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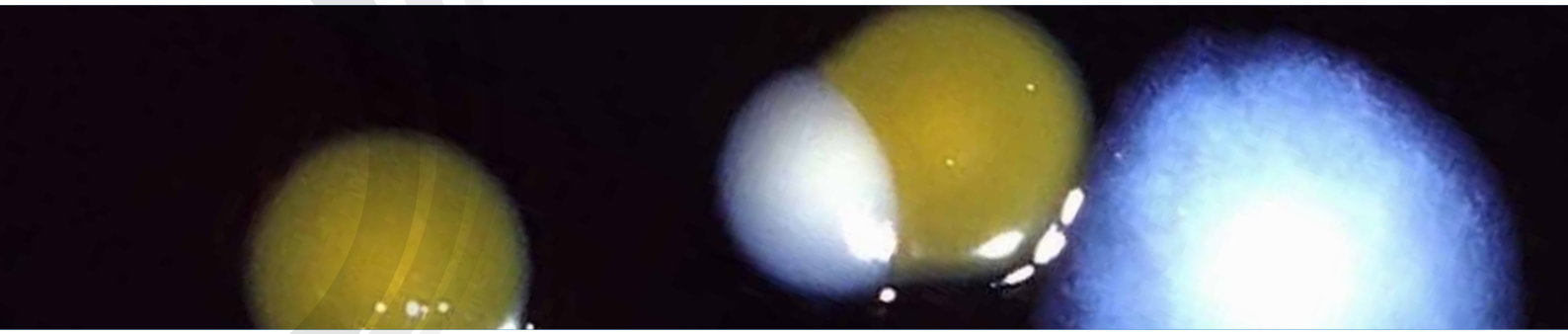

# Legionnaires' disease in Europe

## 2012

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2012

This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Julien Beauté and Emmanuel Robesyn.

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# Abbreviations

| | |
|---|---|
| CFR | Case-fatality ratio |
| 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 |
| EWGLINET | 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 Legionnaires' disease (LD) surveillance data collected for 2012. 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 were collected by nominated ELDSNet experts for each European country and electronically reported to The European Surveillance System (TESSy) database.

The surveillance data are from two different schemes: the first scheme covers all cases reported from European Union (EU) Member States, Iceland and Norway; the second scheme covers all travel-associated cases of Legionnaires' disease (TALD), including reports from countries outside the EU/EEA.

The aims of these two schemes differ. The main objectives of collecting data on all nationally reported cases of LD are:

- to monitor trends over time and to compare them across Member States;
- to provide evidence-based data for public health decisions and actions at an EU and/or Member State level;
- to monitor and evaluate prevention and control programmes targeting LD at the national and European level; and
- to identify population groups at risk and in need of targeted preventive measures.

The surveillance of TALD aims primarily at identifying clusters of cases that may not otherwise 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.

## Total notified cases

In 2012, 5 852 cases of LD were reported by EU Member States, Iceland and Norway. The number of notifications per million inhabitants was 11.5, well within the 2005–2011 range. Six countries (France, Italy, Spain, Germany, Netherlands and the United Kingdom) accounted for 84% of all notified cases. The number of notifications ranged from 0 per million inhabitants in Bulgaria to 39.9 per million in Slovenia. Most cases were community-acquired (69%), while 20% were travel-associated and 8% were linked to healthcare facilities. People over 50 years of age accounted for 79% of all cases. The male-to-female ratio was 2.5. The case-fatality ratio was 9% in 2012, similar to previous years. Most cases (79%) were confirmed by urinary antigen test. *L. pneumophila* and its serogroup 1 were the most commonly identified pathogens, accounting for 98% and 85% of culture-confirmed cases, respectively.

Countries with notification rates below one per million inhabitants should be given priority in order to improve both diagnosis and reporting of LD.

## Travel-associated Legionnaires' disease

In 2012, 831 cases of TALD were reported by 20 EU/EEA countries, Croatia and the United States of America. This was 8% higher than the 763 cases reported in 2011 and in line with the numbers seen in 2008–2010. Five countries (France, Italy, the Netherlands, Spain, and the UK) reported 77% of all TALD cases. The male-to-female ratio was 2.4, and the reported median age was 63 years at the date of onset.

A total of 99 (standard[1]) clusters were detected. The largest cluster (42 cases, 36 of which were travel associated) was reported in Spain. *Legionella* spp. were detected at more than half of the investigated accommodation sites. The name of one accommodation site was published on the ECDC website after the national contact point local reported that control measures were inadequate.

Without ELDSNet it would have been very likely that 44 (44%) of the standard clusters of travel-associated Legionnaires' disease detected in 2012 would have been missed.

[1] Clusters associated with only one accommodation site.

# 1 Background

Legionnaires' disease (LD) is a severe and sometimes fatal form of an infection with *Legionella spp*. These Gram-negative bacteria are found worldwide in freshwater and soil and tend to contaminate man-made water systems [1]. The disease was first described after a large outbreak among members of a US organisation of war veterans (American Legion) in the late 1970s, which also explains its name [2]. LD is not transmitted from person-to-person but through inhalation of contaminated aerosols or aspiration of contaminated water. LD is usually 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 gender, smoking, chronic lung disease, diabetes and various conditions associated with immunodeficiency [3,4]. Most cases (≈70%) are community-acquired and sporadic [5]. Studies suggest that the incidence of LD may be higher under certain environmental conditions such as warm and wet weather [6–8].

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 that are likely to cover *Legionella* spp. Secondly, some health professionals fail to notify cases to health authorities [1].

The situation in Europe is therefore complex, with a broad range of notification rates across countries reflecting both the quality of the national surveillance system and the local risk for LD. Some countries (e.g. France, Italy or the Netherlands) have already assessed their systems' sensitivity, mainly through capture–recapture studies, and showed improvement over time [9–12]. For other countries such as Greece, a study using TALD notification and tourism denominator data strongly suggested substantial under-ascertainment [13]. In eastern and south-eastern countries (e.g. Bulgaria, Poland or Romania), the numbers of reported cases have remained very low and are unlikely to reflect the true burden of LD. Differences in laboratory practice may also partly explain these differences in notification rates [14–16].

Since 2010, the surveillance of LD in Europe has been operated by ELDSNet under the coordination of ECDC. Two distinct LD surveillance systems are currently in place. One is based on an annual passive reporting of all LD cases, the other on the daily reporting of TALD cases. Since some countries are unable to link the TALD cases reported daily and those reported annually, it is not yet possible to merge the two databases.

The first annual Legionnaires' disease surveillance report published by ECDC reported the data collected in 2009 [14]. This is the fourth annual report, presenting the analysis of disaggregated LD surveillance data in Europe, and the third annual report covering both surveillance systems [15,16].

# 2 Methods

## 2.1 The European Legionnaires' Disease Surveillance Network

ELDSNet involves 27 EU Member States, Iceland and Norway. The Network aims at identifying relevant public health risks, enhancing prevention of cases through detection of clusters and monitoring epidemiological trends. The latter objective includes the annual collection, analysis and reporting of all LD cases reported during the previous year.

## 2.2 Data collection

### 2.2.1 Legionnaires' disease (comprehensive notifications)

National data collected by nominated ELDSNet members in each European country were electronically reported to the TESSy database following a strict protocol. The deadline for 2012 data submission was 1 May 2013. Following data validation and cleaning, data for analysis were extracted on 1 June 2013. All LD cases in 2012 meeting the European case definition (see box below) were included. This case definition was amended in August 2012, and it is no longer possible to report probable cases which only have an epidemiological link. Travel-associated Legionnaires' disease cases with a history of travelling abroad were reported by country of residence. Cases were to be classified as travel-associated if they had stayed at an accommodation site away from home during their incubation period of two to ten days prior to falling ill. Cases were to be reported as having formed part of a cluster if they had been exposed to the same source as at least one other case, with their dates of onset within a plausible time period.

#### EU case definition of Legionnaires' disease [17]

**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 for a probable case.

*Confirmed case*

Any person meeting the clinical AND the laboratory criteria for case confirmation.

### 2.2.2 Travel-associated Legionnaires' disease

Individual cases of TALD are reported to ECDC daily via TESSy. The daily surveillance scheme aims at the early detection of TALD clusters, and for this reason the reporting country is generally the country where the case is diagnosed, which also implies that the reporting country can differ from the country of residence of the case.

Case reports include age, gender, date of disease onset, method of diagnosis and travel information for the different places where the case had stayed from two to ten days prior to onset of disease. Only cases that have stayed at a commercial accommodation site are reported (as opposed to cases of LD that have stayed with relatives or friends). After receiving the report, each new case is classified as a single case or as part of a cluster, according to the definitions agreed by the Network:

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

If there are three cases or more with onset of disease within the same three-month period, this 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, and the preliminary results of the risk assessment and the initiation of control measures should be reported back to ELDSNet by nationally nominated contact points within two weeks of the alert using the 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, allowing six weeks in total for all investigations to be completed. If the forms are not returned within the deadlines, or if they report that actions and control measures are unsatisfactory, ECDC publishes the details of the sites associated with the cluster on its website, and tour operators are informed that details of the accommodation sites will be published. If a cluster is associated with more than one accommodation site, it is noted as a 'complex cluster' and all potentially involved cluster sites are subject to the same investigations as described above.

### 2.2.3 Event-based surveillance

ECDC continuously identifies and monitors health threats from a broad range of formal and informal sources through epidemic intelligence activities. Potential threats are documented and monitored by using a dedicated database and a standard protocol. Experts evaluate and select threats that may require further attention by the nationally nominated contact points and surveillance systems, depending on their relevance and potential impact on the health of EU citizens. More details on the tools used for threat detection and threat communication can be found on the ECDC webpages dedicated to epidemic intelligence[2].

## 2.3 Data analysis

### 2.3.1 Legionnaires' disease (comprehensive notifications)

Cases reported without any laboratory method specified 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 2012 were included in the analysis. Since environmental investigations are the responsibility of the Member States, we restricted the analysis to domestic cases for the variables relating to these investigations.

The distribution of all cases and the subset 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. Prevalence ratios 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.

### 2.3.2 Travel-associated Legionnaires' disease

We analysed the TALD data, which are reported on a daily basis, by looking at cases, travel visits, accommodation sites, and clusters. All reported cases with a date of onset in 2012 and their travel records were included in the analysis. When the country of residence was identical to the destination country, the travel was considered domestic. We analysed the temporal and geographic distribution of TALD cases. Standard cluster frequencies within the EU/EEA were mapped at level 2 of the Nomenclature of Territorial Units for Statistics (NUTS 2).

