

SURVEILLANCE REPORT

Annual Epidemiological Report for 2021

Trichinellosis

Key facts

- In 2021, 29 EU/EEA countries reported 79 cases of trichinellosis which represented a 32% decrease compared with 2020.
- In 2021, Bulgaria and Croatia reported the highest notification rate in the EU/EEA at 0.42 cases per 100 000 population and accounted for 58% of all cases reported
- At national level, the highest notification rates of 0.42 cases per 100 000 population were reported by Bulgaria and Croatia.
- 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 *Trichinella* infection in the EU/EEA.

Introduction

Trichinellosis (trichinosis) is a disease caused by zoonotic nematodes (roundworms) of the genus *Trichinella* which occurs 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, fevers, chills, cough, swelling of the face and eyes, aching joints and muscle pain, itchy skin, diarrhoea, 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 2021 retrieved from The European Surveillance System (TESSy) on 9 October 2022. TESSy is hosted at ECDC and is a system for the collection, analysis and dissemination of data on communicable diseases.

For a detailed description of methods used to produce this report, please refer to the *Methods* chapter [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].

Twenty-nine EU/EEA countries reported trichinellosis data for 2021. Thirteen countries reported data according to the current EU case definition for trichinellosis as published in 2018, four countries used the 2012 case definition, and seven 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. Five countries (Belgium, France, Germany, Italy and Liechtenstein) used another case definition.

Twenty-seven countries had a mandatory notification system while France and Belgium used a voluntary system. Twenty-eight countries had comprehensive surveillance of trichinellosis and Belgium had sentinel surveillance.

Denmark has no surveillance system for trichinellosis. For 2020 and 2021, Spain did not receive data from all its regions, so case numbers are lower than expected and notification rates were not calculated. Data were not collected from Belgium in 2019–2020 and Liechtenstein in 2017–2019; the reasons for this are unknown. Data were not collected from the UK in 2020 and 2021, as the country left the EU on 31 January 2020. Twenty-two countries have surveillance systems that integrate laboratory and epidemiological data from physicians or hospitals.

Epidemiology

For 2021, twenty-nine countries reported 79 cases of trichinellosis, eighteen of which reported zero cases (Table 1, Figure 1). The EU/EEA notification rate was 0.02 cases per 100 000 population.

Bulgaria and Croatia reported the highest notification rate in the EU/EEA at 0.42 cases per 100 000 population and accounted for 58% of all cases reported in 2021. The second highest notification rate was reported by Latvia at 0.37 cases per 100 000 population.

Eighteen countries reported zero cases in 2021 including three countries (Cyprus, Luxembourg and Malta) that have never reported any trichinellosis cases since the beginning of EU-level surveillance in 2007. In contrast, Finland reported trichinellosis cases for the first time in 2021.

In 2021, 31 (48%) cases were reported with known travel status of which 29 cases (94%) were reported as domestically acquired. Two travel-associated trichinellosis cases were reported, both by Austria, which had a travel history to Thailand. Among 26 cases (33%) with known hospitalisation, 10 were hospitalised. No deaths were reported.

Among 27 cases (34%) with known species information, all were reported to be infected with *T. spiralis*. Twelve cases were food related, of which six cases consumed pig meat and one case consumed wild boar meat. In one case, transmission was linked to contact with pig meat.

