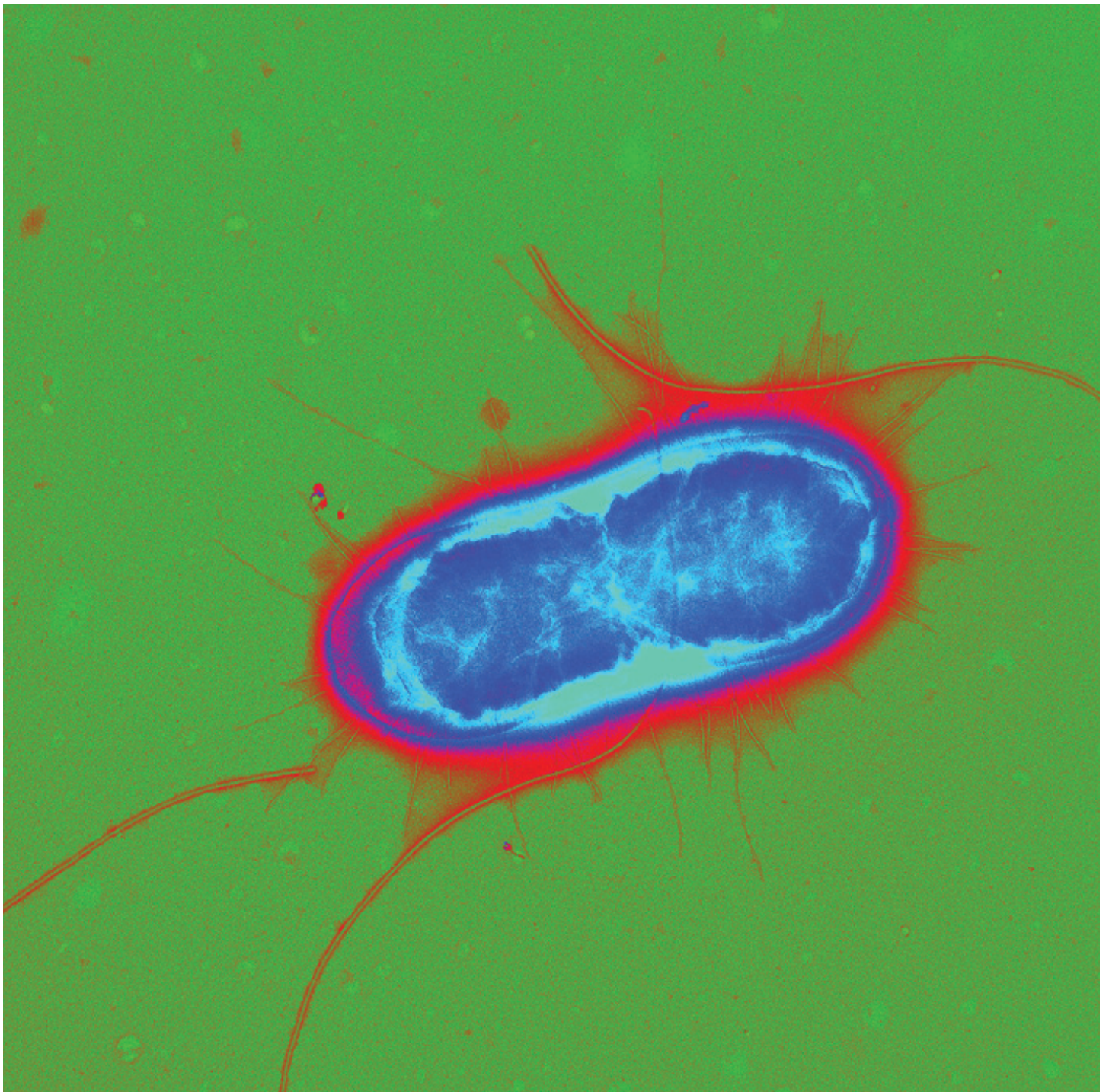


Gastrointestinal infections annual report, 2010

Gastrointestinal, Emerging and Zoonotic Infections Department



This report from the Health Protection Agency reflects understanding and evaluation of the current scientific evidence as presented in this document.

For information or queries relating to this document please contact the Gastrointestinal, Emerging and Zoonotic Infections Department: eedd@hpa.org.uk

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FOREWORD

This is the first annual report from the Gastrointestinal Infections section of the Gastrointestinal, Emerging and Zoonotic Infections (GEZI) department. The GEZI department covers a wide range of gastrointestinal organisms, including bacterial, viral and parasitic pathogens. A number of surveillance systems are in place; most of which rely on laboratory reporting.

During 2010 there were several large national outbreaks of *Salmonella* and frequent smaller outbreaks of other gastrointestinal infections. While *Salmonella* outbreaks and norovirus outbreaks in hospitals decreased in 2010 compared with previous years, *Campylobacter* outbreaks continued to increase. December 2010 also marked the beginning of a national outbreak of VTEC O157 that stretched well into 2011.

The year 2010 was the second year of operation for the enhanced national surveillance of vero cytotoxin-producing *Escherichia coli* (VTEC) and the norovirus hospital outbreak reporting scheme. Both provide valuable data for use by the Health Protection Agency (HPA) and our stakeholders.

In early 2010, the enhanced national surveillance of VTEC was launched online. The system is accessible to local and regional health protection colleagues and new functionality continues to be added. This was followed by work on the foodborne and non-foodborne gastrointestinal outbreak surveillance system (eFOSS), which is also now online and accessible to health protection colleagues.

The surveillance activities of the department ensure the prompt identification of outbreaks. Members of the GEZI department investigated national outbreaks of *Salmonella* and VTEC. They also provided support and expertise during the investigation of outbreaks at a regional and local level. These activities were complemented by eFOSS, which collects data on outbreaks and allows trends in causative agents and source attribution to be analysed.

Recent publications by the GEZI department regarding *Listeria* surveillance illustrate some of the gains from enhanced surveillance. For example, risk factor analysis of cases of listeriosis has helped to redefine the population at risk.

As the newly-implemented surveillance systems mature, it is expected that more epidemiological trends will be elucidated. Work to improve existing surveillance is ongoing and plans for new surveillance systems, such as the surveillance of haemolytic uraemic syndrome (HUS), are underway.

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Key Points

- Cases of vero cytotoxin-producing *Escherichia coli* (VTEC) in 2010 were lower than in 2009, although figures for early 2011 suggest that cases for this year are above average. The proportion of cases developing haemolytic uraemic syndrome (HUS) (15%) was higher than in 2009 (12%).
- The number of cases of *Salmonella enterica* reported annually continues to decrease, from a peak in the 1990s. In 2010, *Salmonella* Typhimurium definitive phage type (DT) 193 was the most frequently reported phage typed *Salmonella*.
- A decrease in *Listeria monocytogenes* infections was observed in 2010, however, the number of cases remains above those levels observed in the 1990s. The *Listeria* surveillance system has allowed analysis of risk factors associated with *Listeria* infection.
- There was an 8.8% increase in *Campylobacter* spp infections in 2010 compared to 2009 and a 39% increase since 2004.
- An increase in *Campylobacter* outbreaks was observed in 2010. By contrast, there was a decrease in *Salmonella* outbreaks. Undercooked chicken liver pâté/parfait has been identified as a common cause of the *Campylobacter* outbreaks.
- There was a 39% reduction in norovirus outbreaks reported to the Hospital Outbreak Reporting Scheme for the July 2010 to June 2011 season compared with the previous season. The same pattern was seen in laboratory reporting. Despite this decrease, norovirus remains a major cause of disruption in the NHS.
- Recent improvements to both the Enhanced National Surveillance of VTEC and eFOSS will aid the HPA Gastrointestinal, Emerging and Zoonotic Infections (GEZI) department in the surveillance of gastrointestinal infections. These systems also provide valuable data and tools for local and regional Health Protection Services.

Surveillance of gastrointestinal infections in England and Wales, 2010

The surveillance systems in place within the GEZI department allow us to monitor long term trends in important gastrointestinal pathogens, identify outbreaks of disease and fulfil European and international reporting requirements. The numbers presented within this report are predominantly derived from laboratory-based data. It is well known that these represent only a proportion of the actual numbers of cases occurring in the community. This under-representation is highlighted by the recently published second study of infectious intestinal disease in the community (IID2 study) [1]. In spite of this limitation laboratory-based surveillance remains a valuable tool in recognising and verifying outbreaks, in identifying trends in infections and in ascertaining new or emerging problems. It also enables the impact of interventions to be assessed in a systematic way.

Since 1981, campylobacteriosis has been the most commonly reported bacterial infection in England and Wales—having overtaken salmonellosis. However, the most common infections are not necessarily the most severe. Over the past 10 years, the number of laboratory reports of vero cytotoxin-producing *Escherichia coli* (VTEC) O157 in England and Wales has averaged just over 800 cases, yet the mortality, severity of disease and sequelae associated with VTEC infection can be significant. The outbreak of VTEC O104 in Germany during May to July 2010 demonstrated how bacteria can evolve and become more virulent than is the norm. During the outbreak, which affected more than 3,500 people in Germany and more than 100 travellers to Germany from 15 countries, the organism picked up the enteroaggregative gene and gave rise to a far higher rate of haemolytic uraemic syndrome (HUS) than had been seen before [2].

