



Benefits and Risks for People and Livestock of Keeping Companion Animals: Searching for a Healthy Balance

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Summary

The mission of the CALLISTO (Companion Animals multisectorial interprofessionaL Interdisciplinary Strategic Think tank On zoonoses) project was to provide an overview of the current situation on the role of companion animals as a source of infectious diseases for people and food animals. It also aimed to identify knowledge and technology gaps for the most important zoonoses and propose targeted actions to reduce the risk of zoonotic diseases transmitted via companion animals. After a 3-year study, its members have developed practical recommendations for improved data collection on companion animal numbers and the mechanisms for disease surveillance in companion animals. They highlight the importance of introducing a system for the unique identification of dogs and other companion animals with an implanted microchip transponder and storage of the details it contains on an internationally accessible online database. Their report also emphasises the need for balanced communication with the public on the risks and benefits of pet ownership and the value of the ‘One Health’ concept to encourage closer collaboration between veterinary and human medical professionals.

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Keywords: companion animal; human–animal bond; One Health; zoonotic disease

Introduction

People have kept companion animals since wolves were first tamed at least 15,000 years ago to become the ancestors of the domestic dog (Freedmann *et al.*, 2014). Pet ownership is, to varying degrees, a feature of every human culture in the world and in many European countries up to 50% of households are home to one or more pet animals (Messent and Serpell, 1981; Serpell, 1986).

People own pets for many different reasons including companionship, sport and entertainment. Therefore, even those people who do not have pets of their own may benefit from the influence of those

around them. Pet ownership contributes both to the personal wellbeing of their owners and to the overall economy, with pet related expenses providing an estimated €12 billion per year in tax revenues across the European Union (EU) (personal communication K. Davenport, European Pet Organisation, 2012).

However, keeping pets is not an activity that is free of inherent risks. Companion animal species, food animals and human beings share much of their evolutionary history and as a consequence, they can act as hosts for pathogenic and parasitic organisms, which may be readily transmitted from one species to another. Therefore, the infections transmitted by pets are a potential cause of serious diseases in both their owners and their domestic livestock.

Moreover, many pet species, if mishandled or kept under inappropriate conditions, can potentially pose

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a physical danger to the people around them. The growing popularity of non-traditional pet species is another possible hazard either through the transmission of exotic pathogens by novelty pets such as fruit bats, or as a possible new route for the transmission of well-established pathogens to people or livestock, in the case of ornamental pig species. The potential impact on public health, the economy and the environment resulting from the trade in wild-caught animals for the pet industry has been highlighted by the Eurogroup for Animals report on the Health risks from new companion animals (<http://eurogroupforanimals.org/files/publications/downloads/Zoonotic-risk-report.pdf>).

Yet, despite such concerns the popularity of companion animals in Europe appears to be increasing. Recent estimates suggest that there are around 66 million cats, 61 million dogs, 39 million ornamental birds, 21 million small mammals, 6 million horses and 9 million aquaria in the EU. The numbers of cats has certainly grown, with the number of households keeping them as pets ranging from 10 to 40% in different countries of the EU. In recent years there has been an unprecedented increase in the numbers of exotic animals kept as pets, notably rodents, birds and reptiles (<http://www.fedial.org/facts-figures/>).

However, reasonably accurate figures on the pet population may only be available for particular species of pets and for certain regions or countries of the EU. Therefore, much of the data are based on rough estimates and, where the information is available, it is often incomplete and difficult to access.

Without accurate data on the numbers of companion animals and how they are distributed across Europe, it is very difficult to determine the health risks from zoonotic diseases carried by pets for their owners and other EU citizens. Better information on pet animal populations will also be indispensable for the design and operation of effective and proportionate measures to prevent or mitigate such risks.

The CALLISTO project was established by the European Commission in 2012 with funding from the EU Seventh Framework initiative. This involved a multidisciplinary, multisectorial and inter-professional network of experts representing the major relevant stakeholders and was established with a 3-year work programme. Its purpose was to develop a detailed overview of the role of companion animals as a source of infectious diseases for people and food animals and to gather information on disease incidence and geographical distribution in the different host categories. It was also tasked with identifying knowledge and technology gaps in the prevention and intervention options of the most important zoo-

noses transmitted by companion animals and proposing targeted actions that would contribute to reducing the risk of infectious disease outbreaks in people and food animals.

