

# Legionnaires' disease

## Annual Epidemiological Report for 2021

### Key facts

- In 2021, the highest annual notification rate of Legionnaires' disease to date in the EU/EEA was observed, at 2.4 cases per 100 000 population.
- The rates are heterogenous across the EU/EEA region, with age-standardised rates varying by country between <1–5 cases per 100 000 population.
- Four countries (Italy, France, Spain, and Germany) accounted for 75% of all the notified cases.
- Males aged 65 years and above were the most affected group (8.9 cases per 100 000 population).
- Only 11% of the cases were reported as culture-confirmed. This is likely leading to an underestimation of cases of Legionnaires' disease caused by *Legionella* species other than *Legionella pneumophila*.
- The majority of the cases were considered to be community-acquired.
- Occurrence of at least one outbreak of Legionnaires' disease was reported by eight of the 27 EU/EEA countries reporting data to the outbreak reporting scheme.
- A total of 19 outbreaks involving 137 confirmed cases were reported.
- The travel-associated Legionnaires' disease (TALD) surveillance scheme observed a 38% increase in cases compared with 2020.
- Similar to previous years, 90% of the TALD cases occurred in individuals aged 45 years and above. A similar age distribution was observed in the annual retrospective data collection of cases of Legionnaires' disease.

### Introduction

Legionnaires' disease is a multi-system disease which causes pneumonia due to an infection with the *Legionella* bacteria, most commonly of the species *Legionella pneumophila*. The bacteria are found in the natural environment, soil and water, but they can become a health risk when they grow within engineered systems that can produce inhalable water aerosols. Cooling towers, evaporative condensers, humidifiers, decorative fountains, hot tubs, showers, etc. are examples of water systems with identified *Legionella* risks. Conditions that are favourable for *Legionella* growth are water temperatures in the range of 25–42 °C, stagnant water with sediment build-up and low biocide levels. The aerosolisation of the contaminated water may cause sporadic cases or outbreaks.

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## Methods

This report is based on data for 2021 retrieved from The European Surveillance System (TESSy) on 9 September 2022. TESSy is a system for the collection, analysis, and dissemination of data on communicable diseases.

The methods used to produce this report are published by ECDC and can be found in the 'Introduction to the Annual Epidemiological Report' [1] together with an overview of the national surveillance systems [2]. A subset of the data used for this report is available through ECDC's online 'Surveillance Atlas of Infectious Diseases' [3].

The surveillance data were collected through three different schemes:

- annual retrospective data collection of cases of Legionnaires' disease (LD) reported in EU Member States, Iceland, Liechtenstein, and Norway;
- annual retrospective data collection of outbreak events detected and reported in EU Member States, Iceland, Liechtenstein, and Norway. The following thresholds for reporting outbreaks are used:
  - $\geq$  five cases, if these are not exposed in the same building, and there isn't evidence of exposure to the same aerosol-producing installation/device, nor microbiological evidence of linked cases;
  - $\geq$  three cases, if these are exposed in the same building, or if there is evidence for exposure to the same aerosol-producing installation/device, or microbiological evidence of linked cases;
- near real-time reporting of travel-associated cases of Legionnaires' disease (TALD) through the European Legionnaires' disease surveillance network (ELDSNet) [4], including reports from countries outside the EU/EEA. This scheme primarily aims at identifying clusters of cases that may otherwise not be detected at the national level, in order to quickly investigate them and take control measures at the implicated tourist accommodation site(s) to prevent further infections.

Cases of Legionnaires' disease should be reported to these surveillance schemes in accordance with the 2018 EU/EEA case definition [5] for confirmed or probable cases, that includes at least one positive laboratory test and a clinical diagnosis of pneumonia.

## Annual case surveillance

### Epidemiology

In 2021, 29 countries reported 10 723 cases (Table 1), of which 10 004 (93%) were classified as confirmed. The number of notifications per 100 000 population increased to 2.4, which was higher than any precedent year under surveillance. Four countries, Italy, France, Spain, and Germany, continued to account for the majority of notified cases (75%), although their combined populations represented approximately 50% of the EU/EEA population. Out of 8 054 cases with known outcome, 704 (9%) were reported to have a fatal outcome.

**Table 1. Distribution of cases of Legionnaires' disease and rates per 100 000 population by country and year, EU/EEA, 2017–2021**

