Leishmaniases are endemic in humans and animals in part of the European Union (EU) and its neighboring countries. Leishmania species in this region are L. major, L. tropica, and the L. donovani complex species (including L. infantum and L. donovani sensu stricto). All cause cutaneous leishmaniasis (CL); visceral leishmaniasis (VL) is caused mainly by L. donovani complex species. There is evidence that the risk for leishmaniases is increasing in some EU and neighboring countries (1). We conducted a questionnaire survey to gather information on the epidemiologic situation, surveillance, prevention and control measures, and drivers of emergence of animal and human leishmaniases in this region during 2010–2020.

The Study
The survey included an animal leishmaniasis (AniL) questionnaire referring to L. infantum infections in domestic or wildlife hosts and a human leishmaniasis (HumL) questionnaire referring to infections by L. infantum, L. major, L. tropica and L. donovani s.s. (Appendix, https://wwwnc.cdc.gov/EID/article/27/6/21-0239-App1.pdf). The target audience was the national focal points (national institutes or ministries) of the European Centre for Disease Prevention and Control, the World Health Organization, the European Food Safety Authority, and the World Organisation for Animal Health in countries in which leishmaniases are endemic or those with confirmed or suspected presence of sand fly vectors (2). These countries were Albania, Algeria, Armenia, Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, Egypt, France, Georgia, Germany, Greece, Hungary, Israel, Italy, Jordan, Kosovo, Lebanon, Libya, Liechtenstein, Luxembourg, Malta, Moldova, Montenegro, Morocco, North Macedonia, Palestine, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Tunisia, Turkey, and Ukraine (Figure 1). The questionnaires were administered electronically using the EU survey tool and shared on September 11, 2020 (3). Twenty-seven countries (70%) replied to the AniL questionnaire and 24 countries (60%) to the HumL questionnaires; 19 countries (48%) replied to both (Table 1).

We reviewed the countries’ epidemiologic status with regards to autochthonous Leishmania spp. infections in animals and humans and clinical forms in humans. The mapping of the countries with autochthonous transmission matches previous published information with few discrepancies. For instance, according to the questionnaire, Bosnia and Herzegovina and Hungary do not have autochthonous canine leishmaniasis cases, although such cases have been described (4,5). Human cases of leishmaniasis due to L. tropica were reported in Cyprus and Serbia and due to L. major in Georgia; however, none of the literature presents concurring evidence (Table 2).

Animal leishmaniases are notifiable in 17 countries and human leishmaniases in 20 countries (Table 1; Figure 2). In Palestine and Turkey, AniL is not notifiable despite a high prevalence among dogs (6,7). Similarly,
in France, neither AniL nor HumL are notifiable although the diseases are endemic in the south (8). Leishmaniases surveillance is not mandatory at the EU level which constitutes a limitation for successful control.

Seven countries conduct AniL surveillance (Table 1), indicative of its low priority among the animal health authorities. The target animal population for surveillance included symptomatic and asymptomatic dogs in Armenia, Cyprus, Italy, Spain, and Ukraine; we also studied wildlife in leishmaniasis foci in Spain. Testing subclinically infected dogs indicated awareness of their role as reservoirs of the parasite (1). Similarly, wild lagomorphs were the main reservoir of L. infantum in a HumL outbreak in Madrid in Spain (9). Surveillance of HumL is conducted in 19 countries, including all of those with autochthonous infections except Serbia (Table 1).

Antibody tests, including the immunofluorescence antibody test, ELISA, and the rapid immunochromatography test, are the main surveillance diagnostic methods used, followed by PCR. Antibody tests play a fundamental role in disease surveillance because they are relatively cheap and easy to use (10). However, their sensitivity to detect subclinical infections is lower than that of PCR tests (10), and they do not discriminate naturally infected from vaccinated dogs (11). PCR tests are ideal for epidemiologic studies to estimate Leishmania spp. infection prevalence in healthy hosts, but their diagnostic validity depends on the sample used, the DNA sequence target, and the PCR protocol. Standardization of PCR tests in leishmaniasis diagnosis is needed (12).

Of the 7 countries that have ongoing AniL prevention and control programs (Table 1), 5 use topical insecticides for dogs, 5 are diagnosing and treating leishmaniases in dogs, and 2 use canine leishmaniosis vaccines. In all countries, infected dogs may be euthanized on welfare grounds. Lack of funds and treatment costs were considered the most important AniL control challenges. Human leishmaniasis prevention and control activities are implemented in 12 countries (Table 1); for L. infantum, actions focused on the use of insecticides on dogs, and for L. major, L. tropica, and L. donovani, the common activity was the use of peridomiciliary and intradomiciliary insecticides. Lack of funds and capacity constraints are considered the main challenges for HumL.

Although zoonotic L. infantum strategies are centered on preventing and eliminating infections in dogs, the main parasite reservoir host, we found that insecticides and treatments are not fully effective and are expensive, and so provided to a relatively small proportion of dogs. Leishmaniasis control needs the One Health approach to account for the complexity of its transmission cycle involving humans, domestic animals, wildlife, and sand fly vectors (13).