Table 1. Number of confirmed trichinellosis cases 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	3	0.03	2	0.02	1	0.01	6	0.07	10	0.11	0.12
Belgium	0	NR	0	NR	ND	ND	ND	ND	0	NR	NR
Bulgaria	55	0.77	45	0.64	55	0.79	13	0.19	29	0.42	0.45
Croatia	21	0.51	0	0.00	3	0.07	0	0.00	17	0.42	0.45
Cyprus	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Czechia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Denmark	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Estonia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Finland	0	0.00	0	0.00	0	0.00	0	0.00	2	0.04	0.04
France	8	0.01	0	0.00	2	0.00	1	0.00	2	0.00	0.00
Germany	2	0.00	0	0.00	3	0.00	1	0.00	2	0.00	0.00
Greece	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Hungary	0	0.00	2	0.02	0	0.00	0	0.00	0	0.00	0.00
Iceland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Ireland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Italy	4	0.01	2	0.00	10	0.02	79	0.13	0	0.00	0.00
Latvia	1	0.05	1	0.05	1	0.05	1	0.05	7	0.37	0.36
Liechtenstein	ND	ND	ND	ND	ND	ND	ND	ND	0	0.00	0.00
Lithuania	9	0.32	0	0.00	0	0.00	0	0.00	1	0.04	0.03
Luxembourg	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Malta	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Netherlands	0	0.00	0	0.00	1	0.01	0	0.00	0	0.00	0.00
Norway	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Poland	9	0.02	2	0.01	2	0.01	11	0.03	2	0.01	0.01
Portugal	1	0.01	0	0.00	1	0.01	0	0.00	0	0.00	0.00
Romania	48	0.24	10	0.05	6	0.03	4	0.02	6	0.03	0.03
Slovakia	1	0.02	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Slovenia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
Spain	5	0.01	2	0.00	12	0.03	1	NR	1	NR	NR
Sweden	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00
United Kingdom	0	0.00	0	0.00	0	0.00	ND	ND	ND	ND	ND
EU-EEA	168	0.03	66	0.01	97	0.02	117	0.03	79	0.02	0.02

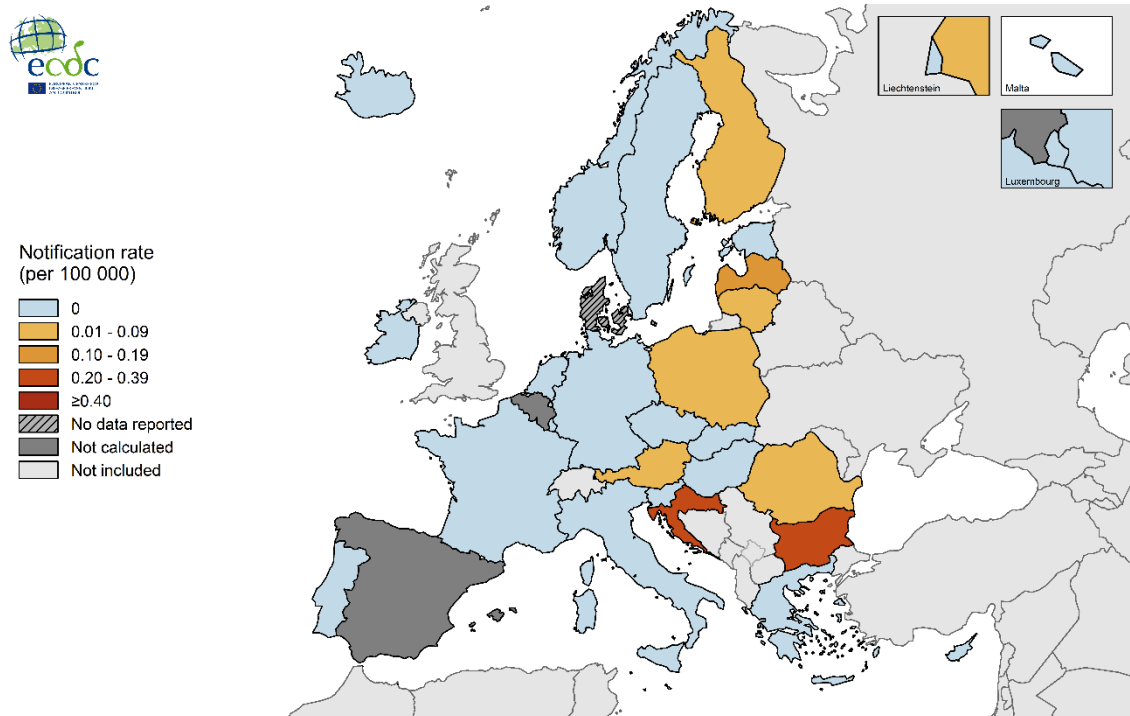
Source: Country reports.

ASR: age-standardised rate.

ND: no data reported.

NR: no rate calculated.