Country	2017		2018		2019		2020		2021		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Austria	219	2.5	237	2.7	255	2.9	249	2.8	278	3.1	2.8
Belgium	235	2.1	270	2.4	224	2.0	143	1.2	274	2.4	2.2
Bulgaria	2	0.0	11	0.2	5	0.1	7	0.1	1	0.0	0.0
Croatia	33	0.8	43	1.0	ND	NR	ND	NR	ND	NR	NR
Cyprus	1	0.1	5	0.6	4	0.5	3	0.3	4	0.4	0.5
Czechia	217	2.1	231	2.2	277	2.6	231	2.2	219	2.0	1.8
Denmark	278	4.8	264	4.6	269	4.6	278	4.8	281	4.8	4.3
Estonia	16	1.2	18	1.4	12	0.9	18	1.4	10	0.8	0.7
Finland	27	0.5	24	0.4	44	0.8	24	0.4	34	0.6	0.5
France	1 630	2.4	2 133	3.2	1 816	2.7	1 328	2.0	2 039	3.0	2.8
Germany	1 279	1.5	1 448	1.7	1 554	1.9	1 272	1.5	1 524	1.8	1.5
Greece	43	0.4	65	0.6	45	0.4	29	0.3	25	0.2	0.2
Hungary	62	0.6	74	0.8	113	1.2	101	1.0	85	0.9	0.8
Iceland	3	0.9	5	1.4	4	1.1	4	1.1	10	2.7	3.1
Ireland	25	0.5	25	0.5	21	0.4	12	0.2	4	0.1	0.1
Italy	2 037	3.4	3 018	5.0	3 205	5.4	2 120	3.6	2 726	4.6	3.6
Latvia	31	1.6	37	1.9	42	2.2	27	1.4	61	3.2	3.0
Liechtenstein	ND	NR	ND	NR	ND	NR	ND	NR	2	5.1	4.7
Lithuania	14	0.5	21	0.7	17	0.6	12	0.4	4	0.1	0.1
Luxembourg	9	1.5	10	1.7	14	2.3	10	1.6	17	2.7	2.8
Malta	11	2.4	13	2.7	5	1.0	16	3.1	8	1.6	1.5
Netherlands	561	3.3	584	3.4	566	3.3	461	2.6	658	3.8	3.4
Norway	52	1.0	69	1.3	65	1.2	39	0.7	43	0.8	0.8
Poland	38	0.1	70	0.2	74	0.2	46	0.1	46	0.1	0.1
Portugal	231	2.2	211	2.1	201	2.0	307	3.0	254	2.5	2.2
Romania	19	0.1	62	0.3	19	0.1	8	0.0	8	0.0	0.0
Slovakia	14	0.3	54	1.0	85	1.6	98	1.8	148	2.7	2.7
Slovenia	117	5.7	160	7.7	196	9.4	120	5.7	88	4.2	3.7
Spain	1 363	2.9	1 513	3.2	1 542	3.3	1 336	2.8	1 704	3.6	3.1
Sweden	189	1.9	198	2.0	182	1.8	135	1.3	168	1.6	1.4
United Kingdom <sup>1</sup>	504	0.8	532	0.8	517	0.8	ND	ND	ND	ND	ND
<b>EU/EEA</b>	<b>9 260</b>	<b>1.8</b>	<b>11 405</b>	<b>2.2</b>	<b>11 373</b>	<b>2.2</b>	<b>8 434</b>	<b>1.9</b>	<b>10 723</b>	<b>2.4</b>	<b>2.1</b>

Source: country reports

ASR: age-standardised rate

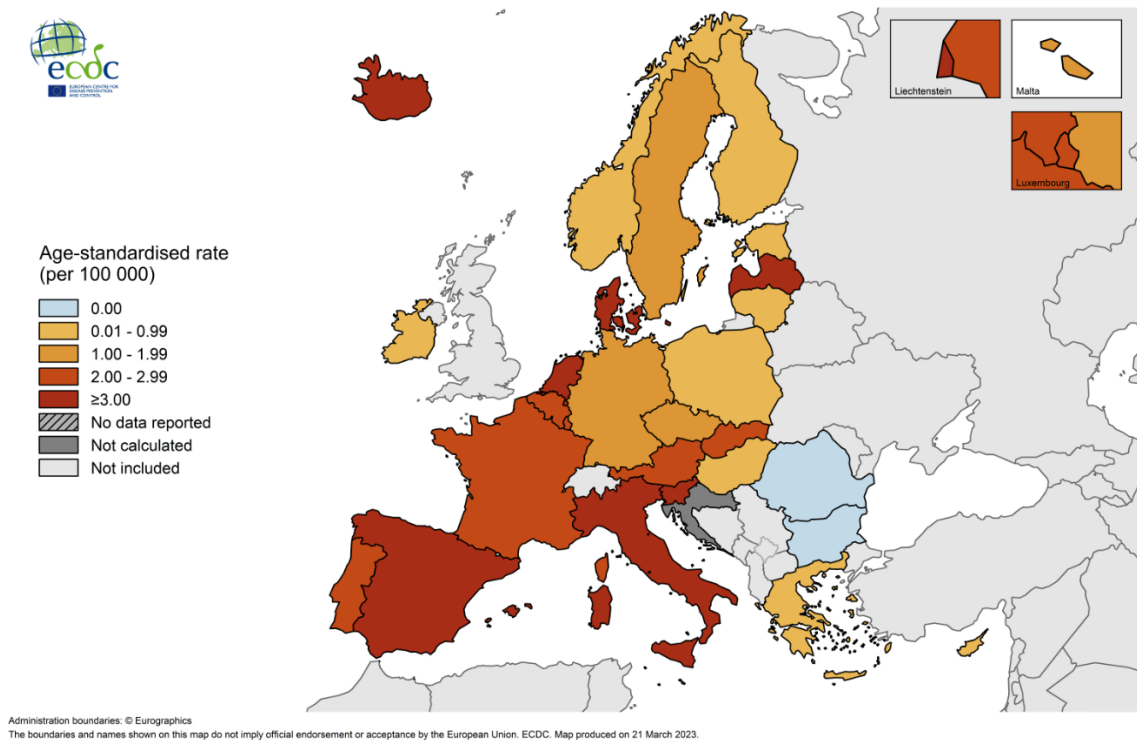
ND: no data reported

NR: no rate calculated.