Animal leishmaniases are considered emergent diseases in Cyprus and Jordan and in parts of Algeria,
Armenia, France, Georgia, Jordan, Montenegro, North Macedonia, Romania, Slovenia, Turkey, and Ukraine. The most important AniL emergence risk factor is the lack of control. Human leishmaniases are considered emerging diseases in Cyprus, Libya and Malta and in parts of Albania, Austria, Armenia, Azerbaijan, Georgia, Israel, Italy, Montenegro, and Spain. The main risk factors for HumL emergence are vector expansion for *L. infantum*, and movement of infected persons between countries for *L. major*, *L. tropica*, and *L. donovani*.

In general, the perceived increasing risk for AniL and HumL was in line with the literature. In the EU and its neighborhood, the risks include movement of humans and dogs, increased number of immunosuppressed patients, climate warming, and other environmental changes affecting vector and reservoir host distribution (1,14). Limitations associated with existing surveillance and control programs, along with the fact that leishmaniases are often regarded as a local problem rather than a transnational problem, are deemed major obstacles to overcome to prevent leishmaniases emergence in the EU and its neighborhood.

**Conclusions**

Leishmaniases are considered widespread, endemic, or emerging infections in the EU and its neighborhood, yet are neglected and underreported because they are low priority at the country and EU level. Our study revealed a clear need to strengthen leishmaniasis prevention and control programs in the EU and its neighborhood. We recommend analysis of leishmaniasis incidence in the region for an objective assessment of disease emergence, and also improvement of surveillance and following a One Health approach.

**Acknowledgments**

We thank experts from the public health institutes, animal health institutes, ministries of health, and ministries of agriculture from Albania, Algeria, Armenia, Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czechia, France, Georgia, Germany, Greece, Hungary, Israel, Italy, Jordan, Libya, Luxembourg, Malta, Moldova, Montenegro, North Macedonia, Palestine, Romania, Serbia, Slovenia, Spain, Turkey, and Ukraine for...
taking the time to answer the questionnaires and providing us the information used to prepare this review on leishmaniasis. In particular, we thank: Silva Bino, Adela Vasili and Teita Myrseli (Albania), Ahmed Chawki El Karim Boughalem (Algeria), Arman Gevoryan, Lusine Paronyan and Narek Hayrapetyan (Armenia), Irene Kászoni-Rückerl and Julia Walochnik (Austria), Yagut Garayeva (Azerbaijan), Javiera Rebolledo (Belgium), Aleksandar Nemet (Bosnia and Herzegovina), Rumen Harizanov (Bulgaria), Tihana Miškić, Ivana Lohman Janković and Eddy Listeš (Croatia), Maria G. Koliou and Vasiliki Christodoulou (Cyprus), Jerome Depaquit, Laurence Lachaud, Christophe Ravel and Patrick Bastien (France), Merab Iosava and Tegniz Chaligava (Georgia),

Figure 2. Geographic distribution of mandatory notification status for animal (A) and human (B) leishmaniasis, 2020.
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Parasitic diseases and specifically leishmaniases. Dr. Berriatua is a professor of animal health at the University of Murcia in Spain, where he teaches and conducts research on the epidemiology and ecology of parasitic diseases and specifically leishmaniases.

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**Table 2. Declared status of endemicity of Leishmania spp. affecting humans, by country**

| Country          | L. infantum | L. major | L. tropica | L. donovani |
|------------------|-------------|----------|------------|-------------|
| Albania          | Yes         | No       | No         | No          |
| Armenia          | Yes         | No       | No         | No          |
| Austria          | No          | No       | No         | No          |
| Azerbaijan       | Yes         | Yes      | Yes        | No          |
| Belgium          | No          | No       | No         | No          |
| Bulgaria         | Yes         | No       | No         | No          |
| Croatia          | Not known   | Not known| Not known  | Not known   |
| Cyprus           | No          | No       | Yes        | Yes         |
| Czechia          | No          | No       | No         | No          |
| France           | Yes         | No       | No         | No          |
| Georgia          | Yes         | Yes      | No         | No          |
| Germany          | No          | No       | No         | No          |
| Greece           | Yes         | No       | No         | No          |
| Israel           | Yes         | Yes      | Yes        | Yes         |
| Italy            | Yes         | No       | No         | No          |
| Libya            | Yes         | Yes      | No         | Not known   |
| Malta            | Yes         | No       | No         | No          |
| Montenegro       | Yes         | Not known| Not known  | No          |
| Romania          | No          | No       | No         | No          |
| Serbia           | Yes         | Not known| Yes        | Yes         |
| Slovenia         | No          | No       | No         | No          |
| Spain            | Yes         | No       | No         | No          |
| Turkey           | Not known   | Not known| Not known  | Not known   |
| Ukraine          | No          | Not known| Yes        | Not known   |

Franz J. Conraths (Germany), Danai Pervanidou and Michail Floros (Greece), Tamás Šréter (Hungary), Emilia Anis, Roe Singer, Yael Glazer and Michel Bellaiche (Israel), Alda Natale, Gianluca Rugna, Mose’ Alise, Patrizia Parodi, Luigi Gradoni and Pellegrino Daniele (Italy), Mahmoud Alhanateh (Jordan), Badereddin Ananjar (Libya), Maxim Sirbu (Moldova), Mevlida Hrapovic and Nebojša Sekulić (Montenegro), Iyad Adra (Palestine), Alexandru Supeanu and Cristina Daniela Pop (Romania), Mitra Drakulovic and Sasa Ostojc (Serbia), Maja Sočan (Slovenia), Beatriz Fernández Martínez, Francisco Javier Moreno Nuncio, Francisco Javier Nieto Martínez, Soledad Collado Cortés, José Luis Sáez Llorente and Alejandro Pérez Riquelme (Spain), Anil Demeli, Ahmet Deniz and Seher Topluoglu (Turkey) and Ihor Kuzin (Ukraine). In addition, we thank Tamás Bakonyi for reviewing and testing the questionnaire.