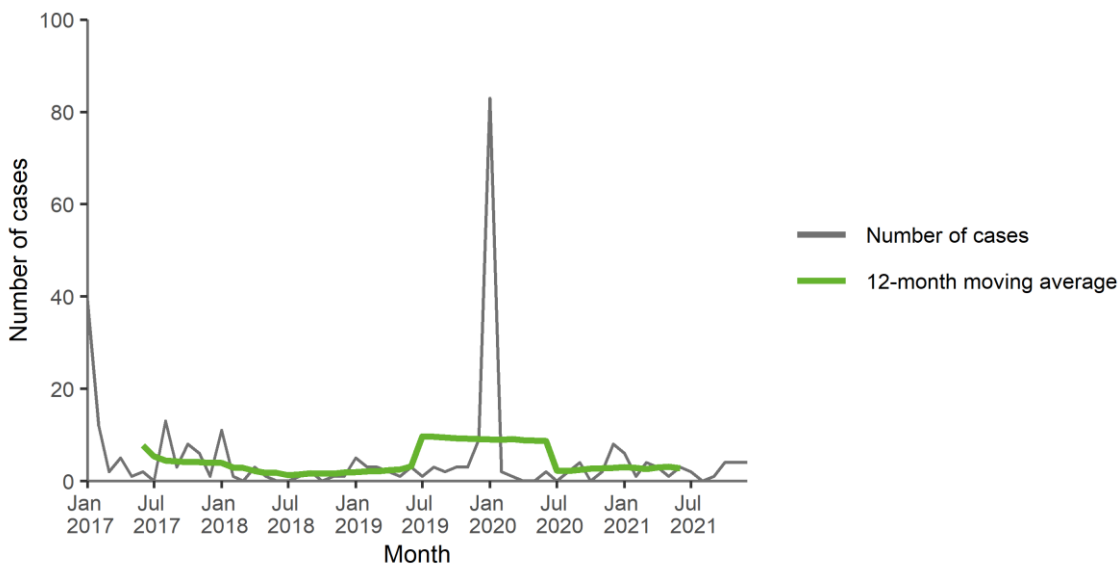
Figure 1. Number of confirmed trichinellosis cases per 100 000 population by country, EU/EEA, 2021



Source: Country reports. Denmark, Belgium, and Spain are excluded due to missing or incomplete data.

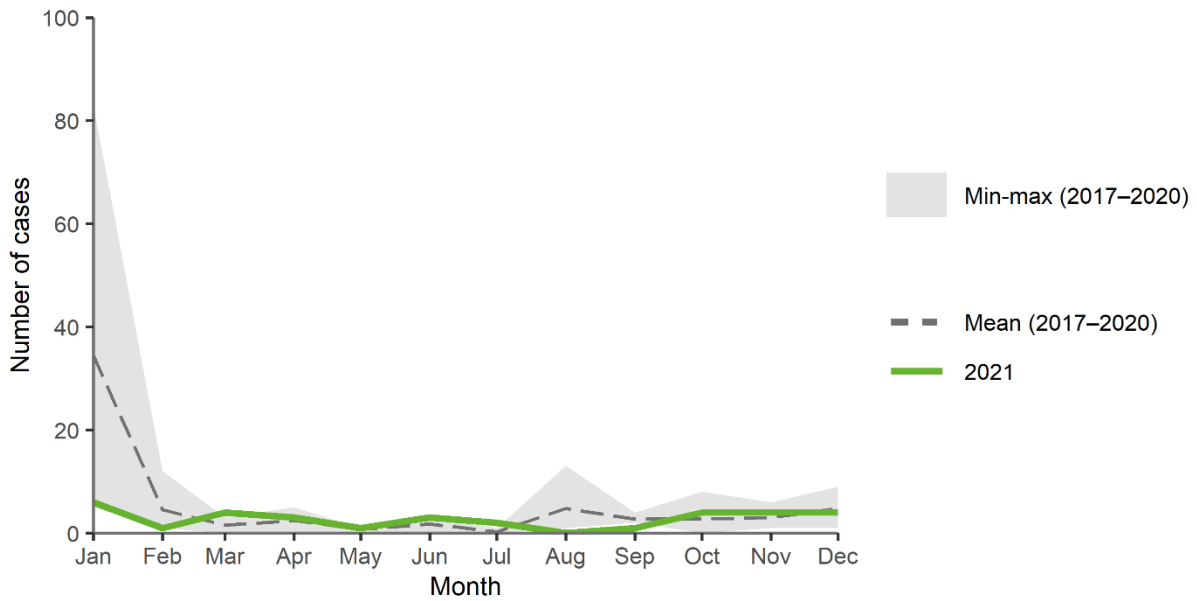
Trichinellosis in the EU/EEA follows a seasonal pattern, with case numbers typically peaking in January and February (Figures 2, 3). The EU trend of trichinellosis did not show evidence of a significant increase or decrease over the period 2017–2021 (Figure 3). During the same period, only Romania showed a decreasing trend and no country showed an increasing trend. Bulgaria, which had reported most cases until 2019 and had the highest notification rate in the EU between 2017–2021, was not included in the EU/EEA monthly trend calculations because monthly data were not available. Croatia, which also reported a large proportion of cases in 2020 was also excluded from the EU/EEA monthly trend calculations because monthly data were not available for all years.

