ACMSF (HPA, 2008; Little et al., 2008). These incidents/outbreaks have highlighted the potential for sandwiches contaminated with *L. monocytogenes* to cause severe infection in vulnerable people. Since then, there have been two other similar outbreaks, one in Northern Ireland in 2008 and the other in North East England in 2010.

In 2010, five cases of *L. monocytogenes* were reported from a hospital in the North East over a five month period. Three of the cases had had long in-patient stays during their incubation period, one had had several shorter in-patient stays and the fifth case had attended the hospital frequently as an out patient for chemotherapy treatment. Three of the cases were found to be infected with *L. monocytogenes* serotype 4 Amplified Fragment Length Polymorphism (AFLP) type I, fluorescent AFLP type 33 (henceforth Lm 4 I.33).

Food served to these cases during their inpatient stays included sandwiches. Environmental investigation included sampling of ready-to-eat foods; two sandwiches provided by an external supplier were found to contain low levels (<20 cfu/g) of Lm 4 I.33. Other sandwich fillings sampled contained *L. monocytogenes* serotype 1/2a (<20 cfu/g). Environmental sampling at the sandwich manufacturing premises confirmed the presence of this unusual strain (Lm 4 I.33) in the sandwich production environment. All foods consumed by hospital patients should be free from potential pathogens, including *L. monocytogenes*, and those responsible for procuring sandwiches for hospitals should ensure the safety of vulnerable patients in their care. Businesses manufacturing sandwiches should aim to ensure *L. monocytogenes* is absent from their product wherever possible.

An alert was circulated in December 2010 by the HPA North East Health Protection Unit to all hospitals in the region highlighting the risk to immune-compromised patient of *L. monocytogenes* in ready-to-eat foods, including sandwiches, and advised hospital infection control and catering teams to review foods served to this patient group. Practical difficulties are recognised in (i) defining immune-compromised patients (given the increasing number of treatments now in use) and (ii) restricting foods served in hospital settings, but pragmatic measures, such as not serving sandwiches on oncology wards/chemotherapy units, could be taken to reduce the risk to this vulnerable patient group.

5. Shellfish consumption and the risk of norovirus infection

Recurrent norovirus outbreaks have been identified in England and Wales due to the consumption of raw oysters in hotels and restaurants indicating that control measures are not completely effective. Between January and March 2010, several outbreaks linked to the consumption of raw oysters were also reported across Europe (including the UK), which affected over 300 people (120 of which were in the UK) (Westrell et al., 2010).

Norovirus infections are seasonal; the number of laboratory confirmed isolates and reported outbreaks of norovirus infection increases markedly during the winter months. Studies of the detection of norovirus in oysters also show higher rates of detection during the months of October to March. Norovirus is extremely difficult to remove from contaminated shellfish and consuming raw molluscs, such as oysters, involves potential exposure to norovirus. Food handlers may also contaminate food if they are working while they are still infectious. The public should be aware of the potential risks of norovirus associated with the consumption of raw shellfish such as oysters in order to make an informed choice about eating them (HPA, 2010d).

Draft proposed Codex (2010) guidelines state that there are no validated post-harvest risk management options and this therefore places the emphasis on effective control strategies for the prevention of contamination. Ultimately, it is the seafood producers' responsibility to produce safe seafood whether this relates to bacterial or viral contamination.

6. Ready-to-eat fruit and vegetables

Supplementing the information provided in the previous update paper to the ACMSF (Little et al., 2008), there were seven foodborne outbreaks reported to HPA in 2008 to 2010 that was associated with the consumption of fresh produce (Table 4). Five hundred and thirty one people were affected and 57 were admitted to hospital. One death was reported. In five of the seven outbreaks more than 30 people were affected (range 6 to 231). The most commonly identified aetiological agent was *Salmonella* (Table 4). All seven outbreaks were associated with the consumption of vegetables, three of which were lettuce. The fresh produce outbreaks were associated with both the retail and commercial food service sector (Table 4). Food vehicles were implicated in four of the outbreaks using analytical epidemiological techniques, in two of the outbreaks on the basis of microbiological evidence and in three, on the basis of descriptive epidemiology. The factors identified by investigators as contributing to the outbreaks are outlined in Table 4.

A notable outbreak of *S.* Bareilly infection linked with the consumption of bean sprouts occurred in 2010 and a comprehensive account of this outbreak has been published (Cleary et al., 2010). Epidemiological and microbiological investigations implicated bean sprouts as a vehicle for *S.* Bareilly transmission, consistent with previous research showing that bean sprouts can be a vehicle for *Salmonella* transmission. As in previous outbreaks, this investigation concluded that the seeds were likely to have been contaminated. Based on the experience of this investigation, the methodology used for routine microbiological quality control testing of bean sprouts may not be sensitive to low levels of *Salmonella* contamination. This may have implications for future testing protocols.

