SURVEILLANCE REPORT

Annual Epidemiological Report for 2022

Trichinellosis

Key facts

- In 2022, 28 European Union/European Economic Area (EU/EEA) countries reported 39 cases of trichinellosis, which represented a 49% decrease compared with 2021.
- The EU/EEA notification rate was 0.01 cases per 100 000 population.
- Latvia and Bulgaria reported the highest notification rates in the EU/EEA at 0.16 and 0.13 cases per 100 000 population, respectively.
- Consumption of undercooked meat from pigs raised under non-controlled (non-confined/free-range) housing conditions or hunted wild boar constitutes the highest risk for acquiring trichinellosis in the EU/EEA.

Introduction

Trichinellosis (trichinosis) is a disease caused by zoonotic nematodes (roundworms) of the genus *Trichinella*, which are present worldwide. A wide range of animals act as reservoirs of human infection, but the most common are pigs, horses and wild game such as wild boars. Infected animals harbour larvae encysted in the muscle tissue. In Europe, several *Trichinella* species are known to occur, including *T. spiralis*, *T. nativa*, *T. britovi* and *T. pseudospiralis*. Consumption of infected raw or undercooked meat or meat products can lead to human infection and disease. The severity of disease is related to the number of viable larvae consumed. Symptoms can range from none or mild to very severe or even fatal. The initial symptoms of trichinellosis often include nausea, diarrhoea, vomiting, fatigue, fever and abdominal discomfort. Headaches, chills, cough, swelling of the face and eyes, aching joints and muscle pain, itchy skin, or constipation may follow. Trichinellosis can be treated with suitable anti-parasitic drugs. Disease prevention is based on accurate meat inspection of all slaughtered pigs and horses, which is mandatory in the EU, in addition to thorough cooking of meat to adequate temperatures prior to consumption.

Methods

This report is based on data for 2022 retrieved from The European Surveillance System (TESSy) on 1 February 2024. TESSy is a system for the collection, analysis and dissemination of data on communicable diseases.

For a detailed description of the methods used to produce this report, please refer to the Methods chapter of the 'ECDC Annual Epidemiological Report' [1]. An overview of the national surveillance systems is available online [2].

A subset of the data used for this report is available through ECDC's online 'Surveillance Atlas of Infectious Diseases' [3].

Suggested citation: European Centre for Disease Prevention and Control. Trichinellosis. In: ECDC. Annual epidemiological report for 2022. Stockholm: ECDC; 2024.

Stockholm, May 2024

Twenty-eight EU/EEA countries reported trichinellosis data for 2022. Sixteen countries reported data according to the current EU case definition for trichinellosis published in 2018, two countries used the 2012 case definition and six countries used the 2008 case definition. The only difference between the 2018 definition and the 2012 and 2008 definitions is that the former considers laboratory confirmation as sufficient for a confirmed case when information on clinical symptoms is missing. Four countries (France, Germany, Italy and Liechtenstein) used another unspecified case definition.

Twenty-six countries had a mandatory notification system, while France and Belgium used a voluntary system. All countries had comprehensive surveillance of trichinellosis. All countries reported case-based data except Belgium, Bulgaria and the Netherlands, which reported aggregated data.

Denmark did not report data, as it has no surveillance system for trichinellosis. For 2020 and 2021, Spain did not receive data from all of its regions, so case numbers are lower than expected and notification rates were not calculated. Belgium did not report data in 2019 and 2020, and Liechtenstein did not report data from 2017 to 2019. The reasons for this are unknown. Twenty-two countries have surveillance systems that integrate laboratory and epidemiological data from physicians or hospitals.

In addition to TESSy reporting, information from event-based surveillance for trichinellosis clusters or outbreaks with a potential EU dimension was collected through EpiPulse, the European surveillance portal for infectious diseases.

Epidemiology

For 2022, 28 countries reported 39 cases of trichinellosis (Table 1, Figure 1). The EU/EEA notification rate was 0.01 cases per 100 000 population. Latvia reported the highest notification rate in the EU/EEA at 0.16 cases per 100 000 population. Bulgaria reported the second highest notification rate at 0.13 cases per 100 000 population. France reported the highest number of cases, accounting for 38% of all cases reported.

Most countries (20/28 countries) reported zero cases, including four countries (Cyprus, Finland, Luxembourg and Malta) that have never reported any trichinellosis cases since the beginning of EU-level surveillance in 2007.