Y.V.d.S. is employed with the European Food Safety Authority (EFSA) in the ALPHA Unit that provides scientific and administrative support to EFSA’s scientific activities in the area of Animal Health and Welfare. The positions and opinions presented in this article are those of the authors alone and are not intended to represent the views or scientific work of EFSA.

**About the Author**

Dr. Berriatua is a professor of animal health at the University of Murcia in Spain, where he teaches and conducts research on the epidemiology and ecology of parasitic diseases and specifically leishmaniases.
Leishmaniasis in the European Union and Neighboring Countries

Appendix

Shown on the following pages are 2 surveys used to gather information on the epidemiologic situation, surveillance, prevention and control measures, and drivers of emergence of animal and human leishmaniasis in Europe during 2010–2020. The first is an animal leishmaniasis questionnaire referring to *Leishmania infantum* infections in domestic or wildlife hosts. The second is a human leishmaniasis questionnaire referring to infections by *L. infantum*, *L. major*, *L. tropica*, and *L. donovani* sensu stricto.
A - INTRODUCTION

Dear Participants,

The European Centre for Disease Prevention and Control (ECDC), in collaboration with the European Food Safety Authority (EFSA), the World Health Organization Regional Office for Europe (WHO EURO) and the World Organisation for Animal Health (OIE), initiated the review of the epidemiological situation of human and animal leishmaniasis in the European Union and its neighbourhood.

To collect data on the surveillance, control, diagnosis and treatment of leishmaniasis, we would like you to complete the following questionnaire by 30 September. This will take you approximately 15 minutes. Note that this questionnaire targets the public health authorities and focuses on human leishmaniasis. A complementary questionnaire focusing on animal leishmaniasis will be sent to the animal health authorities in your country.

Based on the responses to this questionnaire and a literature review, a technical report will be prepared. If you want to receive the finalised technical report and have your contribution acknowledged in the technical report, please express this in the first part of the questionnaire.

B - ECDC DATA PRIVACY STATEMENT

Do you agree with the following ECDC privacy statement? *By agreeing with ECDC privacy statement and answering this questionnaire, you agree that your answers are used in the technical report that will be produced. Note that ECDC may contact you afterwards for clarification.*

- [ ] Yes

Download

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You can only proceed with the questionnaire by accepting ECDC data privacy statement.
C - GENERAL INFORMATION

Name (only visible to ECDC). This information will be treated as strictly confidential.

Email (only visible to ECDC). This information will be treated as strictly confidential.

Affiliation

- Country
  - Albania
  - Algeria
  - Andorra
  - Armenia
  - Austria
  - Azerbaijan
  - Belgium
  - Bosnia and Herzegovina
  - Bulgaria
  - Croatia
  - Cyprus
  - Czechia
  - Denmark
  - Egypt
  - Estonia
  - Finland
  - France
  - Georgia
  - Germany
  - Greece
  - Hungary
  - Ireland
  - Israel
  - Italy
  - Jordan
  - Kosovo
  - Latvia
  - Lebanon
  - Libya
  - Liechtenstein
  - Lithuania
* Do you want to receive a final copy of the technical report (expected early 2021)?
  ○ Yes
  ○ No

* Do you want to have your contribution acknowledged in the technical report that will be prepared? If yes, please make sure you provide your name and affiliation.
  ○ Yes
  ○ No

**D - SURVEILLANCE OF ANIMAL LEISHMANIASIS**

* 1. Have **autochthonous cases of animal** (dog or other domestic or wildlife) **leishmaniasis** been identified in your country **since 2010**?
Animal leishmaniasis in this context refers to a laboratory confirmed infection case by *Leishmania infantum*. Other domestic animals include cats, horses, etc. Wildlife include foxes, wolves, rodents, rabbits, hares, etc. Autochthonous cases result from existing natural leishmania transmission in the country.
  ○ Yes
  ○ No
  ○ I don't know

Selecting "No" or "I don't know" skips question 2
2. Which of the following clinical presentations of autochthonous leishmaniasis have been identified in animals in your country? You may choose more than one.

- [ ] Visceral
- [ ] Cutaneous
- [ ] I don’t know

3. Is animal (canine or other) leishmaniasis a mandatory notifiable disease in your country? A notifiable disease is required by law to be reported to government authorities.

- [ ] Yes, in the entire country
- [ ] Yes, in some regions only
- [ ] No
- [ ] I don’t know

Please specify which region(s)

Selecting “No” or “I don’t know” skips question 4

4. In which host species is leishmaniasis notification mandatory?

- [ ] All species (dogs and other domestic animals and wildlife)
- [ ] Dogs and other domestic animals only
- [ ] Dogs only
- [ ] I don’t know

5. Is surveillance of animal leishmaniasis implemented in your country? Surveillance refers to the systematic and continuous collection, management, analysis, interpretation and reporting of infection/disease data to drive health actions.