Laboratory reports provide only part of the information required for effective surveillance. While they provide data on the incidence of infection, more information may be required to identify outbreaks and inform policy makers of any changes in the epidemiology of infections. Enhanced surveillance systems are therefore used to supplement laboratory-based data and provide the extra information that is required. The enhanced systems in place in England and Wales are listed in Box 1 and detailed later in this report. In addition, organism-specific surveillance is not satisfactory when conducting surveillance of outbreaks of gastrointestinal infections and a specific system (eFOSS) exists in England and Wales to respond to this need.

This is the first annual report from the Gastrointestinal, Emerging and Zoonotic Infections (GEZI) department that brings together outputs from the wide range of organisms and outbreaks under surveillance. We hope the report will assist all those working in gastrointestinal disease.

Box 1. Enhanced surveillance systems for gastrointestinal pathogens currently in place within GEZI.

VTEC – Enhanced national surveillance of VTEC in England.

Listeria – National surveillance of listeriosis in England and Wales.

Norovirus – The hospital norovirus outbreak reporting scheme.

eFOSS – Electronic foodborne and non-foodborne gastrointestinal outbreaks surveillance system.

Developing surveillance systems

Enhanced national surveillance of VTEC in England

The enhanced national surveillance of VTEC in England began in 2009 and was developed in 2010 with the launch of the secure web-based relational database. The database is used by GEZI to monitor trends and outbreaks of VTEC and also by local Health Protection Units (HPUs), which have access to data regarding cases in their area. This surveillance system currently holds around 3,000 patients' records and 3,300 sets of isolate data (some patients have multiple isolates). Further improvements to the secure web-based system are detailed below.

Mapping

Each patient has postcode data from the surveillance questionnaires mapped onto an online map (viewable when the user has edit rights for that patient). In addition, there are national maps that can be searched by VTEC isolate typing data, date of onset, and travel abroad, to show an overview in England (figure 1).

Exposure search

The surveillance questionnaires can now be searched online for keywords through the exposure search section. A general overview of the different types of exposure can be viewed via the exposure map.

Outbreaks

Patients can be grouped into outbreaks and linked together with additional outbreak data such as ILOG, HPzone identifiers and a description.

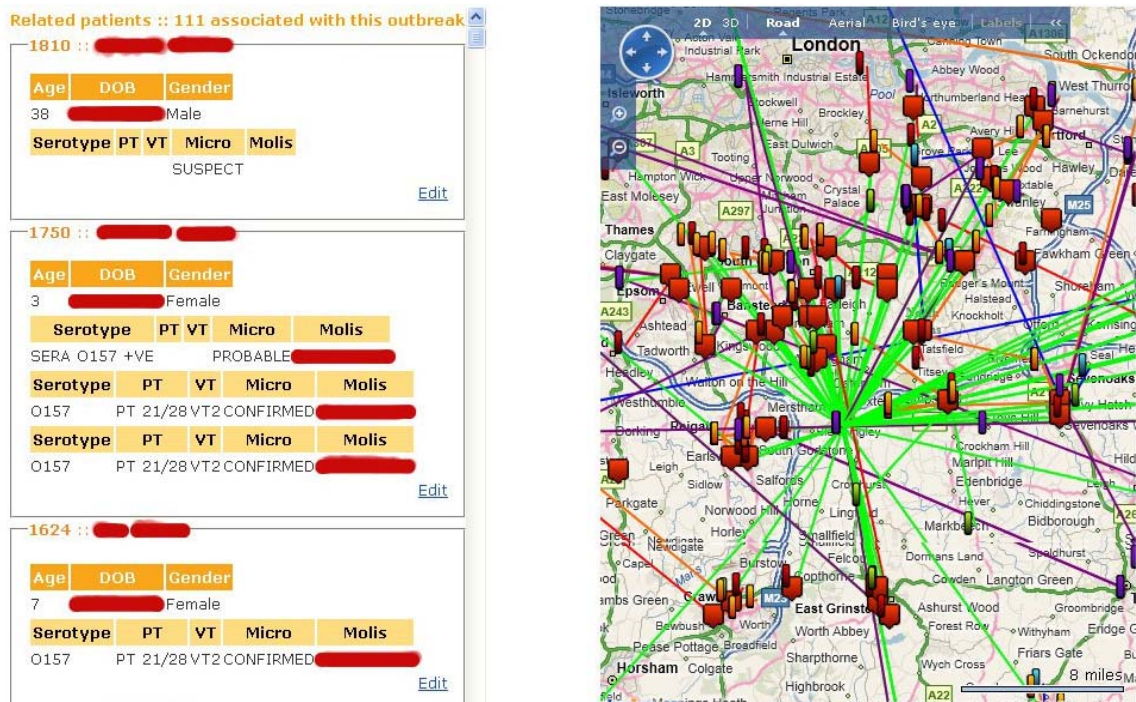


Figure 1: Map dashboard for an outbreak of VTEC O157

Electronic Foodborne and non-Foodborne Gastrointestinal Outbreak Surveillance System (eFOSS)

The development of the HPA's secure web-based outbreak system is intended to facilitate local and national public health action and fulfil statutory reporting responsibilities (see page 11). Development of the eFOSS web-based relational database began in September 2010 and was completed in August 2011.

The eFOSS database holds data on foodborne and non-foodborne outbreaks of gastrointestinal infections dating back to 1992 and thus provides an overview on trends and sources of outbreaks in England and Wales spanning 20 years. Analysis of data from outbreak investigations has been valuable in identifying novel vehicles of infection as well as confirming the continued role of known vehicles and pathogens in, for example, current food safety problems, such as *Salmonella* and *Campylobacter* infections.

The eFOSS web-based system is designed so that, on completion of investigation, data on outbreaks can be entered directly by local and national investigators. Additionally, HPA users are able to search data directly, using a wide range of search menu fields, in order to review local and national outbreak data. Outbreaks are mapped online by outbreak setting (i.e. by postcode of the outbreak location) providing an overview of outbreaks in England and Wales by mode of transmission, agent type, by year, and by a range of other search criteria (figure 2). Further features added to the eFOSS web-based system include dynamic chart outputs on foodborne and non-foodborne outbreaks.

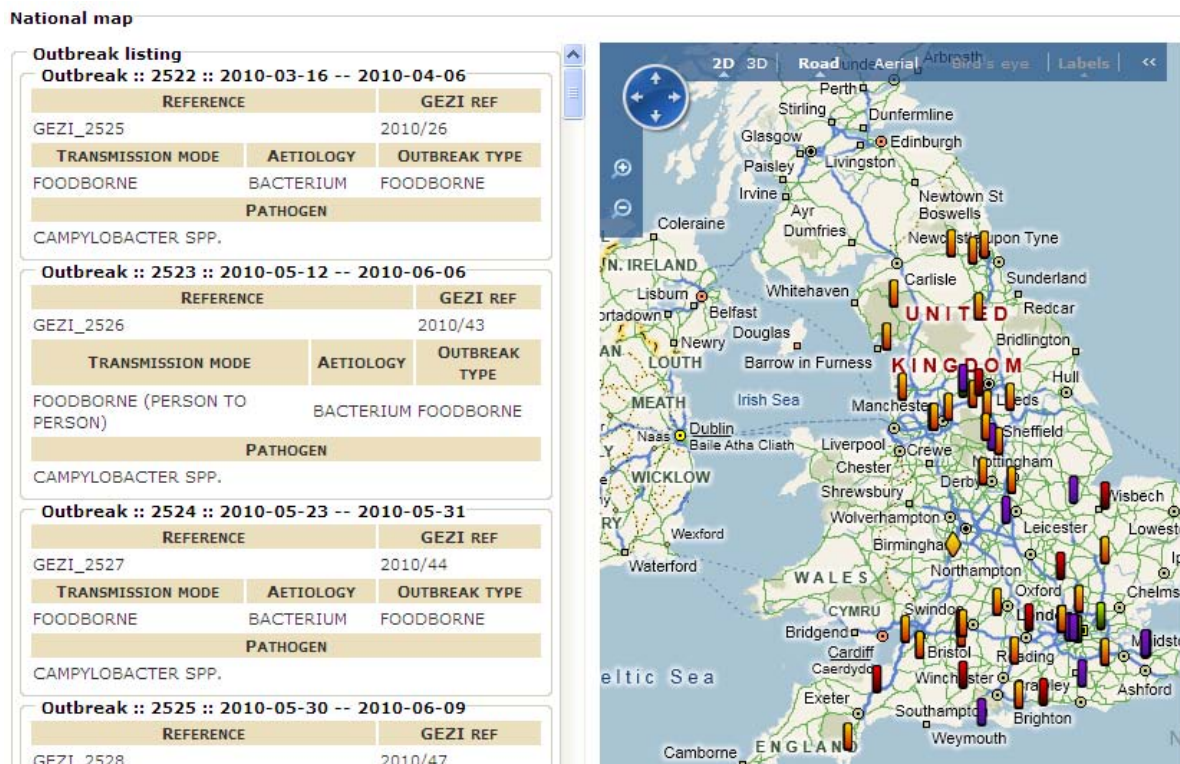


Figure 2: Map dashboard for foodborne outbreaks in 2010

Reporting of gastrointestinal infections and outbreaks in a European context

In addition to the surveillance of gastrointestinal infections and outbreaks undertaken by GEZI on behalf of the population of England and Wales, the HPA has the responsibility to report these data to the European Centre for Disease Prevention and Control (ECDC, based in Stockholm, Sweden) and the European Food Safety Authority (EFSA, based in Parma, Italy). For gastrointestinal infections, this reporting can range from completing a table of total number of cases, such as that required by the World Health Organization (WHO) at the beginning of each year, to submitting a sub-set of national data to the ECDC. The founding regulation of ECDC (Regulation 851/2004) obliges all Member States to supply data to them. Article 4 states that “Member States shall: (a) provide to the Centre in a timely manner available scientific and technical data relevant to its mission” and is further defined by Article 11: “Collection and analysis of data, 1. The Centre shall coordinate data collection, validation, analysis and dissemination of data at Community level, including on vaccination strategies. The statistical element of this data collection will be developed in collaboration with Member States using, as necessary, the Community statistical programme, to promote synergy and avoid duplication.”

