The role of companion animals in the emergence of parasitic zoonoses

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Abstract
Pets offer individuals and the community significant benefits, however cognisance must be taken of the potential for transmission of infectious agents from these animals to humans. The prevalence of many parasites, such as Giardia and Cryptosporidium, has increased over the past few decades while others, such as Toxocara and Ancylostoma, have decreased. These changes could be real, associated with the ready availability of efficacious anthelmintic products or could be artificial due to the type of surveys conducted, the animals surveyed and the diagnostic tests used. Immunocompromised people, in particular, must be aware of the potential risk of acquiring parasitic infections from their pets. However, with the adoption of good hygiene and a thorough knowledge of the transmission of these parasites, immunocompromised people should be able to continue to enjoy the significant benefits of pet ownership. As many owners are not aware of the zoonotic parasites that could be carried by their pets or their mode of transmission, it is concluded that veterinarians need to play a greater role in the education of their clients.

Keywords: Parasites; Zoonoses; Pets; Companion animals

1. Introduction
Pet animals, particularly dogs and cats, play an important role in societies throughout the world. They are important companions in many households, contributing to the physical, social and emotional development of children and the well-being of their owners (in particular elderly people) [1–7]. Furthermore, pet owners are reported to visit their doctor less often, use fewer medications and have lower blood pressure and cholesterol levels than non-pet owners [8].

Although pets offer significant benefits to our society, there are well-documented health hazards associated with owning a pet. Animal bites and allergy to pets are the commonest health hazards, however a diverse range of infections, including parasitic, bacterial, fungal and viral diseases are capable of being transmitted to humans from domestic pets [9,10]. Schantz [11] reported that the potential health risk to humans of enteric parasites harboured by pet dogs and cats remains a significant problem in most parts of the world.

Details of the specific zoonotic parasites of pets have been presented elsewhere in this issue, and this review will concentrate on factors affecting the prevalence of parasites, the risk of infection and managing and reducing these risks.

2. Changes in the distribution of parasites in dogs and cats
Recent parasitological surveys of dogs and cats have indicated that the prevalence of intestinal helminths has declined over the last 20 years in the developed world [12–14]. This may be a real decrease associated with the ready availability and adoption of safe and effective drugs to eliminate these infections from pets. Alternatively, differences in sampling protocols including source and age of animals; prior anthelmintic usage in sampled animals; diagnostic techniques; or environmental conditions between surveys may account for the decrease in prevalence [15–17].

2.1. Sampling protocols
Bugg et al. [14] demonstrated the significant effect of dog source in their study where stool samples were collected from dog refuges, pet shops, veterinary clinics, breeding kennels and from exercise areas in Perth, Australia. The prevalence of zoonotic helminths was low in dogs sampled at veterinary clinics, exercise areas or breeding kennels (less than 1.5%). In contrast, the prevalence of Toxocara canis and Ancylostoma caninum in dogs from refuges and pups...
from pet shops was higher (up to 7%). Schantz et al. [18] and Blagburn et al. [19] also reported that in the USA, dogs from refuges and shelters had higher prevalences of *T. canis* and *Ancylostoma* spp. than did dogs sampled at veterinary clinics. Similarly for cats, higher prevalences of zoonotic parasites have been reported in shelter cats (18.2%) than client owned cats (10.1%) [20]. The lower prevalence in well cared for pets is probably associated with the type of owner surveyed, as Schantz [11] reported that clients of veterinarians were more likely to treat their pets with anthelmintics than were other pet owners. Animals in refuges are less likely to have received a high degree of care or veterinary attention and are unlikely to receive routine anthelmintic treatments.

2.2. Demographic factors

Young animals are at a greater risk of being infected with parasites such as *Toxocara*. For example, Schantz et al. [18] observed that the prevalence of *T. canis* in dogs aged from 7 weeks to 3 months in shelters in the USA was nearly 100%. However, even after allowing for age differences in the study of Bugg et al. [14], different levels of infection were found between sources, indicating the importance of other factors, such as frequency of anthelmintic use, in influencing the prevalence of parasites.

Infections of *T. canis* and hookworms have been reported to be more prevalent in intact male and female dogs than in neutered animals [16]. This may be related to hormonal or behavioural differences between intact and neutered animals. However, Robertson et al. [21] observed that mature entire animals (other than those used for breeding) were taken to veterinarians less frequently and received fewer prophylactic treatments, such as anthelmintics, than did similar aged neutered animals.

