Human Listeria monocytogenes infections in Europe - an opportunity for improved European surveillance

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The 2006 Community Summary Report from the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC) was published recently with the latest trends and figures on the occurrence of zoonotic infections and agents, antimicrobial resistance and foodborne outbreaks in the then 25 European Union (EU) Member States and five non-EU countries [1]. This article seeks to expand further upon reports of human listeriosis (Listeria monocytogenes infections) and changes in the epidemiology of this disease, and to inform of important developments as they relate to an opportunity for the establishment of a formalized listeriosis surveillance network in Europe.

Introduction

Listeria monocytogenes is a ubiquitous organism in the environment and a rare cause of human disease. In 2006, listeriosis was reported in 23 EU Member States and was the fifth most common zoonotic infection in Europe, after Campylobacter, Salmonella, Yersinia, and VTEC infections [1]. Even though listeriosis occurs infrequently (0.3 cases per year per 100,000 of the population for the whole of the EU, Table 1), it is characterised by a high case-fatality rate which can exceed 30% percent [2,3]. It also carries one of the highest hospitalisation rates among known foodborne pathogens, 91%, with additional long term sequelae in some patients [4]. Cases occur in well-defined risk groups, including immunocompromised individuals, elderly (aged 65 years and older), pregnant women, unborn infants and neonates [5]. The high morbidity and mortality of this infection make a strong case for the importance and priority of improved surveillance of the disease.

The Zoonoses Community Summary Report [1] also contains data on identified L. monocytogenes in food and animals. Microbiological criteria providing limits to the levels of this bacterium in food were introduced in 2005 [6]. In 2006, this bacterium was reported to occur in ready-to-eat products in 2.4% of bovine meat, 3.9% of pork meat, 2.7% of poultry, 2.7% of other or unspecified meats, 1.3% of cheese, and 12.6% of fishery products [1]. Since listeriosis is predominantly transmitted by the consumption of contaminated foods (although other modes of transmission such as vertical transmission do occur), active responses are essential to control this organism in the food chain.

In addition to the collection of data via the Zoonoses Community Summary Report, an active surveillance system combining food and human surveillance activities is required to respond to changes in the incidence of the disease and to promptly recognize foodborne outbreaks, particularly those that involve more Member States.

Methods

There is a statutory obligation for Member States to report cases of human listeriosis to the European Union (EFSA) as part of the Zoonoses Directive [7]. Cases are typically defined as those microbiologically confirmed by the isolation of L. monocytogenes from a normally sterile site and by classifying a mother-baby pair as a single case. There is, however, variation on how each country classifies and confirms cases, given that the EU has not yet approved and put to use a common set of case definitions [8].

Analysis in this study was performed by a SPSS 15.0 statistical analysis using data from the 2006 and 2004 Zoonoses Community Summary Reports [1,6]. When looking at overall and disease-specific EU trends, numbers of cases per 100,000 were analyzed from 1999 to 2006 using a linear regression method and Pearson's R correlation to assess for significance. Those with statistical significance of $p<0.05$ are reported and graphed. Population sizes for EU Member States and other European countries were obtained from Eurostat [9].

Listeria trends across Europe

The numbers of cases of human listeriosis reported from European countries between 1999 and 2006 are shown in Table 1*. In 2006, cases of human listeriosis were reported from 23 EU Member States as well as from Bulgaria (in EU since 2007) and Norway, all of which were laboratory-confirmed. The data were reported as case-based from all countries except Austria and Lithuania who reported aggregated data.

In 2006, Member States reported the highest number of cases (1,583) over the past eight years, representing an increasing and statistically significant trend. More complete longitudinal reporting exists for some Members States, including data from ten MS which acquired membership in 2004, and therefore it is possible to observe long-term trends for these countries. Cases from Germany, France and the United Kingdom accounted for 64% of the total number of cases reported in EU in 2006, a proportion similar to that observed in 2005. Denmark, Finland and Luxembourg reported the highest incidence rates of >=0.9 cases per 100,000 population in 2006 (Table 2*).