- [ ] Yes
- [ ] No
- [ ] I don’t know

Selecting “No” or “I don’t know” skips questions from 6 to 11

6. What type of surveillance system of animal leishmaniasis is implemented in your country?

- [ ] Comprehensive: by all providers of veterinary care, official and private in a particular geographical area
- [ ] Sentinel: by only a subset of veterinary care providers should report cases
- [ ] I don’t know

7. What are the surveillance data providers for animal leishmaniasis in your country? You may choose more than one.

- [ ] Laboratories from the official veterinary services or laboratories accredited by the National Veterinary Authority
- [ ] Laboratories from specialised, private companies not accredited by the National Veterinary Authority
- [ ] Veterinary practices and veterinary hospitals
8. What **type of SURVEILLANCE data** from animal leishmaniasis cases is reported in your country? You may choose more than one.

*Please note that the question also applies to non-endemic regions/countries in the event that a case was diagnosed.*

- [ ] Clinical
- [ ] Epidemiological
- [ ] Laboratorial
- [ ] Other
- [ ] I don't know

Please specify:

9. In addition to surveillance of clinical cases of leishmaniasis, is **SURVEILLANCE OF ASYMPTOMATIC (subclinical) INFECTIONS** implemented in your country?

- [ ] Yes
- [ ] No
- [ ] I don't know

Selecting "No" or "I don't know" skips question 9.

10. What is the **target animal population** on which **SURVEILLANCE** of infection/disease is done? You may select more than one.

- [ ] Privately owned dogs (pets, farm, hunting)
- [ ] Animal shelter and kennel dogs not privately owned (e.g. police dogs)
- [ ] Captured strays and rescued dogs for rehoming
- [ ] Wild canids (e.g. foxes)
- [ ] Wild lagomorphs (e.g. rabbits)
- [ ] Wild rodents
- [ ] Other
- [ ] I don't know

Please specify:

11. What are the **diagnostic techniques used for SURVEILLANCE**? You may select more than one.
Serology (antibody detection) by IFAT (indirect immunofluorescence test)
Serology by ELISA (Enzyme linked immunosorbent assay)
Serology by DAT (direct agglutination test)
Serology by rapid immunochromatography (e.g. IDEXX snap test)
PCR (Polymerase chain reaction) in blood samples
PCR of skin/tissue samples
PCR of conjunctival/oral swabs
Microscopy of biological samples with or without prior culture
Necropsy and PCR of biological samples
Other
I don't know

Please specify:

### E - PREVENTION AND CONTROL OF ANIMAL LEISHMANIASIS

12. Following surveillance results, is there a **PREVENTION AND CONTROL PROGRAMME** implemented in your country by **veterinary authorities** against animal leishmaniasis?

*Prevention and control actions may include: treatment of infected animals, canine vaccination, culling of infected animals, testing animals coming from endemic areas, use of insecticides and mechanical barriers against sand fly vectors.*

- [ ] Yes
- [ ] No
- [ ] I don't know

Selecting "No" or "I don't know" skips questions 13 and 14

Which of the following actions are taken? You may select more than one.

| Action                                                                 | Yes | No | I don’t know |
|------------------------------------------------------------------------|-----|----|--------------|
| Treatment of infected dogs                                             |     |    |              |
| Vaccination of dogs                                                    |     |    |              |
| Insecticide use in dogs                                                |     |    |              |
| Diagnostic testing of pet dogs                                         |     |    |              |
| Diagnostic testing of pet dogs travelling from endemic areas (e.g. after holidays) |     |    |              |
| Collect and test stray/abandoned dogs                                  |     |    |              |
| Collect and test wildlife (foxes, rabbits, etc.)                       |     |    |              |
| Euthanasia of dogs and other infected animals                           |     |    |              |
13. Do you have national **PREVENTION AND CONTROL official guidelines** for animal leishmaniasis?
   - [ ] Yes
   - [ ] No
   - [ ] I don't know

Please provide the link where to find these guidelines:

14. Are you aware of **intersectorial (“One Health”) collaboration** between animal, human and environmental sectors to **PREVENT AND CONTROL** leishmaniasis in your country?

   - [ ] Yes
   - [ ] No
   - [ ] I don't know

Please describe:

15. What are in your opinion the **challenges for the PREVENTION AND CONTROL** of leishmaniasis in animals in your country? Please rate from 0 (not important) to 3 (very important).

| Challenge                                                                 | 0 | 1 | 2 | 3 | I don't know |
|---------------------------------------------------------------------------|---|---|---|---|-------------|
| Lack of legislation from responsible authorities                          |   |   |   |   |             |
| Lack of political willingness/awareness                                   |   |   |   |   |             |
| Lack of funding                                                           |   |   |   |   |             |
| Collaborative constraints (between stakeholders)                          |   |   |   |   |             |
| Operational capacity constraints (Knowledge, people, equipment)           |   |   |   |   |             |
| Lack of national/international regulation against culling infected/sick dogs/animals |   |   |   |   |             |
| Limited availability of diagnostic techniques                             |   |   |   |   |             |
High cost of diagnosis
Limited availability of treatments
High cost of treatment
Limited availability of vaccines
Limited availability of insecticides
No regulatory basis for insecticide use
Other

Please specify:

F - DIAGNOSIS AND TREATMENT OF ANIMAL LEISHMANIASIS

16. Are there any official guidelines in your country for animal leishmaniasis DIAGNOSIS?
   ○ Yes
   ○ No
   ○ I don't know

Please provide the link where to find these guidelines:

17. Which of the following LABORATORY TECHNIQUES are employed in your country for animal leishmaniasis DIAGNOSIS by governmental or private laboratories?
   Please note that this does not necessarily imply that animal leishmaniosis surveillance is being carried out in your country.

|                     | Yes | No | I don’t know |
|---------------------|-----|----|--------------|
| Serology (antibody detection) by IFAT(indirect immunofluorescence antibody test) |     |    |              |
| Serology by ELISA (enzyme-linked immunosorbent assay) |     |    |              |
| Serology by DAT (direct agglutination test) |     |    |              |
| Serology by rapid immunochromatography (e.g. IDEXX snap test) |     |    |              |
| PCR (Polymerase chain reaction) of blood samples |     |    |              |
PCR of skin/tissue samples
Microscopy of biological samples with or without prior culture
Other

Please specify:

18. Are there any guidelines in your country for animal leishmaniasis TREATMENT?
   ○ Yes
   ○ No
   ○ I don’t know

Please provide the link where to find these guidelines:

19. What are the DRUGS (medicines) used for animal leishmaniasis treatment in your country?

| Drug                                               | Yes | No | I don’t know |
|----------------------------------------------------|-----|----|--------------|
| Meglumine antimoniate (E.g. Glucantime®)           | ○   | ○  | ○            |
| Allopurinol                                        | ○   | ○  | ○            |
| Miltefosine                                        | ○   | ○  | ○            |
| Sodium stibogluconate (E.g. Pentostam®)            | ○   | ○  | ○            |
| Aminosidine                                        | ○   | ○  | ○            |
| Immunomodulatory drugs (e.g. Domperidone)          | ○   | ○  | ○            |
| Other                                              | ○   | ○  | ○            |

Please specify

G - DRIVERS OF EMERGENCE OF ANIMAL LEISHMANIASIS

Emergence refers to the establishment of infection/disease in a previously free area or to an increase in incidence of infection/disease in an endemic area. Disease emergence is also considered when the rise in incidence occurs as a result of improved and wider diagnosis.
20. Is **animal leishmaniasis emerging** in your country?
- Yes, in all the country
- Yes, in some regions
- No
- I don't know

Please specify which region(s)

21. WHICH of the following **DRIVERS** do you think that are important in your country? Please rate from 0 (not important) to 3 (very important).

|                                           | 0 | 1 | 2 | 3 |
|-------------------------------------------|---|---|---|---|
| Pet animals travelling to Leishmania endemic areas |   |   |   |   |
| Importation of pet animals from Leishmania endemic areas |   |   |   |   |
| Immigration of Leishmania infected people   |   |   |   |   |
| Sand fly vector expansion into previously-free areas as a result of climate change |   |   |   |   |
| Environmental changes other than climate change, with an impact in vectors and reservoir hosts (e. g. urbanization) |   |   |   |   |
| Insufficient/lack of surveillance at regional/country level |   |   |   |   |
| Insufficient/lack of prevention and control at regional/country level |   |   |   |   |
| Other                                      |   |   |   |   |

Please comment:

**H - CONCLUDING REMARKS**

Please provide any additional information you consider relevant:
HUMAN LEISHMANIASIS IN THE EUROPEAN UNION AND ITS NEIGHBOURHOOD

A - INTRODUCTION

Dear Participants,

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☐ Yes

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You can only proceed with the questionnaire by accepting ECDC data privacy statement.
C - GENERAL INFORMATION

Name (only visible to ECDC). This information will be treated as strictly confidential

Email (only visible to ECDC). This information will be treated as strictly confidential

Affiliation

- Country
  - Albania
  - Algeria
  - Andorra
  - Armenia
  - Austria
  - Azerbaijan
  - Belgium
  - Bosnia and Herzegovina
  - Bulgaria
  - Croatia
  - Cyprus
  - Czechia
  - Denmark
  - Egypt
  - Estonia
  - Finland
  - France
  - Georgia
  - Germany
  - Greece
  - Hungary
  - Ireland
  - Israel
  - Italy
  - Jordan
  - Kosovo
  - Latvia
  - Lebanon
  - Libya
  - Liechtenstein
  - Lithuania
* Do you want to receive a final copy of the technical report (expected early 2021)?
  ○ Yes
  ○ No

* Do you want to have your contribution acknowledged in the technical report that will be prepared?
  If yes, please make sure you provide your name and affiliation.
  ○ Yes
  ○ No

D - SURVEILLANCE OF HUMAN LEISHMANIASIS

* 1. Have autochthonous cases of human leishmaniasis been identified in your country since 2010?
   A case of human leishmaniasis is a laboratory confirmed infection. Autochthonous cases result from existing natural Leishmania transmission in the country.
   ○ Yes
   ○ No
   ○ I don't know

Selecting "No" or "I don't know" skips questions 2 and 3
2. Which of the following clinical presentations of autochthonous leishmaniasis have been identified in your country? You may choose more than one.