2.3. Anthelmintic usage

While early studies in dogs from Australia found high levels of infection with *T. canis* of up to 38% [22,23], more recent surveys have reported a lower prevalence of this parasite and evidence of the increasing importance of zoonotic protozoa such as *Giardia* and *Cryptosporidium* [24,25]. These earlier surveys involved only small numbers of animals, predominantly sampled younger animals, were restricted to high risk groups and were concerned with specific parasites [26–28]. Bugg et al. [14] considered that one of the major reasons for the reduction in the prevalence of parasites such as *T. canis* and *Dipylidium caninum* was a growing awareness by dog owners about these parasites and methods for controlling them. They proposed that targeted, strategic treatments for parasites such as *T. canis* and *Dirofilaria immitis*, where owners could associate treatment with a particular parasite and its consequences, were more likely to be successful and therefore reduce the risk of transmission of these potentially zoonotic parasites. In contrast, advocating regular anthelmintic treatment of dogs of all ages, without an association with a particular parasite or strategy (e.g. [29], was considered to be less effective and more likely to hasten the appearance of drug resistance, as has been reported in farmed livestock [30].

Bugg et al. [14] found that *Giardia duodenalis* was the most common enteric parasite of domestic dogs in Perth, Western Australia. Although the clinical significance of this parasite appears to be minimal in dogs, Hopkins et al. [31] demonstrated that some strains were shared between humans and dogs. The apparent increase in the prevalence of protozoa, such as *Giardia*, may have arisen from the use of more sensitive diagnostic techniques in recent studies. Alternatively Bugg et al. [14] proposed that as enteric protozoa are unaffected by the anthelmintics currently in common use, the intestinal protozoa may be colonising the niche vacated by parasites such as *T. canis* and *D. caninum*.

2.4. Geographical location

In contrast to Australia, Blagburn et al. [19] found high levels of helminths in a large study in the USA (*A. caninum* 19.2% and *T. canis* 14.5%) but low levels of protozoa. Samples were, however, only collected from animal shelters and also were collected from a wide geographical area. In contrast, a survey of pups for sale at pet stores in Atlanta showed that 34% were infected with *Giardia* [32] even though none had diarrhoea or clinical illness. Similarly a survey of dogs in California detected 35.9% of dogs shedding *Giardia*, with similar rates of infection and also the absence of clinical signs in both shelter and privately owned pups [33].

The high level of pet ownership by American households and the reported high carrier rates of *Toxocara* and *Ancylostoma* by dogs could lead to widespread environmental contamination with eggs and infective larvae. These represent a significant source of infection for humans, in particular children [34,35] and highlight the importance of giving preventive treatments particularly to young pups. Unless anthelmintic treatments are administered to puppies before the age of 4 weeks, female worms can become gravid and produce eggs when the pups are as young as 3 weeks of age. Furthermore, these eggs can remain infective in some environments for months or even years [16].

Toxocarial larva migrans has been reported to be the most common zoonotic parasitic infection acquired from pets in the USA [36] and it has been estimated that this infection causes hundreds of cases of unilateral blindness and less permanent forms of illness in children each year in the USA [34,35]. However these estimations were based on data collected between 10 and 20 years ago. Given the reduction in the prevalence of intestinal helminths reported elsewhere [14] it is probable that a similar reduction in the number of human cases in the USA has occurred.

Differences in the parasites detected between studies may also be attributable to factors related to the environment.
(e.g. soil type and elevation) and climate (rainfall, temperature and humidity) [15,16].

2.5. Diagnostic techniques

Use of different diagnostic tests may account for, in part, differences in prevalences observed between studies. Schantz [16] emphasised that stool examinations were not reliable in young pups, as often worms were prepatent. Schantz et al. [18] reported that although approximately 80% of dogs younger than 6 weeks of age had Toxocara in their intestine, Toxocara eggs were detected in only 20% of their stools.

Other reasons for false negative stool results include the use of poor or inappropriate diagnostic techniques, provision of insufficient faeces or inappropriate handling of faecal material. Chomel [37] highlighted the need for sensitive diagnostic tests to firstly detect and identify parasites and then to establish an effective control program against them. Although faecal flotation tests have been used widely in parasitological studies, the accuracy of the technique varies depending upon the procedure employed. Faecal flotation is not reliable for detecting eggs of many of the tapeworms. Furthermore, eggs of most of the tapeworms are not regularly released from proglottids into the faecal stream leading to false-negative results. Although necropsy is considered the ‘Gold standard’ diagnostic procedure, it has the disadvantage of being time consuming and is obviously not appropriate for domestic pets.

With the development of new diagnostic techniques, such as the polymerase chain reaction (PCR) for Cryptosporidium [38,39] and the enzyme-linked immunosorbent assay (ELISA) for detecting coproantigens of Echinococcus [40], the sensitivity of tests used to detect parasites, in particular protozoa, has increased significantly.

Most studies of parasites of pets have been limited by the fact that only single stool samples have been collected and examined. With the intermittent shedding of many parasites [41], the prevalence of infection with zoonotic parasites in pets may, in fact, be underestimated and the real risk to owners could be greater than that currently assumed.

3. Risk factors

Specific groups of the population have been identified as having a higher risk of acquiring parasitic zoonoses than others. These groups include small children, pregnant women and the immunocompromised [42]. These groups are at a higher risk partly because of behavioural characteristics and partly because of immunological reasons.

Pet ownership is an important risk factor for the occurrence of many zoonoses. For example, Toxocarariosis has been reported to occur more frequently in households with a pup (rather than an adult dog). This risk is further elevated if the household contains a child who has a habit of geophagia [11,43,44].

The presence of multiple dogs in a household was identified by Bugg et al. [14] as increasing the chance of dogs being infected with Giardia. They proposed that given the apparent ease with which infection could be transmitted between dogs, members of households with multiple dogs had a greater chance of acquiring infection with Giardia from their pets. A similar risk would be expected for people who have close associations with pets such as veterinarians, veterinary nurses and breeders. Paradoxically it would seem that while the risk of acquiring infections with Toxocara or Ancylostoma by owners has decreased because of the routine use of anthelmintics, this has led to a concurrent rise in the risk of infection with Giardia. Bugg et al. [14] demonstrated a positive correlation between the number of doses of anthelmintics and the prevalence of Giardia and a negative correlation between parasitism with helminths and the number of doses of anthelmintics administered.

As trade in animal products and the movement of human populations continues to increase, so does the risk that zoonotic diseases will be introduced or reintroduced into certain areas [45]. Effective control of many parasitic zoonoses depends upon a detailed knowledge of life cycle patterns, particularly the role humans play in perpetuating transmission cycles [46]. Juckett [42] proposed that simple procedures to break the faecal-oral route, such as washing hands, not emptying a litter box if pregnant, regular worming of pets and supervising toddler-pet interactions could all reduce the likelihood of infection with parasitic zoonoses. Furthermore, Overgaauw [47] believed that education, along with an appropriate anthelmintic regime and consequent reduction in environmental contamination, would lead to a reduction in the incidence of most parasitic zoonoses. Bugg et al. [14] reported that most owners (56%) collected and removed their dog’s faeces from their yard at least four to five times per week. Such regular disposal of faeces would help reduce the risk of viable eggs of Toxocara and other helminths being maintained in the household environment.

Advances in chemotherapy, the emergence of human immunodeficiency virus and advances in organ transplants have led to an increase in the number of immunocompromised individuals and consequently zoonoses have become a more important threat. Hill et al. [20] proposed that pets residing in the homes of immunocompromised people should be screened for enteric zoonotic organisms. However, Wong et al. [7] believed that, if appropriate care was taken, the risk of transmission of zoonoses to immunocompromised people was minimal.

The United States Public Health Service considered that Cryptosporidium, Giardia and Toxoplasma were of significant risk to immunocompromised people. However, these risks are not necessarily associated with pet ownership as Luft and Remington [48] determined that the risk of cerebral toxoplasmosis was not increased by cat ownership as most cases occurred because of reactivation of previously latent infections acquired from eating undercooked meats [49].
Although pet ownership may present a health risk, it is equally important to take into account adverse physical and emotional effects that may result if immunocompromised individuals are advised to give up loved pets [7]. In a study of HIV infected persons by Angulo et al. [50], pet ownership was associated with a decreased prevalence of depressive symptoms and Chomel [51] believed that provided immunocompromised patients were diligent in washing their hands after handling animals or cleaning cages, the risks of acquiring zoonotic infections were minimal. Angulo et al. [50] also believed that immunocompromised individuals need to be more vigilant of their pet’s health than do other pet owners.

Factors that influence the likelihood of human infection with zoonotic parasites vary depending upon the genus and even species of the parasite involved. Many of these risk factors are changing as the habits of humans and their pets alter, leading to the emergence or re-emergence of parasitic disease or new pathways for transmission. Of particular interest are Echinococcus, Ancylostoma, Giardia, Cryptosporidium, Toxoplasma, Neospora, Leishmania and Pneumocystis and these will be discussed in further detail.

3.1. Echinococcus

The distribution and perpetuation of the hydatid tapeworm, Echinococcus has resulted from human activity. In Australia, the sheep strain of Echinococcus granulosus was introduced during European colonisation with the subsequent establishment of a sheep-dog cycle that has been perpetuated by poor husbandry practices. This subsequently has resulted in establishment of wild animal cycles that serve as reservoirs of infection for both cattle and sheep [52,53]. However, an emerging public health problem has developed through the establishment of urban foci of transmission. These have been detected in several regions of Australia and are a consequence of interaction between wild animals and domestic dogs as a result of increased hunting and recreational activities on the outskirts of urban areas [54–59]. The carcasses of animals shot in areas of bush close to urban areas or killed by motor vehicles, are potential sources of infection for dogs. Management factors, such as not feeding raw offal or allowing dogs access to carcasses of dead animals, can contribute to a reduction in the incidence of dogs with E. granulosus [14].

In the USA and Europe [17,60] foxes represent a significant source of Echinococcus multilocularis (e.g. up to 67% of foxes in areas adjacent to Zurich, Switzerland have been shown to be infected with this parasite [60]). Rodents can act as intermediate hosts for E. multilocularis [11] and Hofer et al. [60] detected infection in up to 20% of sampled rodents. These rodents form a significant source of infection to domestic cats and dogs that acquire patent infections after eating these animals. These pets then represent a significant risk to their owners. Restricting the hunting of animals and the regular use of appropriate anthelmintics has been recommended as an appropriate and easy method of controlling infection with E. multilocularis [61].

3.2. Ancylostoma

Contact with soil or sand contaminated by the faeces of dogs and cats infected with hookworms can lead to the development of cutaneous larva migrans in humans. This is particularly so in areas of higher humidity or in people who have to crawl beneath buildings, or in sunbathers reclining on wet sand contaminated by hookworm larvae [17].

Recently, however, it has been demonstrated that enteric infections with A. caninum can lead to eosinophilic enteritis [62]. Of particular concern with this condition is the fact that single worms have been incriminated in its development [63]. Croese et al. [64] concluded that climate directly influenced the rate of human enteric infections with A. caninum and the frequency of eosinophilic enteritis has been shown to be higher in tropical climates [63,65]. Because the worm could easily be overlooked in pathological specimens, Walker et al. [63] proposed that this condition was likely to be underdiagnosed and may be more widely distributed than is currently appreciated. As with many other parasitic zoonoses the faecal-oral route is important in the development of eosinophilic enteritis in humans, and appropriate hygiene procedures such as hand washing and removal and disposal of faeces will reduce the probability of infection.

3.3. Giardia

Giardiasis is a common illness of humans [17,66–69]. Epidemiological evidence would suggest that humans are likely to be the main reservoir of human giardiasis and it is likely that direct person to person transmission is more important than zoonotic transmission [67,70]. However, dogs and cats can carry strains of Giardia which are potentially infective to humans [31] and therefore the zoonotic potential must be considered, especially for immunocompromised people. Although Giardia is common in dogs and cats, it is rarely associated with overt symptoms or clinical disease. However, if clinical giardiasis is reported, it is usually associated with kennel or cattery situations [71], which are important sources of new pets for households. Therefore treatment of Giardia-infected dogs and cats may be advocated, whether or not they are clinically ill, because of the potential for zoonotic transmission [71–74]. The recent development of vaccines against Giardia and their apparent ability to reduce the duration of shedding of cysts [75,76], may provide an effective method for reducing carrier rates in pets and subsequent environmental contamination. This could be of particular importance to immunocompromised individuals.
3.4. Cryptosporidium

*Cryptosporidium* is a common cause of human diarrhoea [77]. *Cryptosporidium* has also been detected in dogs and cats [24,25,78] and these animals may represent an important reservoir of infection for humans. Molecular studies have indicated that *C. parvum* is not a single uniform species but instead composed of at least six genetically distinct but morphologically identical genotypes, only two of which appear to be capable of infecting immunocompetent humans [38,79–82]. However, the significance of immunocompetence is important since it is possible that individuals whose immune system is deficient, as in AIDS, may be susceptible to other genotypes of the parasite, including the genotype commonly found in dogs [83,84].

The clinical significance of cryptosporidial infection in dogs and cats is unclear but appears to be most severe in the very young where the effects are exacerbated by stress, overcrowding and immune suppression [84]. Most infections of dogs with *C. parvum* are asymptomatic, however concurrent infection with distemper virus can lead to clinical illness. Although only a few dogs have been found to be shedding the oocysts, high rates of seropositivity have been documented, suggesting a history of previous exposure [85]. The infective oocyst may be transmitted directly by the faecal/oral route, or through contamination of water supplies.

Although there are several drugs that can be used to treat infections with *Giardia* and numerous preparations effective against intestinal helminths, there currently are no reliable forms of chemotherapy for cryptosporidial infections [86]. Thus with *Cryptosporidium* early diagnosis is important and clinical intervention will be required to treat the effects of infection. Fortunately in persons with a normal immune system, symptoms of cryptosporidiosis usually last only a few days or weeks, however in the immunocompromised infection can lead to serious, life threatening illness.

3.5. Toxoplasma

Although infection with *T. gondii* is common in humans, most infections occur without the presence of clinical signs. The cat is the only definitive host for this parasite and after oocysts are passed in the faeces they must mature for between 2 and 5 days before they are infective for humans and other animals [50]. Furthermore oocysts are usually only passed for a few weeks during a cats life and <1% of cats examined in the USA have been shown to be shedding oocysts [41]. The risk of acquiring toxoplasmosis from freshly passed cat faeces while cleaning a litter box would therefore appear to be extremely low. However, daily cleaning of cat litter trays, to ensure that if *Toxoplasma* oocysts are shed they do not have time to sporulate and become infective, and wearing gloves while cleaning the trays have been recommended, particularly in high risk groups [87,88]. Many other animals can also be infected with *T. gondii* and it is likely that most humans are infected by eating raw or poorly cooked meat rather than from a cat [50].

3.6. Neospora

At present there is no evidence to suggest that *Neospora caninum* is a cause of disease in humans. However, some non-human primates are susceptible to infection [89] and the parasite can be a significant cause of abortions in cattle [90,91]. Based on the results of a serological survey, Tranas et al. [92] concluded that humans could be exposed to *N. caninum*, however the possible route of exposure or outcome of infection were not known. Given the similarities between *T. gondii* and *N. caninum*, there is the possibility of human infection with *N. caninum* after ingesting raw or under cooked meat containing tissue cysts or by exposure to sporulated oocysts present in the faeces of dogs. As with many other zoonoses, it is probable that immunocompromised individuals are at a greater risk of infection. However, common sense would suggest that every-day hygienic practices should afford protection from what is currently perceived to be a very low risk of disease.

3.7. Leishmania

The distribution of zoonotic forms of *Leishmania* is expanding into areas of Europe not previously regarded as endemic [45,93]. Leishmaniasis caused by *L. infantum* is found throughout the Mediterranean region where dogs are considered to be the main reservoir host [94–96]. Recently, new foci of transmission have been reported, and studies from several areas have found the levels of canine infections to be higher than expected [97–98]. More significant, however, is the high level (up to 75%) of serologically positive dogs that have subclinical, inapparent infections with *L. infantum* [98]. This highlights the dangerous reservoir that dogs represent with regard to the spread of visceral, and possibly cutaneous leishmaniasis [95,99]. Furthermore, pet dogs which accompany their owners on short visits to endemic foci of transmission may act as reservoirs and serve to introduce the infection to other geographical areas. Orndorff et al. [98] emphasised the risk to public health of bringing naïve dogs into such endemic areas.

3.8. Pneumocystis

*Pneumocystis carinii* is a common cause of life-threatening pneumonia in immunocompromised patients [100–102]. Several authors [100,103] have proposed that, although some infections with *Pneumocystis* involve reactivation of previously acquired infections (particularly from childhood), the environment is an important reservoir of infection and nosocomial transmission is possible. *P. carinii* has been considered a zoonotic parasite with morphologically similar forms occurring in a range of mammalian species
including humans. However, recent molecular studies suggest that the taxon ‘P. carinii’ in fact consists of a number of genetically distinct groups associated with single host species [104,105]. Although infections with Pneumocystis are important in both immunocompromised patients and pets [106], it would appear that pets play an insignificant role in the transmission and distribution of this organism.

4. Education

Since infections of pets and humans are often the result of human activity, and a major aim in controlling zoonotic infections is to break the cycle of transmission, education must play a key role in their control. The role of education in preventing infection with parasitic zoonoses has been highlighted by numerous authors [11,14,47,84,107,108] and veterinarians have been identified as a potential provider of this education. The value of education in reducing the incidence of hydatids by changing management practices (such as not feeding the offal of home-killed sheep to dogs) has been well-documented [42,109]. Kornblatt and Schantz [110] and Harvey et al. [107] found that although veterinarians were an effective source of information many were providing incorrect, minimal or out of date information. Although Thompson and Morgan [84] believed that veterinarians and other professionals including medical practitioners could play a vital role in the education of the public, they considered that these ‘educators’ must be aware of the changing trends in the transmission of zoonotic parasites. For example, they considered it was important to be aware that: foodborne transmission of Toxoplasma was a more important source of infection to humans than were cats in many endemic areas [93]; canine scabies was probably not a zoonotic condition [111]; and dogs and cats could harbour strains of Giardia which are potentially infective to humans [31].

Bugg et al. [14] reported that in Perth, Western Australia, many dog owners (62.5%) were aware that canine parasites could be transmitted to humans. However, the awareness of the zoonotic potential of some parasites was variable; eg only 1.5% of pet owners were aware of the zoonotic potential of Cryptosporidium in contrast to 70% for Toxocara. Although the risks of some parasites were appreciated, only one third (34%) of interviewed pet owners could provide correct information on the mode of transmission of these parasites. Correct information was obtained from veterinarians, the health department or from schools, highlighting the value of these information sources. In contrast, incorrect information was being commonly acquired from the mass media. Robertson [112] observed that although most Australian pet owners (and non-pet owners) were aware of the exotic disease rabies and how this disease was transmitted, few were aware of endemic parasitic zoonoses such as toxocariasis or toxoplasmosis. Schantz et al. [43,44] also reported that, in the USA, most pet owners did not know that their pets might carry illnesses transmissible to people.

Strategically timed preventive anthelmintic treatments for dogs and cats have been recommended as an important tool in the control of parasites [16]. In the study of Bugg et al. [14], although a high percentage (82.4%) of owners had wormed their dogs in the twelve-month period preceding the survey, many were giving fewer doses of anthelmintics than recommended. De-worming is most effective for averting morbidity and preventing environmental contamination when aimed at pups and kittens and their dams because they have the highest worm burdens, are most vulnerable to the effects of these infections, and are the main sources of infective stages [16].

Most households acquiring new animals obtain a young pet rather than an older animal [1]. Frequently puppies or kittens are acquired by a household when that household also has a young family. Therefore the risk of infection is heightened by having animals with a potentially higher prevalence of parasitism in a household with members who have a greater chance of becoming infected through close contact with the pet. These owners need to be made aware of the potential dangers from their pets and the simple precautions that can be adopted to reduce these dangers. In the study of Bugg et al. [14], only 23% of owners/managers of pet shops advised customers of the potential zoonotic risks from puppies and no owners/managers were aware that Giardia was potentially zoonotic. Little advice was given on the management or husbandry procedures that could be adopted to minimise the risk of infection of zoonotic parasites, to both puppies and humans. In fact four pet-shops advised customers to worm themselves and/or their children as preventive measures for parasitic infection of their dogs. Stehr-Green et al. [32] observed that pups that received regular anthelmintic treatments in pet shops were infected less commonly with intestinal helminths than those receiving none or only a single treatment. This again highlights the significant benefit of routine prophylactic anthelmintic treatment in minimising the risk to owners.

Although animals in shelters do not constitute a significant risk to the general public, some of these animals are subsequently rehomed and then represent a real risk to their new owners. It is therefore essential that these animals receive treatment to eliminate existing infections prior to rehoming. Without this, environmental contamination with infective stages will continue, facilitating infection of susceptible animals, reinfection of existing pets and potential infection of humans.

Education has an important place in reducing the prevalence and incidence of infections with potentially zoonotic parasites in pets and their owners. Practicing veterinarians, knowledgeable of the potential dangers and how to minimise them, are ideally placed to provide pet owners with sound advice about prevention and to recommend appropriately-timed preventive medications to reduce the zoonotic
risks [11,107,108]. Increased awareness that some diseases may be associated with animals and more effective prevention and treatment programs will help to reduce the prevalence of zoonotic infections so that pets can continue to be integral members of households throughout the world [107,113].

References