To accept and be able to analyse these data ECDC created a database called The European Surveillance System (TESSy). TESSy requires data to be sent in a predefined format on an individual case basis for a range of 49 infections and special health issues [3]. Data are extracted from databases within GEZI and uploaded to TESSy on a quarterly and annual basis. Public domain outputs from ECDC and the TESSy database are relatively limited and currently only consist of the Annual Epidemiological Report. The most recent version is for the year 2008 [4].

In addition to the requirement to report surveillance data to ECDC, there is also a statutory requirement (Zoonoses Directive 2003/99/EC) for Member States to report data on zoonoses and foodborne outbreaks to the European Food Safety Authority (EFSA) on an annual basis. Data on human cases are supplied to EFSA via TESSy and on outbreaks via the UK Department of Environment, Food and Rural Affairs (Defra). The EU Annual Report (most recent version is for the year 2009 [5]) from these surveillance data is produced in collaboration with ECDC, which provides the information on zoonoses cases in humans.

As well as the task of examining and publishing surveillance data on gastrointestinal infections, ECDC have developed a system called the Epidemiological Information System (EPIS) which provides a secure web-based platform for the exchange of information and, if necessary, data when looking at potential or actual international outbreaks. EPIS covers several of the disease specific groups co-ordinated by ECDC and the Food and Waterborne Disease module of EPIS was the first of the groups to go live. The platform has been used to share information on the epidemiology and microbiology of cases in outbreaks in providing more recent epidemiological information that might be available in TESSy and results from other laboratory typing methods that are not routinely reported (such as pulsed-field gel electrophoresis).

The reporting of national data and epidemic intelligence to ECDC helps ECDC and Member States to identify multi-country trends and co-ordinate investigations across countries when international outbreaks are identified.

HPA electronic Foodborne and non-Foodborne Gastrointestinal Outbreak Surveillance System (eFOSS)



General outbreaks are those affecting members of more than one household or residents of an institution. Types of general outbreaks included in eFOSS are: foodborne outbreaks inclusive of potable water; non-foodborne outbreaks associated with recreational water, other/outdoor events (environmental exposure e.g. mud), and animal contact; and those of person to person transmission caused by vero cytotoxin-producing *Escherichia coli* (VTEC).

Key trends - 2010

Sixty-one general outbreaks of foodborne gastrointestinal infection in England and Wales were reported to eFOSS in 2010—fewer than in the previous year (when there were 91 outbreaks). Nineteen non-foodborne outbreaks (mode of transmission: animal contact, recreational water, person to person contact (VTEC only)) occurred in 2010, with 42% associated with animal contact.

The reduction in foodborne outbreaks attributed to *Salmonella* spp.—only eight in 2010 compared with 28 in 2009 and continuing a decade-long trend, particularly in those caused by *S. Enteritidis*—mirrors reported decreases in *Salmonella* laboratory-confirmed cases in 2010, and clearly indicates the effect of successful intervention measures undertaken in poultry flocks.

Bucking this trend in *Salmonella* outbreaks, a further increase in *Campylobacter* outbreaks was reported in 2010 compared to 2009 (18 vs. 13), with an increment in those linked to consumption of poultry liver pâté/parfait (9/13 in 2009 vs. 14/18 in 2010) [6, 7]. Similarly, cases of infection with *Campylobacter* in England and Wales also continued to increase in 2010 compared to 2009 (see page 22). Evidence gained from outbreaks during 2010 revealed that, as in 2009, livers used to make parfait or pâté by caterers were deliberately undercooked—allowing the liver dish to remain pink in the centre—despite specific food safety advice tailored for caterers.

eFOSS surveillance

The investigation and reporting of foodborne outbreaks is mandatory within the EU (Directive 2003/99/EC) and eFOSS is aligned to fulfil these statutory reporting requirements. Upon notification of an outbreak a standardised outbreak surveillance form is sent from eFOSS to the HPU lead investigator (usually a Consultant in Communicable Disease Control) with a request that it is completed once the outbreak investigation has ended. The eFOSS web-based relational database was launched in 2011 enabling outbreak investigators to enter and search data directly in order to review local and national outbreak data. The system can be accessed at:

<https://www.hpa-bioinfosecure.org.uk/efoss/>.

Foodborne outbreaks in 2010

There were 61 reported foodborne outbreaks affecting 1,396 people with 82 hospitalised and five deaths. The pathogens most often associated with foodborne outbreaks were *Campylobacter* (31%), norovirus (16%), those of unknown aetiology (16%), and *Salmonella* (13%). Most foodborne outbreaks occurred in the food service sector (85%), followed by institutional/residential (10%), and retail (5%) settings.

A food vehicle was identified in 84% of outbreaks. The most commonly detected food in the outbreaks was poultry meat (32%), followed by crustacea/shellfish (21%), and red meat (16%). The most common foods associated with foodborne outbreaks according to pathogens were:

- *Campylobacter*: 80% poultry meat
- Norovirus or suspect norovirus: 85% oysters
- *Salmonella*: 38% fresh vegetables, 25% composite foods, 13% eggs.

The evidence implicating a food vehicle in outbreaks included analytical epidemiology plus microbiological in 5% of outbreaks, microbiological evidence alone in 20%, analytical epidemiology alone in 16% and descriptive epidemiology in 43%.

Outbreak contributory factors were identified in 87% of foodborne outbreaks. The most commonly reported contributory factors included:

- Inadequate heat treatment (36%)
- Cross contamination (18%)
- Inappropriate storage (14%)
- An infected food handler (14%).

Non-foodborne outbreaks in 2010

There were 19 reported non-foodborne outbreaks affecting 238 people of whom nine were hospitalised. No deaths were reported. Outbreaks were either caused by VTEC O157 (63%) or *Cryptosporidium* spp. (37%). The most common settings associated with non-foodborne outbreaks according to pathogens were:

- VTEC O157: 42% petting/open farms, 33% schools (nurseries).
- *Cryptosporidium*: 57% swimming pools, 29% petting/open farms.

Outbreak contributory factors were identified in 68% of the non-foodborne outbreaks. The most common contributory factors according to setting were:

- Farms: 100% contact with animals and/ or animal faeces, 38% poor personal hygiene, 25% poor-handwashing facilities.
- Swimming & similar pools: 20% water system failure (i.e. filtration failure), 20% poor personal hygiene.
- Schools: 75% person to person spread of VTEC O157, 50% poor personal hygiene.

Other information

Analyses of the national eFOSS database during 2010 have investigated infection and outbreak risk by: food vehicles and settings; campylobacteriosis associated with poultry liver pâté, and cryptosporidiosis from petting farms [8-10]. Further information and an overview of foodborne and non-foodborne outbreaks reported from 1992 to 2010 is available from:

<http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/FoodborneOutbreakSurveillanceAndRiskAssessment/>

Conclusions

The existence of eFOSS in England and Wales allows trends in foodborne and non-foodborne gastrointestinal outbreaks to be tracked against interventions taken place, provides a useful resource for source attribution of foodborne infections, and can be used for risk profiling and/or microbiological risk assessments on a local or national level.

The number of non-foodborne outbreaks reported in 2010 did not change substantially to that seen in recent years. During 2010, VTEC O157 and *Cryptosporidium* continued to be major causes of illness in non-foodborne outbreaks.

In 2010, most foodborne outbreaks were again linked specifically to food service premises. Caterers need to adopt appropriate hygiene control measures and follow food safety advice provided by the Food Standards Agency (FSA) in order to reduce the risk of infection.

Vero cytotoxin-producing *Escherichia coli* (VTEC)

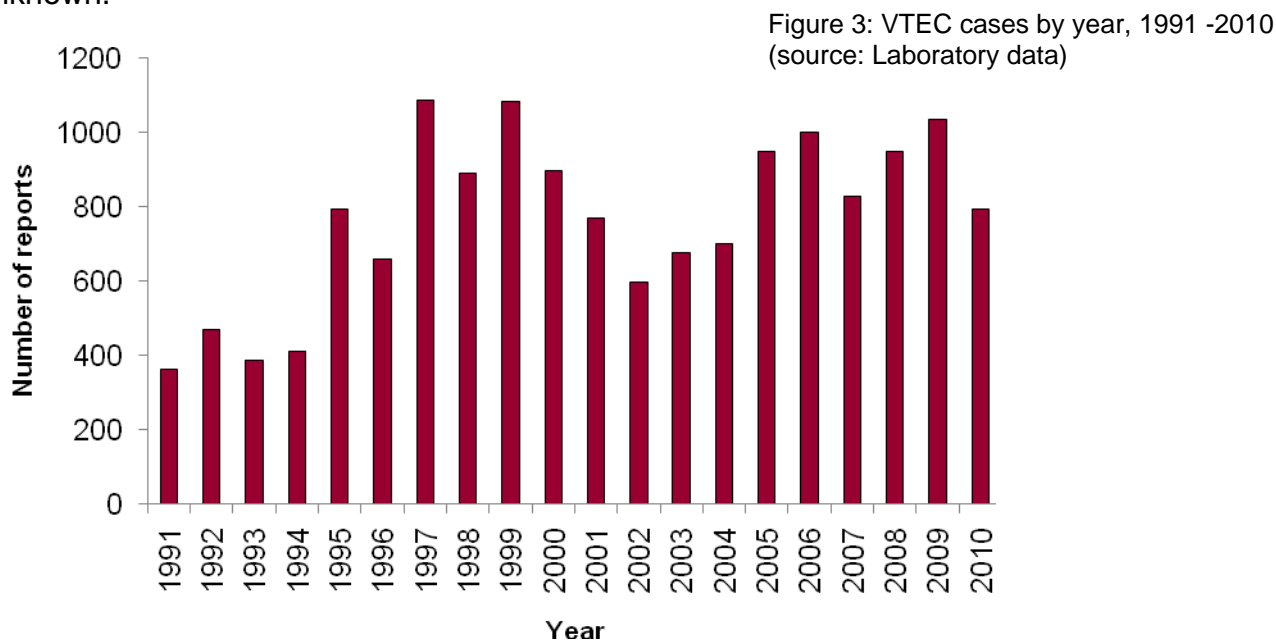
Vero cytotoxin-producing *Escherichia coli* (VTEC) is a bacterial cause of gastroenteritis. Symptoms vary, but may be severe. A small proportion of patients, mainly children, may develop haemolytic uraemic syndrome (HUS) which is a serious life-threatening condition resulting in kidney failure.

