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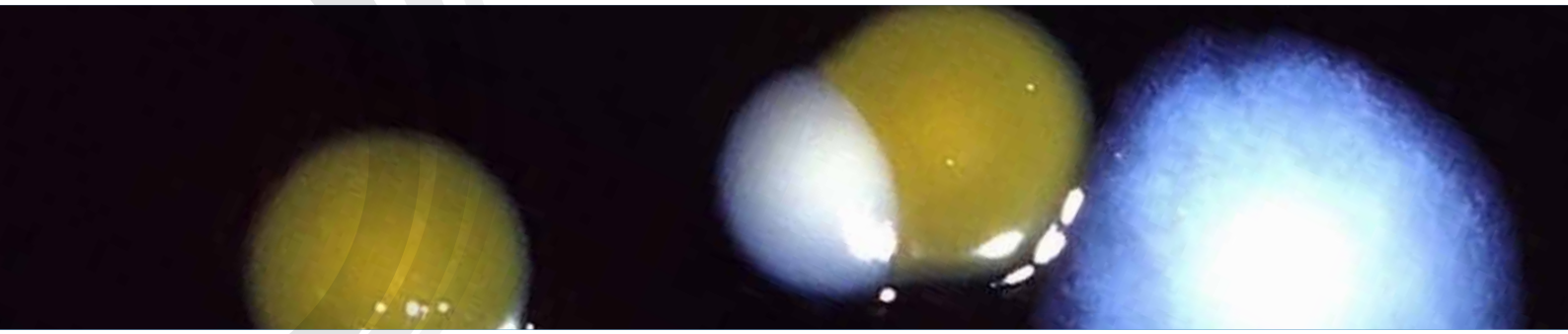

Legionnaires' disease in Europe

2014

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Abbreviations

CF	Case fatality
CI	Confidence interval
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
ELDSNet	European Legionnaires' Disease Surveillance Network
ESCMID	European Society of Clinical Microbiology and Infectious Diseases
ESGLI	ESCMID Study Group for Legionella Infections
EU	European Union
EWGLI	European Working Group for Legionella Infections
IQR	Interquartile range
LD	Legionnaires' disease
MAb	Monoclonal antibodies
NUTS	Nomenclature of Territorial Units for Statistics
PCR	Polymerase chain reaction
PR	Prevalence ratio
TALD	Travel-associated Legionnaires' disease
TESSy	The European Surveillance System
UAT	Urinary antigen test

Executive summary

This surveillance report is based on surveillance data for Legionnaires' disease (LD) collected for 2014. Surveillance is carried out by the European Legionnaires' Disease Surveillance Network (ELDSNet) and coordinated by the European Centre for Disease Prevention and Control (ECDC) in Stockholm. Data for all European countries were collected by nominated ELDSNet experts and electronically reported to The European Surveillance System (TESSy) database.

Surveillance data were collected through two different schemes and sources:

- Cases reported from European Union (EU) Member States, Iceland and Norway; In this context, surveillance has the following objectives:
  - Monitor trends over time and compare them across Member States
  - Provide evidence-based data for public-health decisions and actions at the EU and/or Member State level
  - Monitor and evaluate prevention and control programmes targeting LD at the national and European level
  - Identify population groups at risk who need targeted preventive measures.
- The reporting of travel-associated cases of Legionnaires' disease (TALD), including reports from countries outside the EU/EEA, aims primarily at identifying clusters of cases that may otherwise not have been detected at the national level, and enabling timely investigation and control measures at the implicated accommodation sites in order to prevent further infections.

All notified cases

For 2014, 6 941 cases of LD were reported by 28 EU Member States and Norway. The number of notifications per million inhabitants was 13.5, which was the highest ever observed. Five countries (France, Germany, Italy, Portugal, and Spain) accounted for 74% of notified cases. Notification rates ranged from less than 0.1 per million inhabitants in Bulgaria and Romania to 56.4 per million in Portugal, which reported one of the largest community outbreaks on record. Most cases (74%) were community acquired, whereas 18% were travel associated and 7% were linked to healthcare facilities. People over 50 years of age accounted for 80% of all cases. The male-to-female ratio was 2.6 to 1. Case fatality was 8% in 2014, comparable to previous years.

Most cases (87%) were confirmed by urinary antigen test, but an increasing proportion of cases (8%) are reported to have been diagnosed by PCR. *L. pneumophila* serogroup 1 was the most commonly identified pathogen, accounting for 81% of culture-confirmed cases.

The priority for addressing the apparent gap in surveillance is to assist countries with notification rates below one per million inhabitants in order to improve both the diagnosis and the reporting of LD.

Travel-associated Legionnaires' disease

For 2014, 953 cases of TALD were reported by 25 EU/EEA countries and seven other countries. The number of cases in 2014 was 21% higher than the 787 cases reported in 2013, interrupting a slightly decreasing trend since 2007. Four countries (France, Italy, the Netherlands and the United Kingdom) reported half of all reported cases. Similar to previous years, there were twice as many male cases than female cases. The median age was 61 years. One hundred-and-thirty-two standard clusters – clusters associated with only one accommodation site – were detected, approximately 20% more than in the previous year and in line with the increased number of cases.

Satisfactory control measures were implemented in all notified clusters, with ELDSNet receiving feedback from a first risk assessment within two weeks; a final assessment was received within six weeks. Therefore, no accommodation site names were published on the ECDC website in 2014. (ECDC has a policy to point out 'continued risks' by releasing addresses if assessments are not received within two or six weeks, respectively.)

In 2014, 55% of all detected clusters of travel-associated Legionnaires' disease associated with only one accommodation site involved cases from more than one country. These cluster would probably not have been detected had it not been for the international surveillance of the ELDSNet network.

1 Background

Legionnaires' disease (LD) is a severe and sometimes fatal form of infection by *Legionella spp*. These gram-negative bacteria are found in freshwater and soil worldwide and tend to contaminate man-made water systems [1]. The disease was first described and named after a large outbreak among members of a US organisation of war veterans (American Legion) in the 1970s [2]. LD is not transmitted from person to person, but through inhalation of contaminated aerosols or aspiration of contaminated water. LD is classically described as a severe pneumonia that may be accompanied by systemic symptoms such as fever, diarrhoea, myalgia, impaired renal and liver functions, and delirium. Known risk factors for LD include increasing age, male sex, smoking, chronic lung disease, diabetes and various conditions associated with immunodeficiency [3]. In Europe, most cases (approximately 70%) are community acquired and sporadic [4]. Studies suggest that the incidence of LD may be higher under certain environmental conditions such as warm and wet weather [4–6].

Legionnaires' disease is notifiable in all EU and EEA countries, but is thought to be underreported for two main reasons. Firstly, it is underdiagnosed by clinicians who only rarely test patients for LD before empirically prescribing broad-spectrum antibiotics likely to cover *Legionella* spp. Secondly, some health professionals fail to notify cases to health authorities [1].

The pattern of reporting in Europe is heterogeneous, with a broad range of notification rates across countries reflecting both the sensitivity of the national surveillance system and the local risk for LD. Some countries (e.g. France, Italy or the Netherlands) have already assessed the sensitivity of their systems, mainly through capture-recapture studies, and shown improvement over time [7–9]. For other countries, such as Greece, a study using travel-associated Legionnaires' disease cases (TALD) notification and tourism denominator data strongly suggested substantial under-ascertainment [10]. In eastern and south-eastern countries (e.g. Bulgaria, Poland or Romania), the number of cases reported has remained very low and is unlikely to reflect the true burden of LD. Differences in laboratory practice may also partly explain these differences in notification rates [11].

Since 2010, ELDSNet has been in charge of LD surveillance in Europe, with ECDC coordinating the surveillance efforts. Two distinct LD surveillance systems are currently in place. One is based on the annual reporting of all LD cases, the other on the daily reporting of TALD cases. It is not yet possible to merge the two databases because some countries are unable to link the TALD cases, which are reported daily, with the LD cases, which are reported annually.

This is the sixth annual report presenting the analysis of disaggregated LD surveillance data in Europe and the fifth annual report covering both surveillance systems [11].

2 Methods

2.1 The European Legionnaires' Disease Surveillance Network

ELDSNet comprises 28 EU Member States, Iceland and Norway. The network aims to identify relevant public health risks, enhance prevention of cases through the detection of clusters, and monitor epidemiological trends. The latter objective provides the rationale for the annual collection, analysis and reporting of LD cases notified during the previous year.

2.2 Data collection

2.2.1 Legionnaires' disease (comprehensive notifications)

National data collected by appointed ELDSNet members in each European country were electronically reported to the TESSy database following a strict protocol. The deadline for 2014 data submission was 1 May 2015. Following data validation and cleaning, data for analysis were extracted on 1 July 2015. All LD cases in 2014 meeting the European case definition (see box below) were included.

The EU case definition was amended in August 2012, and since then it has no longer been possible to report probable cases by only referring to an epidemiological link. TALD cases with a history of travelling abroad are reported by country of residence. Cases are classified as travel associated if they stayed at an accommodation site away from home during an incubation period of two to ten days prior to falling ill. Cases are reported as having formed part of a cluster if they were exposed to the same source as at least one other case, with their respective dates of onset within a plausible time period.

EU case definition of Legionnaires' disease [20]

Clinical criteria

Any person with pneumonia

Laboratory criteria for case confirmation

At least one of the following three:

- Isolation of *Legionella* spp. from respiratory secretions or any normally sterile site
- Detection of *Legionella pneumophila* antigen in urine
- Significant rise in specific antibody level to *Legionella pneumophila* serogroup 1 in paired serum samples.

Laboratory criteria for a probable case

At least one of the following four:

- Detection of *Legionella pneumophila* antigen in respiratory secretions or lung tissue, e.g. by DFA staining using monoclonal-antibody-derived reagents
- Detection of *Legionella spp*. nucleic acid in respiratory secretions, lung tissue or any normally sterile site;
- Significant rise in specific antibody level to *Legionella pneumophila* other than serogroup 1 or other *Legionella* spp. in paired serum samples
- Single high level of specific antibody to *Legionella pneumophila* serogroup 1 in serum.

Case classification

Probable case: Any person meeting the clinical criteria AND at least one positive laboratory test

Confirmed case: Any person meeting the clinical AND the laboratory criteria

2.2.2 Travel-associated Legionnaires' disease

Individual cases of travel-associated Legionnaires' disease (TALD) are reported to ECDC on a daily basis via TESSy. The reporting country is generally the country where the case is diagnosed. Therefore, the reporting country can differ from the case's country of residence. Case reports include age, sex, date of onset of disease, method of diagnosis and travel information for the places where the case had stayed from between two and ten days prior to onset of disease. Only cases who stayed at a commercial (or public) accommodation site are reported (as opposed to cases of LD who stayed with relatives or friends). After receiving the report, each new case is classified as a single case or as part of a cluster, in accordance with the definitions agreed upon by the network:

- a single case: a person who stayed at a commercial accommodation site in the two to ten days before onset of disease; the site has not been associated with any other case of Legionnaires' disease in the previous two years.
- a cluster: two or more cases who stayed at the same commercial accommodation site in the two to ten days before onset of disease, and whose dates of onset were within the same two-year period.

A clustering of three cases or more, with onset of disease within a three-month period, is called a 'rapidly evolving cluster' and a summary report is sent to tour operators. When a cluster is detected, an investigation by public health authorities is required at the accommodation site. Preliminary results from that risk assessment and initiation of control measures should be reported back to ELDSNet by nationally nominated contact points, within two weeks of the alert, using a preliminary form (Form A). A final form (Form B) is then used to report – within a further four weeks – the final results of environmental sampling and control measures. If the forms are not returned within the given deadlines, or if they contain unsatisfactory actions and control measures, ECDC publishes the details of the accommodation site associated with the cluster on its website and informs tour operators that the accommodation site is being made public. If a cluster is associated with more than one accommodation site, it is reported as a 'complex cluster', and all potentially involved sites within this cluster are subject to the same investigations as described above. A 'standard cluster' is a cluster associated with only one accommodation site.