Figure 2. Number of confirmed trichinellosis cases by month, EU/EEA, 2017–2021



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, Sweden. The following countries are excluded due to missing or incomplete data: Belgium, Bulgaria, Croatia, Denmark, Liechtenstein, Netherlands, and Spain.

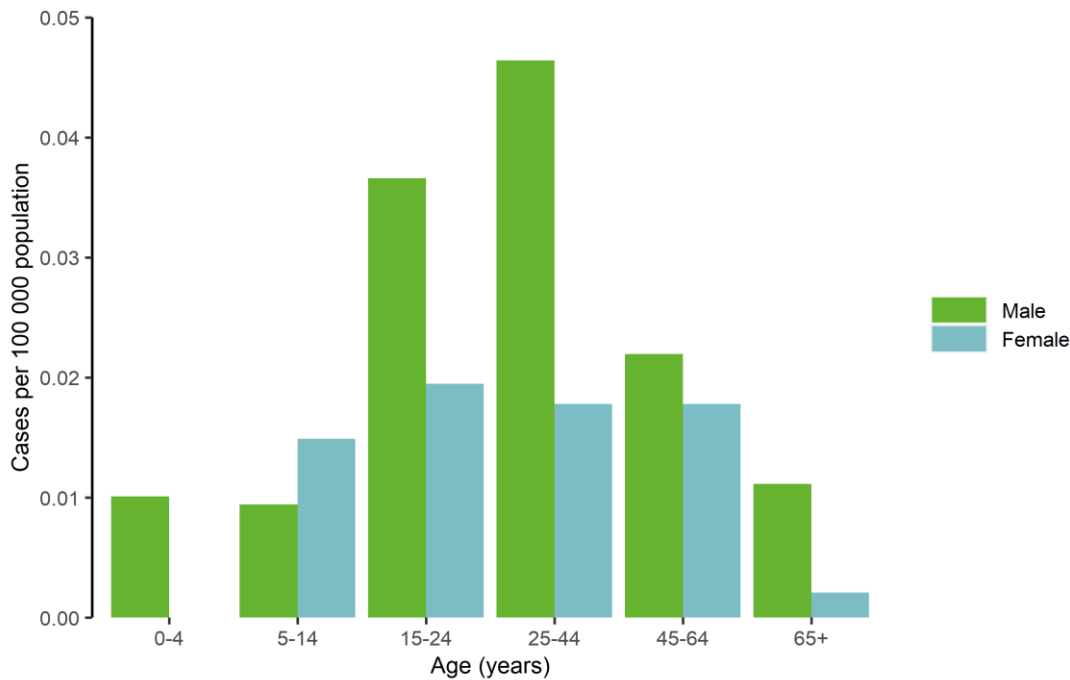
Figure 3. Number of confirmed trichinellosis cases by month, EU/EEA, 2021 and 2017–2020



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, Sweden.