Key trends - 2010

In 2010, 793 cases of VTEC were reported to the enhanced national surveillance of VTEC in England system. Of these, 768 were confirmed as VTEC by the Laboratory of Gastrointestinal Pathogens (Figure 3), 19 were probable cases with serological evidence of infection and six were suspected cases based on the presence of HUS. This compares with 910 confirmed, 15 probable and four suspected cases reported in 2009.

The vast majority of confirmed and probable cases reported in 2010 were serotype O157 (759, 96%). The most commonly reported VTEC O157 phage types (PT) were PT 8 (211 cases), and PT 21/28 (199 cases), which together accounted for 53% of all confirmed cases. Sixty-eight percent of confirmed cases possessed the Verotoxin type (VT) 2 gene, and 32% were VT 1+2.

Of the 793 reported cases, 618 (78%) were classified as primary or co-primary (case whose date of onset is within one incubation period of the primary case, and is thought to have been exposed to the same risk factors). A further 90 cases were secondary cases. For 85 cases the epidemiological status was unknown, for 55 this was because the case was asymptomatic and therefore the period of infection was unknown.



Surveillance of VTEC

Enhanced national surveillance of VTEC infection in England was initiated in January 2009 in order to supplement our understanding of the epidemiology of VTEC infection. The system aims to assemble a standard core clinical, epidemiological and microbiological dataset on all primary indigenous VTEC cases, and to improve

outbreak recognition to facilitate public health investigations. The system can be accessed at: <https://www.hpa-bioinsecure.org.uk/vtec>. As there are only two years of data available so far, laboratory data has been used for longer-term figures.

Trends in cases

Frequently reported subtypes of VTEC O157

The most frequently reported phage type of confirmed cases of VTEC O157 in England in 2010 was PT 8 (211 cases), 95% of which were VT 1+2. However, when travel related cases are excluded, of the 590 indigenous cases the most common phage type was PT 21/28 with 193 cases, all of which were VT2. Other common indigenous subtypes were PT8 VT1+2 (162 cases) and PT2 VT2 (47 cases).

Seasonality of infection

In 2010, the highest number of indigenous cases was reported in June, July and August. The large peak in indigenous cases in September 2009 was due to the Godstone farm outbreak (Figure 4).

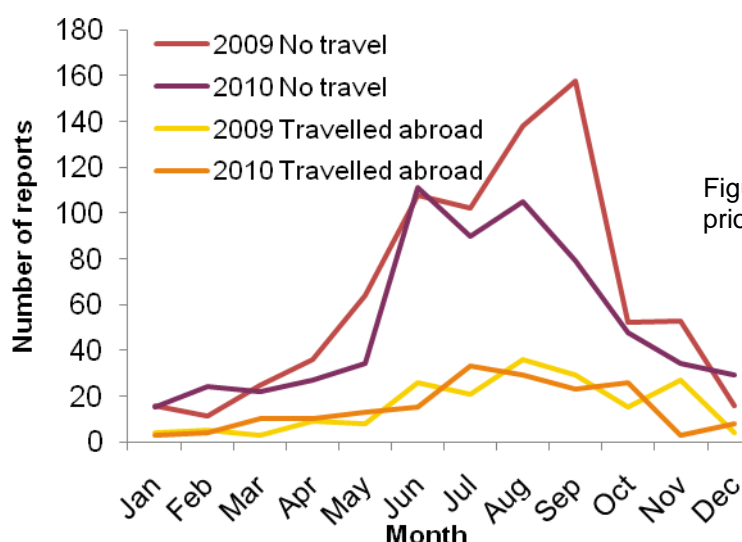


Figure 4: VTEC cases by travel in the week prior to onset and month of the year, 2010

Age, gender and geographic distribution of cases

Thirty-six percent of cases were under 10 years old (Table 1), which compares with 41% in 2009. Fifty-five percent of cases were female. By region, the number of cases per million population ranged from Yorkshire and the Humber, with 13.7 cases per million, to London, with 4.4 per million. Other regions with high incidence were the North West (11.6 cases per million) and the South West (10.1 cases per million).

Age	Female	Male	Total
0-9	138	150	288
10-19	42	64	106
20-29	62	39	101
30-39	40	32	72
40-49	31	17	48
50-59	36	17	53
60-69	41	26	67
70-79	26	11	37
80-89	15	1	16
90-99	5	0	5
Total	436	357	793

Table 1: VTEC cases by age and gender, 2010

Severity

Of the 738 symptomatic cases, the most commonly reported symptom was diarrhoea, with 93% reporting this. Seventy-eight percent reported abdominal pain and 61% reported bloody diarrhoea, with only 38% reporting vomiting. Thirty-two percent of symptomatic cases were hospitalised.

HUS is a serious condition that can be brought on as a result of VTEC infection. In 2010, 9% (53/618) of primary and co-primary cases and 4% (4/90) of secondary cases of VTEC infection reported to the enhanced national surveillance of VTEC developed HUS. This compares to 8% of primary and 2% of secondary cases reporting HUS in 2009.

Travel related cases

One hundred and seventy-six cases had travelled abroad in the week before onset, with the highest risk among those who had travelled to Tunisia (30 cases of VTEC per million visits), closely followed by Turkey (15 cases per million visits).

Conclusions

Although the annual total of VTEC cases has fallen since 2009, it remains a serious condition with severe complications. Early 2011 figures show the numbers are higher than average, in part due to a large outbreak of VTEC O157 PT8 VT1+2 linked to handling raw vegetables. As more data is collected by the enhanced national surveillance of VTEC system, this will provide a greater understanding of VTEC infection in England.

Salmonella

Salmonella infections are a common cause of gastroenteritis worldwide. Symptoms are not normally severe, although infection can be life threatening in the very young, old and immunocompromised.

Key trends - 2010

In 2010, 9,133 *Salmonella* isolates were reported by the Laboratory of Gastrointestinal Pathogens from England and Wales. This is a slight reduction in comparison to 2009 (9,956) and 2008 (10,903) and far fewer than the 33,305 cases reported in 1997. The drop in cases since 1997 is largely due to the decreasing incidence of *Salmonella* Enteritidis phage type (PT) 4.

Serotypes and phage types

Of the indigenous cases reported in 2010, the majority were due to *S. Typhimurium* (27%) or *S. Enteritidis* (24%). Six percent of cases were due to enteric fever (*S. Typhi* and *S. Paratyphi*), the majority of which were travel related.

Salmonella Typhimurium

S. Typhimurium definitive phage type (DT) 193 has shown a steady increase since 2009 and accounted for 18% of all *S. Typhimurium* cases (401 cases) in 2010. *S. Typhimurium* DT 120 (237 cases) and DT 104 (145 cases) were also frequently reported in 2010, as in previous years.

In 2010, 182 cases of *S. Typhimurium* DT 191a were reported. This compares to 69 cases in 2008 and 222 in 2009. The high number of cases reported in 2010 was linked to the continuation of an outbreak in reptile handlers linked to infected feeder mice, which began in 2008 [11].

Salmonella Enteritidis

Between 1991 and 2000 *S. Enteritidis* PT 4 accounted for between 60% and 86% of cases of indigenous *S. Enteritidis*. Following the introduction of a *Salmonella* National Control Programme in poultry, cases fell sharply (figure 5), and in the early 2000s the proportion of *S. Enteritidis* infections due to PT 4 reduced from 60% to under 30%.

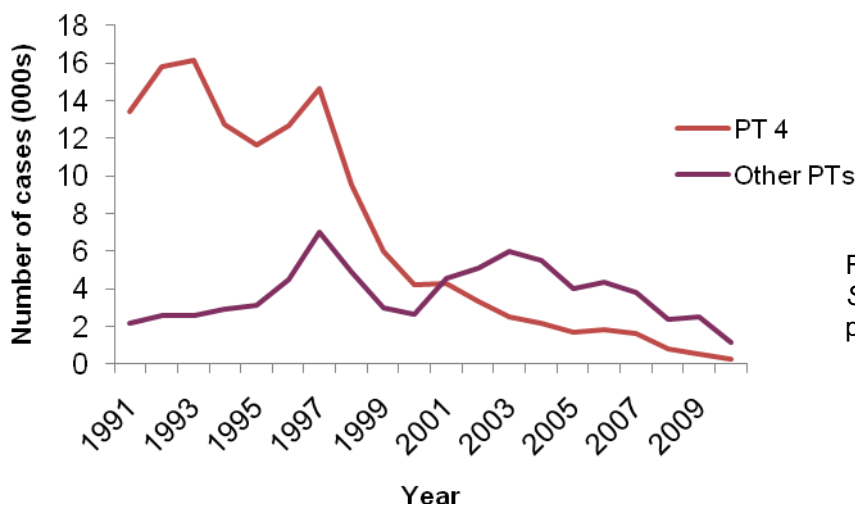


Figure 5: Indigenous *Salmonella* Enteritidis cases per year, 1991-2010.