2.2.3 Event-based surveillance

ECDC identifies and monitors health threats through epidemic intelligence activities through a broad range of formal and informal sources on a daily basis. These threats, including outbreaks of Legionnaires' disease, are documented and monitored through a dedicated database and a standard protocol. Experts evaluate and select threats that may require further attention by the nationally nominated contact points, depending on their potential impact on the health of EU residents. More details on tools used for threat detection and threat communication can be found on the ECDC webpage dedicated to epidemic intelligence [14].

2.3 Data analysis

2.3.1 Legionnaires' disease (comprehensive notifications)

Cases which were reported without specifying the laboratory method were excluded from the analysis. Since countries use diverse dates for national statistical purposes, TESSy collects the so-called 'date used for statistics', which can be the date of onset, diagnosis or notification. Only cases with a date used for statistics in 2014 were included in the analysis. Since environmental investigations are the responsibility of the Member States, we only analysed variables related to investigations of domestic cases.

The distribution of cases and subsets with a fatal outcome were described by relevant independent variables. Continuous variables were summarised as medians with interquartile ranges (IQRs [Q1–Q3]) and compared across strata by using the Mann-Whitney U test. Prevalence ratios were calculated to test possible associations between categorical variables and are presented with their 95% confidence intervals, assuming a Poisson distribution. Age-standardised rates were calculated using the direct method and the average age structure of the EU population for the period 2000–2010.

A linear regression was performed to assess the trend in notification rates.

To identify outliers, a cyclic regression of cases by week of onset was carried out (log transformation, 52-week periodicity).

2.3.2 Travel-associated Legionnaires' disease

We analysed the TALD data at the level of cases, travel visits and accommodation sites, and clusters. All reported cases with a date of onset in 2014 and their travel records were included in the analysis. For cases, we analysed epidemiological and diagnostic characteristics and described the temporal and geographic distribution. When the country of residence was identical to the destination country, travel was considered domestic. The number of travel visits and clusters were mapped at country level. In addition, the number of clusters in the EU/EEA were mapped at the regional level of the Nomenclature of Territorial Units for Statistics (NUTS 2).

3 Results

3.1 Legionnaires' disease (comprehensive notifications)

3.1.1 Cases

Case validation and data completeness

For 2014, 7 022 cases were reported by 29 countries. Eighty-one cases were excluded from analysis because they were reported without laboratory method. Thus, at total of 6 941 cases was included in this analysis.

Overall, data completeness[1] has improved over the past five years (Table 1). Since 2010, an increasing proportion of cases has been reported with known outcome, cluster status, place of residence, and an environmental investigation status. Conversely, information on setting of infection has decreased gradually but steadily.

Table 1. Completeness of reporting for Legionnaire' disease cases, selected variables, EU/EEA countries, 2010–2014

Variable	2010 %	2011 %	2012 %	2013 %	2014 %
Date of onset (complete date)	95	98	98	95	95
Outcome (not reported as unknown)	69	70	71	77	79
Cluster (not reported as unknown)	63	61	72	71	74
Probable country of infection [a] (not missing)	93	95	91	93	91
Place of residence (not missing or not reported at country level [b])	39	48	41	49	60
Sequence type (not missing)	1	3	4	4	4
Setting of infection (not missing or reported as unknown)	93	91	88	89	86
Environmental investigation (not reported as unknown)	33	37	43	55	58
Legionella found [c] (not missing or reported as unknown)	96	92	90	98	91
Positive sampling site [d] (not missing or reported as unknown)	73	83	78	94	99

[a] *Completeness of cases reported as imported.*

[b] *Excludes Iceland, Luxembourg, and Malta*

[c] *Completeness of cases reported to have prompted an environmental investigation.*

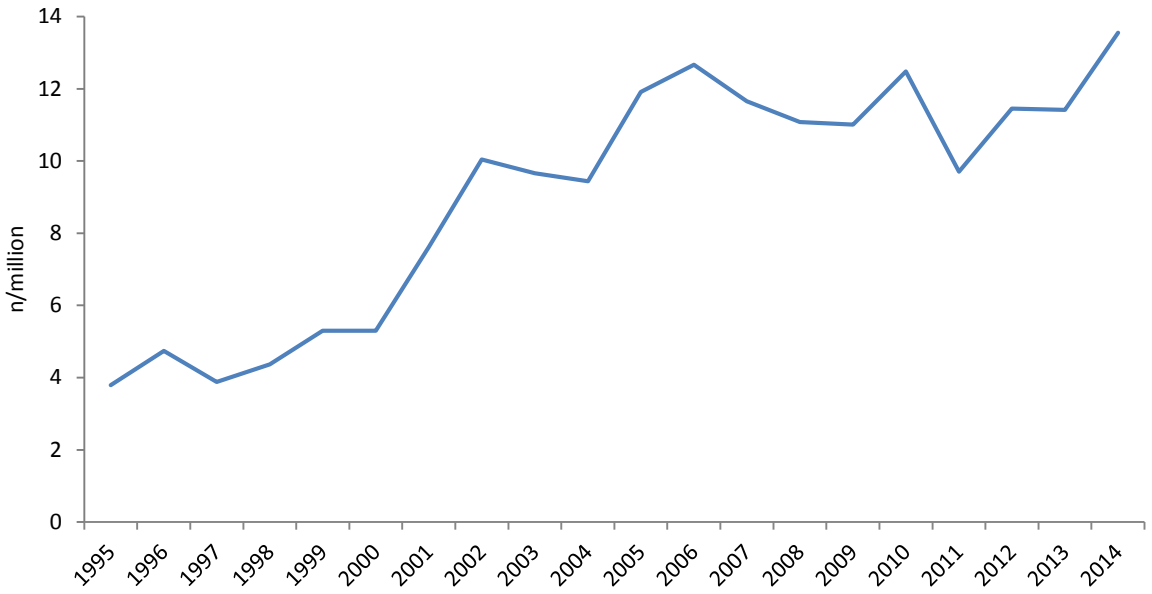
[d] *Completeness of cases for which positive findings in an environmental investigation were reported.*

Case classification and notification rate

Of the 6 941 notified cases, 6 377 (92%) were classified as confirmed and the remaining 564 (8%) as probable. Of 564 probable cases, 227 (40%) were reported by Germany. The number of notifications per million inhabitants was 13.5 in 2014, which was the highest ever observed (Figure 1).

[1] Data completeness was calculated at time of analysis. Since reporting countries have the possibility to update their data, completeness for earlier years might differ from what was presented in previous reports.

Figure 1. Notification rate of Legionnaires' disease in the EU/EEA* by year of reporting, 1995–2014



** EWGLINET member countries outside the EU/EEA were excluded from 1995 to 2008.*

Seasonality and geographical distribution

Date of onset was reported for 6 544 cases in 2014. The distribution of cases by month of onset showed two peaks, one in August and a second in November. Most cases (69%) had a date of onset in the second part of the year (between July and December) (Figure 2). A slightly increasing linear trend was observed over the 2009–2014 period ($p<0.01$) (Figure 3). In weeks 44 and 45/2014, weekly numbers of cases (259 and 321, respectively) were above the upper limit of the confidence interval given by the cyclic regression model (Figure 4). The 580 cases reported during these weeks amount to 331 cases in excess of the cyclical regression estimate. A total of 386 (67%) of these 580 cases was reported by Portugal and associated with a large community outbreak in Vila Franca de Xira near Lisbon in October–November 2014 (12) which accounted for most of the increase during these two weeks. Weekly numbers of cases exceeded predicted numbers for most of the year, but remained below the 95% upper limit (Figure 4).

Figure 2. Reported cases of Legionnaires' disease by month of onset, EU/EEA, 2014, and comparison with 2009–2013 range and average

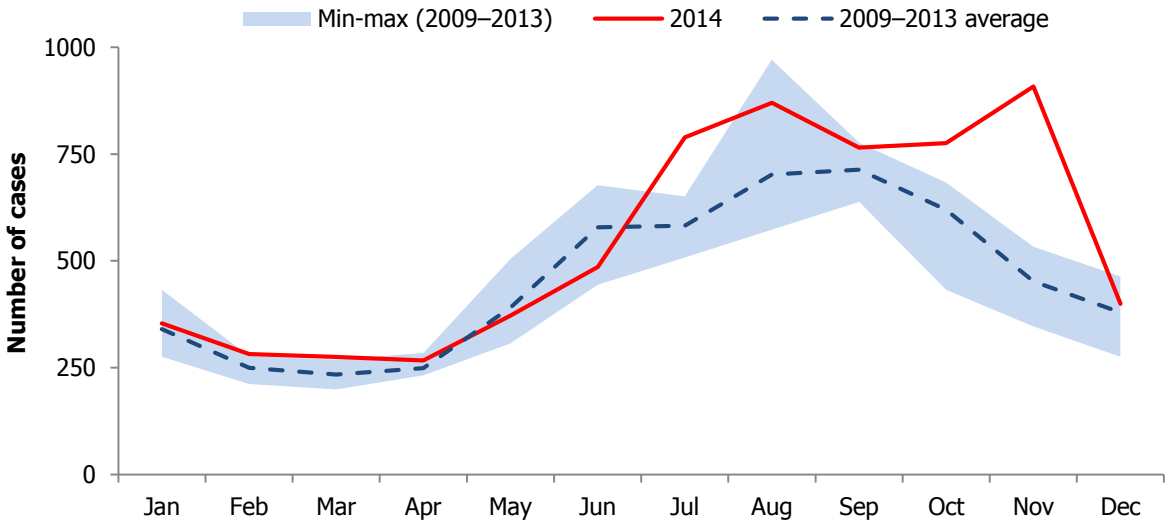


Figure 3. Reported cases of Legionnaires' disease by month of onset, EU/EEA, 2009–2014