<sup>1</sup> The United Kingdom (UK) was a former Member State of the European Union (EU). The UK withdrew from the EU on 31 January 2020.

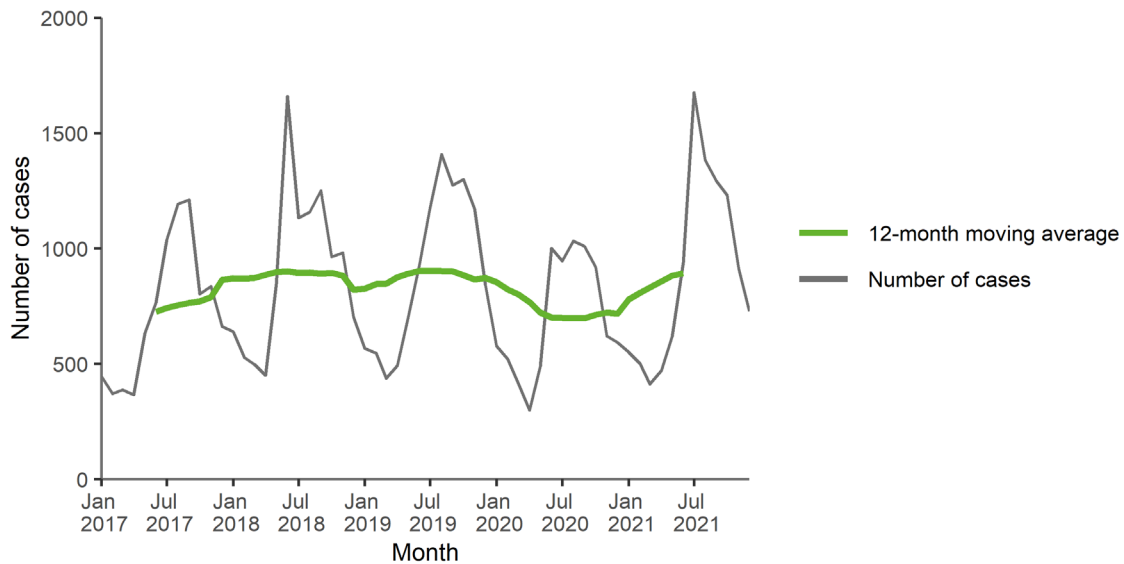
Age-adjusted notification rates ranged from less than 1.0 cases per 100 000 population in 11 countries (Bulgaria, Cyprus, Estonia, Finland, Greece, Hungary, Ireland, Lithuania, Norway, Poland, and Romania), to 3.0 cases or more per 100 000 population in eight countries (Denmark, Iceland, Italy, Latvia, Liechtenstein, Netherlands, Slovenia, and Spain; see Table 1 and Figure 1).

**Figure 1. Distribution of cases of Legionnaires' disease per 100 000 population by country, EU/EEA, 2021**



The general trend in the 2017–2021 period, has been of an increasing number of reported cases, other than the decrease during the COVID-19 pandemic period (Table 1; Figure 2).

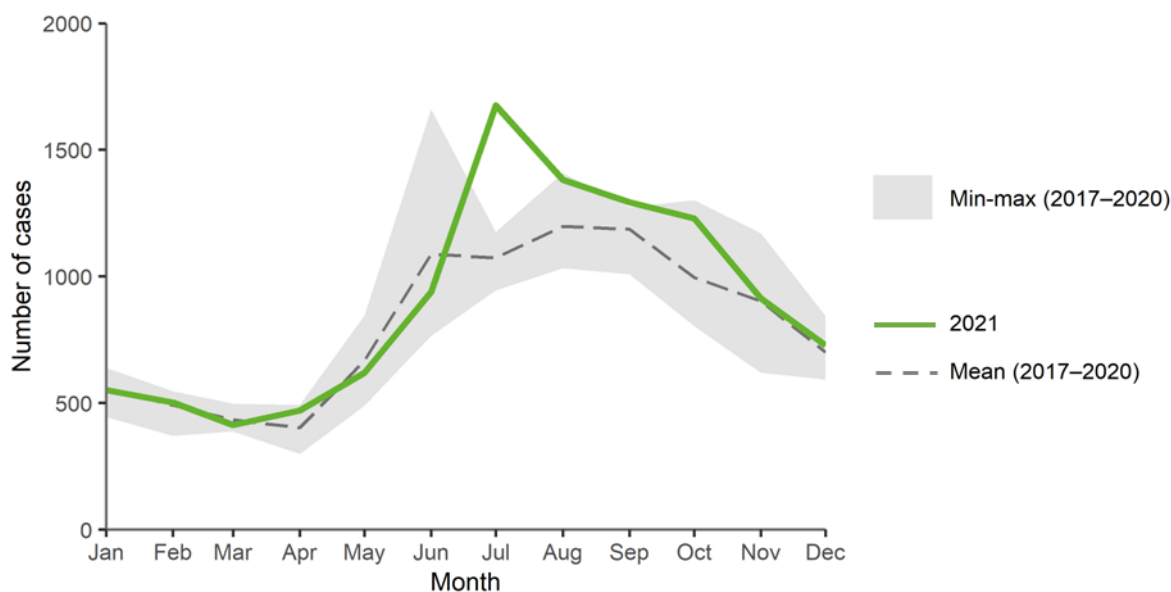
**Figure 2. Distribution of cases of Legionnaires' disease by month, EU/EEA, 2017–2021**



Source: Country reports from Austria, Belgium, Bulgaria, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

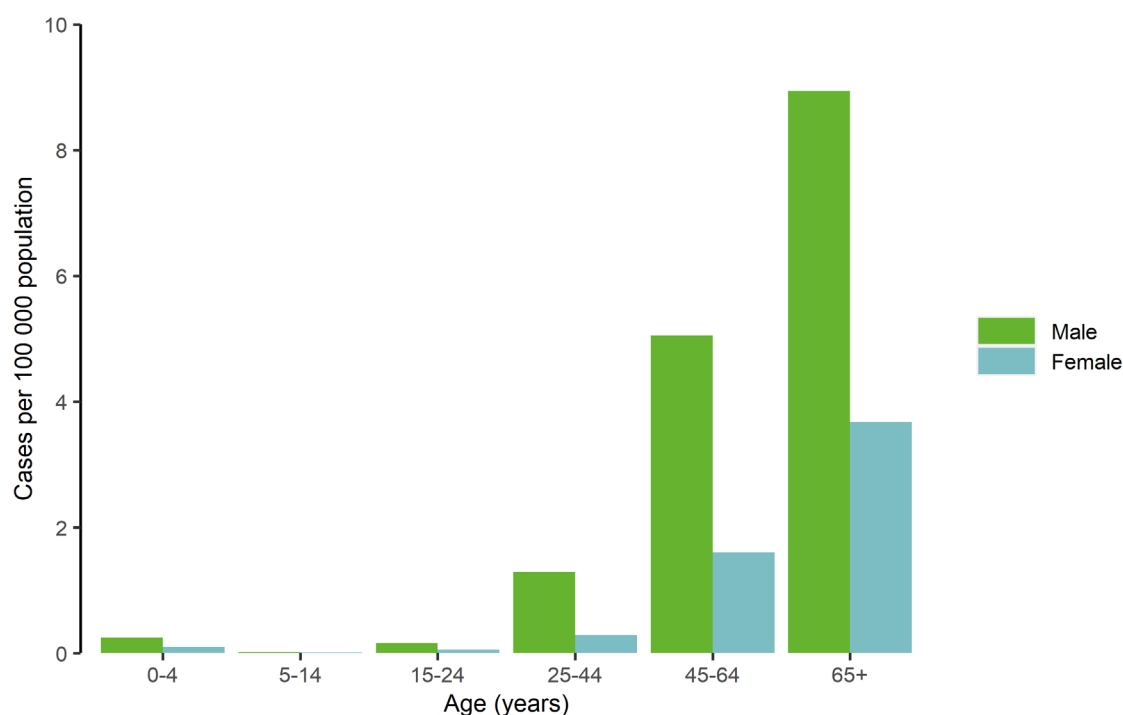
In 2021, the distribution of cases by month of reporting shows that the majority (6 521; 61%) of cases occurred between June and October, similar to previous years (Figure 3). An unusual peak in the number of cases was reported in July (1 676 cases), which was similar to that observed in June 2018 (shown in the range distribution in Figure 3). These peaks occurred in the absence of any specific outbreak event in a country. The overall distribution for all other months was within the range of the previous four years.

**Figure 3. Distribution of cases of Legionnaires' disease by month, EU/EEA, 2021 and 2017–2020**



Source: Country reports from Austria, Belgium, Bulgaria, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

In 2021, people aged 45 years and above accounted for 9 706 (91%) of the 10 720 cases reported with known age. The notification rate increased with age, from  $\leq 0.2$  cases per 100 000 population in the age groups under 25 years, to 6.0 cases per 100 000 population in persons aged 65 years and above. The overall male-to-female ratio was 2.4:1, which remained comparable to previous years (range 2.3–2.4:1, from 2017–2020). The notification rate differed by gender, with the highest rate of 8.9 cases per 100 000 population reported in males aged 65+ years (3.7 cases per 100 000 population for females; Figure 4).

**Figure 4. Distribution of cases of Legionnaires' disease per 100 000 population, by age and gender, EU/EEA, 2021**

The majority of cases in 2021 (9 566/10 723; 89%) were reported to be diagnosed with a urinary antigen test (UAT). This was within the range of cases (88–90%) diagnosed with UAT testing reported since 2012. In comparison, fewer cases were reported having been diagnosed with a culture test (1 183 cases; 11%). This is in line with the low-level use of culture as a reported method of diagnosis, observed during the same period. The use of polymerase chain reaction (PCR) method tests was reported for 1 255 cases (12%).

Among culture-confirmed cases with the pathogen reported (1 133; 11%), a total of 32 *Legionella* non-*pneumophila* species were reported (3%): *L. anisa* (2), *L. bozemanii* (4), *L. longbeachae* (22), *L. micdadei* (3) and *L. cincinnatiensis* (1). Of the 1 133 cases, 14 were reported as *Legionella* species unknown.

Table 2 further illustrates that *Legionella pneumophila* isolates other than serogroup 1 were also detected and reported, but with a low proportion (<20%).

**Table 2. Serogroups reported for culture-confirmed cases of *L. pneumophila*, EU/EEA, 2020 and 2021**

Serogroup (SG)	2020		2021	
	Number	%	Number	%
1	685	83	890	82
2	5	<1	14	1
3	22	3	46	4
4	0	<1	3	<1
5	4	<1	5	<1
6	16	2	10	1
7	3	<1	6	1
8	5	<1	2	<1
9	3	<1	1	<1

Serogroup (SG)	2020		2021	
	Number	%	Number	%
10	1	<1	5	<1
11	0	-	0	-
12	1	<1	1	<1
13	2	<1	1	<1
14	0	-	1	<1
15	2	<1	0	-
16	1	<1	0	-
<i>L. pneumophila</i> non-serogroup 1	5	<1	6	1
<i>L. pneumophila</i> serogroup mixed	3	<1	3	<1
<i>L. pneumophila</i> serogroup unknown	70	8	93	9
<b>TOTAL</b>	<b>828</b>		<b>1 087</b>	

For over 75% of the cases (8 276), the setting of infection was reported as community-acquired. The increase in comparison with 2020 (Table 3) may be due to fewer cases reported with the setting of infection as unknown (19% to 5%). Healthcare-associated infection was identified as the source in 5% of all the cases reported, which was similar to previous years (range: 5–6%, from 2017–2020). The proportion of cases attributed to travel (domestic and international travel, including stays at private accommodations) was 10%, which was still lower than the travel-associated cases prior to the COVID-19 pandemic.

**Table 3. Reported settings of infection for cases of Legionnaires' disease, EU/EEA, 2020 and 2021**

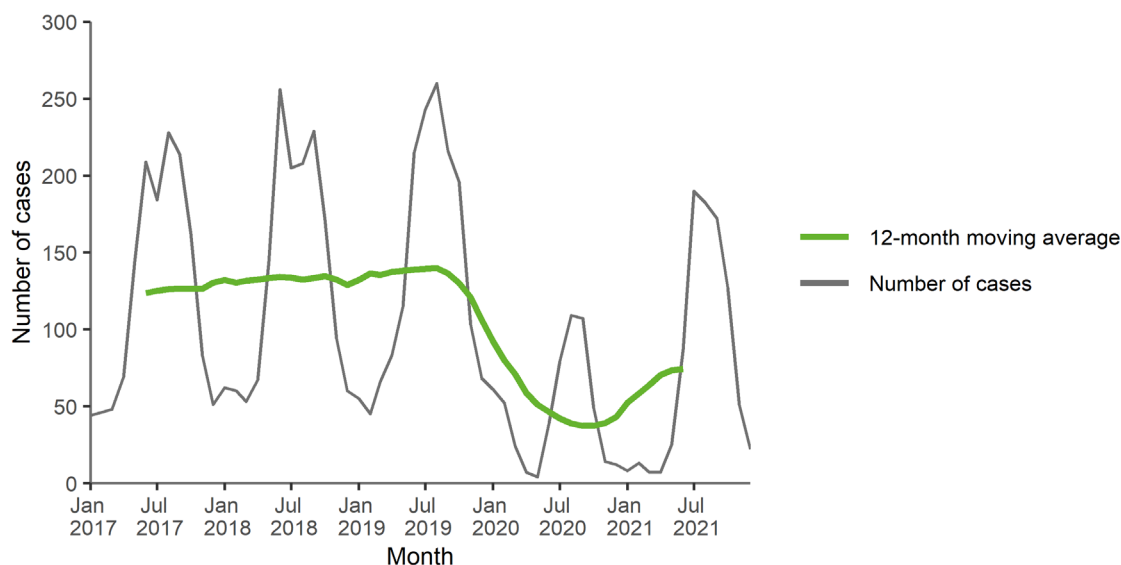
Setting	2020		2021	
	Number	%	Number	%
Community-acquired	5 643	67	8 276	77
Domestic travel	402	5	658	6
Healthcare-associated	432	5	584	5
Travel abroad	253	3	457	4
Other	147	2	268	3
Unknown	1 557	18	480	5
<b>TOTAL</b>	<b>8 434</b>	<b>100</b>	<b>10 723</b>	<b>100</b>

## Travel-associated Legionnaires' disease (TALD)

### TALD case reports

The European Legionnaires' disease surveillance network (ELDSNet) received reports of 895 cases of TALD with dates of onset in 2021, which is 38% more cases compared to 2020. The overall EU/EEA trend of reported cases of TALD (Figure 5) remained stable between 2017 to 2019, but decreased notably in 2020. This was probably an effect of the COVID-19 pandemic and associated travel restrictions. In 2021, the easing of travel restrictions is the likely reason for the observed increase in notified TALD cases compared to 2020.

**Figure 5. Distribution of travel-associated cases of Legionnaires' disease by month, EU/EEA, 2017–2021**



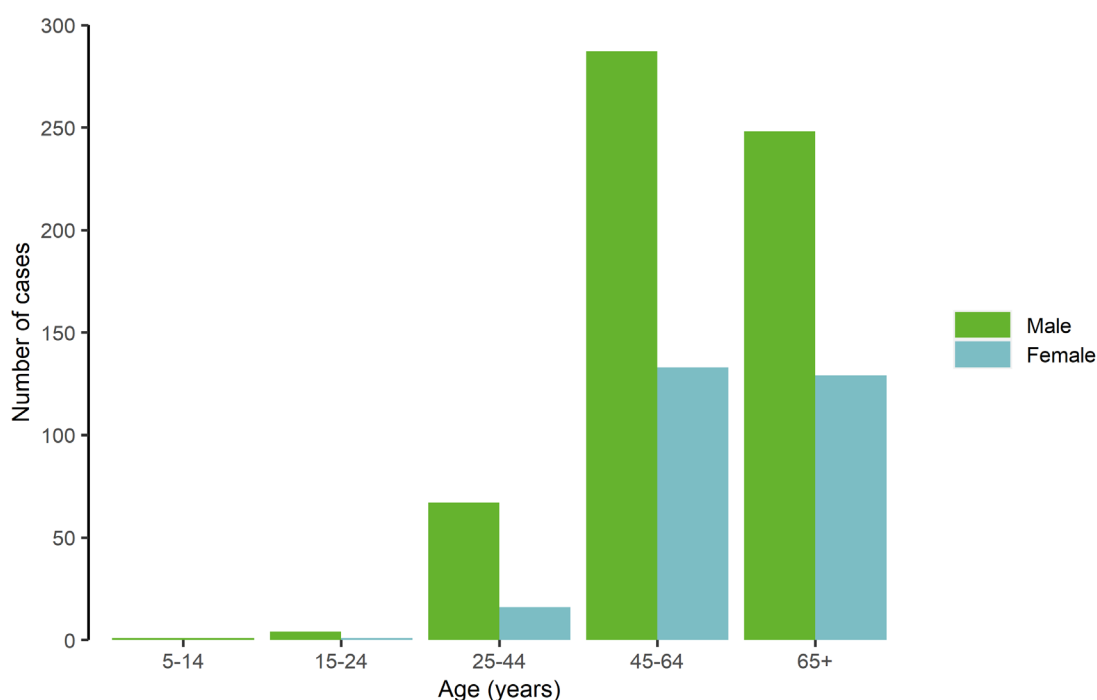
Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, and the United Kingdom (inclusive of data from 2017–2020). The other reporting countries have been excluded from this figure due to missing data from 2017–2021.

TALD cases were reported from 19 countries: 17 EU/EEA countries and two countries outside the EU/EEA. The two countries were, United States (one case) and Switzerland (19 cases). The UK no longer participated in the ELDSNet TALD surveillance scheme from January 2021. The majority (86%; n=722) of all the TALD cases were reported by only four countries: Italy (n=257; 36%), France (n=196; 27%), Germany (n=156; 22%), and the Netherlands (n=113; 16%).

Approximately two-thirds (68%; n=611) of the reported TALD cases were male, which is consistent with previous years. The cases had a median age of 62 years (interquartile range – IQR: 17.5, age range: 10–98 years); 90% of the cases occurred in people aged 45 years and above (Figure 6).



**Figure 6. Distribution of travel-associated cases of Legionnaires' disease by age and gender, 2021**

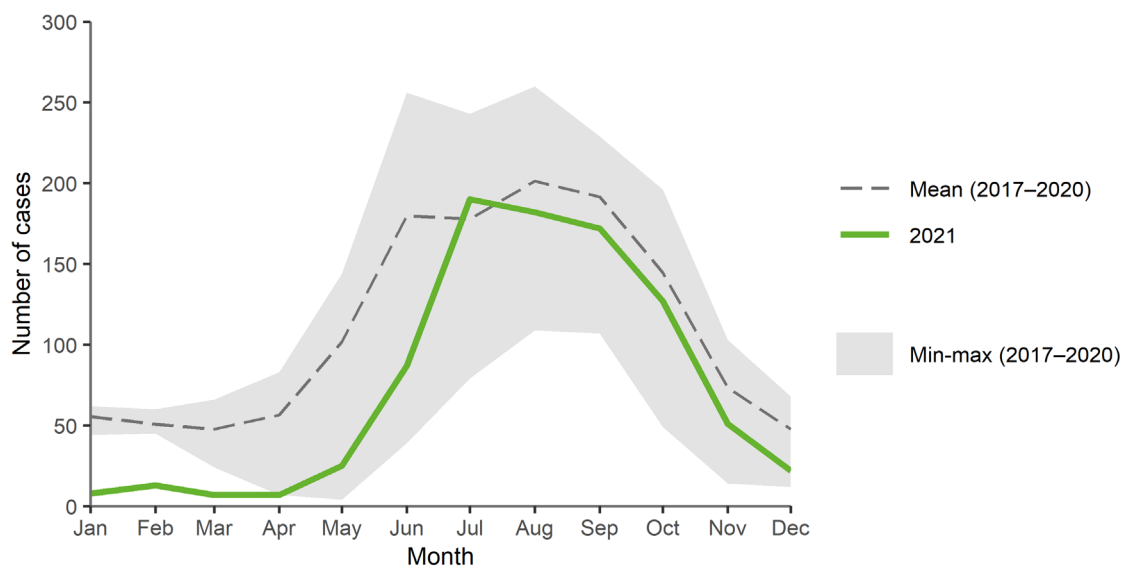


The reported TALD cases were resident in 20 countries. The majority of the cases resided in those countries that reported the most number of cases (Italy, France, Germany, and the Netherlands), while 26 of all cases (3%) were resident outside of the EU/EEA: Switzerland (19), the UK (5), and the United States (2).

In 2021, the median reporting time among countries (from the date of onset of illness, to reporting to ECDC) across countries was 18 days (IQR: 23 days) compared to 22 days (IQR: 42 days) in 2020.

In 2021, three quarters (n=662; 74%) of TALD cases fell ill between July and October, which is consistent with the known seasonality of Legionnaires' disease in Europe. However, there was a slightly delayed start of the summer peak season. This was likely due to the pandemic-related travel restrictions (Figure 7).

**Figure 7. Distribution of travel-associated cases of Legionnaires' disease by month, EU/EEA, 2021 and 2017–2020**



Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, and the United Kingdom (inclusive of data from 2017–2020). The other reporting countries have been excluded from this figure due to missing data from 2017–2021.

The disease outcome was provided for 473 (53%) TALD cases, with 11 (2%) known to have deceased by the time of reporting to ECDC. The deceased cases were between 47 and 95 years old, and 10 were male. A total of 859 TALD cases (96%) were classified as confirmed, and 36 (4%) as probable. Of 945 total laboratory tests reported in the diagnosis of 895 TALD cases, 90% were UATs, 7% were molecular tests (PCR), 3.5% were cultures, and less than one percent were serologic tests.

Among the cases with known information (n=860), the majority of pathogens were labelled as serogroup 1 *Legionella pneumophila* (n=797; 93%) or *Legionella pneumophila* serogroup unknown (n=40; 5%). A few cases were reportedly infected with other *L. pneumophila* serogroups, including serogroup 10 (three cases), serogroup 3 (one case), serogroup 6 (one case), serogroup 14 (one case), and non-serogroup 1 (16 cases). Monoclonal subtyping results were reported for five cases with *L. pneumophila* serogroup 1: France (one case), Allentown/France (one case), Philadelphia (one case), and Benidorm (two cases). The sequence types were reported to ECDC for only nine TALD cases from three countries: Czechia (three), Denmark (four), and Sweden (two). The sequence types reported for each of the nine cases were different (ST1, ST9, ST23, ST42, ST93, ST114, ST213, ST222 and ST1362).

## Travel destinations for TALD cases

The 895 TALD cases reported in 2021 had made a total of 1 125 international journeys. Of these, 1 040 (92%) were within the EU/EEA, 75 (7%) were outside the EU/EEA, and 10 (1%) journeys were on ships. The three destination countries with most TALD-associated travel visits were Italy (n=475, 42%), France (n=220, 20%), and Spain (n=80, 7%). Seventy-seven percent of the overnight stays were in hotels, 10% were on camp sites, 10% in rentals, 1% on ships, and 2% were reported as other types of accommodation.

## TALD clusters

In 2021, the ELDSNet surveillance scheme detected 79 new TALD clusters. A TALD cluster is the event of two cases having visited the same accommodation site within a two-year period [4]. The clusters were associated with accommodations in 14 countries worldwide (10 within the EU/EEA, and four outside the EU/EEA) and two ships. Of the 79 new clusters, 51 clusters (65%) comprised only two cases, 26 (33%) had between three and six cases, and one cluster each had 10 and 11 cases, respectively. In 2021, ECDC shared 11 summary reports of type 1 TALD clusters (clusters outside the EU/EEA) with tour operators, and 19 summary reports of type 2 TALD clusters (rapidly evolving clusters, i.e. three or more cases associated within a period of three months) [4].

The names of five accommodation sites were published by ECDC, because country assessments reported that recommendations from the competent authorities were not implemented in a satisfactory way.

## Outbreak

In 2021, 27 out of 30 countries participated in the annual outbreak reporting surveillance scheme. Eight EU/EEA countries (Belgium, Germany, Italy, France, Finland, the Netherlands, Portugal, and Spain) reported a total of 19 outbreaks, ranging from one to five per reporting country. In total, 137 outbreak-related confirmed cases were reported. The number of cases per reported outbreak ranged from 3–18 confirmed cases.

Nineteen EU/EEA countries (Austria, Bulgaria, Cyprus, Czechia, Denmark, Estonia, Greece, Hungary, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Norway, Romania, Slovakia, Slovenia, and Sweden) reported no outbreaks of Legionnaires' disease in 2021.

Seven (37%) of the 19 reported outbreaks in the EU/EEA in 2021, were reported as community outbreaks, which were proportionally more than the previous years of reporting. During the period 2016–2020, the number of reported community outbreaks ranged between 2–8, contributing to about 14% of annual outbreaks. One outbreak was reported to be associated with a car wash, and another was reported to be linked with a municipal water system. Five outbreaks had a positive match with environmental samples. However, this information was only available for 12 out of the 19 outbreaks reported.

## Discussion

The notification rate of cases of Legionnaires' disease increased in 2021 in comparison with 2020, reaching the highest level ever reported through ECDC surveillance in the EU/EEA. This increased annual notification rate may not be unexpected considering the increasing trend observed in recent years prior to the COVID-19 pandemic [6]. The seasonality pattern was similar to previous years, despite a higher peak in the number of cases observed in July. The occurrence of a sporadic high monthly count as noted in July had been previously observed in June 2018. No surveillance-related cause for this increase could be identified, e.g. reporting, definitions, or diagnostic practice. Similar to other years within the last decade, climate records indicate that temperatures are increasing in Europe in summer, with 2021 being among the highest recorded to date. Of note, some countries were also affected by severe flooding in July 2021 [7].

The main characteristics of cases of Legionnaires' disease reported in 2021 were similar to 2020, with most cases being sporadic, community-acquired, and among those aged over 45 years. The disease continues to affect males more than females, and reaches the highest rates in those aged 65 years and above.

A number of countries continue to have very low notification rates below 0.5 cases per 100 000 population. This probably represents an underestimation of the case incidence in these countries. As only 11% of cases are reported with a culture-confirmed diagnosis, there is a likely underestimation of the burden of disease caused by the *Legionella* species across the EU/EEA other than *Legionella pneumophila*.

In 2021, outbreaks were detected and investigated in several countries. Proportionally more community outbreaks were reported compared to previous years, though the number of cases per outbreak were similar.

The cause of the higher notification rate observed in Europe both in the years immediately preceding 2020, and in 2021 during the COVID-19 pandemic, remains unknown. Factors that may explain these increases include: changes in national testing policies and surveillance systems, an ageing EU/EEA population, the design, infrastructure, and maintenance of water systems used in buildings. Changes in climate and weather patterns across Europe and worldwide can also impact both the ecology of *Legionella* in the environment and the exposure to water aerosols containing the bacteria.

## Public health implications

Legionnaires' disease remains an important cause of potentially preventable morbidity and mortality in Europe.

The overall EU/EEA notification rates have been rising in the last few years, although there was a decrease observed in 2020 during the first phase of the pandemic when stringent restrictions were in place. Variation in rates across EU/EEA countries remain, which likely reflect the under-diagnosis of this disease in many Member States. Support to countries with very low notification rates remains a priority to improve both the diagnosis and reporting of Legionnaires' disease to public health authorities.

Outbreaks of Legionnaires' disease with varying sizes and causes continue to be identified and investigated by public health authorities in EU/EEA countries. Due to the relatively high mortality associated with the disease and the considerable challenges for the rapid identification and control of environmental sources, it remains important to be vigilant to detect clusters and outbreak events through surveillance.

As the detection of TALD clusters through the ELDSNet surveillance scheme leads to investigations and preventive actions at accommodation sites by participating countries, cluster detection through this multi-country joint surveillance scheme shows its importance for public health.

To support the strengthening of surveillance and outbreak investigation capacity in European countries, in 2019, ECDC started an annual external quality assessment (EQA) scheme on clinical and environmental samples of *Legionella* species. Annual summary reports for the results of this EQA scheme are published by ECDC [8].

Regular checks for the presence of *Legionella* bacteria and appropriate control measures applied to engineered water systems [9] can prevent cases of Legionnaires' disease at tourist accommodation sites, hospitals, long-term healthcare facilities, or other settings where sizeable populations at higher risk may be exposed to aerosols containing the bacteria.

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