In 2010, PT 4 was still the most common phage type of *S. Enteritidis* reported, but was at a much reduced level both in terms of numbers of cases (291) and proportion of *S. Enteritidis* cases (20%).

Seasonality of infection

Cases of indigenous *Salmonella* show strong seasonality. In 2010, cases peaked between August and October, in line with previous years (Figure 6).

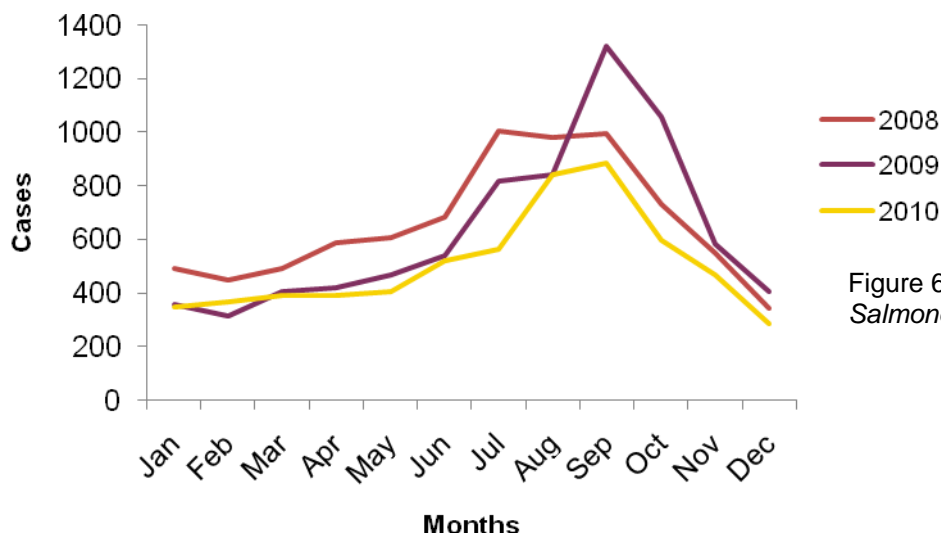


Figure 6: Seasonality of indigenous *Salmonella* infections 2008-2010

Age and gender distribution of cases

In 2010, 48% of indigenous *Salmonella* cases were female. Twenty-three percent of cases were under the age of five, a rate of 396 cases per million population (Table 2).

Age	Number of cases (%)	Cases per million population
0-4	1361 (23)	396
5-9 years	346 (6)	113
10-14 years	243 (4)	77
15-44 years	1933 (32)	86
45-64 years	1292 (21)	92
65-74 years	446 (7)	93
75+ years	408 (7)	93
Unknown	37	
Total	6066	108

Table 2: Age distribution of indigenous *Salmonella* cases, 2010

National outbreaks

Salmonella Java PT 3b Var9

A total of 131 cases were reported between July and October, the majority of which were female (63%). The median age of cases was 39.5 years. London, the South East and East of England reported the most cases (72%). Analytical epidemiological investigations implicated mixed salad leaves as the vehicle of infection [12].

***Salmonella* Typhimurium DT 8**

Between July and October 2010, 81 cases were reported. Descriptive epidemiological and microbiological investigations found an association with infection and consumption of duck eggs. Contaminated duck eggs were collected from a patient's home and also at farms in the duck-egg supply chain [13].

***Salmonella* Bareilly**

Two hundred and forty-one cases were reported across the UK between August and November 2010 (220, England, Wales and Northern Ireland; 21, Scotland). A high proportion of cases were adult females. Analytical epidemiological and microbiological investigations implicated consumption of bean sprouts, which was significantly associated with illness [14].

Travel related cases

In 2010, 3,080 cases (34%) were reported to be travel-related. However, travel history is under reported on laboratory forms and so the true percentage of cases attributable to foreign travel is likely to be much higher. A more detailed analysis of travel related *Salmonella*, and other gastrointestinal infections is available in the HPA Foreign-Travel Associated Illness report, 2010 [15].

Conclusions

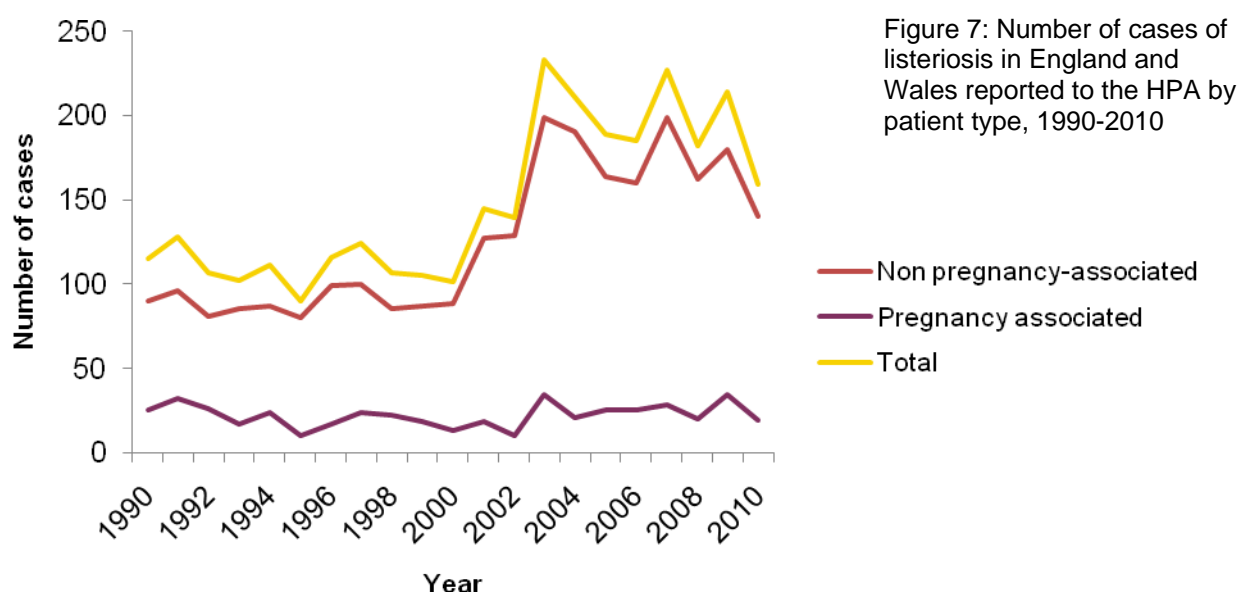
While the incidence of *Salmonella* infections has greatly reduced since the 1990s, *Salmonella* is still one of the leading causes of gastrointestinal infection in the UK, and a major source of both national and local outbreaks of food poisoning. Surveillance is key to determining the burden of disease as well as recognising and controlling outbreaks.

Listeria monocytogenes

Listeriosis is a rare but severe disease caused by infection with the bacterium *Listeria monocytogenes*. Those with underlying conditions, the elderly and pregnant women and their unborn or newborn infants are most at risk of severe infection.

Key trends - 2010

The number of listeriosis cases in England and Wales reported to the HPA in 2010 was below that seen in recent years (since 2002) but still above those levels observed in the 1990s (figure 7). There was an average of 199 cases per year between 2005 and 2009 (a rate of 3.7 cases per million population) but in 2010 there were only 158 cases (2.9 cases per million population). This decrease was previously reported in the Health Protection Report [16].



Surveillance of listeriosis

The national listeriosis surveillance database is dynamic and data presented here may differ slightly to those reported previously. Furthermore, all cases captured by this surveillance scheme are considered to be indigenous.

There have been no recent changes to the ascertainment of cases as part of this surveillance and thus there is no reason to suspect the decrease in 2010 is the result of a reporting artefact.

Trends in cases

Frequently reported molecular types

Serotype 4, amplified fragment length polymorphism (AFLP) type V (seroAFLP type 4 V) was the most prevalent type in 2010 (Table 3). There were proportionally fewer cases infected with SeroAFLP type 4 I in 2010 compared to recent years (Table 3) and more with seroAFLP types 1/2a XIV and 4 V.

Patient type, age, ethnicity, underlying conditions and geographic distribution of cases

The observed decrease in 2010 was not limited to a particular patient type (13% were pregnancy associated between 2005 and 2009 versus 11% in 2010) but there were proportionally fewer cases in the North West region in 2010 compared to the period 2005 to 2009 (table 4). Furthermore, the population at risk of listeriosis in 2010 was similar to that in previous years with regards to the distribution of underlying conditions (80% had an underlying condition between 2005 and 2009 versus 73% in 2010), age (66% were 60 years or over between 2005 and 2009 versus 65% in 2010) and ethnicity (48% of pregnancy associated cases were classified as belonging to an ethnic minority based on name between 2005 and 2009 versus 41% in 2010).

Molecular Typing (SeroAFLP)	2005-2009 (%)	2010 (%)
4 V	117 (11.7)	31 (19.6)
1/2a XIV	63 (6.3)	24 (15.2)
4 IV	126 (12.6)	22 (13.9)
4 I	204 (20.5)	21 (13.3)
1/2a VII	83 (8.3)	13 (8.2)
1/2b IV	31 (3.1)	7 (4.4)
1/2a IX	55 (5.5)	7 (4.4)
1/2b II	40 (4)	4 (2.5)
1/2a III	29 (2.9)	2 (1.3)
1/2c VII	29 (2.9)	2 (1.3)
Others (<20)	53 (5.3)	13 (8.2)
No isolate	167 (16.8)	12 (7.6)
Total	997 (100)	158 (100)

Table 3: Number of cases of listeriosis by molecular typing in England and Wales, 2005-2010

Patient region	2005-2009 (%)	2010 (%)
East Midlands	72 (7.2)	16 (10.1)
East	78 (7.8)	14 (8.9)
London	166 (16.6)	23 (14.6)
North East	68 (6.8)	12 (7.6)
North West	182 (18.3)	17 (10.8)
South East	117 (11.7)	25 (15.8)
South West	77 (7.7)	11 (7)
West Midlands	87 (8.7)	10 (6.3)
Wales	51 (5.1)	7 (4.4)
Yorkshire & Humber	99 (9.9)	23 (14.6)
Total	997 (100)	158 (100)

Table 4: Number of cases of listeriosis by region in England and Wales, 2005-2009 and 2010

Severity of disease

The high case fatality rate associated with listeriosis remained a feature among cases in 2010 (28%). The case fatality rate in 2010 was not significantly different to that observed between 2005 and 2009 (34%).

Recent advances

Analyses of the national listeriosis surveillance database have investigated infection risk by underlying conditions and mortality risk factors [17, 18].

Conclusions

While a decrease in *Listeria* infections was observed in 2010, the number of cases remains above those levels observed in the 1990s. As the most common cause of death from a preventable foodborne illness in UK, it remains imperative that cases continue to be followed up and food exposure data is collected, if at all possible.

Campylobacter

Campylobacter is the most common bacterial cause of gastrointestinal infection. Recent estimates suggest that there are more than half a million infections with *Campylobacter* every year in the UK [1]. The infection is unpleasant, although generally self-limiting; most patients experience acute enteritis for 7 to 10 days. Occasionally extra-intestinal infections or serious sequelae including Guillain-Barré syndrome occur. The majority of cases present as sporadic, with non-household outbreaks rarely identified.

The risk factors for *Campylobacter* gastroenteritis are numerous and varied. There is, however, strong evidence that suggests the handling of raw chicken and eating undercooked chicken is the most common cause of illness. Control of *Campylobacter* in poultry meat is a major public health strategy for the prevention of campylobacteriosis and intervention in poultry production in New Zealand has resulted in a sharp decline in human disease [19, 20].

Key trends - 2010

The number of laboratory confirmed cases of *Campylobacter* in humans in England and Wales continued to increase during 2010 and reached a record level of 62,684 cases. This represented an overall 8.8% increase compared with 2009 and a 39% increase since 2004. The steady increase in the number of cases over the last few years could be due to either improvements in surveillance or an increase in exposure to the bacterium from food or other sources.

In 2010, *Campylobacter* was the most frequently implicated causative agent in reported foodborne outbreaks. There was a significant increase in the number of *Campylobacter* outbreaks, with 18 outbreaks being reported compared to 13 in 2009. The majority of these were associated with the consumption of poultry liver pâté/parfait at food service premises.

Seasonality of infection

Cases of *Campylobacter* display strong seasonality. In 2010, the seasonal rise in cases started at the beginning of May with the peak typically occurring between mid-June and mid-July, and is in line with previous years (figure 8).

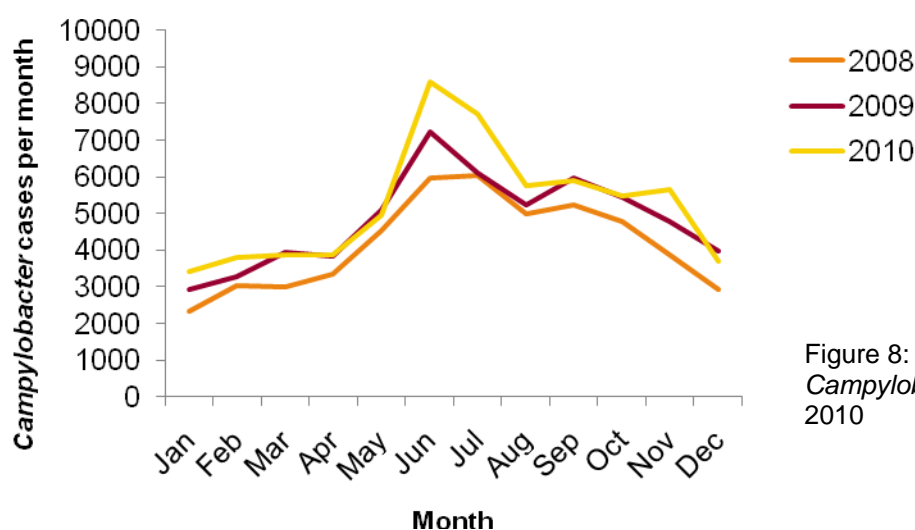
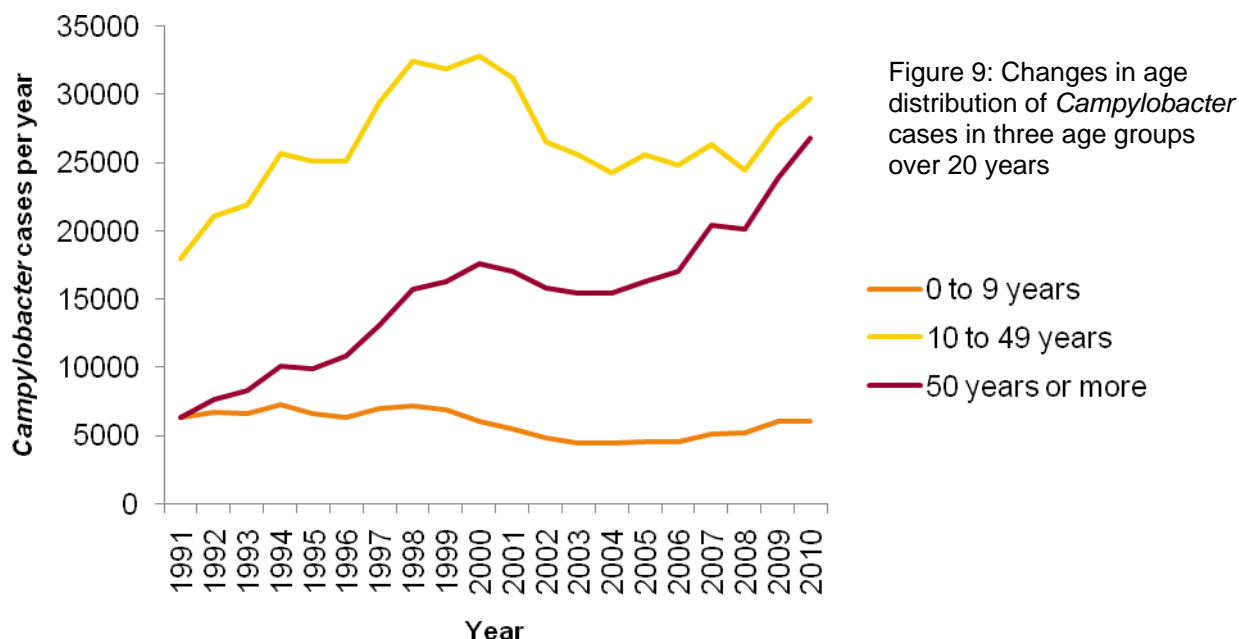


Figure 8: Seasonality of all *Campylobacter* infections 2008-2010

Age and gender distribution of cases

In 2010, 47% of cases were between 10 to 49 years old, 43% were 50 years old or over, and 10% were nine or younger. While infections in people over 50 years old and over have increased dramatically, the cases in young children have generally declined over the last 20 years, although they too have increased in recent years (Figure 9). *Campylobacter* cases in 2010 were higher in males than in females (M/F ratio 1.15). This is in line with previous years.



Travel related cases

In 2010, 667 cases (3%) were reported to be travel-related. However, travel history is under reported on laboratory forms and so the true percentage of cases attributable to foreign travel is likely to be much higher. Where travel data is collected in a more systematic way about 18% of *Campylobacter* cases have been linked to recent foreign travel [21].

Conclusions

Both cases of infection and foodborne outbreaks caused by *Campylobacter* in England and Wales continued to increase in 2010. The reduction of foodborne disease caused by *Campylobacter* is a key aim of the Food Standards Agency (FSA) strategic plan 2010-15. This is focussed on the reduction of *Campylobacter* in chicken because 60-80% of cases of campylobacteriosis can be attributed to chicken. Data from the HPA's human campylobacteriosis surveillance system will support the FSA in monitoring the effectiveness of this new intervention.

Norovirus

Norovirus is the most common cause of gastrointestinal infection in England and Wales. A recent study suggests that three million cases of norovirus occur in the UK each year [1]. It is difficult to know exactly how many people are affected. The disease often begins with a sudden onset of vomiting, often accompanied with diarrhoea, and usually lasts only one or two days. Therefore, few people who become ill will contact medical services and have samples taken for diagnostic purposes.

Norovirus is highly infectious; swallowing as few as 10 to 100 virus particles can cause infection. Immunity is short lived, typically lasting around six months. The virus can survive in the environment for several days. These factors create the potential for outbreaks of norovirus to occur in settings where large numbers of people are in close confinement such as hospitals, care homes and cruise ships.

Hospital outbreak reporting scheme

The hospital outbreak reporting scheme began in January 2009. Data is entered onto a secure web-based database: <http://www.hpa-bioinformatics.org.uk/noroOBK/>.

Until the launch of this reporting scheme, the impact of norovirus in hospitals was difficult to assess. Reporting to the scheme is voluntary, and therefore, a number of incidents will go unreported. Nevertheless, this scheme does provide real time data on norovirus activity within NHS trusts in England.

The reporting scheme utilises field-tested definitions of cases and outbreaks. These are classified as confirmed or suspected and are defined as:

A suspected case of norovirus:

- a) Vomiting: Two or more episodes of vomiting of suspected infectious cause* occurring in a 24 hour period **or**
- b) Diarrhoea: Two or more loose stools in a 24 hour period* **or**
- c) Diarrhoea and vomiting: One or more episodes of both symptoms occurring within a 24 hour period*.

*not associated with prescribed drugs or treatments and not associated with reaction to anaesthetic or an underlying medical condition or existing illness.

- **A confirmed case of norovirus:**

- a, b or c above with microbiological confirmation.

- **Norovirus outbreaks:**

- Suspected outbreak: two or more cases, as defined above, occurring in a functional care unit within the hospital without laboratory confirmation.

- Confirmed outbreak: as above with laboratory confirmation.

Reporters are asked to report both suspected and laboratory confirmed norovirus outbreaks. Outbreaks are considered to be over if no new cases arise seven days after the last case was considered to be symptom free.

Key trends 2010-2011 season

Norovirus is predominantly (but not exclusively) a winter pathogen. For the purpose of norovirus surveillance, the year begins in week 27 (July of each year) and runs to the end of week 26 (June) of the following year to capture a winter season.

In the recent winter season, July 2010 to June 2011, 1,153 outbreaks of suspected and confirmed norovirus were reported to the hospital outbreak reporting scheme from 111 NHS trusts (Figure 10).

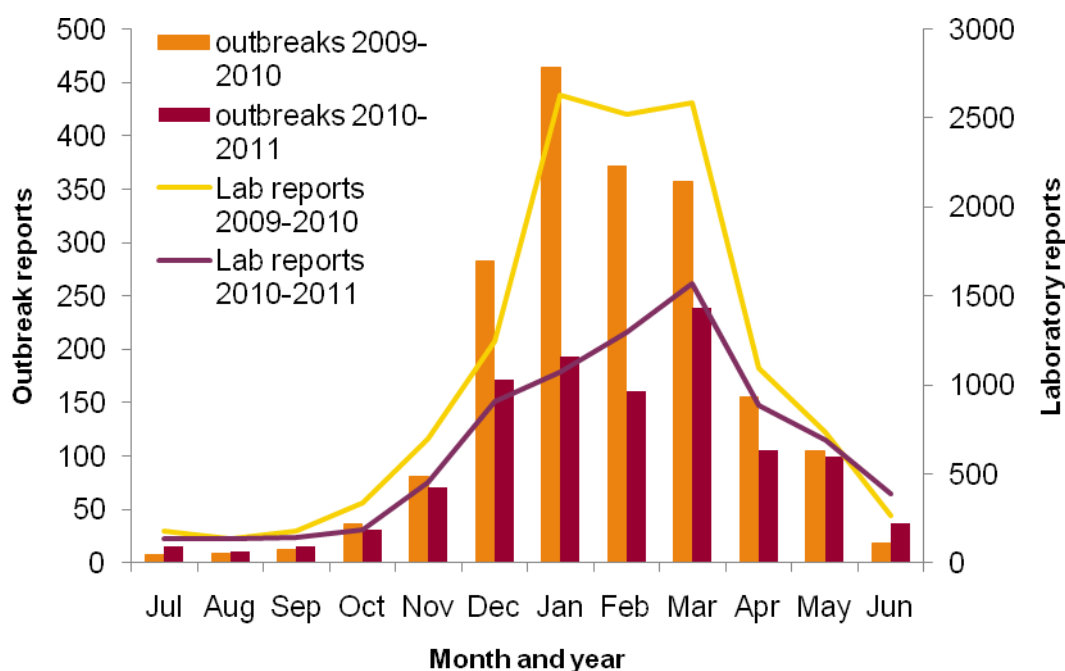


Figure 10: laboratory and outbreak reports by month of occurrence July 2009 - June 2011

This is a 39% reduction in reported outbreaks compared to the previous season. The same pattern was seen in laboratory reports of norovirus, with a 38% reduction from 12,593 in 2009/2010 to 7,856 in 2010/2011. Seventy-six percent of the reported outbreaks in hospitals led to ward closures or restriction to admissions and 61% of outbreaks were laboratory confirmed as due to norovirus.

The reported outbreaks affected a total of 11,257 patients and 2,937 staff. Each reported outbreak affected an average of nine patients (range 2 to 53) and two staff (range 0 to 55). The outbreaks lasted for a total of 6,216 days or an average seven days (range 1 to 59). They led to 6,323 days of ward closure in total, at an average of eight days per outbreak (range 1 to 36 days). A reported 14,522 bed days were lost, with an average of 25 bed days lost (range 0 – 288) in each outbreak (Figure 11).

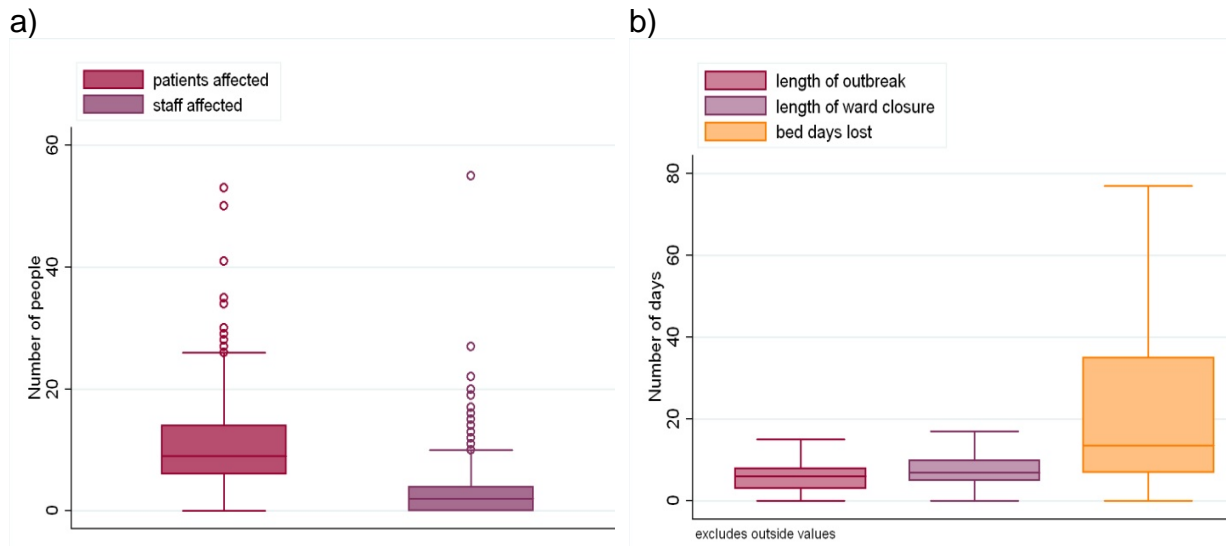


Figure 11: The impacts of norovirus outbreaks on a) patients and staff b) institutional impacts

Conclusions

Despite reported norovirus activity being reduced in the 2010/11 season compared to the previous season, data from the outbreak reporting scheme show that norovirus is still highly disruptive to the NHS. High numbers of patients and staff were infected and outbreaks led to a considerable number of ward closures and bed days lost. The mainstay of outbreak control in hospitals is to close wards and 76% of the reported outbreaks led to some form of ward closures. This action is highly disruptive. The majority of outbreaks occur in the winter which means that disruption due to norovirus occurs at a time of year when there is increased demand for resources, particularly from respiratory disease. The data gathered from this reporting scheme, although voluntary and therefore likely to be an underestimate, provides further insight into the nature of the problem.

Other gastrointestinal pathogens

The burden of infectious intestinal disease (IID) in the UK is high [1]. IID, which often presents as diarrhoea and/or vomiting, is caused by a range of microorganisms, including bacteria (e.g. *Salmonella* and *Campylobacter*), viruses (e.g. norovirus and rotavirus) and parasites (e.g. *Cryptosporidium* and *Giardia*). This equates to one-in-four of the population suffering from vomiting and/or diarrhoea of varying severity annually. The IID2 study followed up people infected with *Campylobacter* spp., VTEC, *Listeria monocytogenes*, *Salmonella* spp., *Shigella* spp., *Yersinia* spp., *Clostridium perfringens*, *Clostridium difficile*, *Cryptosporidium*, *Giardia*, *Cyclospora* and viruses. It found that up to 17 million people in the community in the UK suffer from IID every year [1]. This section provides a summary of the more common gastrointestinal pathogens not covered in the preceding sections.

Key Trends in other gastrointestinal pathogens - 2010

The overall changes in enteric pathogens over recent years have been expressed with a log scale to show the most common and less common infections together (Figure 12).