Public health interventions resulting from this investigation focussed on communications to the public advising of the correct preparation of bean sprouts, and on addressing potentially misleading food labelling with suppliers and producers. Ready-to-eat food is defined as "food intended by the producer or manufacturer for direct human consumption without the need for cooking or other processing effective to eliminate or reduce to an acceptable level micro-organisms of concern" (Regulation (EC) No. 2073/2005). Bean sprouts may be cooked by steaming or quickly stir frying them which may not be sufficient to eliminate pathogens. It is also known that effective washing and decontamination of ready-to-eat vegetables is difficult. Reduction of risk for human illness associated with raw produce cannot rely solely on the end consumer to wash the product before use. This would be better achieved through controlling points of potential contamination in the field, during harvesting, and during processing and distribution of fresh produce.

Discussion

We have presented a summary drawn from the findings of outbreak investigations conducted in England and Wales over the period 2008 to 2010. The information given supplements and updates three reports previously submitted to the Committee.

Outbreaks of infectious intestinal disease (IID) associated with the consumption of microbiologically contaminated ready-to-eat foods continue to be identified and investigated. When the most recent data are considered alongside those presented earlier, four recurrent themes emerge. These are:

- the susceptibility of vulnerable groups to listeriosis associated with the consumption of a range of ready-to-eat foods;
- general kitchen hygiene;
- norovirus infection associated with the consumption of raw oysters;

- salmonellosis associated with the consumption of raw or lightly heat treated vegetables.

The control of listeriosis poses a distinct challenge because pregnant women and those with a specific set of underlying conditions can develop severe illness after ingesting *L. monocytogenes* at levels that would not have an effect on other individuals. The issues related to listeriosis in vulnerable groups are complex but have already been examined in detail in a comprehensive report compiled by an *Ad Hoc* Group of the Advisory Committee on the Microbiological Safety of Food (ACMSF, 2009). Our analyses show that the issues highlighted by the *Ad Hoc* Group continue to cause concern.

Local investigators continue to identify cross-contamination and infected food handlers as contributory factors leading to outbreaks linked to commercial catering. Failure to maintain good standards of kitchen hygiene can result in large numbers of people becoming infected. Although the number of identified outbreaks investigated and reported is small, the problems identified are of wider consequence. This is because identified outbreaks probably represent a small proportion of all the outbreaks that occur in the community. We have to acknowledge that outbreaks affecting institutions, parties and invited groups, such as those attending wedding receptions, are most readily detected and reported to health protection units and local authorities. It is much more difficult to link cases in situations where similar failures lead to contaminated food being served to small groups and individuals. Therefore cases that are infected in high street or city centre restaurants would be expected to present as sporadic cases. The risks from infected food handlers are difficult to control. Norovirus is the pathogen most frequently associated with infection attributable to food handlers (Adak et al, 2005). Food handlers can be infectious while they are asymptomatic and therefore can unknowingly contaminate ready-to-eat foods that they have prepared. Although the occurrence of food hygiene failures should be minimised through good training and the use of directed campaigns, human error is impossible to eradicate and outbreaks will happen.

The association between norovirus infection and the consumption of raw oysters is well described (ACMSF, 1998; Gillespie et al, 2001; Adak et al, 2005). Our surveillance data show that norovirus outbreaks linked to the consumption of oysters continue to occur. Recognised outbreaks are likely to represent a small proportion of the burden of infection attributable to oyster for the reasons given above. In addition the impact of sporadic infection due to the consumption of oysters in the home is unknown because clinical specimens are only tested for norovirus when cases are

known to be part of recognised investigated outbreaks. It has been estimated that the risk of acquiring IID as a result of consuming oysters is higher than that for any other category of food (Adak et al, 2005). At present there are no fully effective measures which can be employed to eliminate the risk of oysters becoming contaminated with norovirus and so it is likely that outbreaks will continue to occur. Under these circumstances it is important that the oysters linked to outbreaks can be traced to enable contaminated batches from being sold or served to consumers.

The problem of geographically disseminated outbreaks of salmonellosis associated with the consumption of salad vegetables emerged over the last two decades. Outbreaks have been reported from many parts of the World. In England and Wales the HPA confirms an average of one national outbreak of this type each year (unpublished data). Data collected from investigations shows that outbreaks linked to this type of product can affect large numbers of people. It is rarely possible to track back and find the root cause of these outbreaks. However it is becoming clear that despite careful production practice and ongoing vigilance by the industry it is almost impossible to ensure that crops can be protected from becoming contaminated with zoonoses across the whole production and distribution chain. Therefore it is important to ensure that the health protection infrastructure can continue to maintain high quality microbiological diagnostic and characterisation facilities. For these play an essential role in enabling sensitive surveillance to be conducted on an ongoing basis. This in turn allows potential outbreaks to be detected and investigated in a timely manner providing risk assessment data for regulators at local, national and international levels which can then be used for effective risk management.