- Visceral
- Cutaneous
- Mucocutaneous
- I don’t know

3. Which of the following Leishmania species are considered endemic among humans in all or some parts of your country? You may choose more than one

3.1 *Leishmania infantum* (human and canine visceral and cutaneous leishmaniosis)
- Yes
- No
- I don’t know

3.2 *Leishmania major* (human cutaneous leishmaniosis)
- Yes
- No
- I don’t know

3.3 *Leishmania tropica* (human cutaneous leishmaniosis)
- Yes
- No
- I don’t know

3.4 *Leishmania donovani* (human visceral and cutaneous leishmaniosis)
- Yes
- No
- I don’t know

4. Is human leishmaniasis a mandatory notifiable disease in your country? A notifiable disease is required by law to be reported to government authorities.

* 4.1 Visceral
- Yes, in the entire country
- Yes, in some regions only
- No
- I don’t know

Please specify which region(s)

* 4.2 Cutaneous
- Yes, in the entire country

Note added after the completion of the questionnaire survey: by mistake the authors included mucocutaneous instead of mucosal leishmaniosis. The specific answers to mucocutaneous were therefore not included in the results presented in the manuscript “Surveillance, prevention and control of leishmaniases in the European Union and its neighborhood.”
4.3 Mucocutaneous

- Yes, in the entire country
- Yes, in some regions only
- No
- I don’t know

Please specify which region(s)

5. Is SURVEILLANCE of human leishmaniasis implemented in your country?

Surveillance refers to the systematic and continuous collection, management, analysis, interpretation and reporting of infection/disease data to drive health actions.

- Yes
- No
- I don’t know

Selecting "No" or "I don’t know" skips questions from 6 to 10

What type of SURVEILLANCE system of human leishmaniasis is implemented in your country?

- Comprehensive: All healthcare providers of at least one level of care are reporting their cases, e.g. all hospitals report cases
- Sentinel: Only a subset of healthcare providers report cases
- I don’t know

6. What are the SURVEILLANCE data providers for human leishmaniasis in your country? You may choose more than one.

- Hospitals
- Local health care centers
- Private physicians
- Laboratories of the Public Health authority or accredited by the Public Health authority
- Laboratories from specialised, private companies not accredited by the Public Health authority
- Other
- I don’t know

Please specify:

* Note added after the completion of the questionnaire survey: by mistake the authors included mucocutaneous instead of mucosal leishmaniosis. The specific answers to mucocutaneous were therefore not included in the results presented in the manuscript "Leishmaniases in the European Union and its neighbourhood: Neglected zoonotic diseases with increasing public health risk"
7. What type of SURVEILLANCE data from human leishmaniasis cases is reported in your country? You may choose more than one. Please note that the question also applies to non-endemic countries in the event that a case was diagnosed.

- Clinical
- Epidemiological
- Laboratorial
- Other
- I don't know

Please specify:

8. In addition to surveillance of clinical leishmaniasis, is SURVEILLANCE OF ASYMPTOMATIC (subclinical) infections implemented in your country?

- Yes
- No
- I don't know

Selecting "No" or "I don't know" skips question 9

9. What is the target human population on which SURVEILLANCE of ASYMPTOMATIC leishmaniasis is done? You may select more than one.

- Blood donors
- Organ donors
- Other target risk groups: e.g. HIV+ patients, intravenous drug users, etc.
- Samples of patients admitted to hospital for reasons other than leishmaniosis
- People coming from endemic zones (travellers, migrants)
- Other
- I don't know

Please specify:

10. What are the diagnostic techniques used for SURVEILLANCE of human leishmaniasis infection (clinical and subclinical) in your country? You may select more than one.

- Serology (antibody detection) by IFAT (indirect immunofluorescence test)
- Serology by rapid immunochromatography (e.g. rK39 test)
- Serology by ELISA (Enzyme-linked immunosorbent assay)
- Serology by DAT (direct agglutination test)
PCR (Polymerase chain reaction) of blood samples
- PCR of skin/tissue samples
- Microscopy of biological samples with or without prior culture
- Other
- I don't know

Please specify:

E - PREVENTION AND CONTROL OF HUMAN LEISHMANIASIS

11. Following surveillance results, is there a PREVENTION AND CONTROL programme implemented in your country by national health authorities against visceral and cutaneous leishmaniasis?

Prevention and control actions include for example: treatment of animal and human cases, use of insecticides and mechanical barriers against sand fly vectors by people or in the environment, canine vaccination, culling of animal reservoirs, testing people and animals coming from endemic areas (travellers and migrants).

- Yes
- No
- I don't know

Selecting "No" or "I don't know" skips questions 12 and 13

Which of the following prevention and control actions are taken? You may select more than one.