Trends in cases infected with bacterial pathogens

Alongside the decline in *Salmonella* and the rise in *Campylobacter* reported earlier, there has been a long-term decline in *Shigella* spp., which are predominantly *S. sonnei*. However, there was an 18% increase in reported cases in 2010 compared with 2009. The majority of infections with *S. flexneri* (502), *S. boydii* (88) and *S. dysenteriae* (43) are related to travel overseas, whereas much of the *S. sonnei* (1,128) is indigenous. *Yersinia* spp. were at the same level in 2010 as they were in 2009 (48).

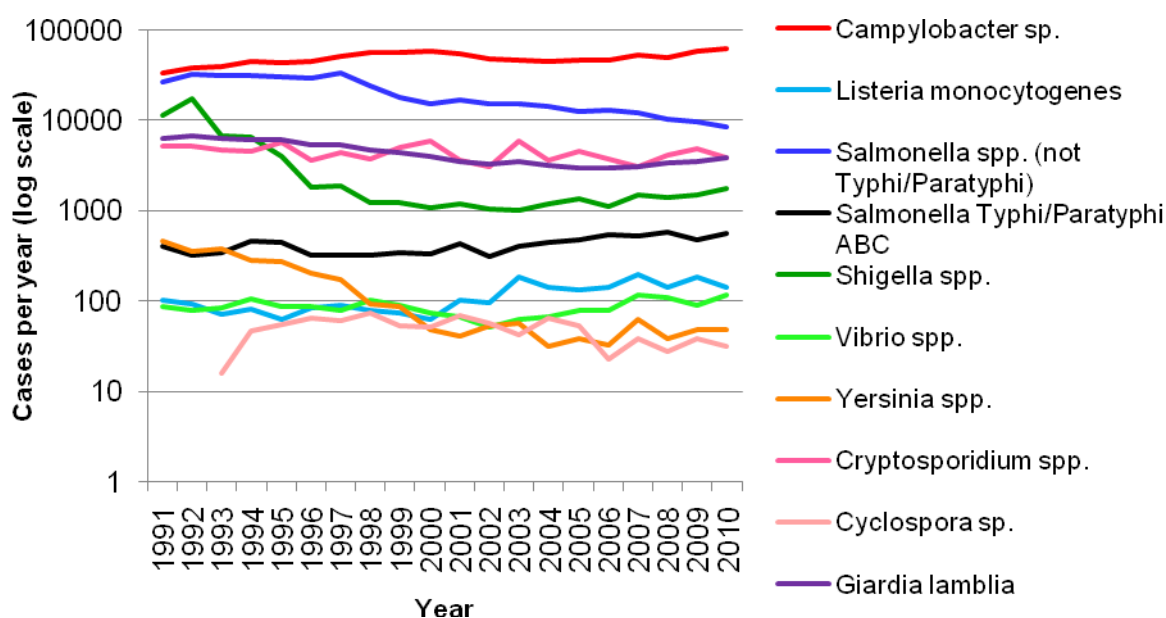


Figure 12: Changes in the occurrence of the main gastrointestinal pathogens over 20 years

Surveillance of food poisoning caused by *Clostridium perfringens*, *Bacillus cereus* and *Staphylococcus aureus* through routine surveillance is limited because these pathogens are not examined routinely in primary laboratory diagnosis. Evidence from

the IID2 study suggests that the incidence of *C. perfringens* has declined over the last 10 years [1].

Trends in cases infected with protozoal infections

There was a long-term decline in reported *Giardia* infections that has changed in recent years, with 3,032 isolates reported in 2007 compared to 3,804 in 2010, an increase of 25%.

By contrast, infections with *Cryptosporidium* declined between 2009 (4,831) and 2010 (3,902). However, *Cryptosporidium* cases per year are volatile and the cases in 2010 were only slightly lower than the five-year average (4,059). Guidance has been issued about the investigation of *Cryptosporidium* linked to swimming pools [22] because swimming pools remain a source of an undefined proportion of the *Cryptosporidium* cases.

The speciation of *Cryptosporidium* was performed on the majority of isolates in 2010. *C. hominis* and *C. parvum* were still the most commonly reported species, representing 97% of isolates and almost equal in number of cases (Figure 13). In the 11 years between 2000 and 2010 there have been 361 isolates of other species including *C. meleagridis* (149), *C. cuniculus* (48), *C. felis* (53), *C. ubiquitum* (30), *C. canis* (3), horse genotype (2), skunk genotype (2), and novel genotypes (10).

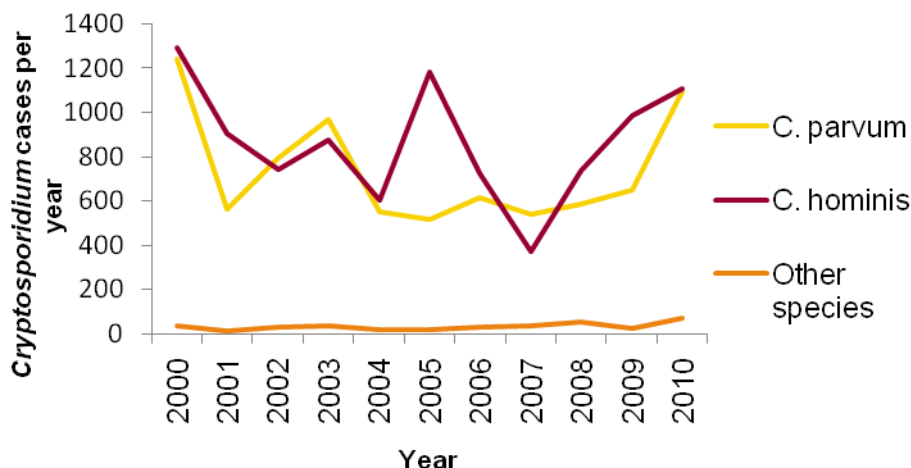


Figure 13: *Cryptosporidium* speciation through the *Cryptosporidium* Reference Unit (each year represents a varying proportion of all diagnosed cases)

In April 2010, the routine reference laboratory typing method changed from conventional PCR to real time PCR [23]. The real-time assay has improved typability and increased the detection of unusual *Cryptosporidium* species. The percentage of isolates belonging to species other than *C. hominis* and *C. parvum* has increased and *C. cuniculus* and *C. meleagridis* are currently thought to be the next most common species in humans in England and Wales. (*C. cuniculus* was identified as *C. hominis* before four years ago, but a new and more specific PCR will be introduced in the near future to allow more specific detection of *C. hominis* and follow up of other strains.) The significance of species identification has been reviewed in the literature [24-26].

Changes in reporting

Trends in some of these pathogens can be linked to how well the infection is diagnosed and reported as well as whether the disease is more common in the population. Changes introduced by the Health Protection (Notification) Regulations 2010 may have increased the laboratory reporting of some of the enteric pathogens because notification by laboratories is now mandatory.

Conclusions

The first step in the control of gastrointestinal infections is prompt recognition and identification. Control of gastrointestinal pathogens requires an understanding of the epidemiology of that disease as well as reliable surveillance data on its prevalence and distribution. Surveillance reporting is just one part, but an essential component, of any comprehensive public health surveillance system.

Laboratory surveillance is the mainstay of surveillance of gastrointestinal infections, and provides useful information on incidence of disease. The quality and completeness of additional information on laboratory reports is improving, allowing analysis of some of the determinants of disease, although foreign travel is often not reported.

While the continued decreasing trend in cases and outbreaks of *Salmonella* in 2010 is encouraging, the occurrence of several large national outbreaks shows that we cannot be complacent. National outbreaks linked to beansprouts (*Salmonella* Bareilly) and salad leaves (*Salmonella* Java PT 3b var 9) highlight that they may be substantial and that the vehicles of transmission in outbreaks may not be the high-risk foods traditionally associated with *Salmonella*. In contrast to *Salmonella*, the incidence of *Campylobacter* infections continued to increase in 2010. Data from the outbreak surveillance system, eFOSS, in 2010 shows a continuing increase in *Campylobacter* outbreaks linked to chicken liver pate or parfait, and it is clear that more work needs to be done to highlight the risks posed by insufficient cooking of these food items.

While England and Wales see fewer cases of VTEC or *Listeria* each year than *Salmonella* or *Campylobacter*, the severity of infection means that surveillance of cases and preventative/control actions are highly important. The number of VTEC cases reported in 2010 was less than in 2009, although the proportion developing HUS as a complication of infection increased from 12% in 2009 to 15% in 2010. A clinical surveillance system for HUS was launched in Autumn 2011, which will provide additional data on the epidemiology of HUS infection.

A decrease in *Listeria* infections was observed in 2010, however the number of cases remains higher than in the 1990s. Recent studies by GEZI [17,18] have shown that concurrent conditions, such as cancer, increase the risk of non-pregnancy related listeriosis. Food safety advice tailored for those with cancer may help to prevent further cases and this is being taken forward with the FSA.

This annual report highlights the seasonality of gastrointestinal infections. While bacterial infections such as *Campylobacter*, *Salmonella* and VTEC cases peak during the summer months, the incidence of norovirus is highest during the winter. Data from 2010 show that norovirus is still highly disruptive in the NHS. High numbers of patients and staff were infected and outbreaks led to a considerable number of ward closures and bed days lost.

The first annual report from the Gastrointestinal Infections Surveillance section of the GEZI department illustrates the various systems in place to monitor gastrointestinal infections, identify outbreaks, and fulfil statutory responsibilities. It also highlights the diversity of gastrointestinal pathogens monitored, and work performed within the department.

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