Its members formed seven Expert Advisory Groups (EAGs) working on specific issues (Fig. 1), with cross EAG meetings and an annual synthesis conference to ensure coordination across the expert level inputs and to stimulate interdisciplinary interaction between the experts. The following report concerns the activities of three EAGs (EAG I, User Community; EAG II, Policy Actions; and EAG VII, Sociology and Welfare). The work of the other four groups (EAG III, Virus Infections; EAG IV, Bacterial Infections; EAG V, Parasitic Infections; and EAG VI, Epidemiology and Underlying Factors) are discussed in separate contributions within this supplement.

From the outset, the members of EAGs I and VII recognized that their investigation should focus on the role of animal keepers, as it was evident that the role of this group is crucial in maximizing the benefits and minimizing the risks of interactions with animals for the whole community. EAG II focused on policy and therefore governments, the European Commission and its agencies, the World Organisation for Animal Health (OIE) and even policy/outreach by non-governmental organizations (NGOs).

The main aim of the actions recommended by EAGs I, II and VII was to develop a clear insight into issues such as:

- Who and where are these owners?
- Which animals do they keep?
- How do we make them aware of potential risks associated with keeping such animals?
- What can they do to avoid these risks?
- How can we motivate them to take appropriate actions?

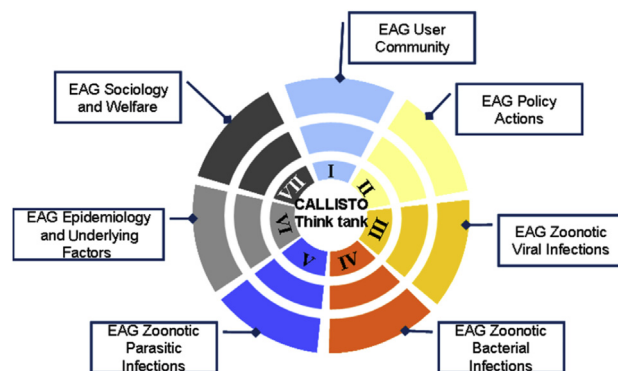


Fig. 1. The seven Expert Advisory Groups of the CALLISTO Project.

- When are policy measures necessary to support these goals?

Methods

There are various definitions of the meaning of the term ‘companion animal’. For the purposes of the CALLISTO project, it was agreed that it would describe:

‘Any domesticated, domestic-bred or wild-caught animals, permanently living in a community and kept by people for company, enjoyment, work (e.g. support for blind or deaf people, police or military dogs) or psychological support – including, but not limited to dogs, cats, horses, rabbits, ferrets, guinea pigs, reptiles, birds and ornamental fish.’

In the first phase of the project, the EAGs assessed current knowledge of diseases in the human and livestock population resulting from contacts with companion animals.

EAG I gathered data from published sources describing the composition of companion animal populations in Europe as well as the social and socio-economic significance of pet ownership. It also attempted to identify and list examples of user communities and animal health organizations in Europe.

EAG II conducted an e-mail questionnaire survey asking for information on actions aimed at preventing the spread of diseases by companion animals to people and food-producing animals. Questionnaires were sent to national authorities, veterinary organizations and other stakeholder groups. These included the World Health Organization (WHO), the US Centers for Disease Control and Prevention (CDC), the European Centre for Disease Prevention and Control (ECDC), the OIE, the European Scientific Council on Companion Animal Parasites (ESCCAP), the European Pet Food Industry Federation (FEDIAF), the International Federation of Animal Health (IFAH), the European Commission, the Council of Europe, the American Veterinary Medical Association and various human–animal interaction NGOs in Europe.

EAG VII examined aspects of sociology and welfare concerning the relationship between companion animals and man, including an investigation into the reasons for keeping companion animals and the beneficial impacts of contact with companion animals on human health. The group also reviewed existing information available on zoonoses for pet owners. A standardized grid was created to assess the information available through their local veterinary practice,

national and international veterinary services, animal welfare societies, the animal health industry, pet food manufacturers and other NGOs.

