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Bovine tuberculosis surveillance in cattle and free-ranging wildlife in EU Member States in 2013: A survey-based review

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ABSTRACT

Bovine tuberculosis (TB) is a common disease in cattle and wildlife, with animal health, zoonotic and economic impacts. Most of the TB data for the European Union (EU) concern the epidemiological situation, but comprehensive descriptions of the way in which surveillance is conducted in each country are rare, despite being essential for cross-Europe comparisons. A European survey was conducted in the 28 Member States and in three other neighboring countries (Norway, Macedonia and Switzerland), to review TB surveillance in cattle and wildlife. EU legislation currently requires TB surveillance solely in cattle. Considerable differences between the surveillance systems of the 26 responding countries were observed, according to the official TB-freedom status of the country and the local prevalence of TB. These differences related principally to the combination of surveillance components (routine screening test in herd and/or movement testing and/or slaughterhouse surveillance), the tests used and their interpretation, and the definition of an infected herd or animal.

For wildlife TB surveillance, only 8 on 21 respondent countries have declared to have implemented passive and/or active surveillance, with marked differences concerning the species and the geographical scale of the surveillance.

The choice of the combination of surveillance components depends on the national or regional epidemiological situation, the species involved in TB epidemiology and epidemiological risk factors, although various surveillance systems have been recorded for countries with similar epidemiological status. Assessments of the cost-effectiveness of each surveillance system would be useful, to confirm the advantages of implementing one or more components.

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1. Introduction

Bovine tuberculosis (TB) is a chronic disease caused by *Mycobacterium bovis* or, less frequently, by *M. caprae* or *M. tuberculosis*. It affects livestock species, especially cattle, but also companion and wild animals, and it may cause zoonotic disease in humans (Müller et al., 2013). In

developed countries, TB results in major economic losses in the livestock sector, with costs to the cattle industry and government, for surveillance, movement restrictions and slaughter of large numbers of cattle.

The diagnosis of TB infection is based on *ante-mortem* screening tests in herds, tests carried out before or after movement, and *post-mortem* examination (Anon, 1964). The tuberculin skin test is the primary screening test used in herds, either single intradermal tuberculin test (SIT) or comparative intradermal tuberculin test (CIT). The CIT has a higher specificity but a lower sensitivity than the SIT (De la Rua-Domenech et al., 2006). The *in vitro* interferon-gamma test (IFN- γ) is considered to be as sensitive as the SIT and more sensitive than the CIT, but less specific than SIT or CIT (De la Rua-Domenech et al., 2006; Vordermeier et al., 2008). A *post-mortem* examination of each animal killed at the slaughterhouse is mandatory for cattle (visual inspection, palpation and incision of relevant organs and lymph nodes) (Anon, 1964). However, lesions could easily be overlooked, particularly if they are small and located on lymph nodes, and this examination is therefore considered to have a very low sensitivity (Schiller et al., 2011; EFSA, 2013). If lesions are found, material from abnormal lymph nodes and parenchymatous organs, and samples from other lymph nodes should be analyzed for stained smears and culture. The polymerase chain reaction (PCR) can also be used to detect the *M. tuberculosis* complex (Anon, 1964).

The EU currently comprises 15 officially tuberculosis free (OTF) countries, 10 not officially tuberculosis free (NOTF) countries and 3 “regionalized” countries (in which only some areas are OTF) (Anon, 2003; last amended in 2012, Anon, 2012). The epidemiological situation may differ between countries, regardless of their official status (cases are also reported in some OTF countries; Anon, 2013), and sometimes in areas within a country, potentially reflecting differences in bovine husbandry systems and environmental situations. Furthermore, infected wild animals have been detected in some European countries, and wildlife reservoirs have been identified (Corner, 2006; Gortazar et al., 2012). Wild species, maintenance hosts in particular, represent a major obstacle to the eradication of TB in cattle, because they constitute a potentially continuous source of re-infection. The identification of wild maintenance hosts and their effective management is a key determinant of the efficacy of control measures (Naranjo et al., 2008; Gortazar et al., 2012; Fitzgerald and Kaneene, 2012), despite the lack of a requirement for mandatory TB surveillance in wildlife in EU legislation.

The surveillance of TB is challenging, due to its underlying complex epidemiology, which involves multiple hosts in domestic and wild populations. Adaptations to EU legislation were required to deal with the heterogeneity of epidemiological situations, which explain the various surveillance systems implemented. However, despite abundant studies on the TB epidemiology and associated risk factors, comprehensive descriptions of the surveillance systems in force are rare. Descriptions focus mostly on particular points, such as the diagnostic tools used (De la Rua-Domenech et al., 2006; Schiller et al., 2010, 2011), the results of the surveillance with a summary of the current situation (number of herds tested, number of

infected herds) without providing a description of the surveillance components (Reviriego-Gordejo and Vermeersch, 2006; Pavlik, 2006), or the evaluation of the current status of wild species in Europe (Gortazar et al., 2012). This lack of description of the surveillance systems makes comparisons within Europe and with other countries difficult.

The aim of this study was to review the current TB surveillance for cattle and free-ranging wildlife implemented in EU Member States, through an online survey, with a view to describe differences between countries according to their TB status and epidemiological situation.

2. Methods

2.1. Data collection

An online survey was carried out with LimeSurvey® software, between April and July 2013. One or more correspondents (managers and/or scientists) were contacted in each country. Two independent questionnaires were sent to each correspondent, one for the cattle surveillance, the other for free-ranging wildlife surveillance, because people from different institutions might be responsible for these two different activities. About 100 people in the 28 Member States were contacted through European Food Safety Authority (EFSA) focal points and foreign partners of the French Association for the Epidemiology of Infectious Animal Diseases (AEEMA). Three European countries that do not belong to the EU (Switzerland, Macedonia and Norway) were also contacted, because of their geographical proximity to EU countries and the availability of contact addresses.

2.2. Variables

Only general and key factors were included in the study, such as the combination of surveillance components, the laboratory tests used, and the definition of a herd or an animal infected with *M. bovis*. Current surveillance was approached through questions relating to the general situation in cattle and wildlife populations (20 questions), cattle surveillance and testing protocols (52 questions) and free-ranging wildlife surveillance (55 questions). Both questionnaires are available online (Supplementary Documents S1 and S2).

Data were mapped with QuantumGis®. In case of disagreement between participants from the same country or missing data, correspondents were again contacted.

3. Results

Twenty-six of the 31 contacted countries participated in the survey (16/17 OTF, 3/3 regionalized, 7/11 NOTF countries), 5 of which did not complete the wildlife questionnaire (Latvia, Luxembourg, Romania, Malta, and Cyprus). Multiple responses were obtained for 3 countries: Belgium, Ireland and Slovakia. One OTF country (Denmark) and 4 NOTF countries (Bulgaria, Greece, Hungary and Lithuania) did not participate in the survey.

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