Table 1

Human cases of listeriosis reported in Europe in 1999–2006

Country	Number of confirmed cases							
	2006	2005	2004	2003	2002	2001*	2000*	1999*
Austria	10	9	19	8	16	9	14	13
Belgium	67	62	70	76	44	57	48	64
Cyprus	1							
Czech Republic+	78	15	16					
Denmark	56	46	41	29	28	38	39	44
Estonia+	1	2	2					1
Finland	45	36	35	41	20	28	18	46
France	290	221	236	220	218	187	261	275
Germany	508	510	296	256	240	216	33	31
Greece	6		3		5	3	2	1
Hungary+	14	10	16					
Ireland	7	11	11	6	6	7	7	
Italy	51	51	25			31	13	17
Latvia+	2	3	5	8	16		36	
Lithuania+	4	2	1	2				
Luxembourg	4							
Malta+	0							
Netherlands	64	96	55	52	32	16		
Poland+	28	22	10	5	31			
Portugal			38					
Slovakia+	12	5	8	6	7			
Slovenia+	7		1	6				
Spain	78	68	100	52	49	57	35	32
Sweden	42	35	44	48	39	67	46	27
United Kingdom	208	223	232	255	158	156	115	116
EU Total	**1583**	**1427**	**1264**	**1070**	**909**	**872**	**586**	**667**
Bulgaria[X]	6							
Iceland								
Liechtenstein								
Norway	27	14	21*	18*	17*	18*		

Table 2

Incidence of human listeriosis per 100,000 population in the European Union, in 1999–2006

Country	2006	2005	2004	2003	2002	2001	2000	1999
Austria	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.2
Belgium	0.6	0.6	0.7	0.7	0.4	0.6	0.5	0.6
Cyprus	0.1	0.0	0.0	0.0	0.0	0.0		
Czech Republic+	0.8	0.1	0.2	0.0	0.0	0.0		
Denmark	1.0	0.9	0.8	0.5	0.5	0.7	0.7	0.8
Estonia+	0.1	0.1	0.2	0.0	0.0	0.0		0.1
Finland	0.9	0.7	0.7	0.8	0.4	0.5	0.4	0.9
France	0.5	0.4	0.4	0.6	0.4	0.3	0.4	0.5
Germany	0.6	0.6	0.4	0.3	0.3	0.3	0.0	0.0
Greece	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Hungary+	0.1	0.1	0.2	0.0	0.0	0.0		
Ireland	0.2	0.3	0.3	0.2	0.2	0.2	0.0	
Italy	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0
Latvia+	0.1	0.1	0.2	0.3	0.7	0.0	0.2	
Lithuania+	0.1	0.1	0.0	0.1	0.0	0.0		
Luxembourg	0.9	0.0	0.0	0.0	0.0	0.0		
Malta+	0.0	0.0	0.0	0.0	0.0	0.0		
Netherlands	0.4	0.6	0.3	0.3	0.2	0.1		
Poland+	0.1	0.1	0.0	0.0	0.1	0.0		
Portugal		0.0	0.4	0.0	0.0	0.0		
Slovakia+	0.2	0.1	0.1	0.1	0.1	0.0		
Slovenia+	0.3	0.0	0.1	0.3	0.0	0.0		
Spain	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Sweden	0.5	0.4	0.5	0.5	0.4	0.8	0.5	0.3
United Kingdom	0.3	0.4	0.4	0.4	0.3	0.3	0.2	0.2
EU Total	**0.3**	**0.3**	**0.3**	**0.2**	**0.3**	**0.2**	**0.1**	**0.2**

+ European Union Member State since 2004

Considering the past eight years, statistically significant and increasing trends were noted in Germany, Ireland, Lithuania, the Netherlands, Spain and the UK (Figure 1). During this period, a decrease of the number of cases in 2001 and 2002 followed by an increase in 2006 was detected in data from Belgium, Denmark, Finland and France (Table 1). An unusual increase in the number of cases was reported in the Czech Republic in 2006 compared to 2004 and 2005. 78 cases including 13 deaths in 2006 were associated with a single outbreak caused by contaminated soft cheese [1,10]. No other large foodborne outbreaks were identified in the European Union during 2006.

In 2006, human cases of listeriosis occurred more frequently later in the year, while in 2005 they were evenly distributed (Figure 2). The incidence and the number of cases of listeriosis in patients aged 65 and older were approximately 2.5 times higher than those reported in any other age group (Figures 3 and 4). Patients aged 65 years and older constituted 64% of all listeriosis cases in Belgium, 32% in the Czech Republic, 64% in Finland, 55% in France, 59% in Germany, 69% in Italy, 52% in the Netherlands, 46% in Spain, 69% in Sweden, 56% in the United Kingdom and 47% in the remaining 12 Member States (combined). More than half (54%) of the reported cases were male.