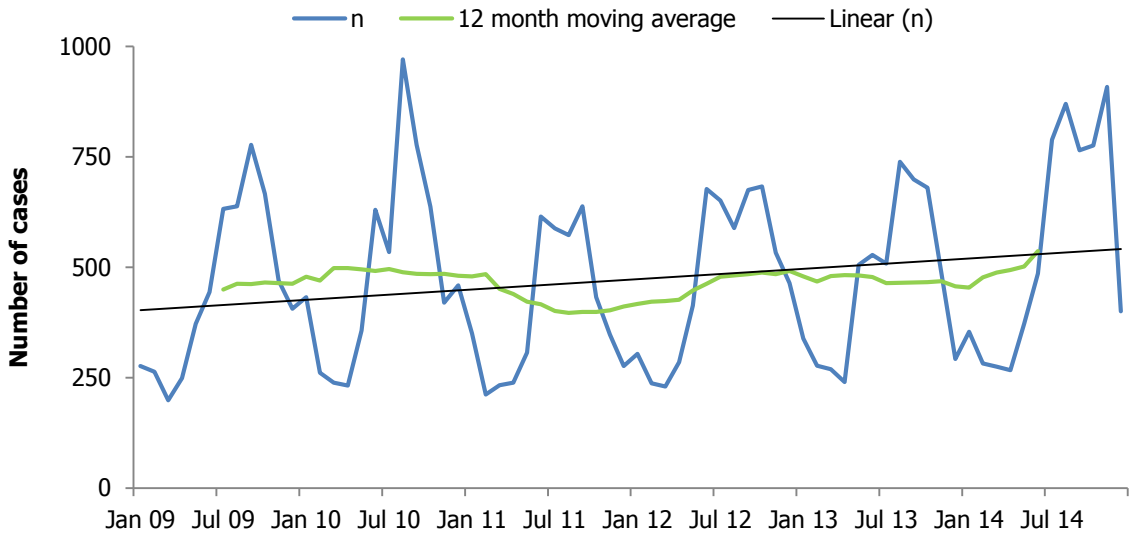
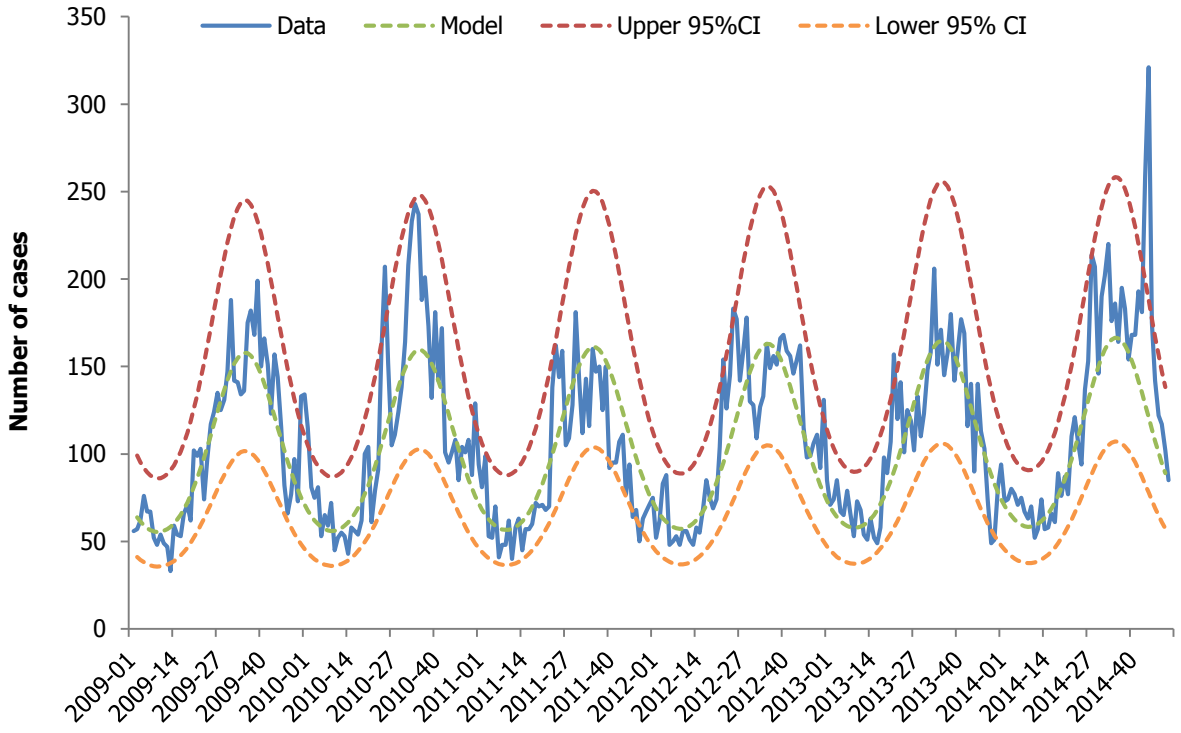


Figure 4. Reported cases of Legionnaires' disease by week of onset and cyclic regression model, EU/EEA, 2009–2014



Country-specific notification rates ranged from 0.1 per million inhabitants in Bulgaria and Romania to 56.4 per million in Portugal (Figure 5 and Table 2). The five largest reporting countries (France, Germany, Italy, Portugal, and Spain) accounted for 74% of cases. Conversely, the 15 lowest reporting countries merely reported 2% of all cases (Figure 5 and Table 2). Age-standardised notification rates did not differ substantially from crude notification rates (Table 2).

Figure 5. Reported cases and notifications of Legionnaires' disease per million, by reporting country, EU/EEA, 2014

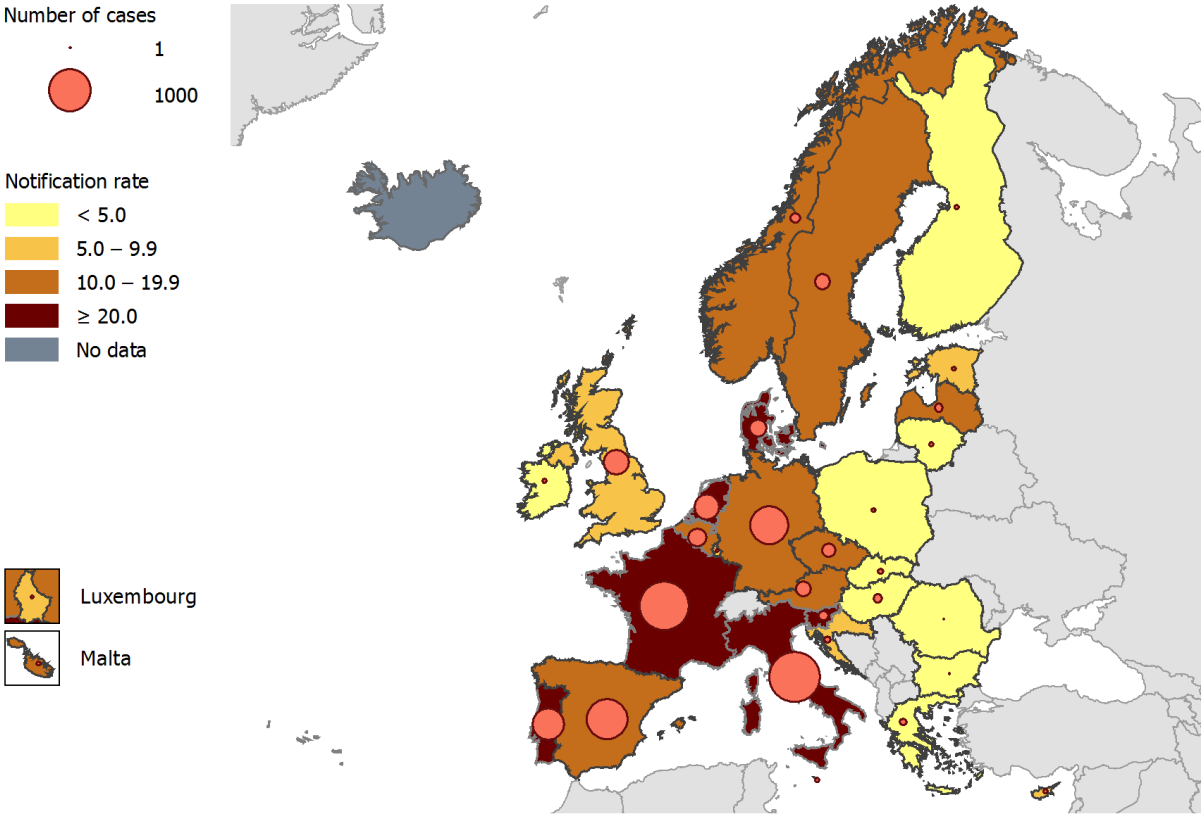


Table 2. Reported cases and notifications of Legionnaires' disease per million, by reporting country, EU/EEA, 2014

Country	Cases[a] (n)	Population (n)	Notification rate (n/million)	Age-standardised notification rate (n/million)	Average notification rate 2009–13 (n/million)
Austria	135	8 506 889	15.9	14.5	11.3
Belgium	195	11 203 992	17.4	16.6	8.9
Bulgaria	1	7 245 677	0.1	0.1	0.1
Croatia	25	4 246 809	5.9	5.4	3.8
Cyprus	6	858 000	7.0	7.7	4.5
Czech Republic	110	10 512 419	10.5	10.0	4.5
Denmark	158	5 627 235	28.1	26.3	22.3
Estonia	8	1 315 819	6.1	5.6	3.9
Finland	10	5 451 270	1.8	1.7	3.0
France	1 348	65 835 579	20.5	19.8	19.9
Germany	833	80 767 463	10.3	8.8	8.0
Greece	27	10 903 704	2.5	2.2	1.9
Hungary	32	9 877 365	3.2	3.1	4.0
Iceland		325 671			11.0
Ireland	8	4 605 501	1.7	2.0	2.4
Italy	1 475	60 782 668	24.3	20.7	20.5
Latvia	38	2 001 468	19.0	18.2	13.1
Lithuania	8	2 943 472	2.7	2.8	0.8
Luxembourg	5	549 680	9.1	9.1	12.8
Malta	8	425 384	18.8	17.8	12.5
Netherlands	348	16 829 289	20.7	19.5	19.7
Norway	51	5 107 970	10.0	10.1	7.3
Poland	12	38 017 856	0.3	0.3	0.4
Portugal	588	10 427 301	56.4	51.6	10.5

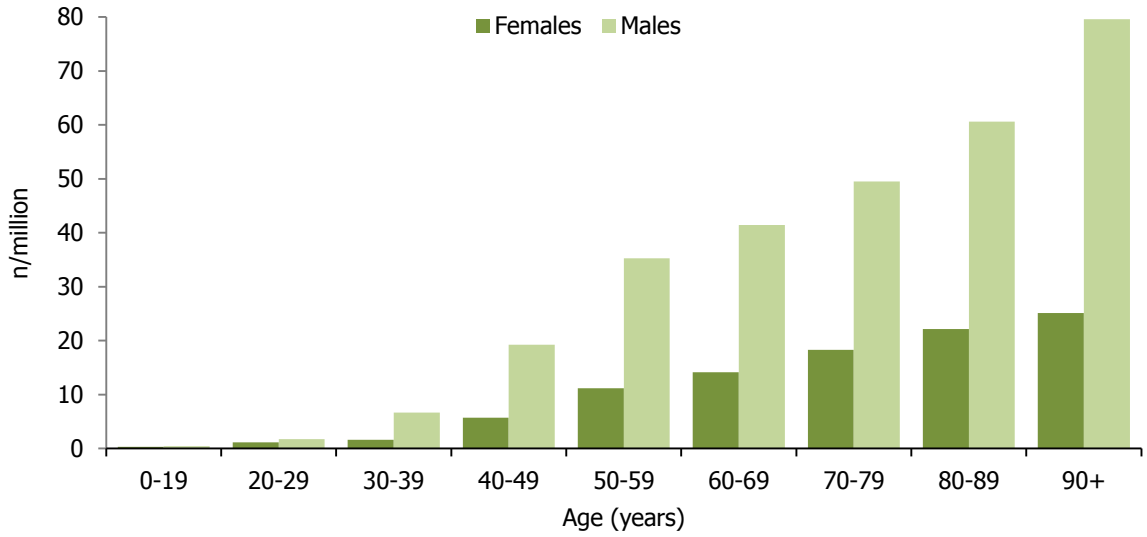
Country	Cases[a] (n)	Population (n)	Notification rate (n/million)	Age-standardised notification rate (n/million)	Average notification rate 2009–13 (n/million)
Romania	1	19 947 311	0.1	0.0	0.1
Slovakia	14	5 415 949	2.6	2.5	0.7
Slovenia	59	2 061 085	28.6	26.8	31.8
Spain	924	46 512 199	19.9	18.6	21.1
Sweden	136	9 644 864	14.1	13.1	12.0
United Kingdom	370	64 308 261	5.8	5.6	5.6
EU/EEA total	**6 933**	**512 295 279**	**13.5**	**12.6**	**11.2**

[a] *Cases with known age*

Age and sex

The median age at date of onset was 62 years (IQR 52–74). It was significantly higher in females (65 years, IQR 54–77) than in males (61 years, IQR 51–72) ($p<0.01$). Notification rates increased with age, with a maximum of 79.6 per million population in males aged 90 years and older (Figure 6). People older than 50 years of age accounted for 5 494 (80%) of the 6 852 cases with known age and sex. Of the 6 852 cases with known age and sex, 4 893 (71%) were males. In all age groups, LD was more common in males, with an overall male-to-female ratio of 2.6 to 1. The male-to-female ratio peaked at 4.1 to 1 in the 30–39-years age group.

Figure 6. Notification rates of Legionnaires' disease per million by sex and age group, EU/EEA, 2014



Settings

Of 5 984 cases with reported probable setting of infection, 4 406 (74%) were reported as community acquired (Table 3). In 2014, travel and healthcare-associated cases accounted for 18% and 7% of the total, respectively. The remaining cases (<2%) were reported with other probable settings of infection. The distribution of cases by probable setting of infection has remained unchanged since 2008. Healthcare-associated cases represented a substantial proportion of cases in older age groups (Table 4).