At the end of each cycle, a network level conference was organized where experts from all of the EAGs worked together and engaged in discussions with each other and with invited expert representatives from outside the CALLISTO network. The outcome of these synthesis conferences was used as input for the next cycle.

The aim of the second cycle of CALLISTO was to provide a bridge between the work done during the first cycle and the current state of knowledge, with the goals of the third annual programme in developing recommendations on future actions. Therefore during the second year, EAG II focussed on the list of priority pathogens (Table 1) as was agreed at the synthesis conference in October 2012 and produced by the pathogen-specific EAGs in collaboration with EAG VI (CALLISTO Strategy Report Second Cycle, http://www.callistoproject.eu/joomla/attachments/callisto_strategy_report%20II_cycle.pdf). It examined whether there was a lack of effective policy actions with regard to these particular pathogens that would pose a risk for the health of people or food-producing animals. Specific attention was given to monitoring and control of these diseases, the effectiveness and compliance with policy actions and collaboration between the veterinary and human healthcare sectors.

In the second cycle, EAGs I and VII examined the range of actions and behaviours exhibited by pet owners that are either protective or hazardous to the health of themselves and others, with respect to the risks of zoonotic diseases; and how these might be promoted or corrected, respectively.

The third and final cycle of the CALLISTO project focused specifically on proposing targeted actions that would contribute to reducing the risk of infectious disease transmission. As the first draft recommendations of EAGs I, II and VII pointed very much in the same direction, it was decided that they should develop one common set of recommendations that cover all three areas.

Results

The user community is divided into large groups without strict organization: pet owners, pet breeders, pet food manufacturers, animal transporters and farmers. Some groups are better organized and have an umbrella organisation like FEDIAF (pet food manufacturers) (CALLISTO Strategy Report Second Cycle, pp. 18, 19). The equine user community is also not very well organized in the smaller EU

Table 1
Notifiable status of 15 paradigmatic pathogens

<i>Paradigmatic pathogen</i>	<i>Zoonotic</i>	<i>OIE notifiable diseases</i>	<i>ECDC notifiable diseases</i>	<i>CALLISTO species</i>
Viral diseases				
Crimean–Congo haemorrhagic fever virus	Yes	Yes	Yes	Dogs, mice, horses, goats, hares, hedgehogs
West-Nile virus	Yes	Yes	Yes	Mammals, birds, reptiles, amphibians
Foot-and-mouth disease virus	No	Yes	No	Cattle, pigs, deer
Rabies virus	Yes	Yes	Yes	Dogs, cats, primates, carnivores, bats
Bluetongue virus	No	Yes	No	Dogs, cats, cattle, sheep, goats
Parasitic diseases				
<i>Echinococcus granulosus sensu lato</i>	Yes	Yes	No	Dogs
<i>Leishmania infantum</i>	Yes	Yes	No	Dogs, cats, horses, rodents, marsupials, monkeys
<i>Toxoplasma gondii</i>	Yes	No	Yes	Cats
<i>Giardia</i> species	Yes	No	Yes	Dogs, cats
<i>Toxocara canis</i> , <i>T. cati</i>	Yes	No	No	Dogs, cats
Bacterial diseases				
<i>Campylobacter jejuni</i>	Yes	No	Yes	Dogs, cats, rodents, birds, reptiles
<i>Leptospira interrogans sensu lato</i>	Yes	No	Yes	Dogs, rodents, wild mammals
<i>Salmonella enterica</i>	Yes	No	Yes	Dogs, cats, rodents, hares, fish, reptiles, amphibians
<i>Bartonella henselae</i>	Yes	No	No	Dogs, cats, rabbits
ESBL-producing pathogens	Yes	No (except <i>S. abortusovis</i>)	Yes	Dogs, cats, horses, exotic pets
Bite wound infections				
Bite wound infections are included in the priority list	Not applicable	Not applicable	Not applicable	Dogs, cats, ferrets, rodents, primates, reptiles

OIE, World Organisation for Animal Health; ECDC, European Centre for Disease Control; ESBL, extended-spectrum beta lactamase.

countries or has no organization at all (CALLISTO Strategy Report Second Cycle, p. 20).

