

SCIENTIFIC REPORT OF ECDC-EFSA

Risk related to household pets in contact with Ebola cases in humans¹

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ABSTRACT

In response to a request from the European Commission to provide advice on risks related to pets having been in contact with people infected with Ebola virus, EFSA and ECDC have jointly prepared a rapid assessment. The assessment addresses three questions: (i) the probability of a pet being in contact with a human Ebola virus disease case; (ii) the probability of a pet being exposed to Ebola virus; and (iii) the probability of a pet infected or contaminated with Ebola virus being capable of transmitting the virus to an uninfected human. This assessment covers dogs and cats as they are the most common pets in Europe. The situation in Europe is different from the one in Western Africa, the area affected by the current Ebola virus (EBOV) epidemic. In Europe, situations where a pet becomes infected through contact with an infected human are likely to be very rare. In the event of contact with an infected human, the probability of a pet becoming infected, or to act as a fomite, can range from very low to high. However, this probability is associated with high uncertainty. In addition, there is high uncertainty about viraemia and virus excretion in pets. The probability of human exposure to the virus through contact with exposed pets is difficult to assess and may range from very low to high depending on the specific circumstances. It is recommended that risk be assessed jointly by veterinary and public health authorities using a case-by-case approach. In the absence of information about possible EBOV infection in pets and the potential for onward transmission, full precautionary measures should be taken when handling pets of persons infected with EBOV. Although it should not be considered a priority during outbreaks, sharing any information that could help to improve our understanding of EBOV in pets and other domestic animals is important for national and international stakeholders.

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KEY WORDS

Ebola, virus, pets, dogs, cats, assessment, transmission

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BACKGROUND

In April 2014, the European Commission requested ECDC to assess the risk of transmission of Ebola virus through contact with bush meat irregularly transported by passengers coming from areas affected by Ebola virus disease.

In October, a subsequent request from the European Commission asked EFSA to provide scientific and technical assistance on the risk of transmission of Ebola virus via the food chain (EFSA, 2014).

In correspondence addressed to EFSA in early November, the European Commission requested EFSA to assess the risk to humans posed by contact with pets in affected areas, taking into account the debate on the possible role of dogs in spreading the virus. The request was considered under the same mandate (M-2014-0279). In its response, EFSA clarified that the assessment would be performed in collaboration with ECDC.

TERMS OF REFERENCE

In view of the above, EFSA was requested to provide technical assistance, in the framework of Article 31 of Regulation (EC) No 178/2002, on the risk related to household pets in contact with Ebola cases in humans.

ASSESSMENT

1. Disease background

Infections with Ebola viruses originating from Africa cause a severe disease in humans called Ebola virus disease (EVD). There are five species of the genus *Ebolavirus* (Filoviridae family): *Zaire ebolavirus*, *Sudan ebolavirus*, *Reston ebolavirus*, *Tai Forest ebolavirus* and *Bundibugyo ebolavirus* (ECDC, 2014; Li and Chen, 2014). The current outbreak in West Africa is caused by *Zaire ebolavirus*. Ebolaviruses are biosafety level-4 pathogens (BSL-4; risk group 4) and require special containment measures and barrier protection. Ebola viruses (EBOV) can survive on solid substrates such as glass and remain active for six days under laboratory conditions (Sagripanti et al. 2010). Ebola viruses are inactivated by gamma irradiation, heating for 60 min at 60°C or boiling for 5 min, and are sensitive to sodium hypochlorite (bleach) and other common disinfectants (Public Health Agency of Canada, 2014; CDC, 2014a). Freezing or refrigeration will not inactivate Ebola viruses (Chepurinov et al. 1995; WHO, 2013).

The incubation period (the period between infection and first symptoms) in humans is usually four to ten days but can be as short as two days and as long as 21 days. The case–fatality rate for *Zaire ebolavirus* infections is estimated to be between 44% and 90% (Bannister, 2010).