11.1. For L. infantum (human and canine visceral leishmaniasis).

| Action                                                                 | Yes | No | I don’t know |
|-----------------------------------------------------------------------|-----|----|--------------|
| Treatment of infected people                                          |     |    |              |
| Treatment of infected dogs                                            |     |    |              |
| Vaccination of dogs                                                   |     |    |              |
| Insecticide use in dogs                                               |     |    |              |
| Collect and test stray/abandoned dogs                                  |     |    |              |
| Collect and test wildlife (foxes, rabbits, etc.)                      |     |    |              |
| Euthanasia of dogs and other infected animals                          |     |    |              |
| Testing people and animals coming from endemic areas (travellers and migrants) |     |    |              |
| Other                                                                 |     |    |              |
### 11.2 For *L. major* (cutaneous leishmaniasis in humans).

| Treatment of cases | Yes | No | I don't know |
|--------------------|-----|----|--------------|
| Leishmanisation: intradermal inoculation of live Leishmania to produce a self-healing lesion and stimulate immunity against reinfection | ❌ | ❌ | ☑ |
| Insecticide application in the peridomestic environment | ❌ | ❌ | ☑ |
| Mechanical barriers for vectors in the peridomestic environment | ❌ | ❌ | ☑ |
| Insecticide application in the intradomestic environment | ❌ | ❌ | ☑ |
| Use of insecticide impregnated bed nets | ❌ | ❌ | ☑ |
| Use of insecticide impregnated bed linen | ❌ | ❌ | ☑ |
| Destruction of animal reservoir habitat (e.g. rodent burrows) | ❌ | ❌ | ☑ |
| Testing people and animals coming from endemic areas (travellers and migrants) | ❌ | ❌ | ☑ |
| Other | ❌ | ❌ | ☑ |

### 11.3 For *L. tropica* (cutaneous leishmaniasis in humans).

| Treatment of cases | Yes | No | I don't know |
|--------------------|-----|----|--------------|
| Leishmanisation: intradermal inoculation of live Leishmania to produce a self-healing lesion and stimulate immunity against reinfection | ❌ | ❌ | ☑ |
| Insecticide application in the peridomestic environment | ❌ | ❌ | ☑ |
| Mechanical barriers for vectors in the peridomestic environment | ❌ | ❌ | ☑ |
| Insecticide application in the intradomestic environment | ❌ | ❌ | ☑ |
| Use of insecticide impregnated bed nets | ❌ | ❌ | ☑ |
| Use of insecticide impregnated bed linen | ❌ | ❌ | ☑ |
### 11.4 For *L. donovani* (visceral and cutaneous leishmaniasis in humans).

| Action                                                                 | Yes | No | I don't know |
|------------------------------------------------------------------------|-----|----|--------------|
| Destruction of animal reservoir habitat (e.g. rodent burrows)         |     |    |              |
| Testing people and animals coming from endemic areas (travellers and migrants) |     |    |              |
| Other                                                                  |     |    |              |
| **Treatment of cases**                                                 |     |    |              |
| Leishmanisation: intradermal inoculation of live Leishmania to produce a self-healing lesion and stimulate immunity against reinfection |     |    |              |
| Insecticide application in the peridomiciliary environment            |     |    |              |
| Mechanical barriers for vectors in the peridomiciliary environment    |     |    |              |
| Insecticide application in the intradomiciliary environment           |     |    |              |
| Use of insecticide impregnated bed nets                               |     |    |              |
| Use of insecticide impregnated bed linen                              |     |    |              |
| Destruction of animal reservoir habitat (e.g. rodent burrows)         |     |    |              |
| Testing people and animals coming from endemic areas (travellers and migrants) |     |    |              |
| Other                                                                  |     |    |              |

Please specify:

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12. Do you have national **PREVENTION AND CONTROL official guidelines** for human leishmaniasis?

- [ ] Yes
- [ ] No
- [ ] I don't know

Please provide the link where to find these guidelines:
13. Are you aware of intersectorial (“One Health”) collaboration between animal, human and environmental sectors to PREVENT AND CONTROL leishmaniasis in your country?

- Yes
- No
- I don't know

Please describe:

14. What are the challenges for the PREVENTION AND CONTROL of leishmaniasis in humans in your country? Please rate from 0 (not important) to 3 (very important).

| Challenge                                                                 | 0 | 1 | 2 | 3 | I don't know |
|----------------------------------------------------------------------------|---|---|---|---|--------------|
| Lack of legislation from responsible authorities                           |   |   |   |   |              |
| Lack of political willingness/awareness                                    |   |   |   |   |              |
| Financial constraints                                                     |   |   |   |   |              |
| Collaborative constraints (between stakeholders)                          |   |   |   |   |              |
| Operational capacity constraints (knowledge, people, equipment)           |   |   |   |   |              |
| National/EU regulation against culling infected/sick dogs/animals         |   |   |   |   |              |
| Limited availability of diagnostic techniques                             |   |   |   |   |              |
| High cost of diagnosis                                                    |   |   |   |   |              |
| Limited availability of treatments                                         |   |   |   |   |              |
| High cost of treatment                                                    |   |   |   |   |              |
| Limited availability of vaccines                                          |   |   |   |   |              |
| Limited availability of rodenticides                                      |   |   |   |   |              |
| No regulatory basis for rodenticide use                                   |   |   |   |   |              |
| Limited availability of insecticides                                      |   |   |   |   |              |
| No regulatory basis for insecticide use                                   |   |   |   |   |              |
| Environmental interventions to destroy the habitat of reservoirs           |   |   |   |   |              |
| Other                                                                      |   |   |   |   |              |

Please specify:
F - DIAGNOSIS AND TREATMENT OF HUMAN LEISHMANIASIS

15. Are there any **official guidelines** in your country for human leishmaniasis **DIAGNOSIS**?
   - [ ] Yes
   - [ ] No
   - [ ] I don't know

Please provide the link where to find these guidelines:

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16. Which of the following **LABORATORY TECHNIQUES** are employed in your country for human leishmaniasis **DIAGNOSIS** by governmental or private laboratories?