References

Adak GK, Meakins SM, Yip H, Lopman BA, O'Brien SJ. (2005).Disease risks from foods, England and Wales, 1996-2000. *Emerging Infectious Diseases*; 138:3 65-372.

Advisory Committee on the Microbiological Safety of Food, Report on foodborne viral infections. 1998.

Advisory Committee on the Microbiological Safety of Food, *Ad Hoc* Group on Vulnerable Groups. Report on the increased incidence of listeriosis in the UK, July 2009.

Cleary, P., Browning, L., Coia, J., Cowden, J., Fox, A., Kearney, J., Lane, C., Mather, H., Quigley, C., Syed, Q., Tubin-Delic, D. on behalf of the outbreak control team. (2010). A foodborne outbreak of *Salmonella* Bareilly in the United Kingdom, 2010. *Eurosurveillance* 15(48):pii=19732.

Codex Alimentarius Commission (Codex) (2010). Proposed Draft Guidelines on the Application of General Principles of Food Hygiene to the Control of Viruses in Food. Available at: ftp://ftp.fao.org/codex/ccfh42/fh42_05e.pdf.

Food Standards Agency (2010). FSA reminds caterers about safe preparation of chicken livers. 3 December 2010. London: FSA, 2010. Available at http://www.food.gov.uk/news/newsarchive/2010/dec/liver.

Gillespie IA, Adak GK, O'Brien SJ, Brett MM, Bolton FJ. (2001). General outbreaks of infectious intestinal disease associated with fish and shellfish, England and Wales, 1992-1999. *Communicable Disease and Public Health*; 4: 117-123.

Gillespie IA, Elson R (2005). Successful reduction of human Salmonella Enteritidis infection in England and Wales. *Eurosurveillance* ; 10(46):pii=2834. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=2834

Gormley, F.J., Little, C.L., Rawal, N., Gillespie, I.A., LeBaigue, S., Adak, G.K. (2010). A seventeen-year review of foodborne outbreaks - describing the continuing decline in England and Wales. *Epidemiology & Infection*. Available online doi:10.1017/S0950268810001858.

Health Protection Agency (HPA) (2010a). *S.* Enteritidis infections in England in 2009: national case control study report. Health Protection Report Vol 4 (6); 12 February 2010.

Health Protection Agency (HPA) (2010b). Increase in *Salmonella* Typhimurium DT8 in 2010 linked to duck eggs. Health Protection Report 4 (37); 17 September 2010.

Health Protection Agency (HPA) (2010c). Foodborne outbreaks of campylobacter associated with consumption of poultry liver pâté/parfait – spotlight on caterers and food safety. Health Protection Report 4 (48); 3 December 2010.

Health Protection Agency (HPA) (2010d). Shellfish consumption and the risk of norovirus infection. Available at: http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Norovirus/oysterconsumptionnorovirus/.

Health Protection Agency (HPA) (2008). Human listeriosis linked to hospital sandwiches: implications for procurement and storage. Health Protection Report 2 No. 35, 29 August 2008.

Inns, T., Foster, K., Gorton R. Cohort study of a campylobacteriosis outbreak associated with chicken liver parfait, United Kingdom, June 2010. *Eurosurveillance* ; 15(44):pii=19704. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=19704

Little, C.L., Gillespie, I., Adak, G.K. (2008). Update on the microbiological status of ready-to-eat foods (focussing on fruit and vegetables), September 2008. Advisory Committee on the Microbiological Safety of Food ACM/922.

Little, C.L., Gormley, F.J., Rawal, N., Richardson, J. (2010). A recipe for disaster: Outbreaks of campylobacteriosis associated with poultry liver pâté in England and Wales. *Epidemiology & Infection*; 138: 1691 -1694.

Little, C.L., Surman-Lee, S., Greenwood, M., Bolton, F.J., Elson, R., Mitchell, R.T., Nichols, G.N., Sagoo, S.K., Threlfall, E.J., Ward, L.R., Gillespie, I.A., O'Brien, S.J. (2007). Public health investigations of *Salmonella* Enteritidis in catering raw shell eggs, 2002 – 2004. *Letters in Applied Microbiology*; 44: 595-601.

McKeown P. Update on a nationwide Salmonella Typhimurium DT 8 outbreak associated with duck eggs**.** *Epi-Insight - Disease Surveillance Report Ireland* 2010; 11 (10): October 2010.