EBOV is shed in a wide variety of body fluids during the acute period of illness (Ksiazek et al., 1999, Towner et al., 2004). It is highly transmissible by direct contact with blood, secretions, tissues, organs and other body fluids from dead or living infected persons (Bausch et al., 2007). The principal mode of transmission in outbreaks is person-to-person transmission through direct contact with a symptomatic or dead EVD case. Transmission via inanimate objects contaminated with infected body fluids (fomite transmission) is also possible (Colebunders and Borchert, 2000). Airborne transmission has not been documented (WHO, 2014a).

The probability of transmission is considered low in the early phase of human disease (i.e. the prodromal phase) (Bannister, 2010). The risk of transmission increases with transition to later stages of the disease. During the 1995 EVD outbreak in the Democratic Republic of Congo, the most important risk factor was direct physical contact with an infected sick person. The risk was higher with exposure to body fluids during the late stages of the disease (Dowell et al., 1999).

2. Event background

Since December 2013 and as of 26 November 2014, WHO has reported 15 935 confirmed, probable and suspected EVD cases in three affected countries with widespread and intense transmission (Guinea, Liberia and Sierra Leone) and three affected countries with only localised transmission (Mali, Spain and the United States of America) as well as two other considered previously affected (Nigeria and Senegal) (WHO, 2014b). There have been 5 689 reported deaths.

As of the 26 November 2014, two events where pets were potentially exposed to their sick owner have been reported. In Spain, a nurse became infected when caring for an EVD patient who had been evacuated from Sierra Leone. The nurse developed fever on 29 September 2014 and was admitted to the hospital in Madrid on 6 October (ProMED-mail, 2014a). At the time of her hospitalisation, she had acute symptoms with fever, vomiting and diarrhoea (Román et al., 2014). During the five days preceding her hospitalisation, she stayed at home together with her dog. She therefore cohabited with her dog during some of the period of virus excretion. The Spanish authorities decided to euthanize the

dog on 8 October as a precautionary measure. The nurse eventually recovered. In Texas, USA, another nurse became infected after caring for a case returning from Liberia and was confirmed for EVD on 12 October 2014 (ProMED-mail, 2014b). She was cohabiting with her dog prior to confirmation and had stayed in contact with the dog during the first two days of clinical infection (ProMED-mail, 2014c). The dog was therefore placed under a 21-day quarantine on 11 October in a decommissioned naval air base (ProMED-mail, 2014d). Personal protective equipment was used by veterinary staff in contact with the dog. Blood, faeces and urine samples were taken routinely during the quarantine period in order to test for Ebola virus (Scheidegger, 2014). The human case eventually recovered and both sets of testing of the dog were reported to be negative. After completing quarantine, the dog was released on 1 November (Ahmed, 2014).

3. Scope of the assessment and methodology

Risk is usually assessed as a combination of the probability of an event and its impact. However, in the context of this assessment the scope will be limited to assessing the probability. Three questions are addressed:

- The probability of a pet entering into contact with a human EVD case in the EU;
- The probability of a pet in contact with a human EVD case becoming infected or contaminated with EBOV;
- The probability of a pet infected or contaminated with EBOV being capable of transmitting the virus to an uninfected human.

For this assessment, pets are defined as EU household dogs and cats kept in the house and with which the owner has or may have close physical contact. Other animals are not considered. Pets that have travelled to West Africa or pets that could be imported from West Africa are not included.

As this assessment was developed in the context of the Ebola epidemic in West Africa it focuses on the *Zaire ebolavirus* species.

The assessment is based on a review of published studies and information provided by national public and veterinary health authorities. The methodology described in the ECDC guidance for rapid risk assessment was considered and adapted (ECDC, 2011).