[2] http://ecdc.europa.eu/en/activities/epidemicintelligence/Pages/Activities_EpidemicIntelligence.aspx

# 3 Results

## 3.1 Legionnaires' disease (comprehensive notifications)

### 3.1.1 Cases

#### *Case validation and data completeness*

In 2012, 5 952 cases were reported by 29 countries. One hundred cases were excluded from analysis because they were reported without laboratory method (99 from Belgium and one from Hungary). Thus, a total of 5 852 cases were included for this analysis.

Overall, data completeness[3] was similar to previous years (Table 1).

**Table 1. Completeness of reporting Legionnaire' disease cases for selected variables, EU/EEA countries, 2009–2012**

| Variable | 2009 % | 2010 % | 2011 % | 2012 % |
|---|---|---|---|---|
| Date of onset (complete date) | 96 | 95 | 97 | 98 |
| Outcome (not reported as unknown) | 68 | 69 | 70 | 71 |
| Cluster (not reported as unknown) | 70 | 63 | 60 | 72 |
| Cluster ID[a] (not missing) | >99 | 83 | 98 | 85 |
| Probable country of infection[b] (not missing) | 97 | 93 | 94 | 92 |
| Place of residence (not missing) | 21 | 30 | 35 | 36 |
| Sequence type (not missing) | 1 | 1 | 3 | 4 |
| Setting of infection (not missing or reported as unknown) | 89 | 89 | 87 | 88 |
| Environmental investigation (not reported as unknown) | 40 | 33 | 37 | 43 |
| *Legionella* found[c] (not missing or reported as unknown) | 94 | 96 | 92 | 90 |
| Positive sampling site[d] (not missing or reported as unknown) | 85 | 73 | 83 | 77 |

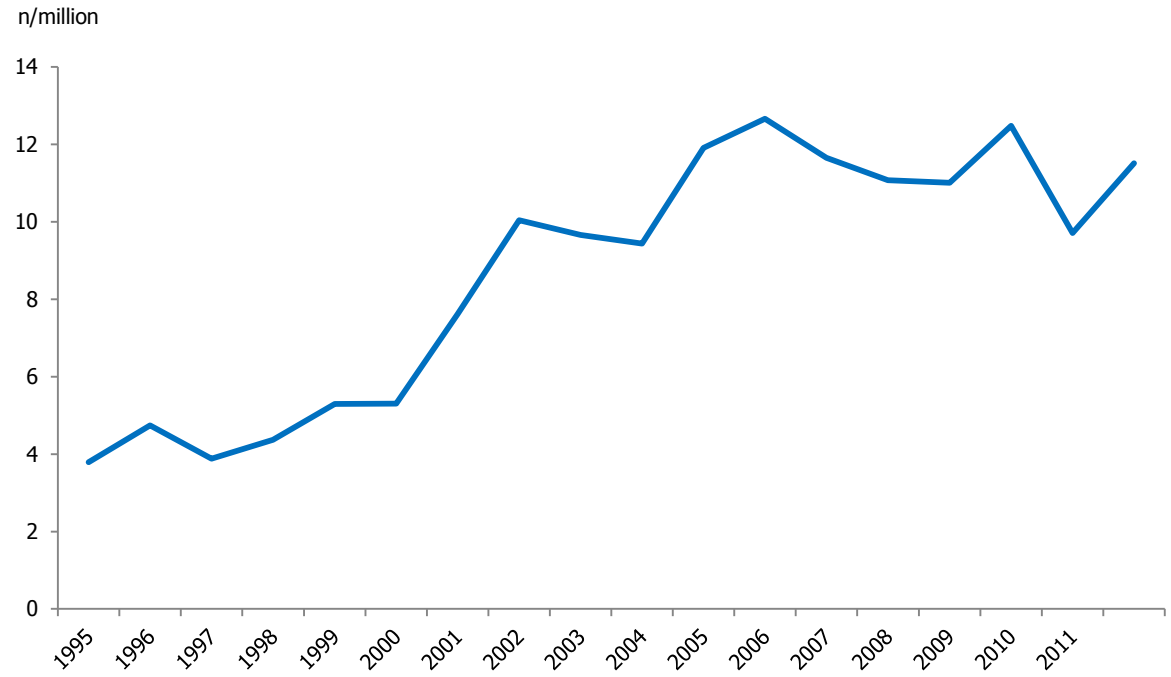
[a] Completeness determined in cases reported to have formed part of a cluster.
[b] Completeness determined in cases reported to have been imported.
[c] Completeness determined in cases reported to have prompted an environmental investigation.
[d] Completeness determined in cases for which positive findings in an environmental investigation were reported.

#### *Case classification and notification rate*

Of the 5 852 notified cases, 5 394 (92%) were classified as confirmed and the remaining 458 (8%) as probable. Of 458 probable cases, 174 (38%) were reported by Germany. It should be noted that Slovakia, Latvia and Finland had a large proportion of their cases reported as probable (100%, 67% and 60%, respectively). The number of notifications per million inhabitants was 11.5 in 2012, which was well within the 2005–2011 range (Figure 1).

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

**Figure 1. Notification rates of Legionnaires' disease in the EU/EEA* by year of reporting, 1995–2012**




** EWGLINET member countries not belonging to the EU/EEA were excluded for 1995–2008.*

## Seasonality and geographical distribution

Date of onset was reported for 5 847 cases. The distribution of cases by month of onset showed a peak during the warm season, with 57% of all cases reported from June to October (Figure 2). The slightly increasing linear trend was not significant over the 2008–2012 period (Figure 3).

**Figure 2. Reported cases of Legionnaires' disease by month of onset, EU/EEA, 2008–2012**

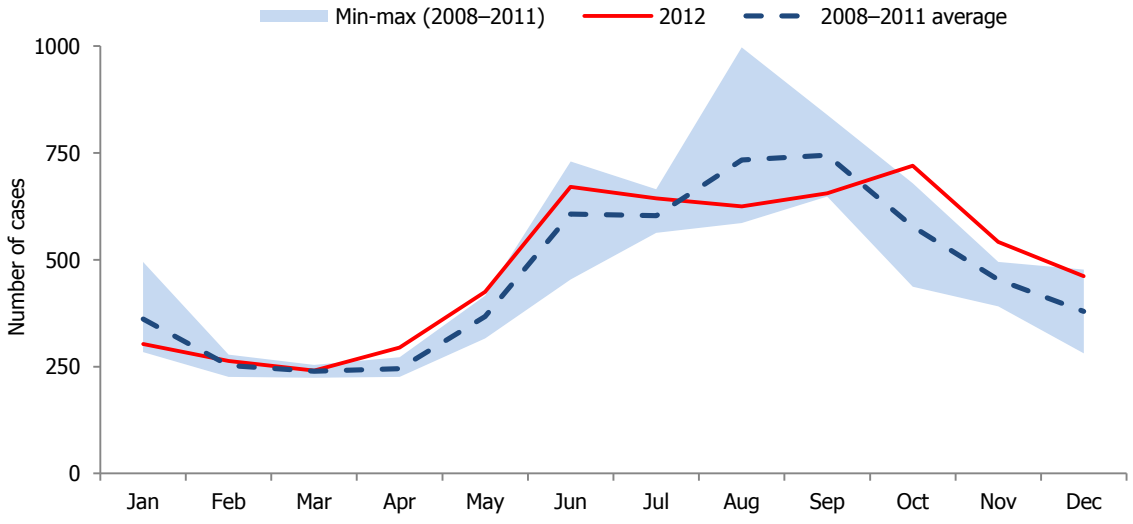
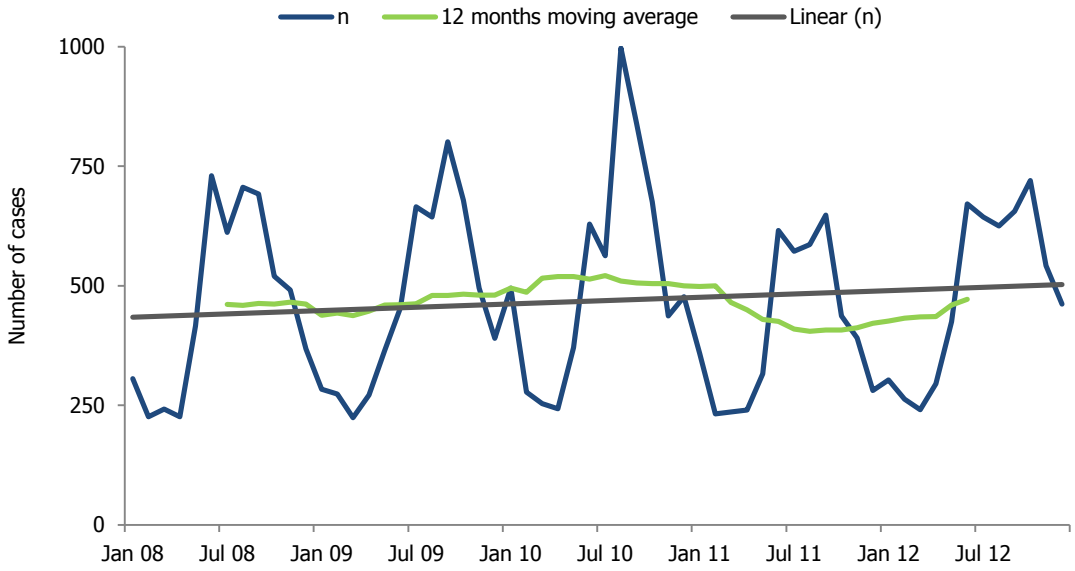


**Figure 3. Reported cases of Legionnaires' disease by month of onset, EU/EEA, 2008–2012**




Country-specific notification rates ranged from 0 per million inhabitants in Bulgaria to 39.9 per million in Slovenia (Figure 4 and Table 2). The three largest reporting countries (France, Italy and Spain) accounted for 62% of cases and the six largest (France, Italy, Spain, Germany, Netherlands and the United Kingdom) for 84%. Conversely, the 15 smallest reporting countries merely accounted for 3% of all cases (Figure 4). Age-standardised notification rates did not differ substantially from crude notification rates (Table 2).