Twenty-six (67%) cases were reported with known travel status, of which 25 cases (96%) were reported as domestically acquired. One travel-associated trichinellosis case that had travel history to Serbia was reported. Among 11 cases (28%) with known hospitalisation, seven were hospitalised. No deaths were reported.

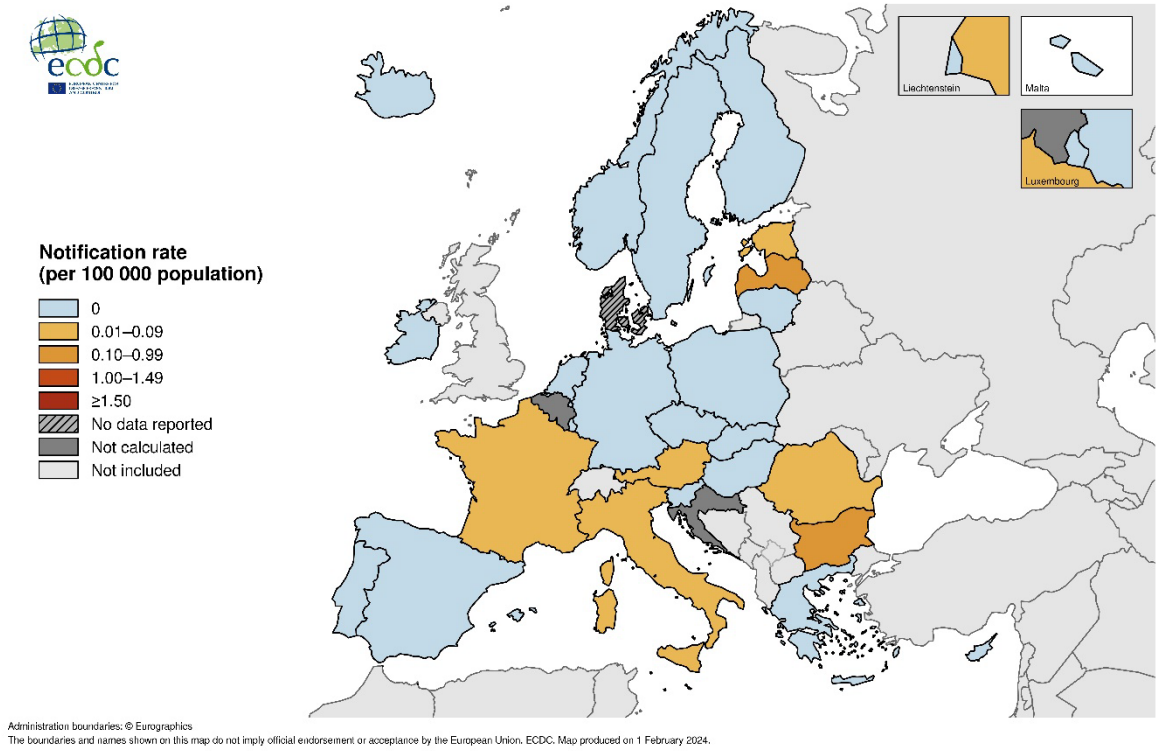
Among 22 cases (56%) with known species information reported from three countries (France, Latvia and Romania), most (19/22; 86%) were reported to be infected with *T. spiralis*. Three cases were reported with *T. britovi* infection. Nineteen cases were food related: sixteen of which consumed wild boar meat and three of which consumed pig meat.

Table 1. Confirmed trichinellosis cases and rates per 100 000 population by country and year, EU/EEA, 2018–2022

Country	2018		2019		2020		2021		2022	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
Austria	2	0.02	1	0.01	6	0.07	10	0.11	2	0.02
Belgium	0	NRC	NDR	NRC	NDR	NRC	0	NRC	0	NRC
Bulgaria	45	0.64	55	0.79	13	0.19	29	0.42	9	0.13
Croatia	0	0.00	3	0.07	0	0.00	17	0.42	NDR	NRC
Cyprus	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Czechia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Denmark	NDR	NRC	NDR	NRC	NDR	NRC	NDR	NRC	NDR	NRC
Estonia	0	0.00	0	0.00	0	0.00	0	0.00	1	0.08
Finland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
France	0	0.00	2	0.00	1	0.00	2	0.00	15	0.02
Germany	0	0.00	3	0.00	1	0.00	2	0.00	0	0.00
Greece	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Hungary	2	0.02	0	0.00	0	0.00	0	0.00	0	0.00
Iceland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Ireland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Italy	2	0.00	10	0.02	79	0.13	0	0.00	4	0.01
Latvia	1	0.05	1	0.05	1	0.05	7	0.37	3	0.16
Liechtenstein	NDR	NRC	NDR	NRC	NDR	NRC	0	0.00	0	0.00
Lithuania	0	0.00	0	0.00	0	0.00	1	0.04	0	0.00
Luxembourg	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Malta	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Netherlands	0	0.00	1	0.01	0	0.00	0	0.00	0	0.00
Norway	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Poland	2	0.01	2	0.01	11	0.03	2	0.01	1	0.00
Portugal	0	0.00	1	0.01	0	0.00	0	0.00	0	0.00
Romania	10	0.05	6	0.03	4	0.02	6	0.03	4	0.02
Slovakia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Slovenia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Spain	2	0.00	12	0.03	1	NRC	1	NRC	0	0.00
Sweden	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
EU/EEA (30 countries)	**66**	**0.02**	**97**	**0.02**	**117**	**0.03**	**77**	**0.02**	**39**	**0.01**
United Kingdom	0	0.00	0	0.00	NA	NA	NA	NA	NA	NA
EU/EEA (31 countries)	**66**	**0.01**	**97**	**0.02**	**117**	**0.03**	**NA**	**NA**	**NA**	**NA**

Source: Country reports.
NA: not applicable; NDR: no data reported; NRC: no rate calculated.
No data from 2020 onwards were reported by the United Kingdom, due to its withdrawal from the EU on 31 January 2020.

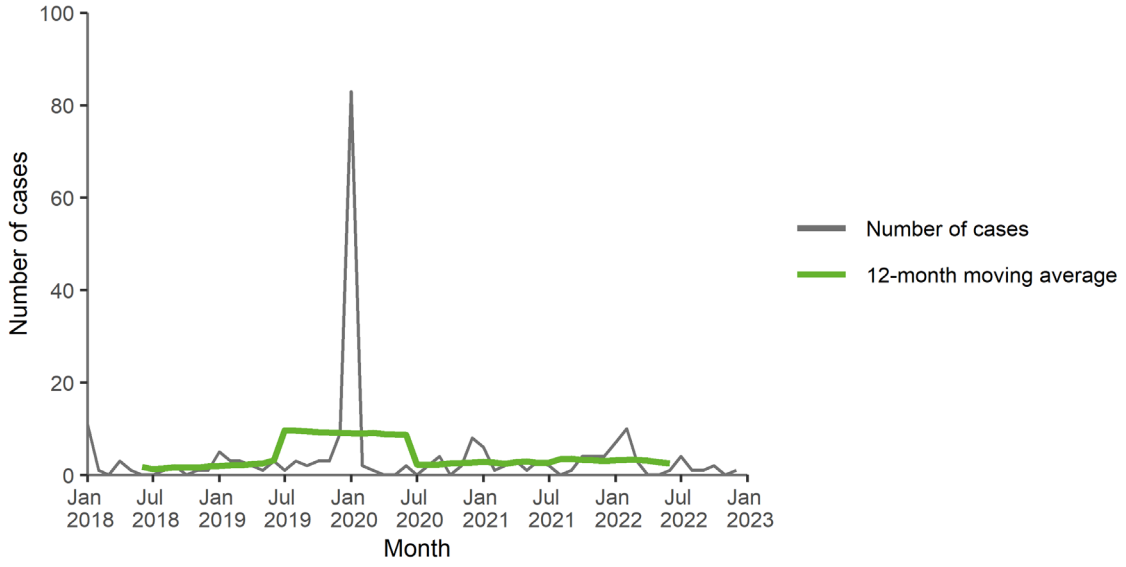
Figure 1. Number of confirmed trichinellosis cases per 100 000 population by country, EU/EEA, 2022



Source: Country reports.

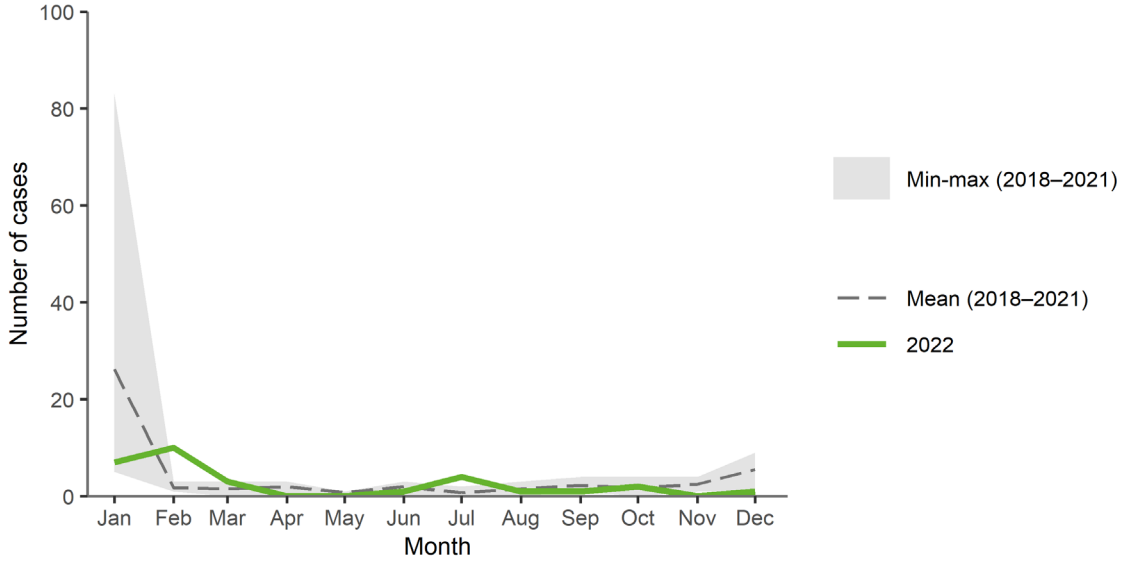
Trichinellosis in the EU/EEA follows a seasonal pattern, with case numbers typically peaking in January and February (Figures 2 and 3). The EU trend of trichinellosis did not show evidence of a significant increase or decrease between 2017 and 2021 (Figure 3). During this same period, only Italy showed a decreasing trend and no country showed an increasing trend. Bulgaria was not included in the EU trend analyses, as monthly data were not available.