Table 3. Reported cases of Legionnaires' disease by country and setting of infection, EU/EEA, 2014[a]

Country	Community n (%)	Nosocomial n (%)	Other healthcare n (%)	Travel abroad n (%)	Domestic travel n (%)	Other n (%)	Total n (%)
Austria	89 (74)	3 (3)	0	8 (7)	16 (13)	4 (3)	120 (100)
Belgium[b]	9 (28)	4 (13)	0	13 (41)	6 (19)	0	32 (100)
Bulgaria	0	1 (100)	0	0	0	0	1 (100)
Croatia	18 (72)	2 (8)	1 (4)	2 (8)	2 (8)	0	25 (100)
Cyprus[b]	0	0	0	1 (100)	0	0	1 (100)
Czech Republic	47 (75)	3 (5)	0	10 (15)	3 (5)	0	63 (100)
Denmark	88 (61)	12 (8)	4 (3)	39 (27)	2 (1)	0	145 (100)
Estonia	6 (75)	1 (13)	0	1 (13)	0	0	8 (100)
Finland	7 (70)	0	0	3 (30)	0	0	10 (100)
France	857 (64)	72 (5)	68 (5)	83 (6)	178 (13)	90 (7)	1 348 (100)

Country	Community n (%)	Nosocomial n (%)	Other healthcare n (%)	Travel abroad n (%)	Domestic travel n (%)	Other n (%)	Total n (%)
Germany[b]	225 (65)	18 (5)	6 (2)	78 (22)	20 (6)	0	347 (100)
Greece	20 (74)	4 (15)	0	0	3 (11)	0	27 (100)
Hungary[b]	0	6 (55)	0	4 (36)	1 (9)	0	11 (100)
Ireland	4 (50)	0	0	4 (50)	0	0	8 (100)
Italy	1 228 (83)	61 (4)	36 (2)	12 (1)	134 (9)	5 (<1)	1 476 (100)
Latvia	38 (100)	0	0	0	0	0	38 (100)
Lithuania[b]	2 (50)	0	1 (25)	1 (25)	0	0	4 (100)
Netherlands	188 (54)	4 (1)	6 (2)	131 (38)	19 (5)	0	348 (100)
Norway	21 (41)	0	0	30 (59)	0	0	51 (100)
Poland[b]	0	2 (50)	0	1 (25)	0	1 (25)	4 (100)
Portugal	521 (95)	7 (1)	2 (<1)	6 (1)	11 (2)	1 (<1)	548 (100)
Romania	1 (100)	0	0	0	0	0	1 (100)
Slovakia	10 (71)	3 (21)	0	1 (7)	0	0	14 (100)
Slovenia	56(95)	0	0	3 (5)	0	0	59 (100)
Spain	798 (86)	45 (5)	29 (3)	11 (1)	42 (5)	0	925 (100)
United Kingdom	173 (47)	6 (2)	0	168 (45)	23 (6)	0	370 (100)
EU/EEA total	**4 406 (74)**	**254 (4)**	**153 (3)**	**610 (10)**	**460 (8)**	**101 (<2)**	**5 984 (100)**

[a] *Luxembourg, Malta, and Sweden did not report setting of infection.*

[b] *Country reported 50% or more cases without probable setting of infection.*

Table 4. Reported cases of Legionnaires' disease by setting of infection and age group, EU/EEA, 2014

Age (years)	Community n (%)	Nosocomial n (%)	Other healthcare n (%)	Travel abroad n (%)	Domestic travel n (%)	Other n (%)	Total n (%)
0–19	21 (78)	5 (19)	0	1 (4)	0	0	27 (100)
20–29	56 (74)	2 (3)	0	8 (11)	5 (7)	5 (7)	76 (100)
30–39	204 (79)	5 (2)	1 (<1)	23 (9)	14 (5)	11 (4)	258 (100)
40–49	623 (77)	23 (3)	4 (<1)	79 (10)	65 (8)	17 (2)	811 (100)
50–59	1 036 (75)	40 (3)	5 (<1)	171 (12)	102 (7)	35 (3)	1 389 (100)
60–69	986 (72)	46 (3)	12 (1)	187 (14)	122 (9)	17 (1)	1 370 (100)
70–79	834 (72)	64 (6)	23 (2)	117 (10)	113 (10)	11 (1)	1 162 (100)
80–89	544 (74)	58 (8)	76 (10)	22 (3)	35 (5)	4 (1)	739 (100)
≥90	100 (67)	11 (7)	32 (21)	2 (1)	4 (3)	1 (1)	150 (100)
Total	**4 404 (74)**	**254 (4)**	**153 (3)**	**610 (10)**	**460 (8)**	**101 (2)**	**5 982 (100)**

Time to diagnosis

Both date of onset and date of diagnosis were available in only 28% of cases (1 941/6 941). The median time from date of onset to diagnosis was five days (IQR 3–7).

3.1.2 Clusters

Frequency and size

Of 5 122 cases with known cluster status, 747 (14%) were reported as part of a cluster. The information on cluster status was missing in 26% of all cases (Table 5). Of 1 819 cases reported with unknown cluster status, 1 348 (74%) were reported by France.

Table 5. Reported clustering of Legionnaires' disease by reporting country, EU/EEA, 2014

Country	Clustered cases n (%)	Sporadic cases n (%)	Unknown n (%)	Total n	Proportion of clustered cases[a] %
Austria	3 (2)	108 (80)	24 (18)	135	3
Belgium	8 (4)	44 (22)	148 (74))	200	NA [b]
Bulgaria	0	1 (100)	0	1	0
Croatia	0	25 (100)	0	25	0
Cyprus	0	0	6 (100)	6	NA
Czech Republic	2 (2)	108 (98)	0	110	2
Denmark	24 (15)	134 (85)	0	158	15

Country	Clustered cases n (%)	Sporadic cases n (%)	Unknown n (%)	Total n	Proportion of clustered cases[a] %
Estonia	0	8 (100)	0	8	0
Finland	0	0	10 (100)	10	NA
France	0	0	1 348 (100)	1 348	NA
Germany	48 (6)	785 (94)	0	833	6
Greece	0	26 (96)	1 (4)	27	0
Hungary	4 (13)	28 (88)	0	32	13
Ireland	0	8 (100)	0	8	0
Italy	51 (3)	1 425 (97)	0	1 476	3
Latvia	0	38 (100)	0	38	0
Lithuania	0	8 (100)	0	8	0
Luxembourg	0	5 (100)	0	5	0
Malta	2 (22)	7 (78)	0	9	22
Netherlands	48 (14)	300 (86)	0	348	14
Norway	0	51 (100)	0	51	0
Poland	0	12 (100)	0	12	0
Portugal	409 (70)	166 (28)	13 (2)	588	71
Romania	0	1 (100)	0	1	0
Slovakia	2 (14)	12 (86)	0	14	14
Slovenia	0	59 (100)	0	59	0
Spain	65 (7)	761 (82)	99 (11)	925	8
Sweden	0	0	136 (100)	136	NA
United Kingdom	81 (22)	255 (69)	34 (9)	370	24
Subtotal[c]	739 (14)	4 331 (83)	171 (3)	5 241	15
Total	**747 (11)**	**4 375 (63)**	**1 819 (26)**	**6 941**	**NA**

[a] *Denominator: cases with known cluster status*

[b] *Not applicable where cluster status was unknown for ≥ 25% of cases*

Time and location

The proportion of clustered cases peaked in November when 401 (51%) of 787 cases reported with a known cluster status were part of a cluster (Figure 7). Of these 401 clustered cases, 375 (94%) were reported by Portugal and associated with the Vila Franca de Xira outbreak [12]. The average proportion of cases belonging to clusters was 15%; country-specific proportions ranged from 0% (12 countries could only supply cluster status for 25% of all cases or less) to 71% of all cases reported as clustered cases status in Portugal (Table 5). The community outbreak reported in Vila de Xira, Portugal, was the largest ever reported to TESSy (Table 6). The investigation identified industrial wet cooling systems as the probable source if infection [12].

Large outbreaks such as the one that occurred in 2010 in Ulm, Germany [13], were not reported to this database and therefore do not appear in this table.

Figure 7. Reported clustering of Legionnaires' disease, by month of onset, EU/EEA, 2014

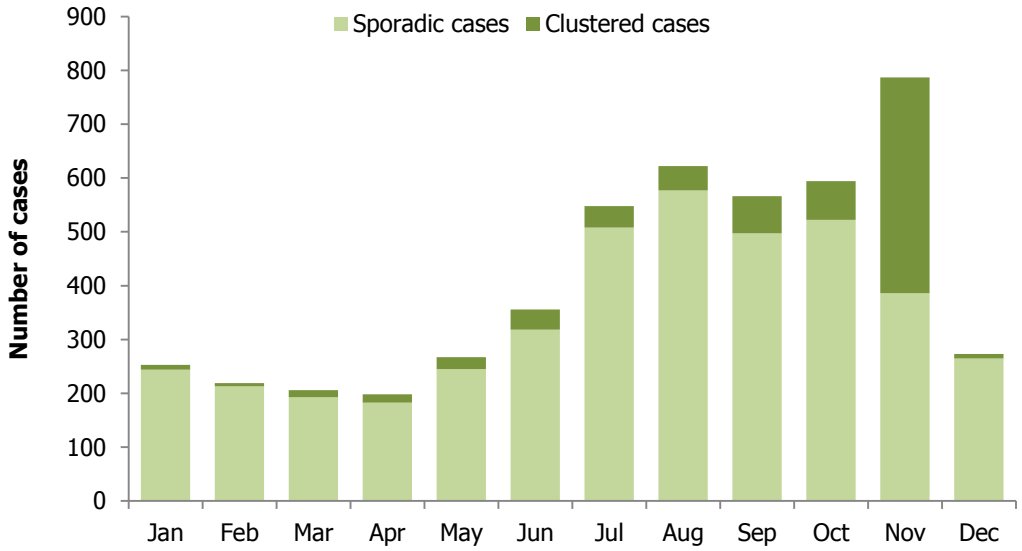


Table 6. Ten largest reported clusters of Legionnaires' disease, EU, 2009–2014

Rank	Reporting country	Year of reporting	Number of cases	Probable setting of infection	Probable source
1	Portugal	2014	403	Community acquired	Cooling tower
2	Spain	2010	51	Community acquired	Cooling tower
3	Spain	2012	39	Community acquired	Decorative fountain
4	Portugal	2012	36	Community acquired	Unknown
5	Spain	2009	25	Community acquired	Unknown
6	United Kingdom	2012	23	Community acquired	Spa pool
7	Spain	2010	22	Community acquired	Water system
8	Poland	2010	19	Community acquired	Water system
9	Spain	2012	18	Travel associated	Pool
10	United Kingdom	2010	15	Community acquired	Multiple unknown sources

Setting of infection

The proportion of cases reported as part of a cluster by setting of infection was highest in those with a history of travel (>20%), both domestic and abroad. Travel-associated cases (domestic and abroad) were more likely to be part of a cluster than cases occurring in other settings (PR 1.7, 95% CI 1.4–1.9). This might reflect both a higher probability of clustering in travel-associated cases and the result of a traditional focus on TALD within ELDSNet.

3.1.3 Mortality

Time and location

The reported mortality rate of LD in 2014 was 0.9 per million inhabitants, which was consistent with the rates recorded since 2008, which have been hovering between 0.7 and 0.9 per million. Of 5 503 cases with a known outcome, 456 were reported to have died, giving a case–fatality ratio (CFR) of 8%. In countries that reported less than 25% of cases with unknown outcome, the average CFR was 7% (Table 7).