**Figure 4. Reported cases and notification rates of Legionnaires' disease per million by reporting country, EU/EEA, 2012**

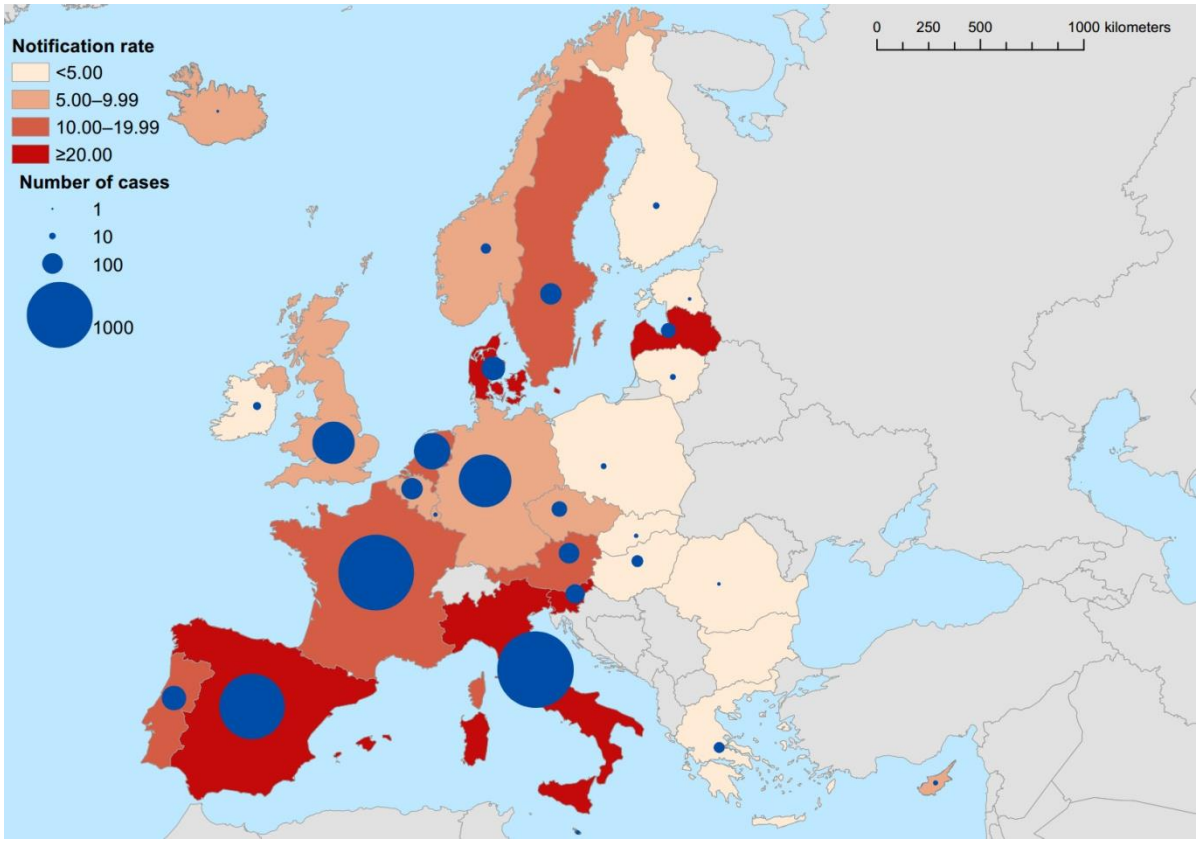


**Table 2. Reported cases and notifications of Legionnaires' disease per million, by reporting country, EU/EEA, 2012**

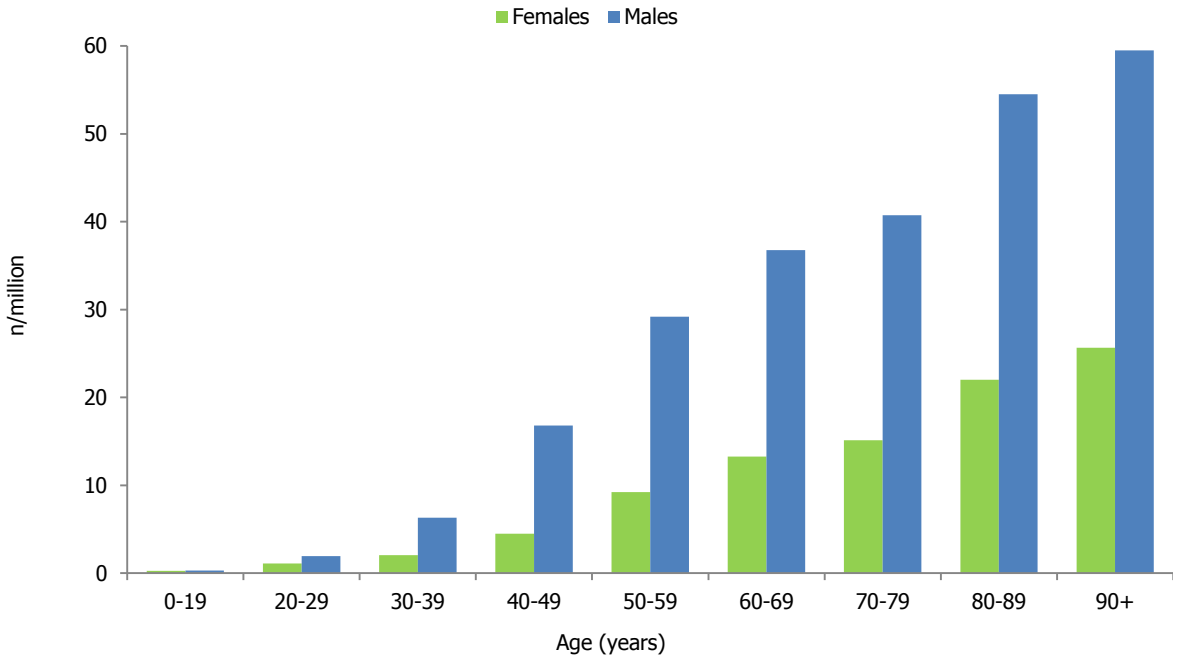
| Country | Cases (n) | Population (n) | Notification rate (n/million) | Average difference between 2012 and 2008–11 rates (%) | Age-standardised notification rate (n/million) |
|---|---|---|---|---|---|
| Slovenia | 82 | 2 055 496 | 39.9 | 53 | 37.7 |
| Latvia | 48 | 2 041 763 | 23.5 | 215 | 23.6 |
| Denmark | 127 | 5 580 516 | 22.8 | -1 | 22.0 |
| Italy | 1 332 | 60 820 696 | 21.9 | 13 | 19.1 |
| Spain | 972 | 46 196 276 | 21.0 | -11 | 20.2 |
| France | 1 298 | 65 327 724 | 19.9 | -1 | 19.6 |
| Netherlands | 304 | 16 730 348 | 18.2 | -12 | 17.6 |
| Portugal | 140 | 10 541 840 | 13.6 | 81 | 12.4 |
| Austria | 101 | 8 443 018 | 12.0 | 7 | 11.3 |
| Sweden | 102 | 9 482 855 | 10.8 | -19 | 10.1 |
| Malta | 4 | 417 520 | 9.6 | -28 | 9.3 |
| Belgium | 106 | 11 094 850 | 9.6 | 67 | NA[a] |
| Luxembourg | 5 | 524 853 | 9.5 | -27 | 10.0 |
| Cyprus | 7 | 862 011 | 8.1 | 73 | 9.6 |
| Germany | 628 | 81 843 743 | 7.7 | 7 | 6.8 |
| United Kingdom | 401 | 62 989 551 | 6.4 | 12 | 6.3 |
| Iceland | 2 | 319 575 | 6.3 | -43 | 6.6 |
| Czech Republic | 56 | 10 505 445 | 5.3 | 77 | 5.1 |
| Norway | 25 | 4 985 870 | 5.0 | -37 | 5.1 |
| Hungary | 33 | 9 957 731 | 3.4 | -29 | 3.2 |
| Ireland | 15 | 4 582 769 | 3.3 | 62 | 4.2 |
| Lithuania | 9 | 3 007 758 | 3.0 | 165 | 3.1 |
| Greece | 27 | 11 290 067 | 2.4 | 52 | 2.1 |
| Estonia | 3 | 1 339 571 | 2.2 | -40 | 2.3 |
| Finland | 10 | 5 401 267 | 1.9 | -44 | 1.8 |
| Slovakia | 4 | 5 404 322 | 0.7 | -20 | 0.8 |
| Poland | 8 | 38 538 447 | 0.2 | -58 | 0.2 |
| Romania | 3 | 21 355 849 | 0.1 | 34 | 0.1 |
| Bulgaria | 0 | 7 327 224 | 0.0 | -100 | 0.0 |
| **EU/EEA total** | **5 852** | **509 005 430** | **11.5** | **4** | **10.8** |

[a] *Not applicable when information on age was not available for >5% of cases*

## *Age and gender*

The median age at date of onset was 62 years (IQR 51–74). 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 59.5 per million population in males aged 90 years and older (Figure 5). People older than 50 years of age accounted for 4 566 (79%) of 5 807 cases with known age. In all age groups, LD was more common in males, with an overall male-to-female ratio of 2.5. The male-to-female ratio peaked at 3.8 in the 40–49-year age group.

**Figure 5. Distribution of notifications rates of Legionnaires' disease per million by gender and age group, EU/EEA, 2012**




## *Settings*

Of 5 136 cases with reported setting of infection, 3 553 (69%) were reported as community acquired (Table 3). In 2012, travel and healthcare-associated cases accounted for 20% and 8% of the total, respectively. The remaining cases (3%) were reported with other probable setting of infection. While the proportion of community-acquired cases remained high in all age groups, the proportion of travel-associated cases peaked between 40 and 79 years of age. 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, 2012**[a]

| Country | Community n (%) | Nosocomial n (%) | Other healthcare n (%) | Travel abroad n (%) | Domestic travel n (%) | Other n (%) | Total n (%) |
|---|---|---|---|---|---|---|---|
| Austria | 70 (69) | 9 (9) | 0 | 17 (17) | 5 (5) | 0 | 101 (100) |
| Belgium | 19 (40) | 6 (13) | 4 (8) | 18 (38) | 1 (2) | 0 | 48 (100) |
| Czech Republic | 23 (70) | 5 (15) | 0 | 4 (12) | 1 (3) | 0 | 33 (100) |
| Germany | 295 (69) | 17 (4) | 7 (2) | 86 (20) | 20 (5) | 0 | 425 (100) |
| Denmark | 59 (53) | 7 (6) | 2 (2) | 43 (38) | 1 (1) | 0 | 112 (100) |
| Estonia | 3 (100) | 0 | 0 | 0 | 0 | 0 | 3 (100) |
| Spain | 557 (76) | 49 (7) | 9 (1) | 21 (3) | 43 (6) | 50 (7) | 729 (100) |
| Finland | 0 | 0 | 0 | 7 (100) | 0 | 0 | 7 (100) |
| France | 826 (64) | 88 (7) | 59 (5) | 88 (7) | 157 (12) | 77 (6) | 1 295 (100) |
| Greece | 17 (63) | 7 (26) | 0 | 0 | 3 (11) | 0 | 27 (100) |
| Hungary | 1 (6) | 7 (41) | 0 | 5 (29) | 2 (12) | 2 (12) | 17 (100) |
| Ireland | 5 (33) | 0 | 2 (13) | 7 (47) | 1 (7) | 0 | 15 (100) |
| Iceland | 0 | 1 (100) | 0 | 0 | 0 | 0 | 1 (100) |
| Italy | 1 062 (80) | 72 (5) | 41 (3) | 11 (1) | 124 (9) | 22 (2) | 1 332 (100) |
| Lithuania | 5 (56) | 0 | 0 | 2 (22) | 0 | 2 (22) | 9 (100) |
| Luxembourg | 0 | 1 (100) | 0 | 0 | 0 | 0 | 1 (100) |
| Latvia | 48 (100) | 0 | 0 | 0 | 0 | 0 | 48 (100) |
| Netherlands | 151 (50) | 1 (<1) | 4 (1) | 130 (43) | 17 (6) | 0 | 303 (100) |
| Norway | 9 (36) | 0 | 0 | 16 (64) | 0 | 0 | 25 (100) |
| Poland | 0 | 0 | 1 (50) | 1 (50) | 0 | 0 | 2 (100) |
| Portugal | 106 (87) | 2 (2) | 0 | 7 (6) | 6 (5) | 1 (1) | 122 (100) |