Figure 2. Confirmed trichinellosis cases by month, EU/EEA, 2018–2022



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

Figure 3. Confirmed trichinellosis cases by month, EU/EEA, 2022 and 2018–2021

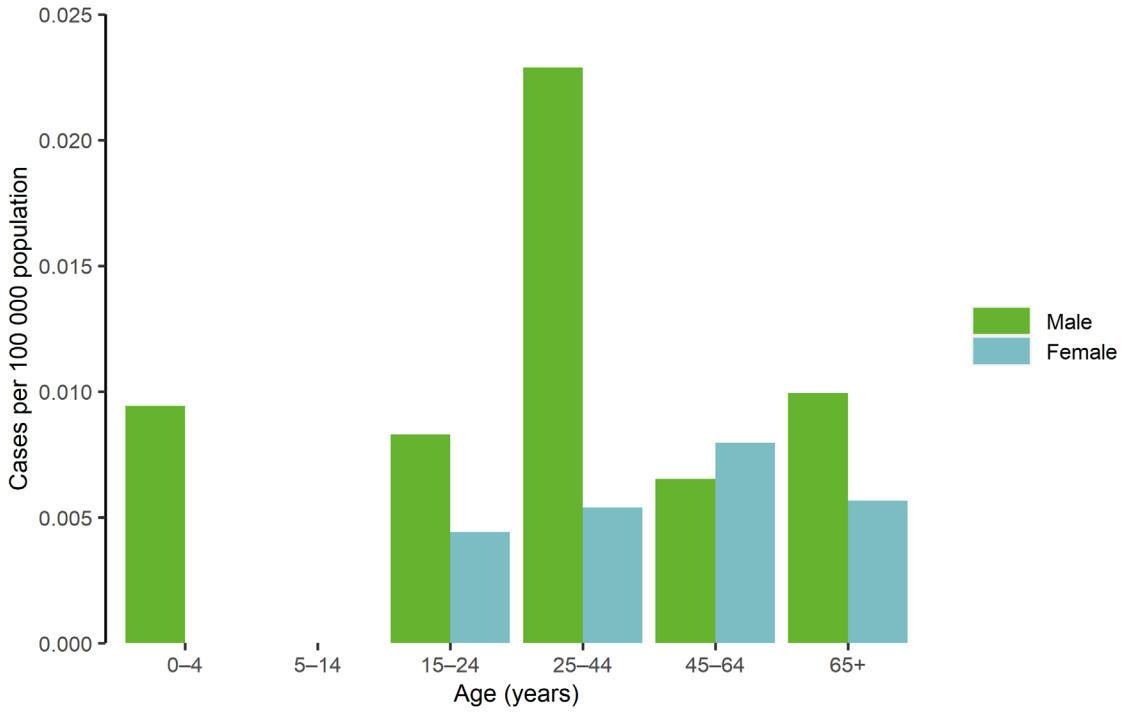


Source: Country reports from Austria, Cyprus, Czechia, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

Age and gender

In 2021, 26 cases were male and 13 were female, with an overall male-to-female ratio of 1.6:1 (Figure 4). Stratified by age and gender, the highest notification rate in 2022 was in males in the age group 25–44 years, at 0.023 cases per 100 000 population. Male cases dominated almost all age groups, except the 45–64 years age group, where more females were reported. France was the only country to report cases in the age group 0–4 years, of which all cases were male.

Figure 4. Confirmed trichinellosis cases per 100 000 population, by age and gender, EU/EEA, 2022



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

Outbreaks and other threats

No national or multi-county trichinellosis outbreaks were reported through EpiPulse in 2022.

Discussion

The EU/EEA trichinellosis notification rate and number of reported cases decreased in 2022 compared with 2021. This may reflect better awareness of infection, increased control measures at slaughterhouses and improvements in pig-rearing practices. Twenty countries reported zero cases in 2022, including four countries (Cyprus, Finland, Luxembourg and Malta) that have never reported any trichinellosis cases since the beginning of EU-level surveillance in 2007. In 2022, Latvia and Bulgaria reported the highest notification rates in the EU/EEA, while France and Bulgaria accounted for the majority (24/39; 62%) of all cases in the region. This shows that while trichinellosis is a rare disease in many countries, outbreaks may still occur. Indeed, in 2022, four strong-evidence food-borne outbreaks caused by *Trichinella* – comprising 40 human cases and eight hospitalisations – were reported to EFSA [4]. Therefore, these nematodes continue to pose a public health threat in the EU/EEA.

In the five years between 2018 and 2022, the EU/EEA (excluding the United Kingdom) notification rate for trichinellosis was reported at or below 0.03 cases per 100 000 population. The highest notification rate (0.03) was reported in 2020 and the lowest rate (0.01) was reported in 2022. While *Trichinella* infections can be sporadic, they are often linked to food-borne outbreaks, such as in settings where multiple people consume the same *Trichinella*-infected meat. Consequently, the EU/EEA trend for trichinellosis has been affected by the number and size of food-borne outbreaks, with peaks frequently observed in January and February. This may reflect the consumption of various pork products during the Christmas period and the wild boar hunting season [4].

In animal husbandry, 'controlled housing conditions' means that the producer controls the animals' feeding and housing conditions. EFSA has identified that raising domestic pigs without controlled housing conditions is an important risk factor for *Trichinella* infections in humans [5,6]. Pigs at risk of *Trichinella* infection include backyard or free-range pigs, which are usually slaughtered at home, and where veterinary control or recording can be easily overlooked [4]. While sporadic animal infections are reported throughout the EU, *Trichinella*-infected pigs are typically clustered in five countries (Bulgaria, Croatia, Poland, Romania and Spain) [9]. In 2022, these countries reported detection of *Trichinella* species in pigs, all of which were not raised under controlled housing conditions [4]. These findings are consistent with the distribution of human cases in EU/EEA countries.