Table 7. Reported outcome of Legionnaires' disease and case fatality by reporting country, EU/EEA, 2014

Country	Survival n (%)	Death n (%)	Unknown n (%)	Total n	CF[a] %
Austria	123 (91)	12 (9)	0	135	9
Belgium	69 (35)	6 (3)	125 (63)	200	NA [b]
Bulgaria	0	1 (100)	0	1	100
Croatia	25 (100)	0	0	25	0
Cyprus	6 (100)	0	0	6	0
Czech Republic	91 (83)	19 (17)	0	110	17
Denmark	146 (92)	12 (8)	0	158	8

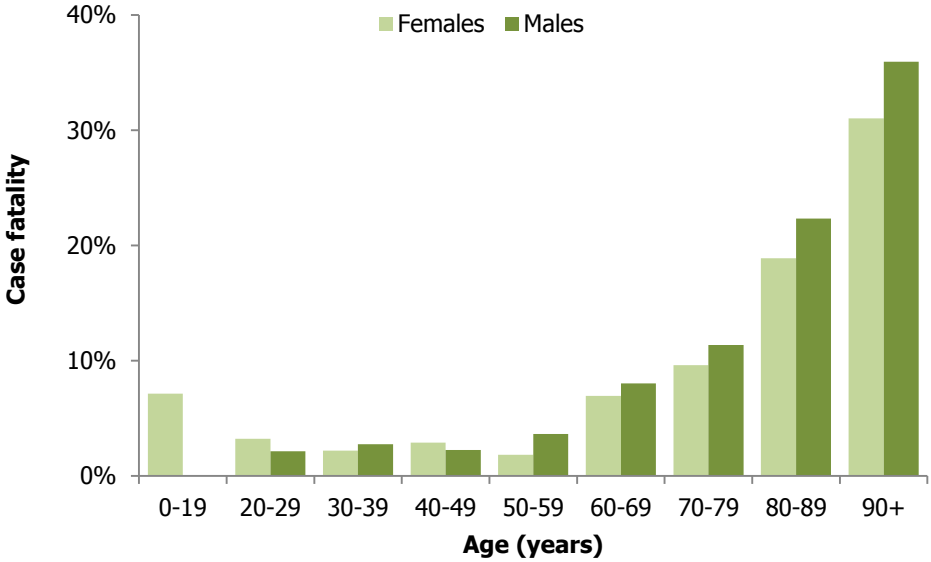
Country	Survival n (%)	Death n (%)	Unknown n (%)	Total n	CF[a] %
Estonia	6 (75)	2 (25)	0	8	25
Finland	0	0	10 (100)	10	NA
France	1 164 (86)	122 (9)	62 (5)	1 348	9
Germany	756 (91)	34 (4)	43 (5)	833	4
Greece	23 (85)	3 (11)	1 (4)	27	12
Hungary	30 (94)	2 (6)	0	32	6
Ireland	5 (63)	0	3 (38)	8	NA
Italy	600 (41)	73 (5)	803 (54)	1 476	NA
Latvia	32 (84)	6 (16)	0	38	16
Lithuania	6 (75)	1 (13)	1 (13)	8	14
Luxembourg	5 (100)	0	0	5	0
Malta	8 (89)	1 (11)	0	9	11
Netherlands	332 (95)	13 (4)	3 (1)	348	4
Norway	31 (61)	5 (10)	15 (29)	51	NA
Poland	9 (75)	3 (25)	0	12	25
Portugal	554 (94)	27 (5)	7 (1)	588	5
Romania	1 (100)	0	0	1	0
Slovakia	13 (93)	1 (7)	0	14	7
Slovenia	59 (100)	0	0	59	0
Spain	505 (55)	69 (7)	351 (38)	925	NA
Sweden	117 (86)	17 (13)	2 (1)	136	13
United Kingdom	331 (89)	27 (7)	12 (3)	370	8
Subtotal[c]	3 837 (90)	303 (7)	131 (3)	4 271	7
Total	**5 047 (73)**	**456 (7)**	**1 438 (21)**	**6 941**	**8**

[a] *Denominator: cases with known outcome (survivals and deaths)*
[b] *Not applicable where ≥ 25% of outcomes were unknown*
[c] *Includes only countries where < 25% of outcomes were unknown*

Age and sex

Case fatality was higher for older age groups, both in males and females (Figure 8). In people above 50 years of age, CF increased with age, showing a similar pattern in males and females.

Figure 8. Reported case fatality of Legionnaires' disease by sex and age group, EU/EEA, 2014



Setting of infection

CF was more than three times higher in healthcare-associated cases (hospitals and other healthcare settings) than in community-acquired cases (Table 8). This is not surprising since healthcare-associated cases are probably more likely to have underlying conditions. Cases with a history of travel abroad had the lowest CF. This could be due to a healthy traveller effect.

Table 8. Reported case–fatality of Legionnaires' disease by setting, EU/EEA, 2014

Setting	Deaths n	Total n	CF %
Nosocomial	59	202	29
Other healthcare	33	120	28
Community	271	3 378	8
Domestic travel	20	343	6
Travel abroad	5	91	5
Other	14	562	2
Total	402	4 696	9

Adjusted predictors for fatal outcome

In a multivariable analysis adjusted for age and sex, healthcare-associated cases were still significantly associated with a higher risk for fatal outcome (Table 9). Women and cases with a history of travel abroad were less likely to die.

Table 9. Adjusted predictors of fatal outcome of Legionnaires' disease, EU/EEA, 2014 (n=4 625)

Risk factor	Odds ratio	95%CI	P-value	Cases exposed %
Age	1.06	1.05–1.07	<0.01	100
Sex				
Male	1 (ref.)			72
Female	0.73	0.57–0.93	0.01	28
Probable setting of infection				
Community	1 (ref.)			71
Nosocomial	3.91	2.75–5.56	<0.01	5
Other healthcare	1.96	1.25–3.06	<0.01	2
Travel abroad	0.35	0.20–0.61	<0.01	11
Domestic travel	0.76	0.38–2.45	0.27	9
Other	0.96	0.38–2.45	0.94	1

3.1.4 Clinical and environmental microbiology

Laboratory methods

For the 6 941 cases reported, 7 750 laboratory tests were performed, 6 038 (78%) of which were urinary antigen detections. Of 29 countries reporting cases, eight reported more than one test per case, with an average of 1.2 tests per case. The distribution of tests varied greatly across countries (Table 10).

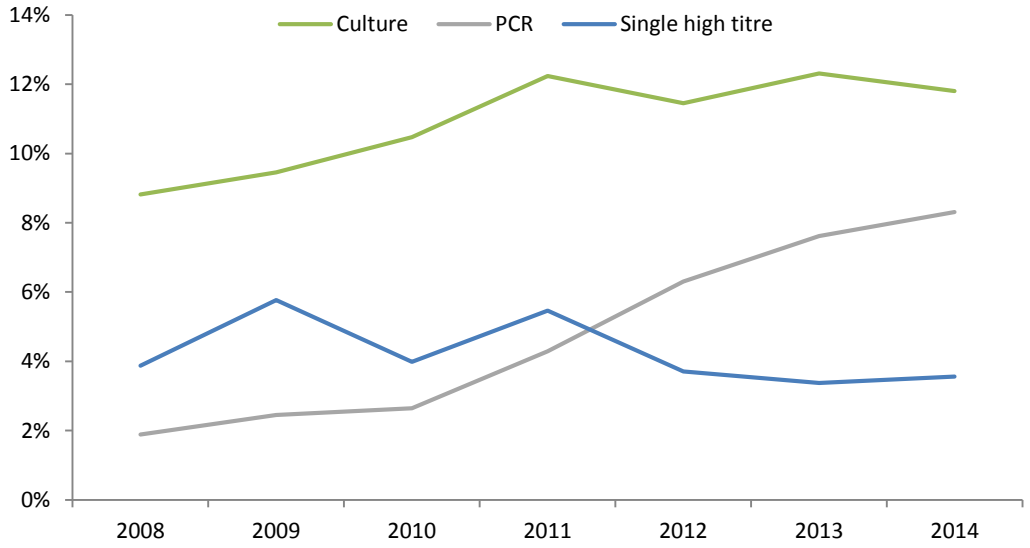
Culture confirmations were not reported by 14 countries, but accounted for 47% of diagnoses in Denmark. Of the countries not reporting any culture confirmations in 2014, eight (Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta, Romania and Slovenia) have never reported any culture confirmations. Some large reporting countries such as Italy or Spain relied almost exclusively on urinary antigen tests (UAT). Of 6 941 cases, 6 038 (87%) were UAT-positive, a proportion similar to 2013. Over the past five years, the proportion of cases reported to have been diagnosed by PCR has continuously increased from less than 2% in 2008 to 8% in 2014 (Figure 9). In 2014, the proportion of PCR-ascertained cases was over 20% in six countries (Austria, the Czech Republic, Denmark, Luxembourg, Sweden, and the United Kingdom).

Table 10. Reported laboratory methods and proportion of cases reported for each method, by reporting country, EU/EEA, 2014 (more than one method per case possible)

Country	Laboratory test method							Total cases n
	Urinary antigen n (%)	Culture n (%)	PCR n (%)	Single high titre n (%)	Fourfold titre rise n (%)	Direct immunofluor-escence n (%)	Total tests n	
Austria	82 (61)	7 (5)	34 (25)	11 (8)	0	1 (1)	135	135
Belgium	163 (82)	4 (2)	14 (7)	3 (2)	16 (8)	0	200	200
Bulgaria	1 (100)	0	0	0	0	0	1	1
Croatia	23 (92)	0	0	0	2 (8)	0	25	25
Cyprus	6 (100)	0	0	0	0	0	6	6
Czech Republic	104 (95)	33 (30)	29 (26)	7 (6)	0	0	173	110
Denmark	41 (26)	74 (47)	40 (25)	2 (1)	1 (1)	0	158	158

Country	Laboratory test method							Total cases n
	Urinary antigen n (%)	Culture n (%)	PCR n (%)	Single high titre n (%)	Fourfold titre rise n (%)	Direct immunofluor-escence n (%)	Total tests n	
Estonia	7 (88)	0	1 (13)	0	0	0	8	8
Finland	7 (70)	2 (20)	0	1 (10)	0	0	10	10
France	1 292 (96)	341 (25)	112 (8)	14 (1)	4 (<1)	0	1 763	1 348
Germany	549 (66)	57 (7)	113 (14)	107 (13)	7 (1)	0	833	833
Greece	26 (96)	0	0	1 (4)	0	0	27	27
Hungary	30 (94)	2 (6)	0	4 (13)	0	0	36	32
Ireland	7 (88)	2 (25)	0	0	0	0	9	8
Italy	1 405 (95)	23 (2)	5 (<1)	35 (2)	7 (<1)	1 (<1)	1 476	1 476
Latvia	23 (61)	0	0	15 (39)	0	0	38	38
Lithuania	6 (75)	0	0	2 (25)	0	0	8	8
Luxembourg	4 (80)	0	1 (20)	0	0	0	5	5
Malta	9 (100)	0	0	0	0	0	9	9
Netherlands	314 (90)	67 (19)	54 (16)	2 (1)	5 (1)	0	442	348
Norway	41 (80)	0	10 (20)	0	0	0	51	51
Poland	10 (83)	0	0	2 (17)	0	0	12	12
Portugal	492 (84)	59 (10)	17 (3)	14 (2)	6 (1)	0	588	588
Romania	1 (100)	0	0	0	0	0	1	1
Slovakia	14 (100)	0	0	0	0	0	14	14
Slovenia	59 (100)	0	0	0	0	0	59	59
Spain	898 (97)	43 (5)	0	9 (1)	10 (1)	0	960	925
Sweden	82 (60)	21 (15)	60 (44)	15 (11)	0	0	178	136
United Kingdom	342 (92)	84 (23)	87 (24)	3 (1)	9 (2)	0	525	370
Total	**6 038 (87)**	**819 (12)**	**577 (8)**	**247 (4)**	**67 (1)**	**2 (<1)**	**7 750**	**6 941**

Figure 9. Proportion of cases reported as diagnosed by culture, PCR and single high titre, EU/EEA, 2008–2014



Pathogens

Of 819 culture-confirmed cases, 777 (95%) were due to *L. pneumophila* (Table 11). Serogroup 1 accounted for 662 (85%) of 777 culture-confirmed cases with *L. pneumophila* (Table 12). Four subtypes (Allentown/France, Benidorm, Knoxville and Philadelphia) accounted for 85% of the 246 isolates that were subtyped by using monoclonal antibodies (MAb) (Table 13). In addition, seven countries (Austria, the Czech Republic, Denmark, the Netherlands, Portugal, Spain and the United Kingdom) reported results of sequence typing for 303 cases.