4. Background information on infection with EBOV in pets

Ebola virus disease can affect humans as well as a range of other mammals including non-human primates, bats, duiker antelopes and pigs (Pigott et al. 2014; Weingartl et al. 2013). However, there have been no publications reporting experimental studies of EBOV infections in pets. At this time, there have been no reports of dogs or cats becoming sick with Ebola or of being able to spread EBOV to people or animals, including in areas in Africa where EBOV is present. Available field data have been collected from outbreaks in Africa. Allela et al. (2005) investigated the 2001-2002 EVD outbreaks in Gabon where, despite numerous severe human cases, there were no reports of dying dogs in the affected villages. The authors conducted a serological investigation for EBOV IgG antibodies in dogs after the occurrence of these outbreaks. They found a significant positive association between seroprevalence in dogs and proximity to EBOV endemic areas and sites with human cases and animal sources. However, results from the study should be considered carefully in terms of specificity of the ELISA technique used for antibody detection: 7/79 (8.9%) in two major towns in Gabon distant from areas where outbreaks occurred and 2/102 (2%) tested in France, an EBOV-free country, were antibody positive as well. Despite these limitations, this study suggests that dogs can, at least, be

asymptomatically infected by Ebola virus. Olson et al. (2012) reviewed the results of animal sampling during 14 Ebola virus outbreaks in Africa and in the Philippines from 1976 to 2011 and reported the presence of antibodies in dogs. The authors recommended sampling domestic animals such as dogs and pigs for EBOV and EBOV antibodies during human EVD outbreaks to better determine transmission sources from animals to humans.

5. Uncertainties and assumptions

This assessment includes several areas of uncertainty and is based on several assumptions:

Uncertainties

- There are no field or experimental data available on infection with EBOV in pets other than dogs. In dogs, positive test results are based on antibody detection from a non validated test.
- There are no field or experimental data available on excretion of EBOV by infected dogs.

Assumptions

- It is assumed that dogs can be asymptotically infected with EBOV.
- In the absence of scientific reports on infection with EBOV in cats, it is assumed in this assessment that cats carry the same risk as dogs.
- By extrapolation and based on the incubation period in humans, it is assumed that pets could have an incubation period of a maximum of 21 days after last contact with an infected source.
- It is assumed that body fluids, including secretions, from infected pets are infectious.
- It is assumed that pets could act as fomites in transmission of EBOV.
- It is assumed that EBOV can survive up to 6 days on body surfaces of pets.

6. Probability of a pet entering in contact with a human EBOV case

The circumstances by which a pet can become infected in the EU are different than the ones in West Africa. Humans repatriated to the EU as Ebola cases are unlikely to have contact with any pet.

In the EU, pets in contact with human cases would be limited to secondary human cases infected in the EU (e.g. if a healthcare worker who cared for a repatriated human case becomes ill) or cases returning from West Africa in the incubation phase or early clinical stage of the disease.

Despite the two incidents whereby a dog is known to have entered into contact with a human case (Section 2), the probability of a pet having contact with a human case is considered to be low considering the very few secondary cases or returning cases seen in the EU.

7. Probability of a pet in contact with a human EVD case becoming infected or contaminated with EBOV

In the absence of sufficient evidence about possible EBOV infection in pets, a case-by-case assessment should be conducted to evaluate the probability based on the closeness of contact between pets and an infected human, as well as the infectiousness of the infected human.

Assessments should be jointly conducted by veterinary authorities and public health authorities, and aim to identify possible exposure of pets to body fluids of persons infected with EBOV. Criteria to consider are:

1. Expected level of virus excretion (florid or non-florid symptoms in humans). Florid symptoms refer to the full clinical manifestation of the EVD symptoms including excretion of contaminated body fluids.
2. Degree of contact between pets and persons infected with EBOV. In the context of this assessment, the definition of high risk contact is where an animal has had contact with the body fluids of a human infected with EBOV.