The e-mail questionnaire survey conducted by EAG II in the first cycle received responses from 21 European countries (18 EU countries and three non-EU countries). Further responses were received from OIE and WHO. Policy actions reported by the respondents include mandatory and voluntary measures, varying from formal legislative measures to less formal guidance documents, support actions, and awareness and communication campaigns. They were collected together in a Microsoft Excel file and were categorized according to type of pathogen (i.e. viral, bacterial or parasitic), disease specificity and country of origin (CALLISTO Strategy Report First Cycle).

In the second cycle, EAG II determined the notifiable status to OIE and ECDC of the 15 paradigmatic

pathogens (Table 1). Among the 13 diseases that affect both man and animals, nine are notifiable to ECDC. Seven of the 15 diseases are notifiable to OIE and three to both OIE and ECDC. Two diseases, those caused by *Toxocara canis*/*T. cati* and *Bartonella henselae*, are not notifiable to either organization.

Looking at the presence of effective policy actions at the EU level with regard to the paradigmatic pathogens, EAG II found that EU legislation lays down general animal health requirements applicable to importation and intra-community movement, including trade and non-commercial movement. The only specific legislation in the EU on companion animal diseases is Regulation 998/2003 on the animal health requirements applicable to the non-commercial movement of pet animals, which covers rabies in cats, dogs and ferrets. Commission delegated regulation 1152/2011 allows member states that are

free of *Echinococcus multilocularis* or that have an eradication programme in place, to apply certain preventive health measures. Concerning the European Commission's proposal for a Community Animal Health Regulation, it is noted that its final impact can only be evaluated when it is adopted and when the secondary legislation (i.e. delegated and implementing acts) is known.

Regarding identification and registration of companion animals, only companion animals that cross borders (i.e. cats, dogs and ferrets) must be identified permanently by means of a microchip. When crossing national borders they must be accompanied by a pet passport. There is no requirement for these animals to be registered in a database.

The literature search conducted by members of EAG VII identified three main theories that have been proposed to explain the popularity of pet keeping: (1) the attachment theory (Bowlby, 1969), a concept first applied to the infant-to-mother relationship, later to the pet–human bond; (2) the socio-emotional support theory (Collis and McNicolas, 1998), which claims that in times of need companion animals provide people with emotional support helping them to cope; and (3) the 'biophilia hypothesis' (Wilson, 1984; Kellert and Wilson, 1993), which suggests that humanity has an innate need to have contact with the natural world, including animals, plants and natural settings.

The group also located two recent reviews that have summarized the proven benefits of contact and/or interactions with companion animals on human health and wellbeing.

Turner *et al.* (2013) identified a wide range of effects on the general public. The acquisition of a pet has been shown to reduce complaints about minor health problems and improve measurable quality of life. Pet ownership was also cited as a main factor in predicting higher 1-year survival rates after hospitalization for acute myocardial infarction (Friedmann and Thomas, 1995).

Meanwhile, pet owners have lower levels of risk factors for cardiovascular disease and typically will visit their primary physicians significantly less often over a 1-year period than non-owners (Anderson *et al.*, 1992). Cat and dog owners have been shown to spend a relatively lower proportion of their income on human health care expenses than non-pet owners (Turner, 2004).

Research has suggested that there may be particular benefits during childhood from contact with pets. In children, stimulating increased empathy towards animals may result in increased empathy towards people and it is suggested that these effects are long-lasting (Ascione and Weber, 1996).

Pets have also been shown to provide emotional support for children and to act as social facilitators for increased social contact with other people. This effect is robust for children, adults (including the elderly), physically challenged persons and those persons that are unable to communicate normally.

Turner *et al.* (2013) also list a number of specific health conditions to which animal-assisted interventions have been applied successfully, including aphasic patients in psychotherapy, persistent vegetative state, children with attention deficit disorder, children with reading difficulties, Down's syndrome, autism spectrum disorders, Alzheimer's disease patients, patients with neurological or motor dysfunction and people with various other physically challenging conditions.