Table 11. Reported culture-confirmed cases of Legionnaires' disease and *Legionella* isolates by species, EU/EEA, 2014

Species	Culture-confirmed cases	
	n	%
L. pneumophila	777	95
L. longbeachae	14	2
L. micdadei	6	1
L. bozemanii	2	<1
L. macaechernii	1	<1
L. sainthelensi	1	<1
L. other species	6	<1
L. species unknown	12	1
Total	**819**	**100**

Table 12. Reported culture-confirmed cases of Legionnaires' disease and *L. pneumophila* isolates by serogroup, EU/EEA, 2014

	Culture-confirmed cases with *L. pneumophila*	
Serogroup	n	%
1	662	85
2	6	1
3	24	3
4	2	<1
5	7	1
6	5	1
7	2	<1
8	3	<1
10	6	1
15	1	<1
L. pneumophila non serogroup 1	2	<1
L. pneumophila serogroup unknown	57	7
Total	**777**	**100**

Table 13. Reported monoclonal subtype for *L. pneumophila* serogroup 1 isolates, EU/EEA, 2014

Monoclonal subtype	n	%
Allentown/France	85	35
Benidorm	43	17
Knoxville	44	18
Philadelphia	38	15
Subtotal MAb 3/1 positive[a]	**210**	**85**
Bellingham	6	6
Camperdown	4	4
Heysham	1	<1
OLDA	5	2
OLDA/Oxford	20	8
Subtotal MAb 3/1 negative	**36**	**15**
Total	**246**	**100**

[a] Monoclonal types are grouped as having, or not having, the virulence-associated epitope recognised by MAb 3/1 (Dresden Panel).

Environment

Environmental investigation status was available for 3 623 (67%) of 4 648 cases known not to have travelled abroad within the incubation period (Table 14). An investigation was carried out for 1 161 (32%) of these 3 623 cases with known status. *Legionella* was detected in 666 (63%) of 1 055 investigations for which environmental findings were reported (Table 15), with 698 sampling sites testing positive: 403 (58%) samples from cooling towers, 281 (26%) water systems – 66 hot water systems, 31 cold water systems and 184 non-specified water systems –, seven (1%) pools and six (1%) sampling sites reported as 'other' (Figure 10). All sampling sites that tested positive and were categorised as cooling towers were associated with the outbreak in Vila Franca de Xira, Portugal. In 59 (9%) of the 666 cases with positive environmental findings, isolates could be matched to clinical

isolates (37 cooling towers, 14 non-specified water systems, three hot water systems, two cold water systems, and two pools; in one system, *Legionella* was detected in the hot and cold water circuits).

Table 14. Environmental follow-up status of reported domestic cases of Legionnaires' disease by reporting country, EU/EEA, 2014*

Country	Cases without investigation		Cases with investigation		Status unknown		Total
	n	%	n	%	n	%	n
Austria	18	16	93	83	1	1	112
Belgium	0	0	0	0	19	100	19
Bulgaria	1	100	0	0	0	0	1
Croatia	0	0	0	0	23	100	23
Czech Republic	6	11	47	89	0	0	53
Denmark	0	0	18	17	88	83	106
Estonia	7	100	0	0	0	0	7
Finland	0	0	0	0	7	100	7
France	0	0	0	0	1 265	100	1 265
Germany	0	0	0	0	269	100	269
Greece	1	4	5	19	21	78	27
Hungary	1	14	6	86	0	0	7
Ireland	1	25	3	75	0	0	4
Italy	1 078	74	386	26	0	0	1 464
Latvia	18	47	20	53	0	0	38
Lithuania	0	0	3	100	0	0	3
Netherlands	166	76	42	19	9	4	217
Norway	0	0	0	0	21	100	21
Poland	1	33	2	67	0	0	3
Portugal	89	16	438	81	15	3	542
Romania	1	100	0	0	0	0	1
Slovakia	0	0	4	31	9	69	13
Slovenia	56	100	0	0	0	0	56
Spain	904	99	10	1	0	0	914
UK	114	56	84	42	4	2	202
Total	**2 462**	**46**	**1 161**	**22**	**1 751**	**33**	**5 374**

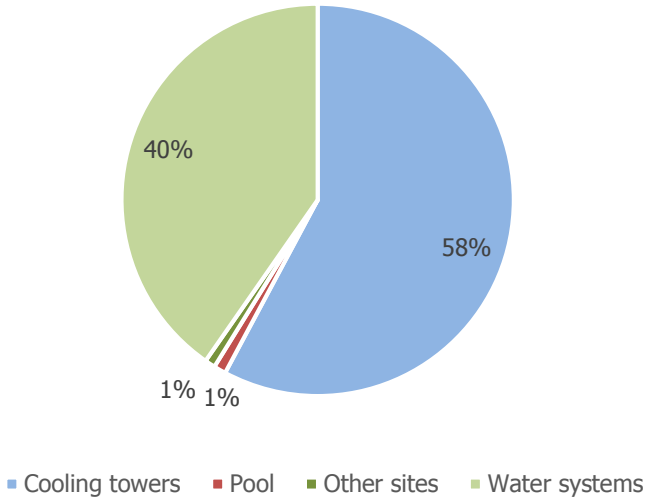
** Cases with setting reported as 'unknown' or 'travel abroad' were not included*

Table 15. *Legionella* findings of environmental investigations by reporting country, EU/EEA, 2014*

Country	Legionella detected		Legionella not detected		Result unknown		Total
	n	%	n	%	n	%	n
Austria	4	4	1	1	88	95	93
Czech Republic	21	45	26	55	0	0	47
Denmark	17	94	0	0	1	6	18
Greece	4	80	1	20	0	0	5
Hungary	6	100	0	0	0	0	6
Ireland	0		2	67	1	33	3
Italy	119	31	267	69	0	0	386
Latvia	20	100	0	0	0	0	20
Lithuania	3	100	0	0	0	0	3
Netherlands	20	48	19	45	3	7	42
Poland	2	100	0	0	0	0	2
Portugal	415	95	14	3	9	2	438
Slovakia	4	100	0	0	0	0	4
Spain	9	90	1	10	0	0	10
UK	22	26	58	69	4	5	84
Total	**666**	**57**	**389**	**34**	**106**	**9**	**1 161**

** Cases with setting reported as 'unknown' or 'travel abroad' were not included*

Figure 10. Distribution of sampling sites which tested positive for *Legionella*, EU/EEA, 2014



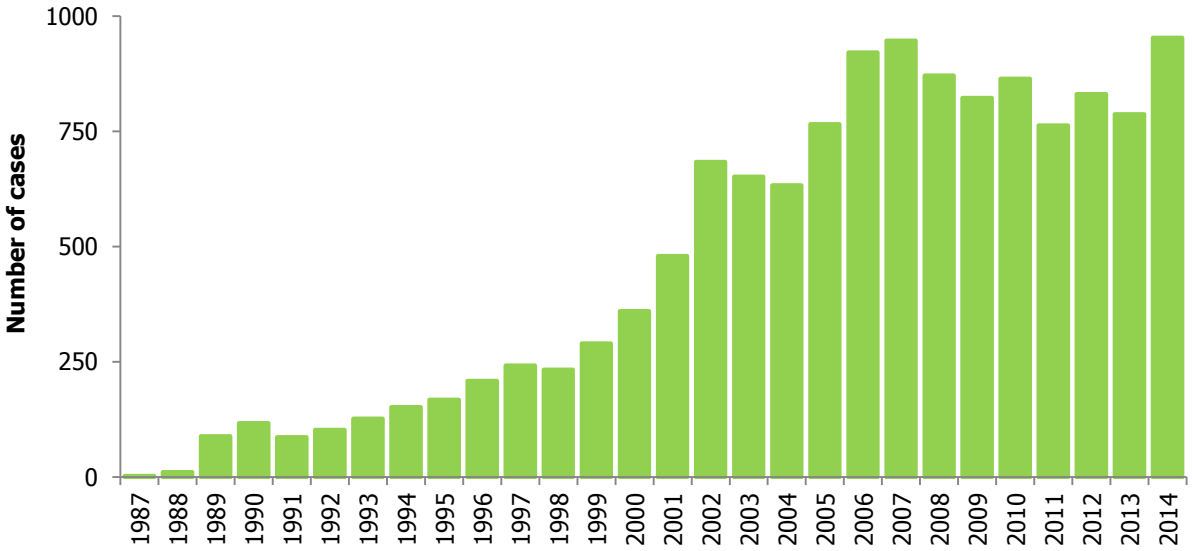
3.2 Travel-associated Legionnaires' disease

3.2.1 Cases

Notifications

ELDSNet received reports of 953 cases of TALD with date of onset in 2014. This was 21% higher than in 2013 (787 cases) and is the highest annual number of TALD cases ever reported by the network (Figure 11).

Figure 11. Number of travel-associated cases of Legionnaires' disease reported to ELDSNet, by year, 1987–2014



Cases were reported from 25 countries: 18 EU/EEA Member States, and seven non-EU/EEA countries: Switzerland (10 cases), Israel (4 cases), the USA (3 cases), Andorra, New Zealand, Thailand and Turkey (one case each). In 2013, five non-EU/EEA countries had reported cases and the three years before, the USA had been the only non-EU/EEA reporting country. With 54 cases, Germany shows a continuing upward trend since the beginning of reporting of travel-associated cases. Half (52%) of all TALD cases were reported (in decreasing order of frequency) by France, the United Kingdom, Italy, and the Netherlands (Table 16), followed by Spain, Germany, and Sweden; these countries reported around 50 cases each. Eleven of the thirteen countries which reported at least 10 cases saw an increase of cases between 2013 and 2014.

Table 16. Number of travel-associated cases of Legionnaires' disease by reporting country[a], 2010–2014[b]

Reporting country	Number of reported cases				
	2010 n (%)	2011 n (%)	2012 n (%)	2013 n (%)	2014 n (%)
France	191 (22)	162 (21)	170 (20)	161 (20)	186 (20)
United Kingdom	154 (18)	116 (15)	135 (16)	115 (15)	160 (17)
Italy	142 (16)	154 (20)	156 (19)	141 (18)	151 (16)
Netherlands	148 (17)	120 (16)	113 (14)	109 (14)	132 (14)
Spain	67 (8)	67 (9)	68 (8)	55 (7)	55 (6)
Germany	0	0	1 (<1)	34 (4)	54 (6)
Sweden	20 (2)	28 (4)	49 (6)	24 (3)	51 (5)
Denmark	32 (4)	32 (4)	41 (5)	25 (3)	37 (4)
Austria	19 (2)	25 (3)	27 (3)	23 (3)	36 (4)
Norway	25 (3)	18 (2)	13 (2)	20 (3)	25 (3)
Czech Republic	5 (1)	7 (1)	5 (1)	5 (1)	14 (1)
Belgium	16 (2)	11 (1)	19 (2)	25 (3)	12 (1)
Switzerland	0	0	0	0	10 (1)
Portugal	0	0	2 (<1)	0	7 (1)
Greece	0	4 (1)	1 (<1)	8 (1)	4 (<1)
Israel	0	0	0	1 (<1)	4 (<1)
Slovenia	1 (<1)	1 (<1)	2 (<1)	5 (1)	3 (<1)
United States of America	11 (1)	5 (1)	6 (1)	9 (1)	3 (<1)
Finland	8 (1)	5 (1)	6 (1)	9 (1)	2 (<1)
Malta	5 (1)	1 (<1)	0	1 (<1)	2 (<1)
Andorra	0	0	0	0	1 (<1)
Ireland	7 (1)	4 (1)	7 (1)	8 (1)	1 (<1)
New Zealand	0	0	0	0	1 (<1)
Thailand	0	0	0	1 (<1)	1 (<1)
Turkey	0	0	0	3 (<1)	1 (<1)
Canada	0	0	0	2 (<1)	0
Cyprus			1 (<1)	1 (<1)	0
Latvia	1 (<1)	1 (<1)	0	1 (<1)	0
Luxembourg	0	0	1 (<1)	1 (<1)	0
Hungary	2 (<1)	2 (<1)	4 (<1)	0	0
Croatia	0	0	4 (<1)	0	0
Others	10 (1)	0	0	0	0
Total	**864 (100)**	**763 (100)**	**831 (100)**	**787 (100)**	**953 (100)**

[a] The reporting country is generally the country where the case is diagnosed ; it can differ from the country of residence.