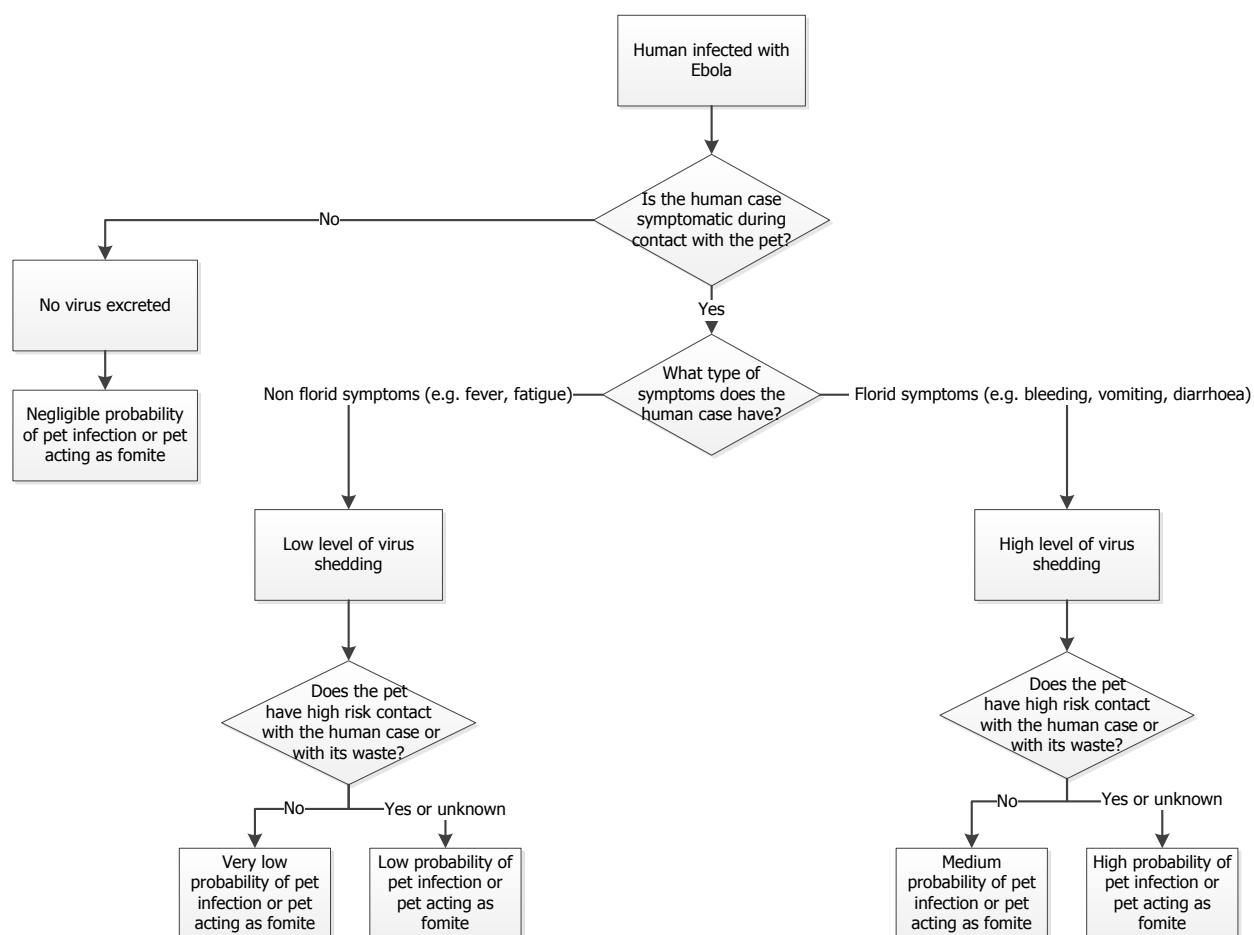


Figure 1: Algorithm for the probability of a pet in contact with a human case becoming infected or contaminated with EBOV. High risk contact is where an animal has had contact with the body fluids of a human infected with EBOV.

The probability of a pet in contact with a human case becoming infected with EBOV depends on whether the human case is symptomatic during contact with the pet, the type of symptoms of the case (florid vs. non-florid) and on the type of contact between the human case or his/her waste and the pet (Figure 1).

In the event of contact with a symptomatic human case, the probability of the pet becoming infected or acting as a fomite can range from very low to high, but the associated uncertainty is high. This

probability can be considered negligible when the human case is asymptomatic as it is assumed that no virus is excreted.

Any human EVD cases with florid disease in the EU would, in principle, be isolated very rapidly, hence the probability of a pet entering into contact with a human florid case is considered to be low.

8. Probability of a pet infected or contaminated with EBOV transmitting the virus to an uninfected human

The probability of human exposure to the virus through contact with exposed pets reflects the level of contact with the pet, the likelihood of the pet shedding the virus and the likelihood of a pet acting as a fomite. High risk contact is defined as a human being in contact with the body fluids of an exposed pet or as a human being in contact with contaminated fur or skin.

There is high uncertainty about viraemia, virus shedding and clinical signs in pets, which reflects the lack of evidence and the limited number of studies available. Considering the assumption that EBOV can survive for 6 days on bodily surfaces of pets and despite the uncertainties mentioned in Section 5, it is assumed that humans can be infected while in contact with an infected or contaminated pet. Humans are highly susceptible and, since the disease is highly infectious, the probability a human becoming infected is considered to be non-negligible. It could therefore range from very low to high.

9. Other questions

Given the serious consequences of such disease transmission occurring, a precautionary approach must be taken. Assessments should be jointly conducted by veterinary authorities and public health authorities. They should aim to identify any possible exposure of humans to body fluids or contaminated fur of exposed pets. All individuals that have had high risk contact with an exposed pet should perform self-monitoring for 21 days after the last contact in order to detect any early symptoms of the disease should the person be infected.

Pets with medium and high probability of becoming infected with EBOV through contact with a human case (Figure 1) should be placed in isolation for at least 21 days (equivalent to the incubation period in humans). The pet should be considered negative only after two negative PCR tests, with the first test conducted on day 21 and with at least a three-day interval between tests, as is recommended for the diagnosis of human EVD cases (ECDC, online). When possible, the pet should be placed in a containment facility. An alternative for pets with low and very low risk would be home restriction of the pet in the house for 21 days.

Precautions should be taken during transport and isolation of pets to ensure a level of biosecurity high enough to prevent further spread or potential spread of the virus. While guidance provided by public health authorities for humans should be followed, it may require adjustment in relation to the handling of animals (CDC, 2014b; CDC, 2014c). Handling of samples and biological material should be performed with the same level of biosecurity as recommended for suspected EVD cases in humans (WHO, 2014c).

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. Probability of a pet entering in contact with a human EVD case

- The circumstances through which a pet might become infected in the EU are different to those that pertain in West Africa.
- The probability of a pet having contact with a human case is assessed to be low considering the very few secondary cases or returning cases seen in the EU.

2. Probability of a pet in contact with a human EVD case becoming infected or contaminated with EBOV

- In the event of contact with a symptomatic human EVD case, the probability of the pet becoming infected or acting as a contaminated fomite can range from very low to high (according to the type of symptoms of the human case and the contact experienced), but the associated uncertainty is high.
- This probability can be considered negligible when the human EVD case is asymptomatic as it is assumed that no EBV is excreted.
- Any human EVD cases with florid disease in the EU would, in principle, be isolated very rapidly, hence the probability of a pet entering into contact with a human florid case is considered to be low.

3. Probability of a pet infected or contaminated with EBOV being capable of transmitting it to an uninfected human

- There is high uncertainty about viraemia, virus shedding or clinical signs in pets, and about pets acting as fomites.
- The probability of human exposure to the virus through contact with exposed pets is difficult to estimate but may range from very low to high depending on the specific circumstances.

4. Other questions

- Appropriate and adapted precautions must be taken during transport and isolation of pets and laboratory handling of samples to a similar level of biosafety as those recommended for suspected EVD cases in humans.

RECOMMENDATIONS

- The risk of a pet in contact with a human case becoming infected with EBOV should be assessed on a case-by-case basis.
- The risk of a pet with EBOV being capable of transmitting the virus to an uninfected human should be assessed on a case-by-case basis.
- The veterinary authorities and public health authorities should conduct assessments jointly.

- In the absence of information about possible EBOV infection in pets and potential further onwards transmission, full precautionary measures should be taken when handling pets of persons infected with EBOV.
- Although it should not be considered a priority during outbreaks, sharing any information that could help improve our understanding of EBOV in pets and other domestic animals would be important for national and international stakeholders.

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