Discussion

The collection of European surveillance data represents a potentially very powerful tool for informing interventions to control infectious diseases. The comparison of national data, however, can be problematic since there are wide variations in the numbers of cases and incidence rates among reporting countries, thus emphasizing the advantage of comparing data over time within each Member State and across the European Union. When making comparisons between Member States, account should be taken of such factors as the variability of case definitions, reporting requirements, surveillance systems and microbiological methods employed by reporting countries. Efforts are currently underway to harmonise case definitions within the EU [8], and it is envisaged that these will improve the comparability of national surveillance data in the future. It is currently not possible to categorise the cases

Figure 1

Listeriosis incidence, European Union countries with statistically significant increases, 1999–2006

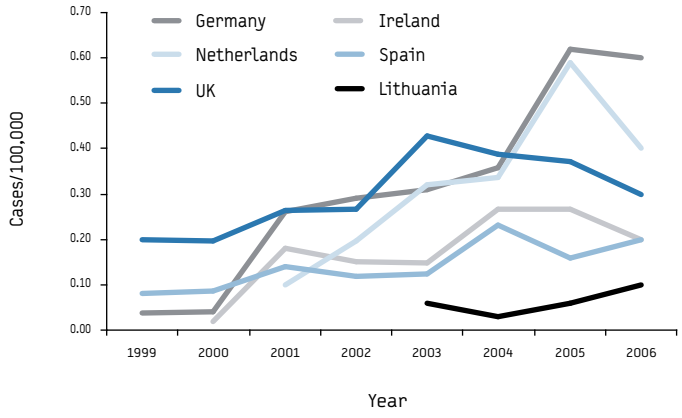


Figure 2

Seasonal distribution of human cases of listeriosis in the European Union in 2005 and 2006

Figure 3

Incidence of human listeriosis by age group, European Union, 2006

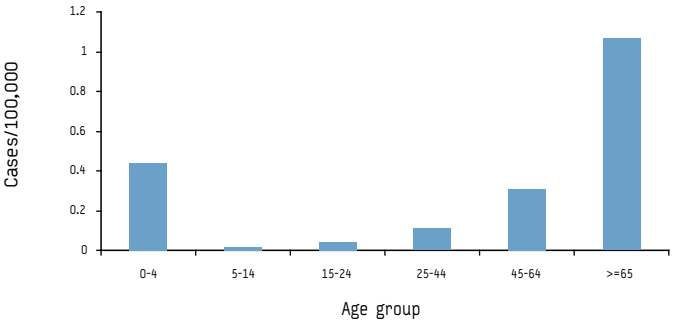
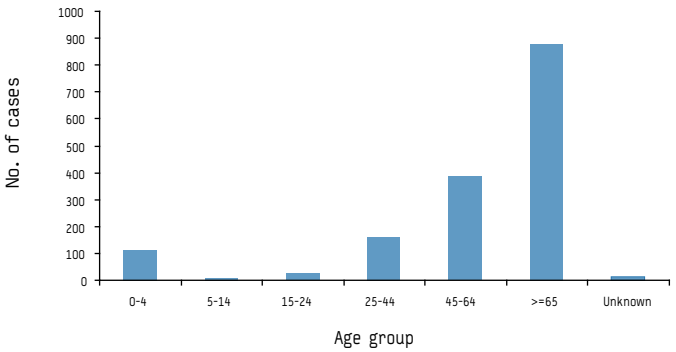


Figure 4

Number of cases of human listeriosis by age group, European Union, 2006



of listeriosis further than by age. However since data from some Member States have been associated with marked changes in the numbers and proportion of cases in different patient groups [5,11] more sophisticated data gathering is necessary to characterise both the trends and affected patients further.

Data from 2006 show an increase in the number of cases of listeriosis in Europe. In order to respond to these findings, it is first of all important to establish if this represents a true increase in incidence. As sustained surveillance activities for listeriosis have been in place in a number of EU Member States since the 1980s and similar, increasing trends have been noted across different countries, it is likely that this represents a true change. However additional surveillance is necessary to investigate this further.

If the increase is real, it is important to establish whether it can be associated with changes in susceptible populations, medical investigations conducted (i.e. improved diagnostic procedures) or treatment. Changes may also have occurred within the food chain to increase the risk of acquiring infection, such as alteration of eating habits, legislative changes, an increase in ambient temperature and/or alternation of food formulations and storage conditions such as refrigeration temperature or shelf life. It is therefore essential to conduct a more extensive and comprehensive investigation of the possible contributing factors affecting the incidence of listeriosis across Europe, performed in a way that the answers to these questions would readily facilitate the prioritization of efforts taken in order to respond to the rise.

Since listeriosis is predominantly foodborne, it is possible to prevent cases of this disease either by removing a single contaminated food source associated with common source outbreaks [12], or by general improvements in food-production hygiene which reduce the levels of L. monocytogenes contamination in ready-to-eat foods [13,14,15]. These intervention strategies showed success in reducing the numbers of cases in both Europe and North America during the 1990s. The data presented here, however, suggests a reversal of this trend in Europe with independent rises in the numbers of cases reported across several EU Member States. A more detailed analysis of national data has been described for Germany [5] and England and Wales [11], providing additional insights into the increases which are not currently possible from the centrally collected data. The increase in Germany was suggested to have occurred despite changes in surveillance and raised diagnostic awareness (listeriosis became a notifiable disease in 2001), and resulted in a more than a doubling of the numbers of reported cases between 2001 and 2005. The German increase occurred almost exclusively in patients >=60 years of age and did not appear to be linked to any single common-source outbreak; the cases were therefore predominantly sporadic in nature. The increase in England and Wales [11] showed similar characteristics to that in Germany, although there is no evidence supporting a relationship between these two national trends. The increase in England and Wales also occurred predominantly in patients aged >=60 years and in those who presented with bacteraemia but without central nervous system infection. The numbers of cases reported amongst patients <60 years of age, those with infections of the central nervous system, and those associated with pregnancy have remained similar since 1990. Increases occurred in most regions of England and Wales, occurred amongst both genders, were due to multiple subtypes of L. monocytogenes, could not be explained by common source outbreaks and were predominantly sporadic in nature. The increase was independent of demographic changes and has resulted in an approximate tripling of the age-specific rates of listeriosis in England and Wales between 1990 and 2006.

The Scientific Panel on Biological Hazards (BIOHAZ) of the European Food Safety Authority (EFSA) recently recommended that efforts to reduce risks to human health should focus on risk reduction practices both during the production process of ready-to-eat foods (RTE) and at home by consumers [16]. The report recommended to further investigate listeriosis cases and to generate and analyse data on ready-to-eat foods where L. monocytogenes was most commonly found. Additional key areas for attention may include food packaging and preparation practices along the food chain (such as the handling and slicing of RTE meat products), changes to food formulation (such as the salt or other preservative contents), storage temperatures, general industrial good hygiene practices and the education and training of food handlers. Consumers are also believe to benefit from clear recommendations on good food hygiene practice (i.e. at what temperature to keep food chilled at all times), and from being encouraged to take careful note of the shelf-life of food in their refrigerators. Such educational messages targeted at those in the older sections of the population may prevent cases, yet care needs to be taken so as not to dissuade this group from making good nutritional choices.

The increase in listeriosis cases, together with the need for further research and the recommendations from the Scientific Panel on Biological Hazards all emphasize the need for enhanced surveillance at the EU level to better estimate the burden of disease and the presence of this bacterium in the food chain. A first step in this process should be to convene expertise from EU Member States, ECDC and EFSA in order to share common efforts, to prioritize research activities, and to decide upon an enhanced and standardised variables to be collected by the Member States and reported at the EU level to ECDC. Now is an opportune time for the ECDC to coordinate these activities. The former Europe-based international surveillance network for the enteric infections Enter-net, now steered by ECDC, provides an ideal mechanism to enhance the surveillance of listeriosis and thus to ensure that the current EU-wide research activities are directed towards a shared vision of listeriosis surveillance and response to reducing the incidence of the disease.

Conclusion

In view of the increase in cases of listeriosis reported from EU Member States over the past five years, the capacity of ECDC to perform disease surveillance at the international level offers a unique opportunity. Surveillance across Europe must include improved reporting of confirmed cases of human listeriosis; centralised collection of data on the characterisation of L. monocytogenes; shared best practices for the detection, investigation and control of foodborne outbreaks, and methods to reduce the incidence of this bacterium throughout the food chain. It is an opportune time for coordinated action between EU Member States, EFSA and ECDC to effectively target risk reduction strategies at the sections of the European population at highest risk of contracting listeriosis.

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