Beetz *et al.* (2012) also list a number of positive aspects of interactions with animals. These include effects on social interaction, such as increased positive social attention from others and the stimulation of social behaviour. Effects on empathy are also observed, together with a reduction in aggression, improvements in the symptoms of depression and the promotion of positive mood states. The same study also identified anti-stress effects resulting from contact with animals, in terms of changes in cortisol, epinephrine and norepinephrine levels and effects on blood pressure, heart rate and heart rate variability. There are also potential effects on anxiety and pain perception, improvements in learning ability and impacts on existing illnesses as a result of improved function within the cardiovascular and immune systems.

While searching information already available to pet owners on the risk of zoonoses, EAG VII found that there was little mention of the above mentioned health benefits on websites, in brochures and other information sources, which provide information for the general public on the potential negative impacts of zoonotic disease. However, there was usually some discussion of the importance of good hygiene in minimizing those risks.

Members of the various EAGs were concerned that such information sources might scare people away from keeping companion animals and may be counterproductive for any attempts to improve public health. If only negative themes are presented, many pet owners will tend to disengage from the disease prevention message. Furthermore, attempting to address the potential risks associated with keeping companion animals by discouraging or even banning companion animals would be ineffective. The CALLISTO report therefore highlighted the importance of achieving a balanced message when addressing the public health implications of zoonotic diseases, as this would be likely to improve overall compliance with its goals.

However, participants in the CALLISTO project also recognized that ownership of a companion animal should come with a commitment to looking after the health and welfare of the pet, as well as a responsibility for any consequences of that animal's actions for others.

These are the principles underlying the idea of 'responsible pet ownership' (RPO). Broader acceptance and promotion of this concept is essential to reduce the risks of transmission of zoonoses from companion animals to man or production animals. RPO involves both a duty of care to the companion and a duty to protect the interests of not only the animal concerned, but all those with which it may come into contact.

The CALLISTO project defined RPO as 'a duty of care based on the principle that animals are sentient beings having intrinsic value, are dependent on humans for their health and welfare and are part of the ecosystem. RPO aims to maintain a good level of animal health and welfare, to maximize physical and psychological benefits to humans and to minimize the potential risk that pets may pose to the public, other animals or the environment. This duty starts with responsible acquisition and continues with providing appropriate care and protection for pets and their offspring.'

Therefore, duty of care requires owners or keepers to provide the physical resources necessary for an individual animal to maintain an acceptable level of health and wellbeing in its environment. The concept of the 'five freedoms' (freedom from hunger or thirst; from discomfort; from pain, injury or disease; to express normal behaviour; and from fear and distress) may serve as a useful guide.

Establishing a clear definition of the meaning of RPO was regarded as necessary, because in some information sources available to owners, the term is used to describe a duty that does not extend much beyond the need to neuter those pet cats and dogs that are not intended to be used for breeding. Those sources rarely emphasise that a commitment to RPO should start before an animal enters the home. It is essential that prospective owners consider both the type of animal they should choose and whether they have the knowledge and resources to look after it properly. Questions that they should ask themselves include:

- Can I take responsibility and fulfil my duty of care and duty to protect now and for the rest of the animal's life?
- Do I have enough time, means and relevant knowledge?
- What animal suits my situation?

These questions should all be considered and answered before a companion animal is obtained.

Efforts to encourage and support RPO should include a combination of education and incentives to undertake the correct behaviours and legislation, with penalties for not performing these behaviours or doing the opposite. Establishing the best way to encourage RPO requires an assessment of what is currently blocking acceptance and adoption of those behaviours that would reduce zoonosis risk. This may be a lack of understanding of why this behaviour is important (e.g. not even knowing what the disease is) or a lack of understanding of what behaviour is required to prevent the disease risk (e.g. insecticidal collars). In some cases the question of how it may be achieved is the problem (e.g. when flea collars are considered too expensive or there are no local outlets that stock them).

A range of methods could be used to address companion animal owners with a simple message: via veterinary practices or through educational sources such as television, radio, print and online media. Those sources should emphasize the importance of good standards of hygiene and measures such as professional veterinary care and regular parasite control in protecting the health of the animal, its owner and all other members of the household.