In 2015, the European Commission implemented Regulation (EU) 2015/1375 laying down specific rules on official controls for *Trichinella* in meat, with the aim to reduce trichinellosis cases in Europe [7]. The regulation covers all *Trichinella*-susceptible animals intended for human consumption in the EU: domestic pigs (both fattening and breeding animals), farmed wild boar, and solipeds (e.g. horses). Carcasses should be tested for the presence of *Trichinella* larvae in the muscles if they have not undergone freezing treatment (freezing inactivates the parasite). Subsequently, this regulation was amended to allow producers to only perform tests on some pigs, on the condition that they are reared on farms that use controlled housing conditions [8]. Domestic pigs, farmed and hunted wild boar, and other wild animals (e.g. bears) that are not processed to be placed on the EU market (e.g. those intended for private consumption) are exempted from the Commission Implementing Regulation (EU) 2015/1375 and their control falls under national legislation.

Trichinella is also commonly detected in wildlife [4] and cases related to hunting may account for the higher notification rates observed among adult males. Investigations into domestic pig *Trichinella* infections identified direct (free-range pigs) and indirect (e.g. through farmers who hunted) contacts with wild animals, which are reservoirs of these zoonotic nematodes, as sources of domestic pig infections [9]. Hunted wild boar are an important source of *Trichinella* infections in humans, as evidenced by previous food-borne outbreaks [10]. Human behaviour can strongly influence the wildlife (sylvatic) transmission cycles, both favouring and reducing the transmission of *Trichinella* species [4]. Carcasses of *Trichinella*-infected animals that hunters leave in the wild after skinning and removing the entrails, or that remain after road accidents, represent an important source of infection readily available to the wild cycle [4].

Public health implications

Products derived from pig and wild boar meat remain the most important source of human trichinellosis in the EU/EEA. Trichinellosis prevention is based on accurate meat inspection of all slaughtered pigs and horses, which is mandatory in the EU, with some derogations. Thoroughly cooking meat to adequate temperatures is recommended to prevent trichinellosis. Consuming undercooked meat from pigs, especially those not raised under controlled housing conditions or hunted wild boar that have not been tested for *Trichinella,* constitutes a risk factor for trichinellosis [4]. It is important that relevant prevention information reaches consumers of such products.

References

1. European Centre for Disease Prevention and Control (ECDC). Introduction to the Annual Epidemiological Report. In: ECDC. Annual epidemiological report. Stockholm: ECDC Available at: https://www.ecdc.europa.eu/en/surveillance-and-disease-data/annual-epidemiological-reports/introduction-annual
2. European Centre for Disease Prevention and Control (ECDC). Surveillance systems overview [downloadable spreadsheet]. Stockholm: ECDC. Available at: https://www.ecdc.europa.eu/en/publications-data/surveillance-systems-overview-2022
3. European Centre for Disease Prevention and Control (ECDC). Surveillance Atlas of Infectious Diseases. Stockholm: ECDC. Available at: https://atlas.ecdc.europa.eu/public/index.aspx?Dataset=27&HealthTopic=53
4. European Food Safety Authority (EFSA) and European Centre for Disease Prevention and Control (ECDC). The European Union 2022 One health Zoonoses report. EFSA Journal 2023. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/EFS2_8442.pdf
5. EFSA BIOHAZ Panel (EFSA Panel on Biological Hazards), EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain) and EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare). Scientific opinion on the public health hazards to be covered by inspection of meat (swine). EFSA Journal. 2011;9(10):2351. Available at: https://doi.org/10.2903/j.efsa.2011.2351
6. European Food Safety Authority (EFSA) and European Centre for Disease Prevention and Control (ECDC). The European Union summary report on trends and sources of zoonoses, zoonotic agents and foodborne outbreaks in 2009. EFSA Journal. 2011;9(3):2090. Available at: https://doi.org/10.2903/j.efsa.2011.2090
7. European Commission (EC). Commission Implementing Regulation EC No 2075/2005 of 5 December 2005 Laying Down Specific Rules on Official Controls for Trichinella in Meat. Brussels: EC; 2005. Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32005R2075
8. European Commission (EC). Commission Implementing Regulation (EU) 2015/1375 of 10 August 2015 Laying Down Specific Rules on Official Controls for Trichinella in Meat. Brussels: EC; 2015. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R1375
9. Pozio E. Searching for *Trichinella*: not all pigs are created equal. Trends Parasitol. 2014;30(1):4–11. Available at: https://doi.org/10.1016/j.pt.2013.11.001
10. European Food Safety Authority (EFSA) and European Centre for Disease Prevention and Control (ECDC). The European Union One Health 2019 Zoonoses Report. EFSA Journal. 2021;19(2):6406. Available at: https://doi.org/10.2903/j.efsa.2021.6406