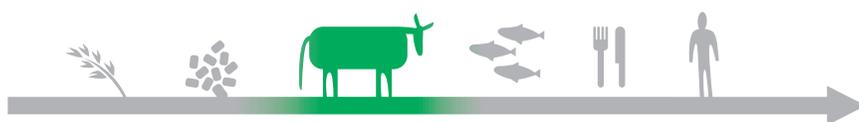
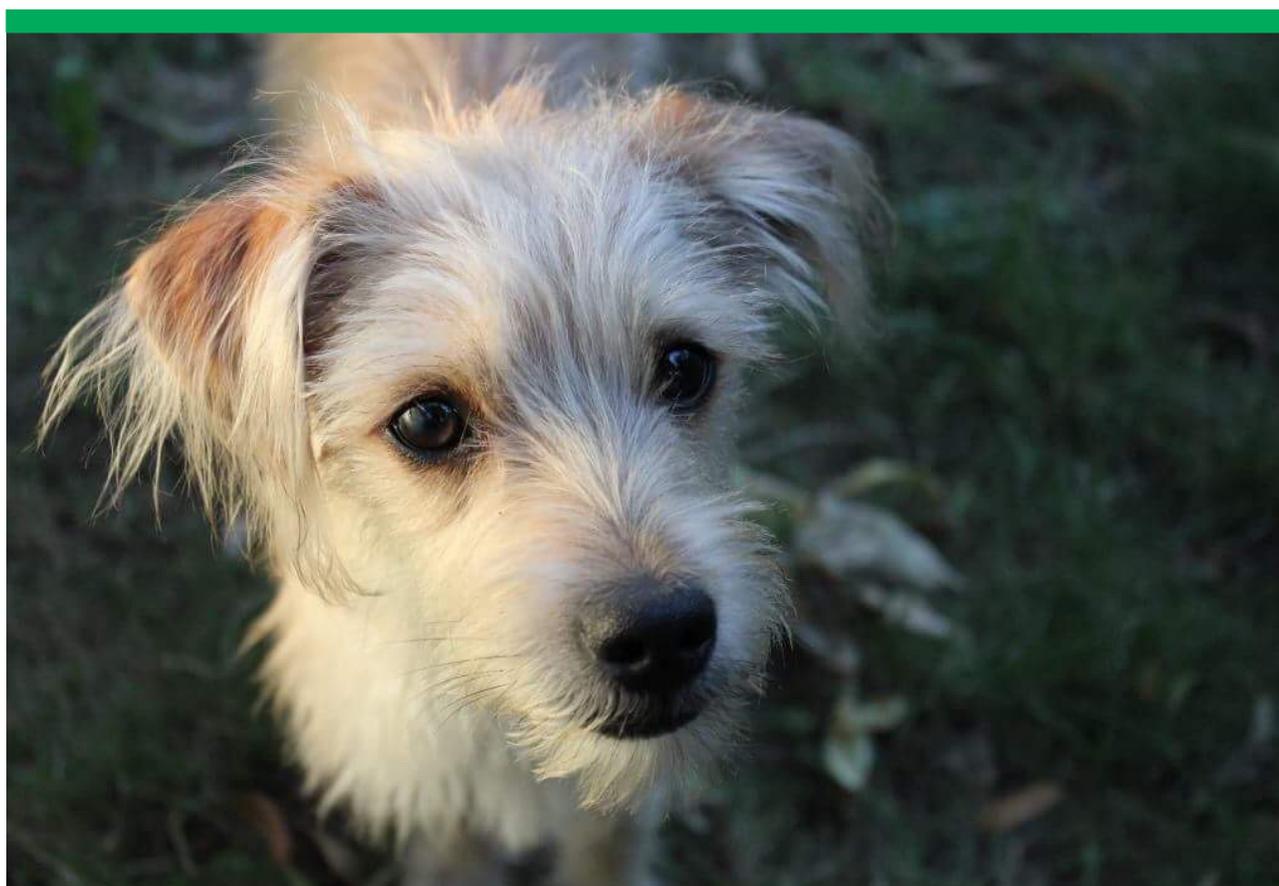


The surveillance programme for imported dogs in Norway in 2017



Veterinærinstituttet
Norwegian Veterinary Institute



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Summary

A total of 72 dogs imported to Norway from 8 different countries were included in the surveillance programme in 2017. The majority of included dogs (79%) were imported from Spain. Documentation of rabies vaccination is compulsory for entry of dogs into Norway from most countries. Eighty-seven percent of the dogs had a rabies antibody level greater than 0.5 IU, and 8.6% of the dogs had so low antibody levels that one may question the validity of the rabies vaccination document. The most frequently detected infection was *Leishmania infantum* (6.9%), followed by antibodies against *Ehrlichia canis/ewingii* (2.8%) and heartworm *Dirofilaria immitis* (1.4%). No dogs tested positive for French heartworm (*Angiostrongylus vasorum*).