EAG VII also drew up a list of behaviours, based on an extensive literature search to highlight those behaviours which may heighten the risks of zoonotic disease transmission. These may include those actions that result in contact with animal saliva, skin, urine and faeces and a lack of awareness/misinterpretation of typical behaviour of a species. Meanwhile, activities that pose a significant and growing risk to human and animal health include the acquisition of animals from unknown sources, the aggregation of animals in shows, shelters and markets, the rehoming of stray animals across borders; an increase in the numbers of owners wanting to spend holidays away with their dogs and the increasing popularity of exotic pet species.

Other unwanted behaviours reflect a basic unwillingness to embrace RPO. These would include a failure to provide proper housing of animals or to invest in preventative care, as well as the irresponsible acquisition of pets and the abandonment of those animals when they are no longer considered desirable or necessary.

EAG VII suggested use of the 'theory of planned behaviour' (Ajzen, 1991) to encourage attitudinal and behavioural changes that may reduce hazardous behaviours and increase protective behaviours of companion animal owners. According to this theory, people's intentions and behaviour are guided by three

main factors: (1) the expected consequences of performing the behaviour, (2) the perceived social pressures and norms from other people regarding whether the behaviour should or should not be performed and (3) the anticipated difficulties in performing the behaviour. While changing adult behaviour may be more complex, the behaviour of children, and thus future adults, can be influenced through education. There are several issues that could be emphasized from a young age with respect to reducing the risks posed by interacting with animals.

Children may be particularly vulnerable to the risk of zoonotic infections because of a physically close relationship with their pets and a lack of attention to hygiene measures. Therefore, school educational programmes for young children must include training in basic hygiene and proper hand washing techniques, particularly after they have touched an animal.

Children also need education on what constitutes RPO, including the acquisition of pet animals and the necessity for routine veterinary care. They would also benefit greatly from instruction on animal behaviour and how to interact safely with animals. It was noted that people who are not aware of typical species behaviour may find themselves at a higher risk of bites and scratches, especially where they fail to accurately interpret fear and aggression. Young children are at particular risk of being bitten by dogs because they are small in size and often have no understanding how their actions, such as play or taunting, may provoke an animal to bite.

EAGII investigated whether specific groups (i.e. the young, old, pregnant or immunocompromised; YOPIs) are at particular risk of zoonotic infections. It was concluded that while these groups are not necessarily at greater risk of exposure, the consequences are potentially more serious. Therefore, any advice offered would need to be tailored to their specific situation.

The expert groups felt that special attention should be given to stray animals, especially cats and dogs. Stray dogs, in particular, may pose serious health and welfare problems for man and animals, including the transmission of zoonotic diseases such as rabies. Effective stray dog and cat population control plans should be implemented in order to reduce these risks.

Discussion

As has already been noted, there is very little information on the numbers and species of companion animals in the EU and on their geographical distribution. Therefore, the expert groups highlighted the need to collect data that would allow monitoring

of trends in population size and diversity of different companion animal species, including details of imports.

Many zoonoses are reportable or notifiable in man or in both man and farmed animals, but not in companion animals. It is therefore impossible to identify their geographical distribution. Moreover, the utility of any information that is available may be limited because of differences in testing methods.

From the second cycle onwards, particular attention was paid to the 15 paradigmatic pathogens as selected by EAGs III, IV, V and VI (Table 1). Most of these pathogens are linked to cats and dogs and only eight are relevant to other pet species. Yet, from the list of selected pathogens, only three (Crimean–Congo haemorrhagic fever virus, West Nile virus and rabies virus) are notifiable when found both in animals and in people.

Those EU member states that are free of the pathogenic tapeworm *E. multilocularis* can apply specific measures to prevent introduction of the parasite with the importation of companion animals. Often, however, there is a lack of reliable information on the incidence in animals and people in those countries where the parasite is endemic.

While a number of zoonotic pathogens are known to be present in certain companion animal species, it is unclear how readily these are transmitted to the animal owners. This also applies to the transmission of strains of bacteria that are resistant to antimicrobial agents between companion animals and people. That is significant because campylobacteriosis and salmonellosis are the most commonly reported zoonoses with 214,268 and 91,029 confirmed human cases, respectively, in the EU in 2012 (<http://www.ecdc.europa.eu/en/publications/Publications/food-waterborne-diseases-annual-epidemiological-report-2014.pdf>). Most of these cases are food-borne infections, but the role of companion animals in their transmission is unclear. More data on source attribution in TESSy (the ECDC's European surveillance system) would be valuable in helping to fill those particular data gaps.