| Country | Community n (%) | Nosocomial n (%) | Other healthcare n (%) | Travel abroad n (%) | Domestic travel n (%) | Other n (%) | Total n (%) |
|---|---|---|---|---|---|---|---|
| Romania | 3 (100) | 0 | 0 | 0 | 0 | 0 | 3 (100) |
| Slovenia | 74 (99) | 0 | 0 | 1 (1) | 0 | 0 | 75 (100) |
| Slovakia | 3 (75) | 0 | 0 | 1 (25) | 0 | 0 | 4 (100) |
| United Kingdom | 217 (54) | 10 (3) | 0 | 148 (37) | 24 (6) | 0 | 399 (100) |
| **EU/EEA total** | **3 553 (69)** | **282 (5)** | **129 (3)** | **613 (12)** | **405 (8)** | **154 (3)** | **5 136 (100)** |

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

**Table 4. Reported cases of Legionnaires' disease by setting of infection and age group, EU/EEA, 2012**

| Age (years) | Community n (%) | Travel n (%) | Healthcare[a] n (%) | Other n (%) | Total n (%) |
|---|---|---|---|---|---|
| 0–19 | 26 (84) | 2 (6) | 2 (6) | 1 (3) | 31 (100) |
| 20–29 | 62 (76) | 7 (9) | 7 (9) | 6 (7) | 82 (100) |
| 30–39 | 215 (83) | 25 (10) | 7 (3) | 12 (5) | 259 (100) |
| 40–49 | 529 (74) | 128 (18) | 19 (3) | 39 (5) | 715 (100) |
| 50–59 | 804 (71) | 253 (22) | 48 (4) | 35 (3) | 1 140 (100) |
| 60–69 | 779 (66) | 297 (25) | 67 (6) | 38 (3) | 1 181 (100) |
| 70–79 | 615 (65) | 211 (22) | 104 (11) | 12 (1) | 942 (100) |
| 80–89 | 449 (68) | 78 (12) | 123 (19) | 10 (2) | 660 (100) |
| ≥ 90 | 62 (61) | 6 (6) | 33 (32) | 1 (1) | 102 (100) |
| **Total** | **3 541 (69)** | **1 007 (20)** | **410 (8)** | **154 (3)** | **5 112 (100)** |

[a] *Cases with a probable setting of infection reported as nosocomial or other healthcare*

### *Time to diagnosis*

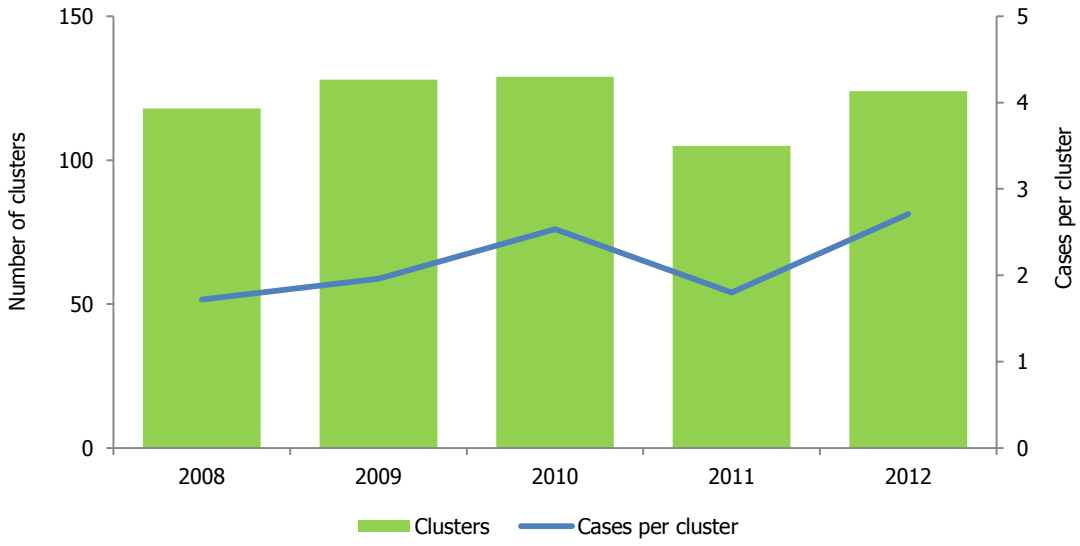
Both date of onset and date of diagnosis were available in only 16% of cases (916/5 852). The median time from date of onset to diagnosis was six days (IQR 4–9).

## 3.1.2 Clusters

### *Frequency and size*

Of 4 195 cases with known cluster status, 393 (9%) were reported as part of a cluster. The information on cluster status was missing in 28% of all cases (Table 5). Of 1 657 cases reported with unknown cluster status, 1 281 (77%) were reported by France. A cluster identifier was provided for 336 cases forming 124 clusters which resulted in an average size of 2.7 cases per cluster (Figure 6).

**Figure 6. Reported clusters of Legionnaires' disease and average number of cases per cluster, by year of reporting, EU/EEA, 2008–2012**



## *Time and location*

The proportion of clustered cases peaked in June–July, but, at a lower level, also in January (Figure 7). These peaks were associated with large outbreaks. The proportion of cases belonging to clusters was on average 7%, with important differences among countries, ranging from 0 in 12 countries with less than 25% unknown cluster status to 30% of cases in Hungary (Table 5). Of the ten largest outbreaks reported over the 2008–2012 period, four were reported in 2012 (Table 6). The vast majority of these large outbreaks were community acquired (9/10), with a substantial proportion reported by Spain (6/10).

**Figure 7. Reported clustering of Legionnaires' disease by month of onset, EU/EEA, 2012**

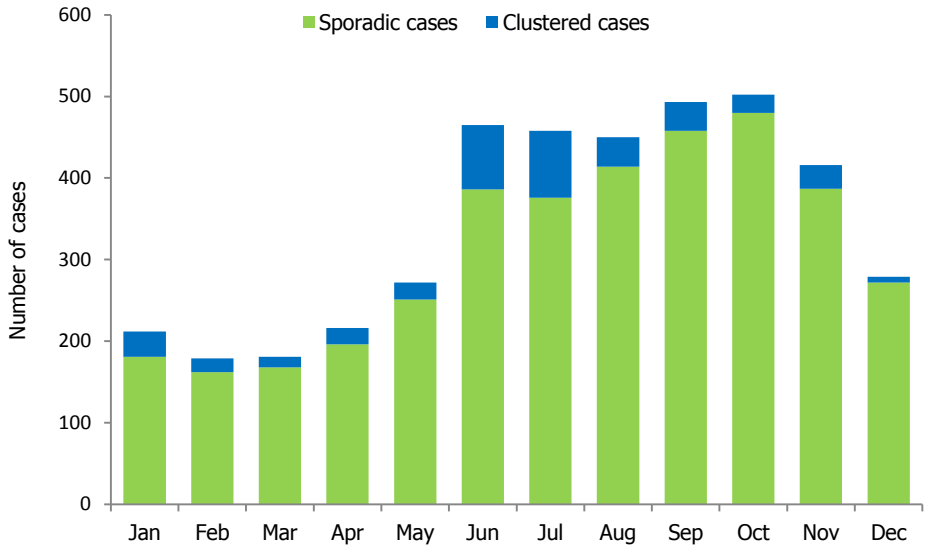



**Table 5. Reported clustering of Legionnaires' disease by reporting country, EU/EEA, 2012**

| Country | Clusters n | Clustered cases n (%) | Sporadic cases n (%) | Unknown n (%) | Total n | Cluster ratio [a] % |
|---|---|---|---|---|---|---|
| Austria | 5 | 7 (7) | 93 (92) | 1 (1) | 101 | 7 |
| Belgium | Unknown | 8 (8) | 39 (37) | 59 (56) | 106 | NA[b] |
| Cyprus | 0 | 0 | 0 | 7 (100) | 7 | NA |
| Czech Republic | 0 | 0 | 48 (86) | 8 (14) | 56 | 0 |
| Denmark | 11 | 22 (17) | 105 (83) | 0 | 127 | 17 |
| Estonia | 0 | 0 | 3 (100) | 0 | 3 | 0 |
| Finland | 0 | 0 | 0 | 10 (100) | 10 | NA |
| France | Unknown | 17 (1) | 0 | 1 281 (99) | 1 298 | NA |
| Germany | Unknown | 19 (3) | 598 (95) | 11 (2) | 628 | 3 |
| Greece | 0 | 0 | 27 (100) | 0 | 27 | 0 |
| Hungary | 3 | 10 (30) | 23 (70) | 0 | 33 | 30 |
| Iceland | 0 | 0 | 2 (100) | 0 | 2 | 0 |
| Ireland | 3 | 4 (27) | 11 (73) | 0 | 15 | 27 |
| Italy | 19 | 42 (3) | 1 290 (97) | 0 | 1 332 | 3 |
| Latvia | 0 | 0 | 48 (100) | 0 | 48 | 0 |
| Lithuania | 0 | 0 | 8 (89) | 1 (11) | 9 | 0 |
| Luxembourg | 0 | 0 | 4 (80) | 1 (20) | 5 | 0 |
| Malta | 0 | 0 | 4 (100) | 0 | 4 | 0 |
| Netherlands | 34 | 46 (15) | 258 (85) | 0 | 304 | 15 |
| Norway | 0 | 0 | 25 (100) | 0 | 25 | 0 |
| Poland | 0 | 0 | 8 (100) | 0 | 8 | 0 |
| Portugal | 4 | 30 (21) | 106 (76) | 4 (3) | 140 | 22 |
| Romania | 0 | 0 | 3 (100) | 0 | 3 | 0 |
| Spain | 16 | 93 (10) | 811 (83) | 68 (7) | 972 | 10 |
| Slovakia | 0 | 0 | 4 (100) | 0 | 4 | 0 |

| Country | Clusters n | Clustered cases n (%) | Sporadic cases n (%) | Unknown n (%) | Total n | Cluster ratio [a] % |
|---|---|---|---|---|---|---|
| Slovenia | 0 | 0 | 82 (100) | 0 | 82 | 0 |
| Sweden | 0 | 0 | 0 | 102 (100) | 102 | NA |
| UK | 31 | 95 (24) | 202 (50) | 104 (26) | 401 | NA |
| Subtotal [c] | 95 | 273 (7) | 3 561 (95) | 94 (3) | 3 734 | 7 |
| **Total** | **126** | **393 (7)** | **3 802 (65)** | **1 657 (28)** | **5 852** | **NA** |