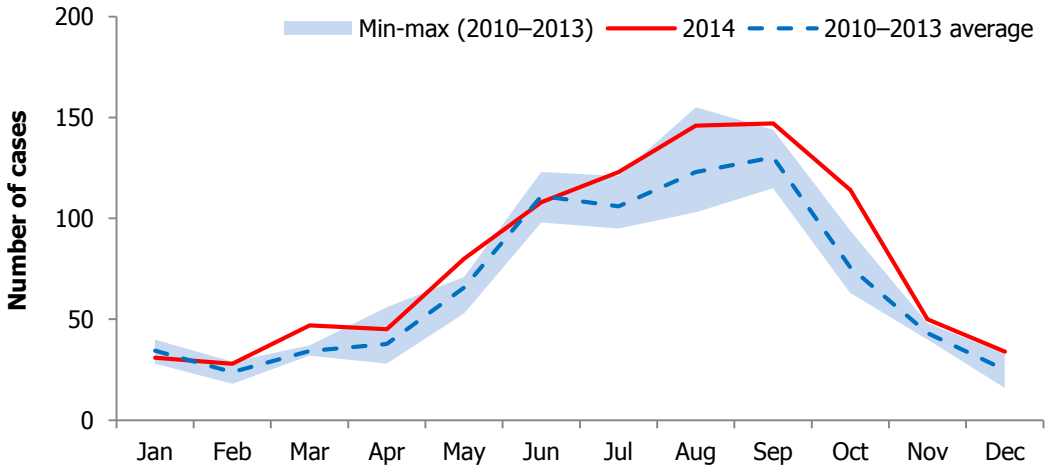
[b] 12 EU/EEA countries did not report any cases in 2014: Bulgaria, Croatia, Cyprus, Estonia, Hungary, Iceland, Latvia, Lithuania, Luxembourg, Poland, Romania and Slovakia.

ELDSNet reported on TALD cases resident in 32 countries. The majority of cases resided in those countries that reported the most cases. However, 37 (4 %) cases were in non-EU/EEA residents from Switzerland (13), the USA (7), Canada (3), Israel (3), Australia (2), Andorra (1), Brazil (1), Burundi (1), Chile (1), Japan (1), New Zealand (1), the Democratic Republic of the Congo (1), Senegal (1), and Turkey (1).

Seasonality

In 2014, seasonal variation was more pronounced, with 81% of TALD occurring in June–October, compared with 69% in 2013 (Figure 12). In each of those five months, over 100 TALD cases were reported to ELDSNet (with a peak of 146 and 147 in August and September, respectively). Similar to 2013, the season was longer than in the years before, with 114 cases occurring as late as October. The monthly minimum was slightly higher than in the previous years, with 28 cases reported in February.

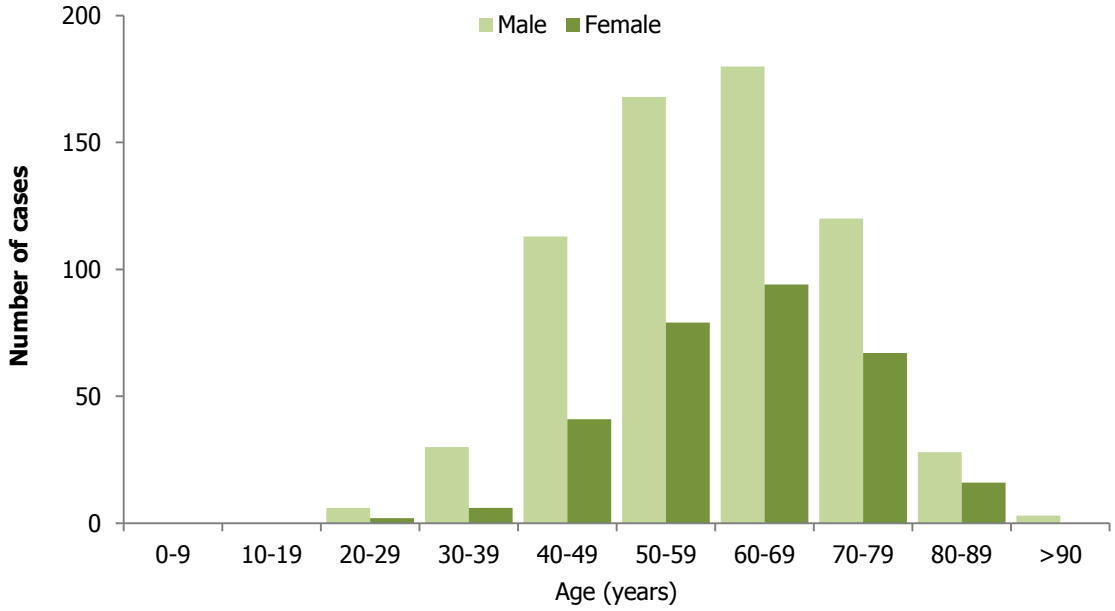
Figure 12. Number of travel-associated cases of Legionnaires' disease by month of disease onset, 2014 and comparison with 2010–2013 range and average



Age and sex

Similar to previous years and the overall Legionnaires' disease gender distribution, two thirds (648, 68%) of the reported TALD cases were male. Cases had a median age of 61 (IQR 52–70), with 79% of cases being 50 years and older (Figure 13).

Figure 13. Number of travel-associated cases of Legionnaires' disease, by age group and sex, 2014



Outcome

Outcome was provided for 520 (55%) TALD cases. Of these, 17 (3%) had died at the time of reporting. They were between 37 and 88 years old, and nine were male.

3.2.2 Clinical microbiology

A total of 891 TALD cases (93%) was classified as confirmed; 62 (7%) were probable cases. Of 1 030 laboratory tests used, 85% were UAT, 4% culture and 9% PCR. The latter remained at the 2012 and 2013 levels, after increasing from 6% in 2011 (Table 17).

Table 17. Reported diagnostic methods in travel-associated cases of Legionnaires' disease, 2014 (more than one method per case possible)

Laboratory method	n	%
Urinary antigen	871	85
Nucleic acid amplification, e.g. PCR	88	9
Culture	46	4
Single high titre	16	2
Fourfold titre rise	9	1
Total	**1 030**	**100**

In 697 (73%) of TALD cases, *L. pneumophila* serogroup 1 was reported as the causative microorganism (Table 18). Monoclonal subtyping results were reported for 25 cases (3%) (Table 19). The sequence type was reported for 27 cases (3%) from six countries: Denmark (12), United Kingdom (5), Czech Republic (4), Sweden (4), Germany (1), and Spain (1).

Table 18. Reported species or *L. pneumophila* serogroup in travel-associated cases of Legionnaires' disease, 2014

L. pneumophila serogroup / L. species	Number/proportion of TALD cases	
	n	%
1	697	73
2	1	<1
3	2	<1
4	1	<1
10	1	<1
12	1	<1
Mix of serogroups	4	<1
L. bozemanii	1	<1
L. longbeachae	2	<1
L. micdadei	2	<1
Pathogen unknown or not reported	241	25
Total	**953**	**100**

Table 19. Reported monoclonal subtype for *L. pneumophila* serogroup 1 in travel-associated cases of Legionnaires' disease, 2014

Monoclonal subtype	n
Benidorm	11
Philadelphia	8
Knoxville	4
OLDA/Oxford	1
Allentown/France	1
Total	**25**

3.2.3 Travel: visits and sites

The 953 TALD cases had made 1 371 visits to 1 225 unique publicly available accommodation sites around the world. Of these visits, 1 000 were within the EU/EEA, 347 were outside the EU/EEA (Figure 14**,** 15) and 24 were to ships. Altogether, the cases had visited 71 countries and 21 ships in the 2–10 days before their date of onset. The three destination countries with most TALD-associated travel visits were Italy (n=302, 22% of 1371 visits), France (n=234, 17%), and Spain (n=155, 11%). Of the 1 345 visits for which the accommodation type was reported, 79% were hotels, 9% camping sites, 5% apartments, 5% other types of accommodations, and 2% were ships. The median length of stay was four days, with the majority of stays ranging between 0 and 91 days (two outliers were recorded: 151 and 550 days). The proportion of domestic travel among the reported cases varied considerably by country (Table 20).

Figure 14. Number of accommodation site visits and clusters associated with travel-associated cases of Legionnaires' disease per destination country, EU/EEA and neighbouring countries, 2014

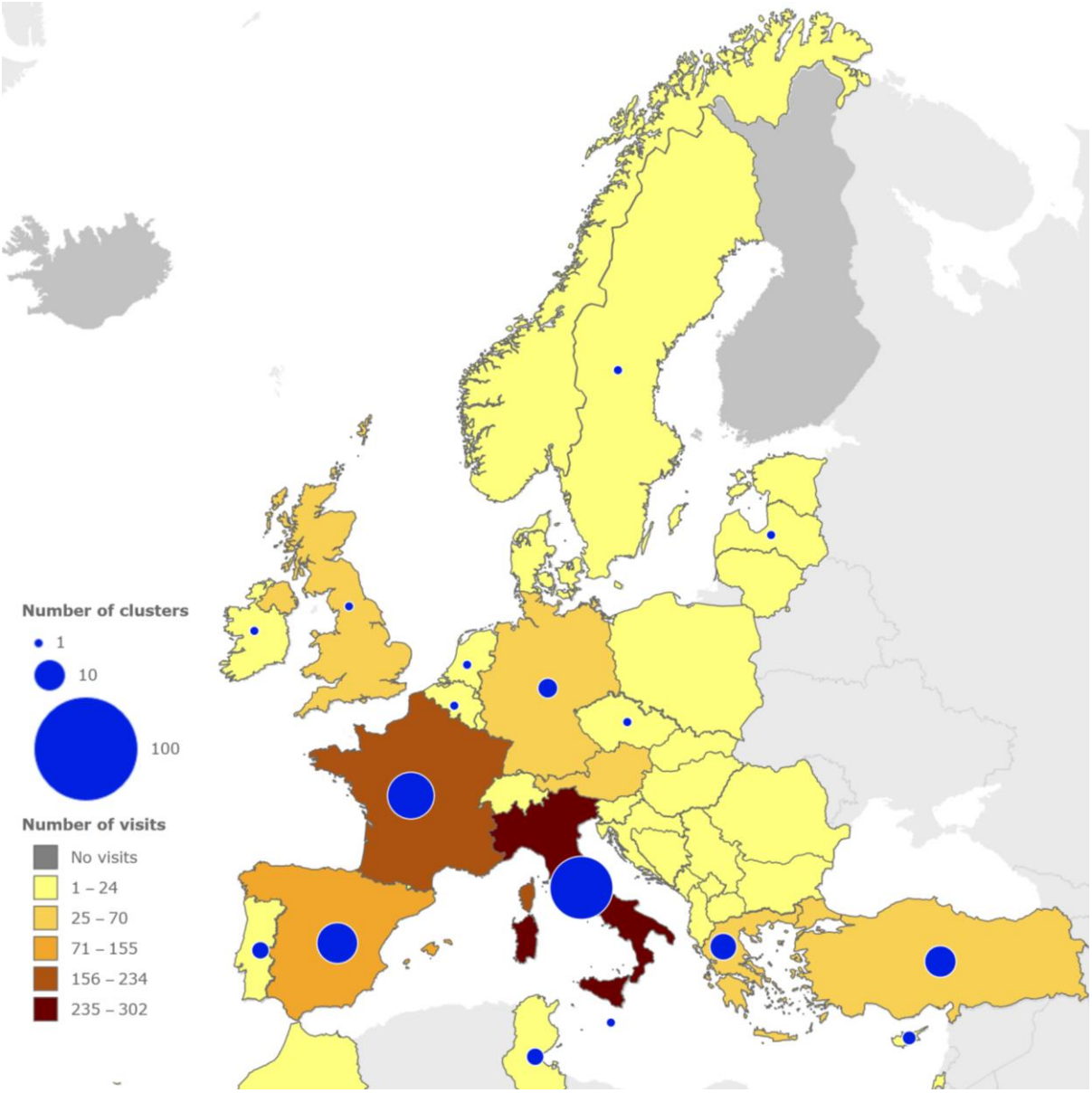


Figure 15. Number of accommodation site visits and clusters associated with travel-associated cases of Legionnaires' disease per destination country, worldwide, 2014

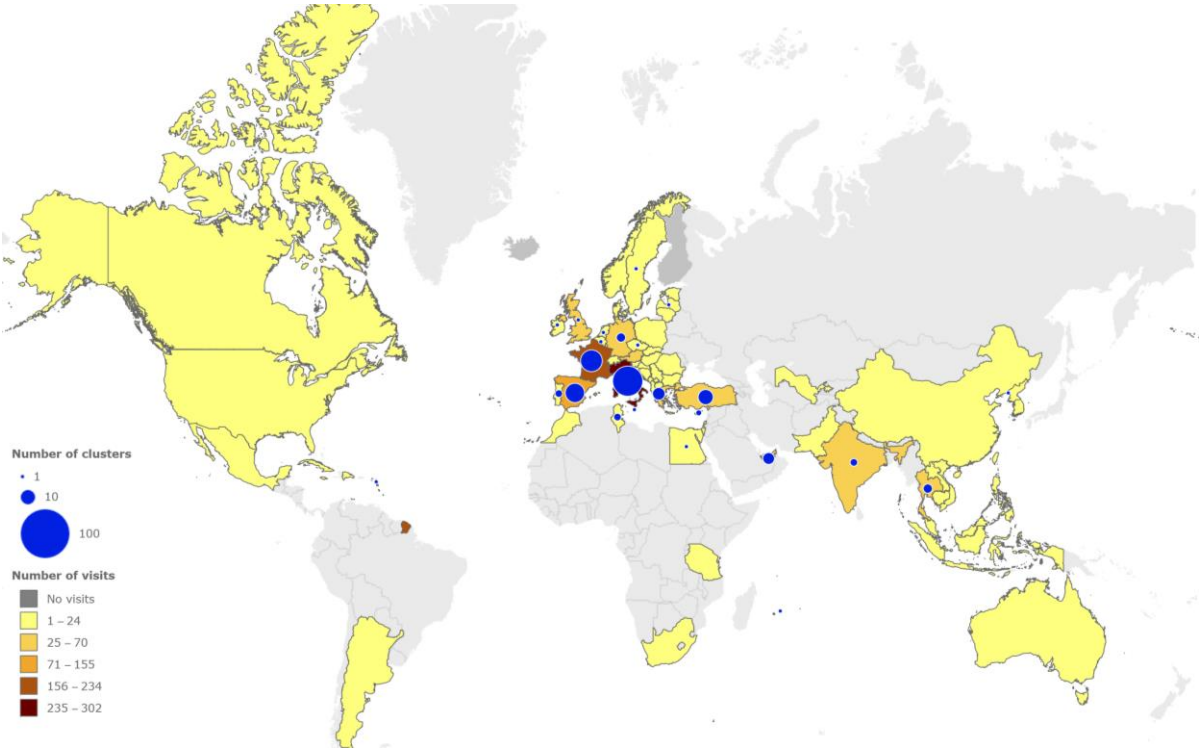


Table 20. Proportion of domestic trips by country of residence among cases of travel-associated Legionnaires' disease, 2014

Country of residence	Number of domestic trips	Number of outbound trips	Total	Proportion of domestic travel (%)
Greece	1	0	1	100
Poland	1	0	1	100
Turkey	1	0	1	100
Italy	149	28	177	84
Spain	45	17	62	73
France	154	125	279	55
Portugal	3	4	7	43
Austria	13	31	44	30
Germany	15	57	72	21
Czech Republic	2	12	14	14
United Kingdom	29	210	239	12
Norway	3	39	42	7
Sweden	5	68	73	7
Netherlands	13	198	211	6
Denmark	1	53	54	2

3.2.4 Clusters

In 2014, ELDSNet detected 132 new standard clusters and 8 complex clusters. Clusters were reported in 25 countries (16 EU/EEA and 9 non-EU/EEA countries) (Figure 14, 15) and on ships (which are not assigned to any specific country).

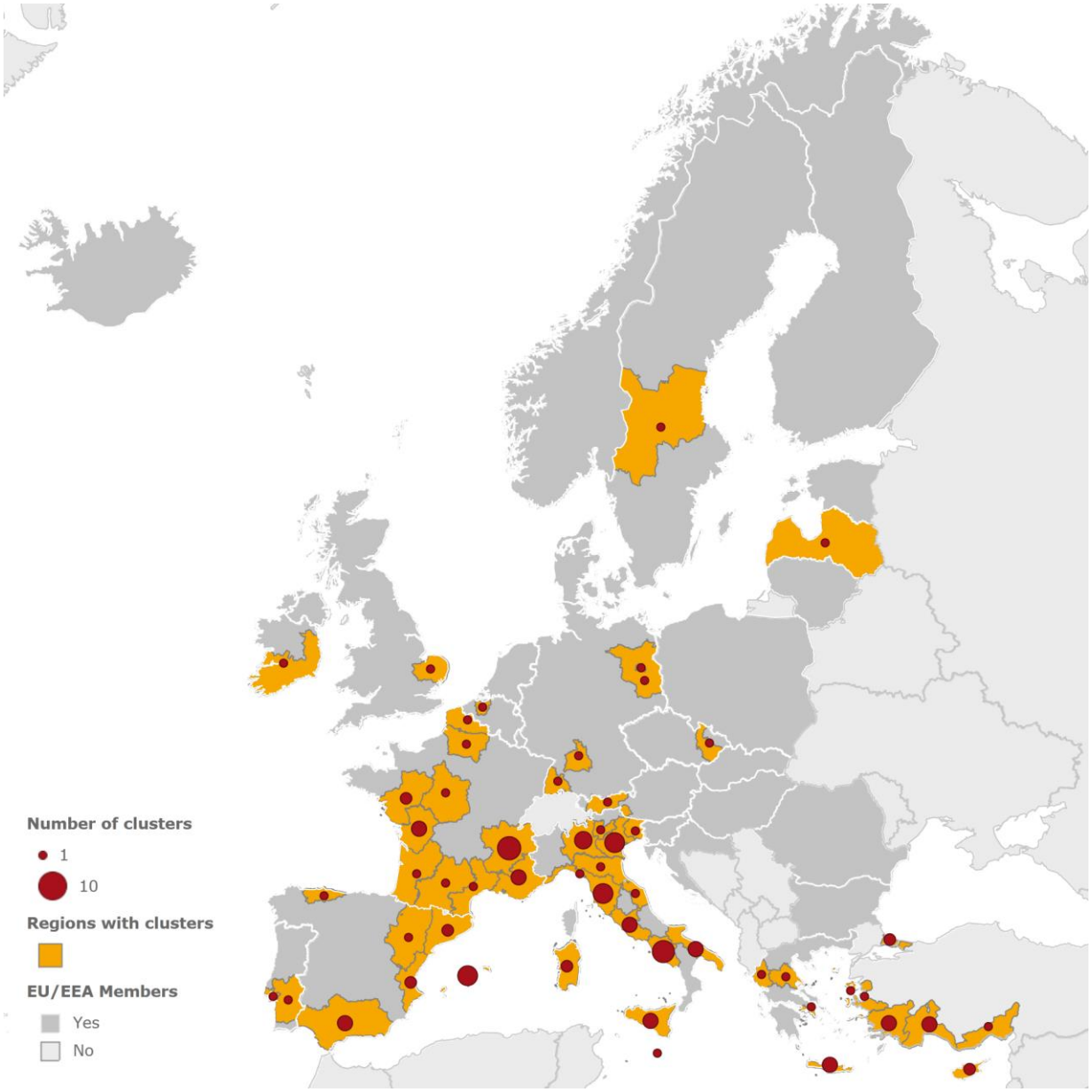
Altogether, 349 (37%) of all TALD cases were part of clusters. There were three clusters of two cases on ships.

Of the 140 clusters reported, 96 (69%) were comprised of two cases (Figure 16). The remaining clusters (31%) ranged between three and nine cases.

Figure 16. Number of cases of travel-associated Legionnaires' disease per cluster, 2014

In 55% of the clusters, the first two reported cases were from different countries. These clusters would probably not have been detected as rapidly had it not been for the ELDSNet surveillance system. The number of TALD clusters at subnational (NUTS2) level is shown in Figure 17.

Figure 17. Number of standard clusters of travel-associated Legionnaires' disease per destination area (NUTS 2), EU/EEA and neighbouring countries, 2014



3.2.5 Investigations and publication of accommodation sites

In 2014, no accommodation names were published on the ECDC website, because assessment reports for all cluster sites in the EU/EEA were received in due time, stating that satisfactory control measures had been implemented. We received a total of 165 preliminary (environmental) assessment reports within two weeks of notification, and the same number of final assessment reports within six weeks of notification.

3.3 Event-based surveillance

In 2014, 14 new and four updates for rapidly evolving clusters in Greece, Italy, Spain, Tunisia and Turkey were reported to tour operators.

4 Discussion

With 6 941 cases reported, the notification rate of Legionnaires' disease in the EU/EEA in 2014 was 13.5 cases per million population, the highest ever observed. This is in line with the increasing trend observed over the 2009–2014 period, notwithstanding the large community outbreak that occurred in Vila Franca de Xira near Lisbon, Portugal, in October–November 2014, which substantially contributed to the high number of reported cases [12].

The fact that 2014 was a difficult year is illustrated by the fact that weekly case numbers exceeded predicted numbers for most of the year. Further investigations, such as an analysis of meteorological conditions favourable to LD, may explain the reasons for this increase.

Five countries (France, Germany, Italy, Portugal, and Spain) accounted for 74% of all cases, yet their combined populations represent only half of the EU/EEA inhabitants. The 15 countries that reported the lowest numbers merely accounted for 2% of all cases. Many countries had a notification rate below five cases per million population (with several below one per million), a situation unchanged over the past five years and unlikely to reflect the true incidence of LD in these countries.

The main characteristics of the cases reported in 2014 were very similar to those reported in previous years: most cases were sporadic and community acquired, and the disease affected mostly older males.

Over the past five years, the proportion of cases diagnosed by PCR has continuously increased from less than 2% in 2008 to 8% in 2014. Six countries reported that 20% of all cases were diagnosed by PCR. The proportion of cases for which culture was used remains low overall and varies greatly across countries (0–45%).

In 2014, 953 travel-associated cases of LD were reported, 21% more than in 2013. This is in line with the increased overall notification rate for Legionnaires' disease. Further analyses may provide a better insight in the factors behind this year's increase.

A total of 132 new standard travel-associated clusters were identified, compared with 110 in 2013 and 99 in 2012. More than half of these TALD clusters would most probably not have been detected without international collaboration. This confirms the added value of ELDSNet's daily TALD surveillance in protecting the health of travellers in the EU/EEA and other participating countries.

5 Conclusion

Legionnaires' disease remains a significant cause of potentially preventable morbidity and mortality in Europe. Large outbreaks such as the one in Portugal remind us of the enormous challenges of preventing and controlling this disease. Further review and sharing of best practice in cooling tower maintenance could help prevent large outbreaks in the future.

ECDC will explore the possibilities to assist countries with notification rates below one per million inhabitants to improve clinical awareness, laboratory diagnosis and reporting of LD.

The use of laboratory tests for diagnosis is rapidly changing, with an increasing number of PCR tests performed in several countries.

In 2014, ELDSNET has continued to demonstrate its effectiveness in daily surveillance of TALD, early detection and follow-up of clusters. ECDC will continue to promote the reporting of cases from countries outside of Europe to facilitate the early detection of clusters.

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