In 2021, 51 cases were male and 28 were female, with an overall male-to-female ratio of 1.8:1 (Figure 4). Bulgaria was the only country to report cases in the age group 0–4 years, of which all cases were male. Male cases dominated in all age groups from 15 years and older, with most cases reported by Bulgaria, and Croatia. Stratified by age and gender, the highest notification rates in 2021 were in males in the age-groups 25-44 years and 15-24 years, at 0.046 and 0.037 cases per 100 000 population, respectively (Figure 4).

Figure 4. Number of confirmed trichinellosis cases per 100 000 population, by age and gender, EU/EEA, 2021



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

Outbreaks and other threats

In the summer of 2021, there was a transition from the Epidemic Intelligence Information System for Food and Waterborne Diseases (FWD-EPIS) to the new EpiPulse system for the reporting of outbreaks/unusual events of food- or waterborne diseases. No national or multicounty trichinellosis outbreaks were reported through EpiPulse in 2021.

Discussion

The EU/EEA trichinellosis notification rate and number of reported cases decreased in 2021 compared to 2020. Of note, the number of cases reported in 2020 was higher than in previous years due to a large outbreak in Italy linked to the consumption of wild boar sausages [5]. Eighteen countries reported zero cases in 2021, including three countries (Cyprus, Luxembourg and Malta) which have never reported any trichinellosis cases since the beginning of EU-level surveillance in 2007. This shows that while trichinellosis is a rare disease in many countries, outbreaks may still occur. Therefore, these nematodes continue to pose a public health threat in the EU/EEA.

In the five years between 2017 and 2021, the EU/EEA 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 2017 and 2020, and the lowest rate (0.01) was reported in 2018 (this was the lowest notification rate ever reported since the beginning of EU-level trichinellosis surveillance in 2007). In 2020 and 2021, there was no apparent impact of the COVID-19 pandemic on the reported trichinellosis case numbers in the EU/EEA. 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 2021, Bulgaria and Croatia both reported the highest notification rate in the EU/EEA, and accounted for more than half (58%) of all reported cases in the region. Neither country reported a trichinellosis foodborne outbreak to the European Food Safety Authority (EFSA) in 2021 (only France reported one weak evidence outbreak) [4]. This may reflect possible under reporting and/or under ascertainment of such food-borne outbreaks in the EU/EEA. Of note, among the seventeen cases reported by Croatia, fourteen (82%) were reported in December, possibly reflecting a foodborne outbreak.

Romania, which had experienced the most *Trichinella* outbreaks in previous years, showed a significant decrease in the five-year trend from 2017 to 2021 [4]. This may reflect better awareness of infection, increased control measures at slaughterhouses and improvements in pig-rearing practices [6].

Controlled housing conditions means a type of animal husbandry where swine are kept under conditions controlled by the producer regarding feeding and housing. EFSA has identified that not raising domestic pigs under controlled housing conditions is an important risk factor for *Trichinella* infections in humans [7, 8]. 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 evaded [4]. In the EU, *Trichinella* infected pigs are primarily clustered in five countries (Bulgaria, Croatia, Poland, Romania and Spain) while sporadic animal infections are reported in other Member States [9]. In 2021, six Member States (Croatia, Finland, France, Poland, Romania and Spain) reported detection of *Trichinella* species in pigs in 2021, all of which were not raised under controlled housing conditions. These findings are consistent with the distribution of human cases in EU/EEA countries. In 2021, Bulgaria did not report data for pigs not raised under controlled housing conditions and reported zero positive out of all tested pigs raised under controlled housing conditions [4].

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 [9]. The regulation covers all *Trichinella* susceptible animals intended for human consumption in the EU, i.e. 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, unless carcasses have undergone a freezing treatment (freezing inactivates the parasite). Subsequently, amendments to this regulation allowed for the possibility of not performing tests on all pigs, on condition that they are reared on farms which meet controlled housing conditions [10]. 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 own consumption) are exempted from 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 [11]. Hunted wild boar are an important source of trichinellosis infections in humans, as evidenced by foodborne outbreaks previously [12].

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 left by hunters in the field after skinning, removing and discarding the entrails, or 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 sources 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. Thorough cooking of 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 which have not been tested for *Trichinella*, is a major risk factor for trichinellosis [4], and it is important that relevant information reaches such consumers.

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