*Please note that this does not necessarily imply that human leishmaniosis surveillance is being carried out in your country.*

| Laboratory Technique                                                                 | Yes | No | I don't know |
|--------------------------------------------------------------------------------------|-----|----|--------------|
| Serology (antibody detection) by IFAT (indirect immunofluorescence antibody test)    |     |    |              |
| Serology by ELISA (enzyme-linked immunosorbent assay)                                |     |    |              |
| Serology by DAT (direct agglutination test)                                          |     |    |              |
| Serology by rapid immunochromatography (e.g. rk39 test)                              |     |    |              |
| PCR (Polymerase chain reaction) in blood samples                                     |     |    |              |
| PCR in skin/tissue samples                                                           |     |    |              |
| Microscopy of biological samples with or without prior culture                      |     |    |              |
| Other                                                                                |     |    |              |

Please specify:

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17. Are there any **national guidelines** in your country for human leishmaniasis **TREATMENT**?
   - [ ] Yes
   - [ ] No
I don't know

Please provide the link where to find these guidelines:

18. What are the DRUGS (medicines) used for human leishmaniasis treatment in your country?

|                                | Yes | No | I don't know |
|--------------------------------|-----|----|--------------|
| Liposomal amphotericin B       |     |    |              |
| Amphotericin B deoxicholate    |     |    |              |
| Sodium stibogluconate (E.g. Pentostam®) |     |    |              |
| Meglumine antimoniate (E.g. Glucantime®) |     |    |              |
| Miltefosine                    |     |    |              |
| Other                          |     |    |              |

Please specify

G - DRIVERS OF EMERGENCE OF HUMAN LEISHMANIASIS

Emergence refers to the establishment of infection/disease in a previously free area or to an increase in incidence of infection/disease in an endemic area. Disease emergence is also considered when the rise in incidence occurs as a result of improved and wider diagnosis.

19. Is cutaneous and/or visceral leishmaniasis emerging in your country?
   - Yes, in all the country
   - Yes, in some regions
   - No
   - I don't know

Please specify which region(s)

Selecting "No" or "I don't know" skips question 20
20. WHICH of the following DRIVERS do you think that are important in your country? Please rate from 0 (not important) to 3 (very important) for the *Leishmania* species endemic in your country.

### 20.1 *L. infantum* (human and canine visceral and cutaneous leishmaniasis)

|                                                                 | 0 | 1 | 2 | 3 |
|-----------------------------------------------------------------|---|---|---|---|
| Infected people and animals coming from endemic areas (travellers and migrants) |   |   |   |   |
| Sand fly vector expansion into previously-free areas as a result of climate change |   |   |   |   |
| Environmental changes other than climate change, with an impact in vectors and reservoir hosts (e. g. urbanization, agricultural projects) |   |   |   |   |
| Insufficient/lack of surveillance at regional/country level     |   |   |   |   |
| Insufficient/lack of prevention and control at regional/country level |   |   |   |   |
| Other                                                           |   |   |   |   |

Please comment:

### 20.2 *L. major* (human cutaneous leishmaniasis)

|                                                                 | 0 | 1 | 2 | 3 |
|-----------------------------------------------------------------|---|---|---|---|
| Infected people and animals coming from endemic areas (travellers and migrants) |   |   |   |   |
| Sand fly vector expansion into previously-free areas as a result of climate change |   |   |   |   |
| Human-made environmental changes with an impact in vectors and reservoir hosts (e. g. urbanization, agricultural projects) |   |   |   |   |
| Insufficient/lack of surveillance at regional/country level     |   |   |   |   |
| Insufficient/lack of prevention and control at regional/country level |   |   |   |   |
| Other                                                           |   |   |   |   |

Please comment:

### 20.3 *L. tropica* (human cutaneous leishmaniasis)

|                                                                 | 0 | 1 | 2 | 3 |
|-----------------------------------------------------------------|---|---|---|---|
| Infected people and animals coming from endemic areas (travellers and migrants) |   |   |   |   |
|                                    | 0 | 1 | 2 | 3 |
|------------------------------------|---|---|---|---|
| Sand fly vector expansion into previously-free areas as a result of climate change |   |   |   |   |
| Human-made environmental changes with an impact in vectors and reservoir hosts (e.g., urbanization, agricultural projects) |   |   |   |   |
| Insufficient/lack of surveillance at regional/country level |   |   |   |   |
| Insufficient/lack of prevention and control at regional/country level |   |   |   |   |
| Other                              |   |   |   |   |

Please comment:

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### 20.4 *L. donovani* (human visceral and cutaneous leishmaniasis)

|                                    | 0 | 1 | 2 | 3 |
|------------------------------------|---|---|---|---|
| Infected people and animals coming from endemic areas (travellers and migrants) |   |   |   |   |
| Sand fly vector expansion into previously-free areas as a result of climate change |   |   |   |   |
| Human-made environmental changes with an impact in vectors and reservoir hosts (e.g., urbanization, agricultural projects) |   |   |   |   |
| Insufficient/lack of surveillance at regional/country level |   |   |   |   |
| Insufficient/lack of prevention and control at regional/country level |   |   |   |   |
| Other                              |   |   |   |   |

Please comment:

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### H - CONCLUDING REMARKS

Please provide any additional information you consider relevant: