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Commentary

COVID-19 is likely to impact animal health

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ABSTRACT

Responses to the ongoing COVID-19 pandemic have included travel bans and social distancing with "shelter in place" orders, resulting in sudden changes in human activity and subsequent effects on the global and national economy. We speculate that animal health will likely be impacted by COVID-19 through the immediate consequences of sudden human confinement and inactivity, and through the long-term consequences of the upcoming economic crisis on farmer livelihoods and veterinary service capacities. We expect the COVID-19 pandemic and the subsequent economic crisis to impact negatively on the control of diseases that are already present in Europe, as well as on the European capacity to prevent and respond in a timely manner to new and emerging animal diseases. We also expect an increased attention to the animal health implications of coronavirus infections in animals. Mechanisms explaining these outcomes include increased wildlife-livestock contacts due to human confinement; disruption of ongoing testing schemes for endemic diseases; lower disease surveillance efforts; and lower capacity for managing populations of relevant wildlife reservoirs. The main mitigation action consists in adapting animal health management strategies to the available resources.

1. Introduction

The ongoing COVID-19 pandemic is caused by SARS-CoV-2, a betacoronavirus of zoonotic origin that has successfully adapted to human-to-human transmission (Li et al., 2020). At the time of writing (May 10th, 2020), over four million COVID-19 cases have been reported from 187 countries, causing 279,000 deaths (https://coronavirus.jhu.edu/map.html; last access 10/05/2020). Responses to this unprecedented challenge often include travel bans and social distancing, even with "shelter in place" orders (Pung et al., 2020), which imply sudden changes in human activity and determine severe subsequent effects on the economy. There is variation among countries in the intensity and timing of these responses. Consequently, differences between countries are also expected regarding the societal and economic consequences of the COVID-19 pandemic. China, where COVID-19 originated, is expected to recover sooner than Europe and North America, and countries or regions with more prolonged social distancing measures or greater dependence on those sectors that are most severely affected, such as tourism or the automobile industry, will face bigger challenges. It has been estimated that return to normal economic growth in Europe may take as long as Q3 2023 under a scenario of western countries failing to contain the virus within one quarter and being forced to maintain some interventions through summer (McKinsey report at https://t.co/iFC1k1A2WM; last access 10/05/2020).

The COVID-19 pandemic will affect all aspects of society, globally, from health services (Propper et al., 2020) to conservation (Corlett et al., 2020). Regarding the animal health field, we speculate that three impacts are likely to occur: (1) the immediate one due to the sudden human confinement and inactivity; (2) a medium to long-term one due to the effects of the upcoming economic crisis on farming and on veterinary services; and (3) an increased attention to the public health implications of coronavirus infections in animals, both in farms (Van der Waal and Deen, 2018) and regarding pets (Shi et al., 2020).

According to the World Organization for Animal Health (OIE), essential activities to be maintained by each country during the COVID-19 crisis include national and regional veterinary regulatory and inspection services, food inspection and safety, attention to emergency situations, preventative measures such as vaccination against diseases with a significant public health or economic impact, and priority research activities (https://www.oie.int/en/for-the-media/press-releases/detail/article/covid-19-and-veterinary-activities-designated-as-essential/; last access 10/05/2020). In fact, animal health plays an important role in improving the quality of life and as a driver of economic growth (McKibbin and Roshen, 2020). The aim of this commentary is to provide insights into the likely short- and long-term effects of the COVID-19 pandemic on animal health from a European

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perspective and to suggest appropriate mitigation actions.

2. Short-term consequences

The disease where there is most prior knowledge on the effect of crises on control efforts is animal tuberculosis (TB). The impact of the 2001 foot-and-mouth disease (FMD) outbreak in the UK on cattle TB control was substantial, with TB herd tests dropping by three quarters in 2001 and the number of new TB incidents almost doubling subsequently in 2002 (Vial et al. 2013).

Another aspect regarding TB and other multi-host infections is the wildlife-livestock interface. With human activity strongly reduced during lockdown, closer proximity of wildlife to suburban areas or to farm buildings and pastures is likely to occur, increasing the risk of infection spillover (Payne et al., 2016). In the UK, badger (*Meles meles*) presence on farms became more relevant as a TB risk factor after FMD (Vial et al. 2013). Moreover, a drop in hunting as a consequence of restrictions on non-essential activity during the lockdown or beyond could result in insufficient population control of wildlife reservoir hosts such as the wild boar (Sus scrofa). It is known that wild boar population density can double in one single year (Quirós-Fernández et al., 2017), leading to a likely subsequent increase in both wild boar and cattle TB (Tanner et al., 2019). Further likely consequences of COVID-19 are represented in Fig. 1 on the example of TB.

Another relevant disease likely to become affected in the short-term by the COVID-19 crisis is African swine fever (ASF). This devastating disease of pigs and wild boar is currently emerging in large parts of Eurasia and is of special concern in Europe. ASF entered the EU in the Baltic countries and Poland in 2014, expanding to several countries in central and southeastern Europe (EFSA, 2019). In Poland, ASF is currently expanding westwards close to the German border. Another region of attention is the Belgian province of Luxembourg, close to France, Luxembourg and Germany, where ASF has been present since 2018 (EFSA, 2019). In order to control ASF, it is important to act quickly (i.e. detect early, mainly by increased scanning surveillance), and to combine two key tools, namely culling and carcass destruction (O'Neill et al., 2020). If disease surveillance and wild boar control (mainly by hunting) are limited due to human confinement, as is currently happening, or when effective carcass finding and removal is impeded by resource limitations or other causes (Jo and Gortázar, 2020), geographical spread of ASF is a likely consequence.

Coronavirus infections in domestic animals will most likely receive increased attention. The role of companion animals in the epidemiology of COVID-19 is currently uncertain and deserves research. Early insights highlight the possibility of cats and other carnivores, such as mink (*Neovison vison*) as SARS-CoV-2 hosts, and also as indicators for surveillance (Shi et al., 2020; https://www.euronews.com/2020/04/26/coronavirus-minks-test-positive-for-covid-19-at-two-dutch-farms; last access 10/05/2020). Furthermore, COVID-19 is also impacting the activity of veterinary clinics and laboratories, with differences in regulation between EU countries and US states (https://ebusiness.avma.org/misc/stateorders.aspx; last access 10/05/2020), and additional immediate impacts of the pandemic are hitting the animal farming and processing/packing industries (https://www.fda.gov/food/food-safety-during-emergencies/food-safety-and-coronavirus-disease-2019-covid-19#foodsupply; last access 10/05/2020).

3. Long-term consequences

There is also evidence of the impact of long-term budget restrictions due to economic crises on the success of disease eradication in several countries. For instance, by delaying the removal of infected cattle from the environment, the UK FMD epidemic provided increased opportunities for them to spread *Mycobacterium bovis* infection to other hosts (Woodroffe et al., 2006). Spain suffered an economic crisis from 2008 to 2014. The results of nationwide cattle TB-testing within the Spanish TB eradication scheme (MAPA 2020) show that herd prevalence declined from 2.81 in 2001 to 1.31 in 2012, returning to a maximum of 2.87 in 2016. While this increase has not been attributed to the crisis, public resources for TB testing were limited during this period. In New Zealand, most of the funds for TB control are spent for reservoir control. Resources were scarce in the 1980's due to budget constraints and, consequently, cattle herd TB prevalence rose significantly until investment in reservoir control increased again in the 1990's (Livingstone et al., 2015).

Several exotic transboundary animal diseases (TADs) are present at the borders of the EU, to the east and south. These include FMD, peste des petits ruminants (PPR), sheep and goat pox (SGP), Rift valley fever (RVF), lumpy skin disease (LSD), and Japanese encephalitis (JE), among others (Ruiz-Fons, 2017; Kardjadj, 2018; EFSA, 2020a). These exotic diseases can enter the EU by different routes, including the movement of infected human beings (e.g. JE or RVF), transport of infected animals (e.g. PPR, SGP, RVF), or natural or human-mediated movement of infected vectors (e.g. RVF, JE) (EFSA, 2020a). Human

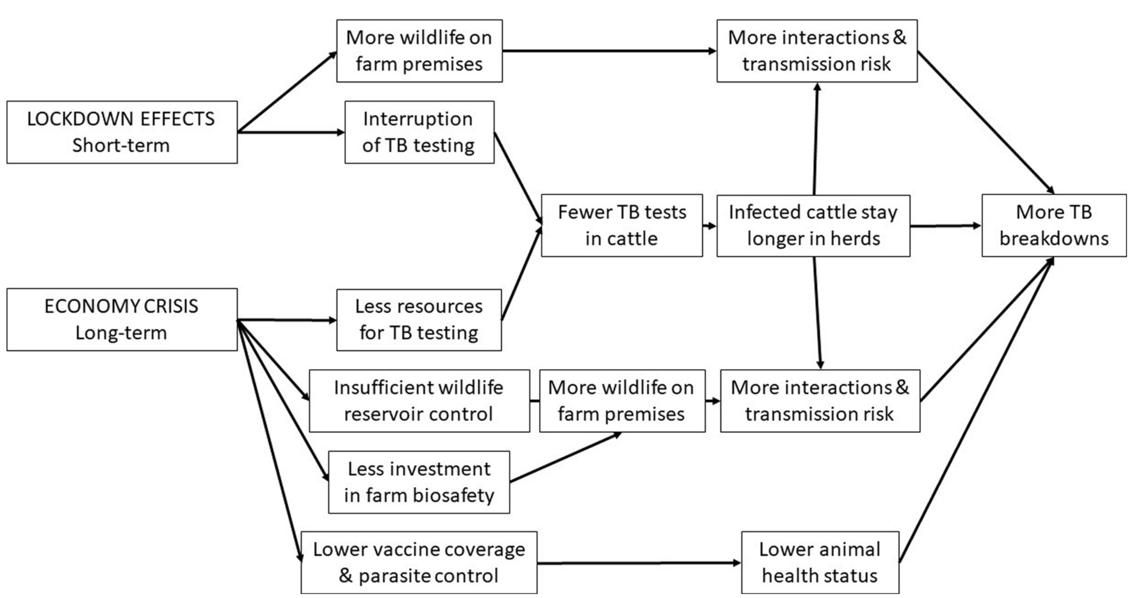

Fig. 1. Expected short- and long-term effects of the COVID-19 pandemic on infectious disease occurrence in farm animals, on the example of animal tuberculosis.

movements are currently restricted due to the COVID-19 pandemic (Pung et al., 2020), but wildlife or vector-mediated entry remains possible. Entry of any of these diseases would demand significant resources from the veterinary services and farmers in order to control the outbreak, as for FMD in the UK in 2001. Yet, in the coming months or even years the capacities of farmers and veterinary services to invest resources may be compromised due to a global economic crisis.

During the last economic crisis, the veterinary drug sector suffered a significant drop in activity in 2009 (Crosia, 2011). This triggered significant restructuring efforts including acquisitions, re-positioning and diversification, but also workforce reduction and shut-down of research facilities (Jarvis, 2009). Similar events are likely to take place during the ongoing COVID-19 crisis, too.

4. Discussion

Although it is too early for a full assessment, we suggest that the COVID-19 pandemic and the subsequent economic crisis will severely affect animal health in several ways. In the short term, some of the veterinary activities regarded as essential by the OIE, such as preventative measures against diseases with a significant public health or economic impact, are already either working at lower intensity or have been suppressed during the lockdown. This, in addition to other short-term effects such as increased wildlife-livestock contacts, less population control, or longer on-farm stays of stock, will trigger effects on the distribution and incidence of transmissible animal diseases (Vial et al. 2013, O'Neill et al., 2020). If the economic crisis evolves into a deep and long depression, the overall capacity of regional, national and supra-national veterinary services might be compromised. Thus, the long-term effects of COVID-19 on animal health will largely depend on the impact of the crisis on farmer livelihoods and on the capacities of the animal health services (Woods, 2011; Schwabenbauer, 2012).

The following actions might contribute to buffering these adverse effects of COVID-19 on animal health. Short term recommendations are to avoid an interruption to ongoing vaccination or test and cull schemes, or at least to limit such interruptions as little as possible; and to pay special attention to changes in pathogen distribution during and after the confinement period. Suggested long-term actions include adapting animal health management strategies to the available resources. Awareness of the socio-economic context of disease control is required for greater disease control success (Schwabenbauer, 2012), and the potential for a future of concatenated shocks requires adaptations in both science and governance (Biggs et al., 2011). Thus, while investment in animal health should be maintained as a priority despite the economic crisis, greater use of co-funding from the private farming sector will be needed, leading in return to a transfer of management and decision-making to the relevant sector. For instance, TB management is run by a public-private partnership in New Zealand (https://ospri.co.nz/; last access 09/04/2020) and in the UK, the Godfrey report (DEFRA, 2020) proposes that TB management is removed from government to make it easier for the new body to work collaboratively with industry and other stakeholders.

We also propose that it is time to take One Health seriously. This concept implies that pathogen ecology and disease management need to integrate human, animal and environmental perspectives, with the implication that medics, veterinarians and ecologists should collaborate to efficiently address health issues. As stated by the OIE, veterinarians are an integral part of the global health community and have a key role to play in disease prevention and management, including those diseases that are transmissible to humans. Moreover, veterinary laboratory capacities are often better suited for large-throughput PCR or ELISA testing than medical facilities, and thus, many veterinary laboratories are currently devoted to COVID-19 under coordination of the health authorities. In the same way, it could be useful to make more use of the capacities of veterinary epidemiologists and of ecologists in order to improve our collective understanding of SARS-CoV-2 and identify the most appropriate intervention strategies.

Author contributions

Both authors contributed equally to the idea, literature review and writing of this manuscript.

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Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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