EAG II found that regulation on the control of zoonotic diseases is extremely variable across the EU and there is also little available information on compliance. Current EU regulations dealing specifically with companion animal disease are limited to two specific diseases. One of these is Regulation 998/2003 on the animal health requirements applicable to the non-commercial movement of pet animals, which covers rabies in cats, dogs and ferrets. While animals travelling across national boundaries under these rules must be uniquely identified with a microchip implant and be accompanied by a pet passport,

there is no requirement for the details to be included in an online database. Meanwhile, Regulation 1152/2011 allows member states that are free of *E. multilocularis*, or that have an eradication programme in place, to apply certain preventive health measures.

Bite wounds were highlighted as a special category of companion animal-related disease incidents that are not included under current EU or international monitoring programmes. There are figures from the USA on the numbers of bites and the frequency of these incidents resulting in a need for medical attention (4–4.5 million and 800,000–900,000, respectively), but it was noted that there are no reliable European figures.

Recommendations

EAGs I, II and VII agreed the need to strengthen data on the size and nature of the pet population and its role in disease transmission to other groups as their most important recommendation. Priority should be given to improving surveillance of those animal diseases with potentially the greatest impact on human health.

Improved collection of these data could be achieved by exploiting existing national databases and by involving relevant partners such as the veterinary services, companion animal food industry (e.g. FEDIAF), animal welfare organizations, competent authorities and international organizations, border inspection posts, dealers, traders and breeder associations. A Eurobarometer survey into pet ownership in the EU should also be considered.

Particular attention should be paid to the threat of new and emerging zoonotic conditions by creating a European network for the early detection of infectious diseases associated with companion animals, including research institutes, diagnostic laboratories and other stakeholders.

Existing networks, such as the UK VetCompass and Small Animal Veterinary Surveillance Network (SAVSNET) initiatives, are useful examples of systems designed to obtain information directly from the field. Another example is the Global Early Warning System (GLEWS), which is a joint system that builds on the added value of combining and coordinating the alert and disease intelligence mechanisms of OIE, the Food and Agriculture Organisation (FAO) and the WHO. It allows the international community and stakeholders to assist in the prediction, prevention and control of animal disease threats, including zoonoses, through sharing of information, epidemiological analysis and joint risk assessment. At EU level, lessons could be learned from the Food- and Water-borne Disease Network (FWD-

net), which is a network coordinated by ECDC that aims to ensure surveillance, early detection and response to food and waterborne diseases outbreaks, including zoonoses such as salmonellosis and campylobacteriosis. Future collaboration between ECDC and EFSA is therefore recommended and the EAGs welcome initiatives towards establishing joint surveillance databases.

In cases of notifiable human diseases, information on the source of infection should be provided by the national authority reporting the disease to ECDC through TESSy and on an annual basis to the OIE using its *World Animal Health Information System (WAHIS)* database, in accordance with the agreement between the WHO and OIE.

The process of exchange of information between risk analysts and stakeholders in regard to companion animals should be subjected to fair and rigorous assessment. This should take into account both the potential benefits and harmful impacts of pet ownership. The final goal is to achieve a balance between maintaining or possibly increasing, the benefits of companion animals and mitigating or eradicating potential risks.

Another key recommendation from the EAGs is that the European Commission should consider a system for the unique identification of pet animals, particularly dogs, and the recording of details on a readily accessible database.

The European Commission has already noted the potential value of such a system in the control of infectious disease. In its proposal for an Animal Health Law, it said: 'Efficient traceability is a key element of disease control policy. Identification and registration requirements... should be in place in order to facilitate the effective application of the disease prevention and control rules...'

Another reason for identification and registration is the need to provide information for epidemiological studies and surveys, but potentially there are also considerable welfare benefits. The trafficking of animals can be better controlled if the animals are identified and registered. Missing or displaced animals can be reunited with their owners after disasters and equally, the owners of lost or abandoned animals can be traced.