[a] *Denominator: cases with known cluster status*
[b] *Not applicable where ≥25% of cluster status unknown*
[c] *Includes only countries where <25% of cluster status unknown*

**Table 6. Ten largest reported clusters of Legionnaires' disease, 2008–2012**

| Rank | Reporting country | Year of reporting | Number of cases | Probable setting of infection | Probable source |
|---|---|---|---|---|---|
| 1 | Spain | 2010 | 51 | Community acquired | Cooling tower |
| 2 | Spain | 2012 | 39 | Community acquired | Decorative fountain |
| 3 | Portugal | 2012 | 36 | Community acquired | Unknown |
| 4 | Spain | 2009 | 25 | Community acquired | Unknown |
| 5 | UK | 2012 | 23 | Community acquired | Spa pool |
| 6 | Spain | 2010 | 22 | Community acquired | Water system |
| 7 | Poland | 2010 | 19 | Community acquired | Water system |
| 8 | Spain | 2012 | 18 | Travel associated | Pool |
| 9 | UK | 2010 | 15 | Community acquired | Multiple unknown source |
| 10 | Spain | 2008 | 14 | Community acquired | Unknown |

## *Setting of infection*

The proportion of cases reported as part of a cluster was highest in domestic travellers, followed by those travelling abroad (Table 7). Travel-associated cases (domestic and abroad) were three times more likely to be part of a cluster than cases occurring in other settings (PR 3.5, 95% CI 2.9–4.2). This may reflect both a higher probability of clustering in travel-associated cases and the result of active surveillance. The average cluster size was higher in community-acquired clusters due to the report of large community-acquired outbreaks (Table 6 and Table 7). It probably takes more cases for a community-acquired outbreak to be acknowledged compared with a travel-associated one.

**Table 7. Reported clustering of Legionnaires' disease by setting, EU/EEA, 2012**

| Setting | Total cases reported | | Clusters [a] | Clustered cases | | Cluster size |
|---|---|---|---|---|---|---|
| | n | % | n | n | % | (cases/cluster) |
| Community | 2 584 | 71 | 22 | 141 | 5 | 6.4 |
| Domestic travel | 245 | 7 | 33 | 74 | 30 | 2.2 |
| Travel abroad | 482 | 13 | 64 | 108 | 22 | 1.7 |
| Nosocomial | 183 | 5 | 7 | 19 | 10 | 2.7 |
| Other healthcare | 70 | 2 | 2 | 4 | 6 | 2.0 |
| Other | 77 | 2 | 4 | 46 | 60 | 11.5 |
| **Total** | **3 641** | **100** | **123** | **392** | **11** | **2.7** |

[a] *Some clusters may include cases with different probable setting of infection*

## 3.1.3 Mortality

### *Time and location*

The reported mortality rate of LD in 2012 was 0.8 per million inhabitants, which was consistent with the rates observed since 2008 (0.7–0.9 per million). Of 4 149 cases with a known outcome, 419 were reported to have died, giving a case fatality ratio (CFR) of 10%. In countries that reported ten or more cases and less than 25% with unknown outcome, the average CFR was 9%, ranging from 1% in Slovenia to 33% in Hungary (Table 8). Cases with a date of onset during the winter period (November to March) were more likely to have died (PR 1.2, 95% CI 1.0–1.5). The case fatality ratio ranged from 16% in January to 8% in June.

**Table 8. Reported outcome of Legionnaires' disease and case fatality by reporting country, EU/EEA, 2012**

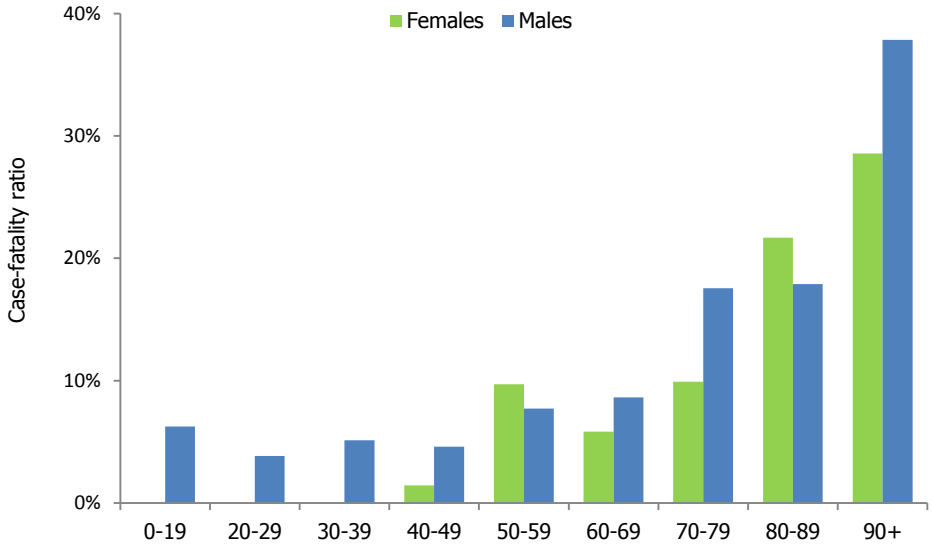
| Country | Survival n (%) | Death n (%) | Unknown n (%) | Total n | CFR [a] % |
|---|---|---|---|---|---|
| Austria | 87 (86) | 14 (14) | 0 | 101 | 14 |
| Belgium | 40 (38) | 7 (7) | 59 (56) | 106 | NA[b] |
| Cyprus | 7 (100) | 0 | 0 | 7 | 0 |
| Czech Republic | 46 (82) | 10 (18) | 0 | 56 | 18 |
| Denmark | 60 (47) | 12 (9) | 55 (43) | 127 | NA |
| Estonia | 1 (33) | 2 (67) | 0 | 3 | 67 |
| Finland | 0 | 0 | 10 (100) | 10 | NA |
| France | 1 088 (84) | 130 (10) | 80 (6) | 1 298 | 11 |
| Germany | 596 (95) | 31 (5) | 1 (<1) | 628 | 5 |
| Greece | 23 (86) | 2 (7) | 2 (7) | 27 | 8 |
| Hungary | 22 (67) | 11 (33) | 0 | 33 | 33 |
| Iceland | 2 (100) | 0 | 0 | 2 | 0 |
| Ireland | 14 (93) | 1 (7) | 0 | 15 | 7 |
| Italy | 468 (35) | 70 (5) | 794 (60) | 1 332 | NA |
| Latvia | 48 (100) | 0 | 0 | 48 | 0 |
| Lithuania | 4 (44) | 1 (11) | 4 (44) | 9 | NA |
| Luxembourg | 5 (100) | 0 | 0 | 5 | 0 |
| Malta | 4 (100) | 0 | 0 | 4 | 0 |
| Netherlands | 286 (94) | 16 (5) | 2 (1) | 304 | 5 |
| Norway | 19 (76) | 1 (4) | 5 (20) | 25 | 5 |
| Poland | 6 (75) | 2 (25) | 0 | 8 | 25 |
| Portugal | 123 (88) | 8 (6) | 9 (6) | 140 | 6 |
| Romania | 2 (67) | 1 (33) | 0 | 3 | 33 |
| Slovakia | 4 (100) | 0 | 0 | 4 | 0 |
| Slovenia | 81 (99) | 1 (1) | 0 | 82 | 1 |
| Spain | 500 (51) | 54 (6) | 418 (43) | 972 | NA |
| Sweden | 93 (91) | 9 (9) | 0 | 102 | 9 |
| UK | 101 (25) | 36 (9) | 264 (66) | 401 | NA |
| Total | 3 730 (64) | 419 (7) | 1 703 (29) | 5 852 | NA |
| Subtotal [c] | 2 557 (88) | 239 (8) | 99 (3) | 2 895 | 9 |

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

### *Age and gender*

The case-fatality ratio was higher for older age groups in both genders (Figure 8). In younger age groups, CFR was higher in males. Over 50 years of age, CFR increased with age, showing a similar pattern in both genders.

**Figure 8. Reported case-fatality of Legionnaires' disease by gender and age group, EU/EEA, 2012**




### *Setting of infection*

The CFR was more than three times higher in healthcare-associated cases (nosocomial and other healthcare) than in community-acquired cases (Table 9). Travel-associated cases had the lowest CFR.

**Table 9. Reported case-fatality of Legionnaires' disease by setting, EU/EEA, 2012**

| Setting | Deaths n | Total n | CFR % |
|---|---|---|---|
| Nosocomial | 55 | 194 | 28 |
| Other healthcare | 28 | 102 | 27 |
| Community | 236 | 2 503 | 9 |
| Domestic travel | 21 | 269 | 8 |
| Other | 6 | 107 | 6 |
| Travel abroad | 24 | 439 | 5 |
| **Total** | **370** | **3 614** | **10** |

## 3.1.4 Laboratory, pathogens and environment

### *Laboratory methods*

For the 5 852 cases reported, 6 477 laboratory tests were performed, of which 5 149 (79%) were urinary antigen detections. Of 29 countries reporting cases, nine reported more than one test per case with a maximum of 1.5 tests per case in the Czech Republic. The distribution of tests varied greatly across countries (Table 10). Culture confirmations were not reported by some countries, but accounted for 42% of diagnoses in Denmark. Of the eight countries who did not report any culture confirmations in 2012, six (Cyprus, Latvia, Lithuania, Malta, Romania and Slovenia) have never reported any culture confirmations. Some large reporters such as Italy or Spain relied almost exclusively on urinary antigen tests (UAT). Other countries, such as Finland or Latvia relied on single high titres for the majority of their cases (60% and 67%, respectively). Over the past five years, the proportion of cases reported with a PCR has continuously increased from less than 2% in 2008 to 6% in 2012. In some countries such as Denmark or Sweden, more than 25% of the cases reported in 2012 were diagnosed with a PCR test.

**Table 10. Reported laboratory methods by reporting country, EU/EEA, 2012 (more than one method per case possible)**

| Country | Laboratory method | | | | | | |
|---|---|---|---|---|---|---|---|
| | Culture n (%) | Fourfold titre rise n (%) | Direct immunofluorescence n (%) | PCR n (%) | Single high titre n (%) | Urinary antigen n (%) | Total n |
| Austria | 4 (4) | 1 (1) | 0 | 3 (3) | 3 (3) | 90 (89) | 101 |
| Belgium | 15 (14) | 1 (1) | 0 | 15 (14) | 5 (5) | 70 (66) | 106 |
| Cyprus | 0 | 0 | 0 | 0 | 0 | 7 (100) | 7 |
| Czech Republic | 15 (18) | 1 (1) | 0 | 16 (20) | 4 (5) | 46 (56) | 82 |
| Denmark | 53 (42) | 0 | 0 | 35 (28) | 2 (2) | 37 (29) | 127 |

| Country | Laboratory method | | | | | | |
|---|---|---|---|---|---|---|---|
| | Culture n (%) | Fourfold titre rise n (%) | Direct immunofluorescence n (%) | PCR n (%) | Single high titre n (%) | Urinary antigen n (%) | Total n |
| Estonia | 0 | 0 | 0 | 0 | 0 | 3 (100) | 3 |
| Finland | 0 | 0 | 0 | 0 | 6 (60) | 4 (4) | 10 |
| France | 308 (19) | 11 (1) | 0 | 41 (3) | 18 (1) | 1 245 (77) | 1 623 |
| Germany | 28 (4) | 13 (2) | 0 | 82 (13) | 79 (13) | 426 (68) | 628 |
| Greece | 1 (4) | 0 | 0 | 0 | 0 | 26 (96) | 27 |
| Hungary | 2 (5) | 4 (11) | 2 (5) | 4 (11) | 4 (11) | 21 (57) | 37 |
| Iceland | 2 (100) | 0 | 0 | 0 | 0 | 0 | 2 |
| Ireland | 3 (18) | 0 | 0 | 1 (6) | 0 | 13 (76) | 17 |
| Italy | 22 (2) | 7 (1) | 1 | 2 (<1) | 22 (2) | 1 278 (96) | 1 332 |
| Latvia | 0 | 0 | 0 | 0 | 32 (67) | 16 (33) | 48 |
| Lithuania | 0 | 0 | 0 | 0 | 0 | 9 (100) | 9 |
| Luxembourg | 2 (40) | 1 (20) | 0 | 0 | 0 | 2 (40) | 5 |
| Malta | 0 | 0 | 0 | 0 | 0 | 4 (100) | 4 |
| Netherlands | 59 (16) | 6 (2) | 2 (1) | 40 (11) | 14 (4) | 257 (68) | 378 |
| Norway | 2 (8) | 0 | 0 | 5 (20) | 0 | 18 (72) | 25 |
| Poland | 0 | 0 | 0 | 0 | 3 (38) | 5 (62) | 8 |
| Portugal | 6 (4) | 0 | 2 (1) | 1 (1) | 5 (4) | 126 (90) | 140 |
| Romania | 0 | 1 (33) | 0 | 0 | 0 | 2 (67) | 3 |
| Slovakia | 0 | 2 (50) | 0 | 1 (25) | 1 (25) | 0 | 4 |
| Slovenia | 0 | 0 | 0 | 0 | 0 | 82 (100) | 82 |
| Spain | 47 (5) | 12 (1) | 0 | 18 (2) | 2 (<1) | 942 (92) | 1 021 |
| Sweden | 19 (13) | 6 (4) | 0 | 37 (26) | 11 (8) | 70 (49) | 143 |
| UK | 73 (14) | 8 (2) | 0 | 68 (13) | 6 (1) | 350 (69) | 505 |
| Total | 670 (10) | 74 (1) | 7 (<1) | 369 (6) | 217 (3) | 5 140 (79) | 6 477 |

## *Pathogens*

Of 661 culture-confirmed cases, 649 (98%) were due to *L. pneumophila* (Table 11). Serogroup 1 represented 561 (85%) of 661 culture-confirmed cases (Table 12). Half of the 193 isolates that were subtyped using monoclonal antibodies (MAb) were Allentown/France and Knoxville subtypes (Table 13). In addition, seven countries (Austria, the Czech Republic, Denmark, the Netherlands, Portugal, Spain and the UK) reported results of sequence typing for 238 cases, 201 of which were culture confirmed (84%).

**Table 11. Reported culture-confirmed cases of Legionnaires' disease and *Legionella* isolates by species, EU/EEA, 2012**

| Species | Culture-confirmed cases | |
|---|---|---|
| | n | % |
| *L. pneumophila* | 649 | 98 |
| *L. bozemanii* | 3 | <1 |
| *L. longbeachae* | 2 | <1 |
| *L. anisa* | 1 | <1 |
| *L. dumoffii* | 1 | <1 |
| *L. micdadei* | 1 | <1 |
| *L.* other species | 2 | <1 |
| *L.* species unknown | 2 | <1 |
| Total | 661 | 100 |

**Table 12. Reported culture-confirmed cases of Legionnaires' disease and *L. pneumophila* isolates by serogroup, EU/EEA, 2012**

| | Culture-confirmed cases with *L. pneumophila* | |
|---|---|---|
| Serogroup | n | % |
| 1 | 561 | 85 |
| 2 | 2 | <1 |
| 3 | 28 | 4 |
| 4 | 1 | <1 |
| 5 | 1 | <1 |
| 6 | 6 | 1 |
| 7 | 0 | <1 |
| 8 | 1 | <1 |
| 9 | 3 | <1 |
| 10 | 3 | <1 |
| 12 | 0 | <1 |
| 14 | 1 | <1 |
| 15 | 1 | <1 |
| *L. pneumophila* serogroup unknown | 41 | 6 |
| **Total** | **649** | **100** |

**Table 13. Reported monoclonal subtype for *L. pneumophila* serogroup 1 isolates, EU/EEA, 2012**

| Monoclonal subtype | n | % |
|---|---|---|
| Allentown | 52 | 27 |
| Benidorm | 34 | 18 |
| Knoxville | 53 | 27 |
| Philadelphia | 26 | 13 |
| **Subtotal MAb 3/1 positive[a]** | **165** | **85** |
| Bellingham | 8 | 4 |
| OLDA | 20 | 11 |
| **Subtotal MAb 3/1 negative** | **28** | **15** |
| **Total** | **193** | **100** |

[a] *Monoclonal types are grouped based on the virulence-associated epitope recognised by the MAb 3/1 (Dresden Panel).*

## *Environment*

Environmental investigation status was available for 2 218 (49%) of 4 523 cases known not to have travelled abroad within the incubation period (Table 14). An investigation was carried out in 768 (16%) of these 2 218 cases with known status. Such investigations were more likely in culture-confirmed (PR 1.9, 95% CI 1.6–2.1), but not in fatal cases (PR 1.2, 95% CI 0.9–1.4). *Legionella* was detected in 403 (52%) of 768 investigations for which environmental findings were reported (Table 15), with 411 sampling sites testing positive: 256 (62%) water systems (52 hot water systems, 15 cold water systems and 189 non-specified water systems), 33 (8%) pools, 2 cooling towers (<1%) and 38 (9%) other sampling sites (Figure 9). For 82 (20%) of those 411 investigations with positive findings, the sampling site was missing or unknown. In 35 (9%) of the 403 cases with positive environmental findings, isolates could be matched to clinical isolates.

**Table 14. Environmental follow-up status of reported cases of Legionnaires' disease by reporting country, EU/EEA, 2012***

| Country | Cases with investigation | | Cases without investigation | | Status unknown | | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n |
| Austria | 74 | 88 | 3 | 4 | 7 | 8 | 84 |
| Belgium | 0 | 0 | 0 | 0 | 30 | 100 | 30 |
| Czech Republic | 24 | 83 | 4 | 14 | 1 | 3 | 29 |
| Denmark | 11 | 16 | 58 | 84 | 0 | 0 | 69 |
| Estonia | 0 | 0 | 3 | 100 | 0 | 0 | 3 |
| France | 0 | 0 | 0 | 0 | 1 207 | 100 | 1 207 |
| Germany | 0 | 0 | 0 | 0 | 339 | 100 | 339 |
| Greece | 5 | 19 | 16 | 59 | 6 | 22 | 27 |

| Country | Cases with investigation | | Cases without investigation | | Status unknown | | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n |
| Hungary | 7 | 58 | 5 | 42 | 0 | 0 | 12 |
| Iceland | 0 | 0 | 1 | 100 | 0 | 0 | 1 |
| Ireland | 4 | 50 | 3 | 38 | 1 | 13 | 8 |
| Italy | 256 | 19 | 1 065 | 81 | 0 | 0 | 1 321 |
| Latvia | 48 | 100 | 0 | 0 | 0 | 0 | 48 |
| Lithuania | 7 | 100 | 0 | 0 | 0 | 0 | 7 |
| Luxembourg | 1 | 100 | 0 | 0 | 0 | 0 | 1 |
| Netherlands | 46 | 27 | 121 | 70 | 6 | 3 | 173 |
| Norway | 0 | 0 | 0 | 0 | 9 | 100 | 9 |
| Poland | 1 | 100 | 0 | 0 | 0 | 0 | 1 |
| Portugal | 40 | 35 | 73 | 63 | 2 | 2 | 115 |
| Romania | 0 | 0 | 0 | 0 | 3 | 100 | 3 |
| Slovakia | 1 | 33 | 2 | 67 | 0 | 0 | 3 |
| Slovenia | 0 | 0 | 74 | 100 | 0 | 0 | 74 |
| Spain | 101 | 14 | 0 | 0 | 607 | 86 | 708 |
| UK | 142 | 57 | 22 | 9 | 87 | 35 | 251 |
| **Total** | **768** | **17** | **1 450** | **32** | **2 305** | **51** | **4 523** |

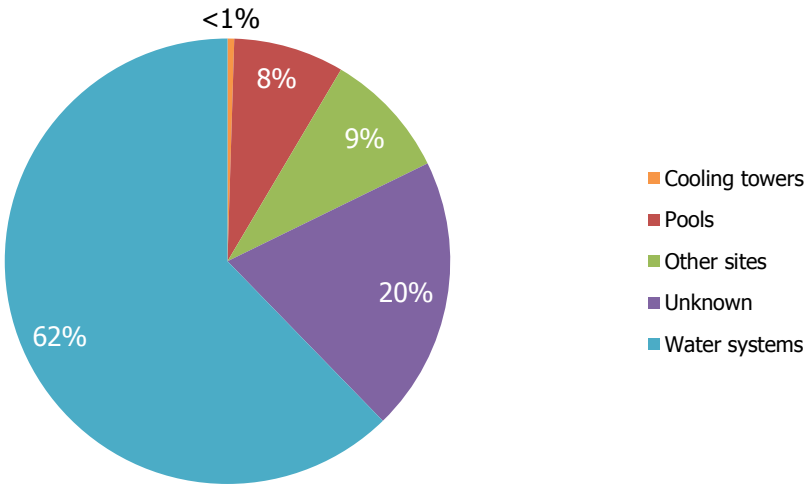
** Cases with setting reported as unknown or travel abroad were not included*

**Table 15. *Legionella* detected through environmental investigations, by reporting country, EU/EEA, 2012***

| Country | *Legionella* detected | | *Legionella* not detected | | Result unknown | | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n |
| Austria | 27 | 36 | 47 | 64 | 0 | 0 | 74 |
| Czech Republic | 14 | 58 | 0 | 0 | 10 | 42 | 24 |
| Denmark | 11 | 100 | 0 | 0 | 0 | 0 | 11 |
| Greece | 4 | 80 | 1 | 20 | 0 | 0 | 5 |
| Hungary | 7 | 100 | 0 | 0 | 0 | 0 | 7 |
| Ireland | 4 | 100 | 0 | 0 | 0 | 0 | 4 |
| Italy | 106 | 41 | 150 | 59 | 0 | 0 | 256 |
| Latvia | 28 | 58 | 20 | 42 | 0 | 0 | 48 |
| Lithuania | 2 | 29 | 0 | 0 | 5 | 71 | 7 |
| Luxembourg | 0 | 0 | 1 | 100 | 0 | 0 | 1 |
| Netherlands | 22 | 48 | 21 | 46 | 3 | 7 | 46 |
| Poland | 0 | 0 | 1 | 100 | 0 | 0 | 1 |
| Portugal | 11 | 28 | 27 | 68 | 2 | 5 | 40 |
| Slovakia | 1 | 100 | 0 | 0 | 0 | 0 | 1 |
| Spain | 73 | 72 | 0 | 0 | 28 | 28 | 101 |
| UK | 93 | 65 | 32 | 23 | 17 | 12 | 142 |
| **Total** | **403** | **52** | **300** | **39** | **65** | **8** | **768** |

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

**Figure 9. Distribution of sampling sites testing positive for *Legionella*, EU/EEA, 2012**



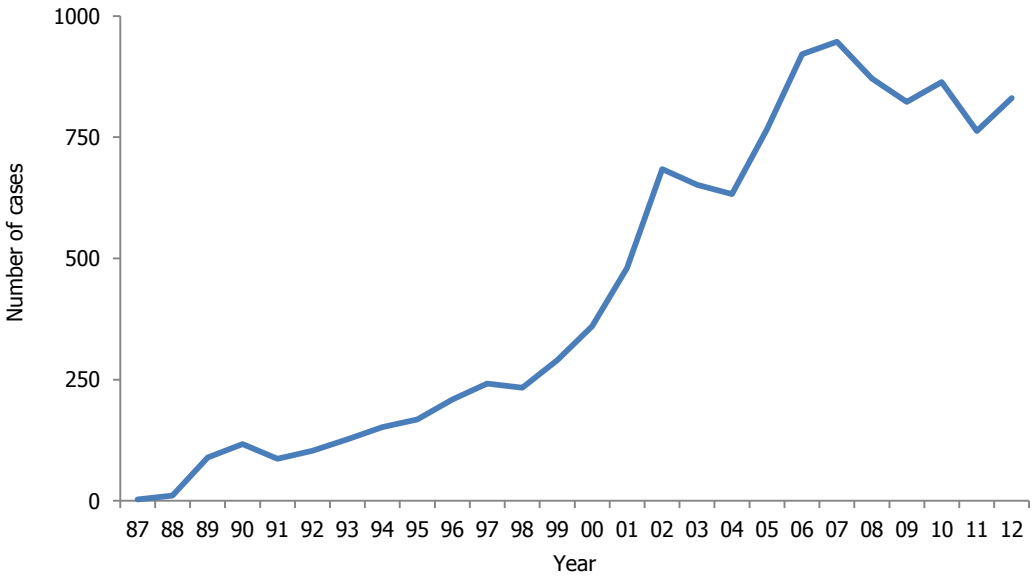

# 3.2 Travel-associated Legionnaires' disease

## 3.2.1 Cases

### *Notifications*

ELDSNet received reports of 831 cases of TALD with date of onset in 2012. This was 9% higher than in 2011 and in line with the reporting levels seen in 2008–2010 (Figure 10).

**Figure 10. Number of travel-associated cases of Legionnaires' disease reported to ELDSNet, by year, 1987–2012**




Cases were reported from 22 countries: 20 EU/EEA Member States, Croatia (Candidate Member State in 2012) and the United States. Germany reported for the first time since joining the TALD surveillance scheme in 2012. Of all reported TALD cases, 642 (77%) were reported – in decreasing order of frequency – by the following five countries: France, Italy, the Netherlands, United Kingdom, and Spain (Table 16).

**Table 16. Number of travel-associated cases of Legionnaires' disease by reporting country*, 2009–12****

| Reporting country | Number of reported cases | | | |
|---|---|---|---|---|
| | 2009 n (%) | 2010 n (%) | 2011 n (%) | 2012 n (%) |
| France | 163 (20) | 191 (22) | 162 (21) | 170 (20) |
| Italy | 169 (21) | 142 (16) | 154 (20) | 156 (19) |
| United Kingdom | 173 (21) | 154 (18) | 116 (15) | 135 (16) |
| Netherlands | 109 (13) | 148 (17) | 120 (16) | 113 (14) |
| Spain | 65 (8) | 67 (8) | 67 (9) | 68 (8) |
| Sweden | 21 (3) | 20 (2) | 28 (4) | 49 (6) |
| Denmark | 34 (4) | 32 (4) | 32 (4) | 41 (5) |
| Austria | 16 (2) | 19 (2) | 25 (3) | 27 (3) |
| Belgium | 12 (1) | 16 (2) | 11 (1) | 19 (2) |
| Norway | 21 (3) | 25 (3) | 18 (2) | 13 (2) |
| Ireland | 2 (<1) | 7 (1) | 4 (1) | 7 (1) |
| Finland | 6 (1) | 8 (1) | 5 (1) | 6 (1) |
| United States | 10 (1) | 11 (1) | 5 (1) | 6 (1) |
| Czech Republic | 5 (1) | 5 (1) | 7 (1) | 5 (1) |
| Hungary | 2 (<1) | 2 (<1) | 2 (<1) | 4 (<1) |
| Croatia | | | | 4 (<1) |
| Slovenia | 2 (<1) | 1 (<1) | 1 (<1) | 2 (<1) |
| Portugal | | | | 2 (<1) |
| Greece | 0 | 0 | 4 (1) | 1 (<1) |
| Cyprus | | | | 1 (<1) |
| Germany | | | | 1 (<1) |
| Luxembourg | | | | 1 (<1) |
| Latvia | 0 | 1 (<1) | 1 (<1) | 0 |
| Malta | 0 | 5 (1) | 1 (<1) | 0 |
| Others | 8 (1) | 10 (1) | 0 | 0 |
| **Total** | **818 (100)** | **864 (100)** | **763 (100)** | **831 (100)** |

** The reporting country is generally the country where the case is diagnosed and can differ from the country of residence of the reported case.*
*** 10 EU/EEA countries did not report any cases in 2012: Bulgaria, Estonia, Iceland, Latvia, Liechtenstein, Lithuania, Malta, Poland, Romania and Slovakia.*

ELDSNet reported on TALD cases resident in 29 countries. Among the reported cases were 29 (3%) non-EU/EEA residents: 11 Swiss residents, seven US residents, five Australians, three Croatians, one Canadian, one Israeli, and one Mexican.

## Seasonality

The cases reported in 2012 showed the well-known seasonal variation, with 57% of all cases occurring in June–September. In each of those four months, over 100 TALD cases were reported to ELDSNet, with a peak of 127 in September. By contrast, only 18 cases were reported in February.

## Age and gender

Among the reported TALD cases, 585 were male (70%, male-female ratio 2.4), similar to previous years and the overall Legionnaires' disease surveillance data. Cases were between 12 and 92 years old, with a median of 63 years; 86% of the cases were over 50 years of age at the time of illness. For both males and females, one third of the cases were in the 60–69-years age group, and approximately one fifth of the cases belonged to the 70–79-years age group.

### *Outcome*

Outcome was provided in 442 (53%) of the cases. Of these cases, 26 (6%) had died. They were between 50 and 92 years old, and 18 (69%) were male.

## 3.2.2 Clinical microbiological analysis

Seven hundred and seventy seven TALD cases (94%) were classified as confirmed and 54 (6%) as probable (17).

Of all laboratory tests used, 82% were UAT, 5% culture and 9% PCR. The latter went up from 6% in 2011 (Table 17).

**Table 17. Reported diagnostic methods TALD, EU/EEA, 2012**

| Laboratory method | n | % |
|---|---|---|
| Urinary antigen | 751 | 82 |
| Nucleic acid amplification, e.g. PCR | 78 | 9 |
| Culture | 46 | 5 |
| Single high titre | 21 | 2 |
| Fourfold titre rise | 14 | 2 |
| Direct immune-fluorescence | 1 | <1 |
| **Total** | **912** | **100** |

*Note: More than one method per case possible*

Of the 777 confirmed cases, 751 (97%) were diagnosed by UAT and 46 (6%) were diagnosed by culture. Of the 46 culture-confirmed cases, 27 were also diagnosed by UAT. Of the confirmed cases, 10 also had a significant rise in specific antibody level (*L. pneumophila* serogroup 1). In 47 confirmed cases, polymerase chain reaction (PCR) was used in addition to another confirmatory method.

Of the 54 probable cases, 31 were diagnosed by PCR, four by a significant rise in specific antibody level (non-*L. pneumophila*. spp. or *L. pneumophila* non-serogroup 1), 19 by a single high level of specific antibody (*L. pneumophila* serogroup1). In one probable case, a direct immunofluorescence technique was used.

In 609 cases (73%), *L. pneumophila* serogroup 1 was reported as the causative microorganism (Table 18).

**Table 18. Reported species or *L. pneumophila* serogroup TALD, EU/EEA, 2012**

| *L. pneumophila* serogroup/ *L.* species | Number/proportion of TALD cases | |
|---|---|---|
| | n | % |
| 1 | 609 | 73 |
| 2 | 1 | <1 |
| 3 | 3 | <1 |
| 6 | 2 | <1 |
| 8 | 1 | <1 |
| 10 | 1 | <1 |
| Mix of serogroups | 4 | <1 |
| *L. bozemanii* | 2 | <1 |
| *L. micdadei* | 1 | <1 |
| Pathogen unknown or not reported | 207 | 25 |
| **Total** | **831** | **100** |

Monoclonal subtyping results were reported for 22 cases (3%) (Table 19).

**Table 19. Reported monoclonal subtype for *L. pneumophila* serogroup 1 in TALD cases, EU/EEA, 2012**

| Monoclonal subtype | n |
|---|---|
| Philadelphia | 4 |
| Allentown/France | 6 |
| Benidorm | 8 |
| Knoxville | 3 |
| OLDA/Oxford | 1 |
| **Total** | **22** |

Sequence type was reported for 16 cases (2%) from six countries: five cases from Austria, three each from Denmark and Sweden, two each from the Czech Republic and the Netherlands, and one from France. By comparison, in 2011 seven countries had reported the sequence type for a total of 21 cases (3%).

## 3.2.3 Travel: visits and sites

The 831 reported TALD cases had made 1 218 visits to commercial accommodation sites around the world. Of 831 cases, 630 (76%) had travelled within the EU/EEA, and 171 (21%) cases had travelled outside the EU/EEA. Twelve cases had travelled to both EU/EEA and non-EU/EEA destinations, and 18 cases were associated with trips on cruise ships (Table 20). Altogether, a total of 67 countries had been visited in the 2–10 days before the date of onset. The four destination countries with the most TALD-associated accommodation sites were Italy (n=318, 27%), France (n=199, 17%), Spain (n=147, 12%), and Turkey (n=80, 7%).

**Table 20. Travel destination of TALD cases reported in 2012**

| Travel destination | | Number of TALD cases | % |
|---|---|---|---|
| Travel in EU/EEA | Visited one country | 504 | 61 |
| | Visited more than one country | 126 | 15 |
| Travel outside EU/EEA | Visited one country | 123 | 15 |
| | Visited more than one country | 48 | 6 |
| Travel to both EU/EEA and outside EU/EEA | | 12 | 1 |
| Cruise ship | | 18 | 2 |
| **Total** | | **831** | **100** |

Of the 1 156 travel visits for which the accommodation type was reported, 83% involved hotels, 6% camping sites, 4% apartments, 2% ships, and 5% other types.

## 3.2.4 Clusters

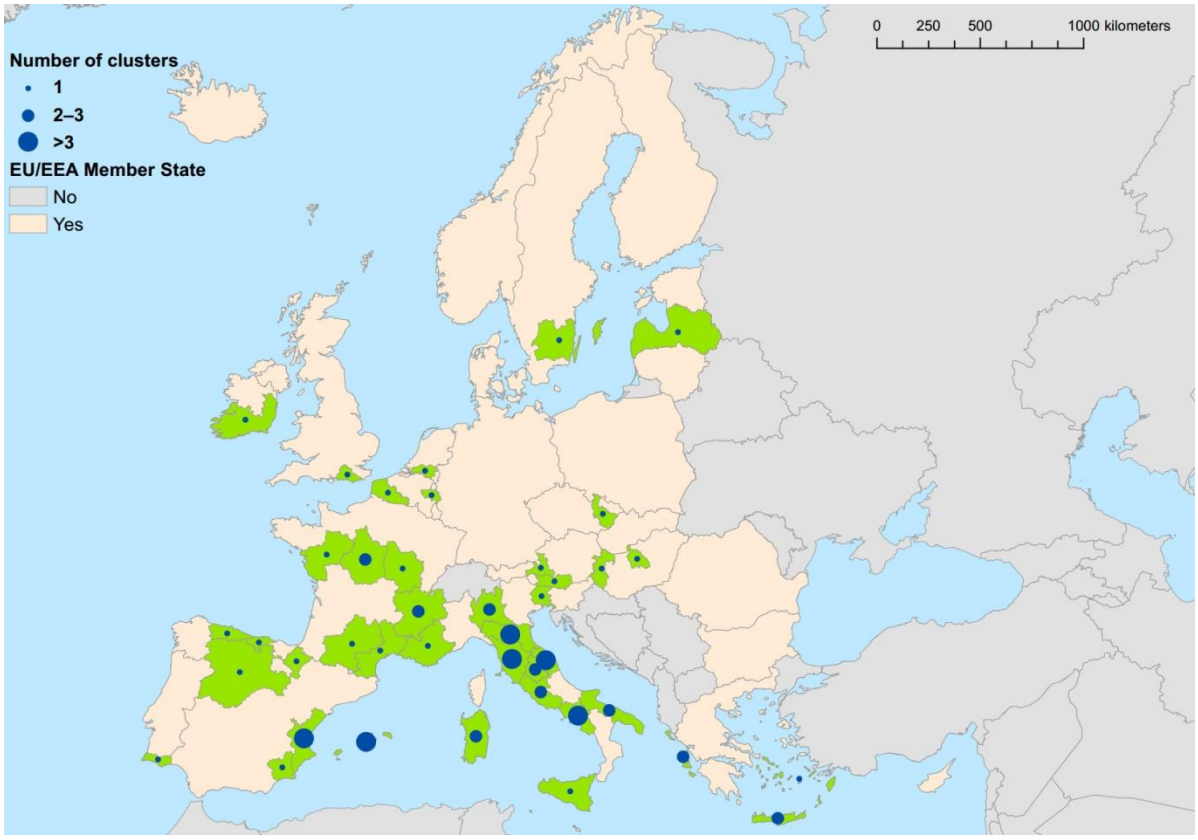
In 2012, 99 new standard clusters were detected: 76 in EU Member States, 20 outside the EU and three on board a ship. In addition, there were also 12 complex clusters, 10 in EU Member States and two outside the EU. There were clusters in 14 EU and 12 non-EU countries. Altogether, 315 TALD cases were involved in clusters during 2012. The largest cluster involved 42 cases, 36 of which were TALD associated through one Spanish hotel. Italy was associated with the highest number of clusters (39), followed by Spain and France with 15 and 12 clusters, respectively.

Of the 76 clusters reported in EU Member States, 54 (71%) comprised two cases, 15 (20%) three cases, six (8%) five or six cases, and one cluster comprised of 36 cases.

In 44 of 99 clusters, the first two reported cases were from different countries; these cases would probably not have been detected, or not been detected in a timely manner, if it had not been for ELDSNet surveillance.

The number of TALD clusters per country is shown in Figure 11.

**Figure 11. Number of standard clusters of travel-associated Legionnaires' disease per destination area (NUTS 2), EU/EEA, 2012**




## 3.2.5 Investigations and publication

In 2012, 146 preliminary and final forms with information about site assessments were shared within the Network. Over 50% (57/106) of the final forms reported the detection of *Legionella* in water installations.

For one cluster in France, the site assessment form stated that no satisfactory control measures had been taken. The accommodation name was therefore temporarily made public on the ECDC website.

# 3.3 Event-based surveillance

Of the 14 threats related to Legionnaires' disease monitored by ECDC in 2012, 13 were travel-associated clusters. The largest outbreak comprised 56 community-acquired cases in Edinburgh, UK [18,19]. The investigation concluded that the outbreak was likely to have been caused by contaminated cooling tower plume. The largest travel-associated cluster was associated with a hotel in Calpe, Spain [20]. It included 42 cases with dates of onset between December 2011 and June 2012. Strong evidence suggested the spa pool to be the source of the outbreak.

# 4 Discussion

With 5 852 cases reported, the notification rate of LD in the EU/EEA in 2012 was 11.5 cases per million population, well within the range observed in the past five years. Data show that the number of reported cases has remained stable since 2005/2006. France, Italy, Spain, Germany, the UK, and the Netherlands have continuously reported the majority of LD cases, accounting for four-fifths of all cases, while only representing two-thirds of the EU/EEA population.

The fluctuations observed in the past years have been mainly driven by the number of community-acquired cases (≈70% of all cases) reported by these six countries, including the high peak observed in August–September 2010 [5-21]. Interestingly, important regional variations have been documented in some countries such as France, with an increasing notification rate from western to eastern regions [12] or Italy where northern regions have a ten-fold higher notification rate than southern ones [22]. These regional variations may be linked to environmental conditions and/or differences in the sensitivity of LD surveillance. Further analyses of regional disparities could help improve our understanding of the epidemiology of LD, but also point to potential weaknesses in surveillance systems. Almost all countries east of an imaginary line between Sweden and Italy had a notification rate below five per million population (with many below one per million). This situation has remained unchanged over the past five years. The only notable exception, Latvia, reported approximately five cases per year during 2008–2010, but 10 times as many in 2011–2012. This might at least partly be due to heavy reliance on single high titres for LD diagnosis, which are known to be prone to false-positive results [1].

The daily surveillance of TALD with its focus on timely cluster detection probably explains why TALD cases are more likely to be reported as part of a cluster. TALD clusters tend to be smaller, possibly because they are detected earlier. Interestingly, a number of large community-acquired clusters were reported in Spain over the past years.

As so often in disease surveillance, results should be interpreted with caution because some large reporting countries such as France fail to report the cluster status of their cases. In addition, the impossibility to merge the TALD dataset with that for comprehensive LD surveillance makes any comparisons difficult.

At 9%, the CFR in 2012 was very similar to that observed in previous years. It should be noted that three of the main reporting countries (Italy, Spain and the UK) reported a high proportion of cases with unknown outcome.

While the proportion of conformation with UAT and culture has remained fairly stable over the past years, it is interesting to see that the proportion of cases analysed with PCR has continuously increased from below 3% in 2010 to 4% in 2011 and 6% in 2012. A recent study in New Zealand has suggested that the routine use of PCR had been useful in improving the detection of LD cases caused by *Legionella* spp. (mainly *L. longbeachae*) [23].

In 2012, 831 travel-associated cases were reported, a 9% increase compared with the number of cases reported in 2011 [3]. Ninety-nine new travel-associated clusters were notified, compared with 82 in 2011 and 100 in 2010 [24]. The proportion of TALD clusters that would have most probably not been detected without international collaboration has remained stable over past years (≈45%), confirming the added value of ELDSNet daily TALD surveillance in protecting the health of travellers in the EU/EEA and other collaborating countries.

Large outbreaks, such as the one in Edinburgh in 2012, served as a reminder that such events are unpredictable and not necessarily restricted to countries with warm climates.

# 5 Conclusion

LD remains an important cause of both morbidity and mortality in Europe. Even though sporadic community-acquired cases represent the majority of notified cases, large outbreaks continue to occur, placing temporary pressure on local healthcare services.

The use of laboratory tests for diagnosis is changing, with an increasing number of PCR tests performed in several countries. These changes and their consequences should be further evaluated. ELDSNet/ESGLI are currently working to standardise a *L. pneumophila* PCR for use across Europe.

In 2012, ELDSNet has continued to demonstrate its effectiveness in the daily surveillance of TALD and the early detection and follow-up of clusters.

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