Westrell, T., Dusch, V., Ethelberg, S., Harris, J., Hjertqvist, M., Jourdan-da Silva, N., Koller, A., Lenglet, A., Lisby, M., Vold, L. (2010). Norovirus outbreaks linked to oyster consumption in the United Kingdom, Norway, France, Sweden and Denmark, 2010. *Euro Surveill*.15(12):pii=19524.

Tables

Table 1. Foodborne outbreaks reported in England and Wales, 2008 and 2009

Pathogen	Number of outbreaks		
	2008	**2009**	**Total**
Salmonella Enteritidis non-PT4	9	22	31
Norovirus	2	16	18
Campylobacter spp.	4	13	17
Mixed / other / unknown*	6	10	16
Escherichia coli O157	3	7	10
Salmonella Typhimurium	6	3	9
Clostridium perfringens	2	4	6
Scombrotoxin	1	5	6
Other *Salmonella* spp.	3	2	5
Salmonella Enteritidis PT4	3	1	4
Staphylococcus aureus	-	3	3
Bacillus spp.	-	2	2
Listeria monocytogenes	1	1	2
Shigella spp.	-	2	2
Cryptosporidium spp.	1	-	1
Total	**41**	**91**	**132**

* Mixed / other / unknown outbreaks are those caused by more than one pathogen, rotavirus and unknown agents.

Source: HPA eFOSS
NB: The database is dynamic and, as such, data are subject to change

Table 2. Foodborne outbreak settings reported in England and Wales, in 2008 and 2009

Setting	Number of outbreaks		
	2008	2009	Total
Food Service	23	70	93
Restaurant	11	44	55
Hotel / guest house	5	7	12
Pub / bar	4	6	10
Other food service premises[a]	2	6	8
Take-away	1	5	6
Event caterer	-	1	1
Mobile vendor	-	1	1
Institutional / Residential	9	12	21
Residential	6	4	10
School	1	4	5
Other[b]	-	2	2
Workplace catering	-	2	2
Armed services catering	1	-	1
Hospital	1	-	1
Other	8	4	12
Community	5	1	6
Private house	2	3	5
Other (picnic site)	1	-	1
Retail	1	5	6
Smaller retailers	1	4	5
Supermarket	-	1	1
Total	**41**	**91**	**132**

[a] Other food service premises included catered halls or community centres.
[b] Other institutional / residential settings included a holiday camp and a hostel.

Source: HPA eFOSS
NB: The database is dynamic and, as such, data are subject to change

Table 3. Food vehicles implicated in foodborne outbreaks in England and Wales, in 2008 and 2009

Food vehicle	Number of outbreaks		
	2008	2009	Total
Poultry	5	24	29
Composite / mixed foods	8	14	22
Crustacea and shellfish	5	11	16
RSE used in uncooked / lightly cooked food[a]	3	12	15
Red meat	3	10	13
Eggs and egg dishes	2	6	8
Dessert, cakes and confectionary	2	5	7
Finfish	1	5	6
Vegetables and fruit	2	4	6
Condiments and sauces	1	4	5
Rice	-	3	3
Potable water	1	1	2
Milk and dairy products	-	1	1
Total[b]	**33**	**100**	**133**

[a] RSE, raw shell egg.
[b] Total number of implicated food vehicles will not equal the total number of foodborne outbreaks as a food may not always be implicated or more than one food vehicle can be identified per outbreak.

Source: HPA eFOSS
NB: The database is dynamic and, as such, data are subject to change

Table 4 Foodborne outbreaks associated with salad, vegetables and fruit

England and Wales, 2008 - 2010

Place	Organism	No. Affected	No. Hospitalised	No. Deaths	Year	Month of outbreak*	Setting	Food vehicle	Factor	Evidence
South West England	*Escherichia coli* O157	6	3	0	2008	July	Retail	Mixed organic vegetables	Cross-contamination	A
National	*Salmonella* Typhimurium U321	14	0	0	2008	September	Retail	Lettuce - bagged mixed baby leaf salad	Not known	MD
National	*Salmonella* Oranienburg	38	0	0	2009	April	Retail	Salad vegetables	Not known	D
South East England	*Salmonella* Enteritidis PT8	92	6	0	2009	August	Food Service	Lettuce - green salad	Infected food handler, Cross-contamination, Storage too warm	A
South East England	Norovirus	20	0	0	2010	May	Food Service	Salad vegetables	Infected food handler	D
National	*Salmonella* Java PT3B var9	130	16	0	2010	August - October	Retail, Food Service	Lettuce – mixed leaf salad	Not known	A
National	*Salmonella* Bareilly	231	32	1	2010	August - November	Retail, Food Service	Bean sprouts	Seeds contaminated	MA

* Based on month of disease onset of first case.

Source: HPA eFOSS
NB: The database is dynamic and, as such, data are subject to change