Experience obtained with the identification and registration of farm animals and the admittedly flawed system for horses will be very helpful in setting up a comparable system for companion animals. In the range of animals kept as companion animals, priority should be given to the identification and registration of dogs first and later cats. However, owners of other pet animal species should be encouraged to voluntarily identify and register their pets.

In some situations, appropriate identification systems are already in place. For example, cats, dogs and ferrets that are taken across national borders need to be identified. Purebred animals also need to be identified to ensure their lineage and many owners already have their animal identified to allow it to be returned when lost. However, identification without registration in a cross-border accessible database is of limited value.

The principles of disease prevention and control measures are comparable in man and animals. Many of the medicines used in human and veterinary care are similar. Therefore, in the case of antimicrobial products, any loss of effectiveness is likely to have serious implications for both human and animal patients. National authorities should be encouraged to include companion animals in existing surveillance programmes for antimicrobial resistance.

These shared concerns are the basis of the 'One Health' concept. Several initiatives are already in place that stimulate collaboration and information exchange between public health and animal health workers. Further development of the One Health relationship would not only focus on physical disease, but would also take account of the psychosocial benefits of human–animal interactions.

Continuous promotion of the One Health concept should be facilitated, for example through the 'Veterinary Week' initiative. It is also recommended that the European Commission support ECDC and EFSA initiatives to improve collaboration at the animal–human interface, as well as the cooperation achieved between OIE, FAO and WHO in the organization of One Health conferences. Consideration should also be given to encouraging greater involvement by those working in the environmental sciences and human–animal bond organizations in these efforts.

The EAGs welcome the European Commission's proposal for Community Animal Health Regulation, but note that its impact can only be evaluated after it is adopted and when the scope of secondary regulations for delegating and implementing those rules is known. Key questions for CALLISTO will be the definitions of different categories of animal and the establishment of a list of diseases/species based on the proposed criteria. A potential complicating factor could be that the status of an animal (e.g. horses) can change over the course of its life.

Many of the health risks occurring in relation to human–companion animal interactions could be prevented if animal owners were better informed of the risks and how they may best be avoided. Professionals such as veterinarians, members of the medical profession and animal behaviour professionals are well

placed to strengthen and deliver educational messages. Informative, attractive brochures for distribution in practice waiting rooms are recommended. Uptake of education messages would be further supported by using information and communication technologies, including social media. Special attention should be given to the education of medical students and the training of all healthcare professionals in the identification and appropriate management of infectious diseases transmitted by companion animals. This must include a balanced assessment of the relative risks and benefits of pet ownership.

Meanwhile, additional guidance should be offered to animal keepers that may need to exercise responsibility in situations that may present an increased risk, such as contacts between companion animals and people with greater vulnerability to infection (YOPIs) or through contacts between companion animals and farm animals, in particular during an outbreak of a transmissible disease.

The prevention of dog bites is a particular issue in which education is important. Potential dog owners, now and in the future, should be aware of the importance of proper socialization of puppies in reducing unwanted behaviour and why it is important to teach children to interact safely with dogs. Parents and school children are both at increased risk when it comes to dog bites and should be taught how to approach a dog. Breeders should also be encouraged to breed for positive behavioural traits.

Identifying the management of stray dog populations as an important risk management factor, the EAGs welcome the OIE Platform on Animal Welfare for Europe, which will, in part, focus on stray dog population management. Raising awareness and education of owners and the general public about their responsibilities in controlling the numbers of unowned and unwanted dogs should be one of the platform's key priorities.

In conclusion, EAGs I, II and VII are convinced that companion animals play an important, positive role in human society. However, it is crucial that in every communication regarding companion animals, both the benefits and the risks of keeping them are communicated in a balanced way, together with recommendations to reduce these risks.

Acknowledgments

The research leading to these results received funding from the EU Seventh Framework Programme for research, technological development and demonstration under grant agreement n° KBBE-2011-5-CALLISTO 289316. Contents of this publication reflect only the contributor's views and the EU is

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Conflict of Interest Statement

The authors whose names are listed immediately below certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or conflicting interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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[Received, February 4th, 2015]
 [Accepted, June 30th, 2015]