Introduction

The import of dogs to Norway from non-Nordic countries has increased in recent years after a change of regulation in movement policy in 2012. The increased import of stray- and shelter dogs is a particular concern, because these dogs may carry infectious agents that do not exist in Norway or are rare in Norway. A study performed in 2012 demonstrated that 53% of 75 dogs imported mainly from Romania had a lower antibody level than that considered adequate for reliable protection despite documented rabies vaccination (1). The low antibody levels can be explained by incorrect vaccination, immunocompromised dogs or false documentation. In the last years, the Norwegian Veterinary Institute (NVI) has detected, in imported dogs, a number of infectious agents that do not exist in Norway including heartworm (*Dirofilaria immitis*), the brown dog tick (*Rhipicephalus sanguineus*), tongue worm (*Linguatula serrata*) and the protozoan parasite *Leishmania infantum*.

Aims

To document the occurrence of exotic infectious agents in imported dogs and to assess compliance with required pre-import rabies vaccination.

Materials and methods

The Norwegian Food Safety Authority (NFSA) was responsible for identifying dogs relevant for inclusion in the programme. These should be imported for the first time to Norway from Southern- or Eastern Europe or “third countries”, be at least 6 months of age and should be sampled within a week of arrival in Norway. The aim was to include 100 dogs in the programme during 2017.

Dogs eligible for inclusion were blood sampled and information regarding age, sex, country of origin and the dog’s immunisation history was documented on a questionnaire. Samples were sent to the NVI for analyses.

An aliquot of 0.5 ml serum from each included dog was sent to the National Veterinary Institute in Sweden (SVA) for detection of antibodies against rabies, and determination of antibody titer, using the Fluorescent Antibody Virus Neutralization test (FAVN). All imported dogs (except dogs traveling from Sweden) should have valid documentation of rabies vaccination for entry into Norway. An antibody level ≥ 0.5 IU is recommended by WHO and OIE* as sufficient for protection against rabies (2), and more than 85% of vaccinated dogs achieve this level after one dosage of rabies vaccine (1).

Serum samples were also tested at the NVI for heartworm (*Dirofilaria immitis*) and French heartworm (*Angiostrongylus vasorum*) using the snap tests IDEXX SNAP 4dx and IDEXX Angio detect, respectively (IDEXX, Hoofddorp, The Netherlands). Both these tests are antigen tests that detect presence of the parasite (i.e ongoing infection). The IDEXX SNAP 4dx also detects antibodies against *Ehrlichia canis/ewingii*. Serum from each dog was also tested for specific antibodies against *Leishmania infantum* using the ELISA

method IDVet ID Screen® Leishmaniasis Indirect (IDVet, Grabels, France) following the manufacturer's instructions.

Although not formally part of the programme, the dogs were also tested for antibodies against *Anaplasma phagocytophilum/platys* and *Borrelia* spp. This was done because the snap test used for detection of heartworm (IDEXX SNAP 4dx) also detects antibodies against these agents. *Anaplasma phagocytophilum* and *Borrelia* spp. are prevalent in some areas of Norway and are transmitted through endemic ticks (*Ixodes ricinus*).

Results

Blood samples were received from 74 imported dogs during 2017. However, samples from two of the dogs had been spoilt and were excluded. Hence, samples from 72 dogs were analysed.

Information regarding country of origin was available for all 72 dogs and data on immunisations were available for 68 (94.4%) of the dogs (Table 1). Fifty-four (75%) of the dogs were mixed breed. Remaining dogs belonged to 14 different breeds.

Table 1. Country of origin of 72 dogs included in the surveillance programme in 2017.

Country of origin	No. of dogs	Number of dogs with documented vaccination against:						No information*
		Rabies	Leishmania	Leptospirosis	Hepatitis	Distemper	Parvo	
Bosnia	2	1		1		1	1	1
Greece	1	1						
Hungary	1	1		1	1	1	1	
Poland	6	6		3	5	5	5	
Romania	3	2		2	1	2	2	1
Russia	1	1			1	1	1	
Spain	57	55	2	45	52	51	52	2
Turkey	1	1			1	1	1	

*No information given regarding vaccinations.

A result for rabies antibodies was available for 70 (97%) of the dogs (Table 2). Samples from two dogs were not of sufficient volume to perform the test. Out of the 70 dogs with a test result, 61 (87.1%) had a rabies antibody level ≥ 0.5 IU. The remaining nine (12.9%) dogs had antibody levels < 0.5 IU.

Table 2. Rabies titer measurement of 70 imported dogs with respect to country of origin.

Country of origin	Rabies titer (%)				
	≥ 0.5 IU	0.2-0.5 IU	0.1-0.2 IU	< 0.1 IU	Not done
Bosnia	1 (50)	1 (50)			
Greece	1 (100)				
Hungary	1 (100)				
Poland	4 (66.7)		1 (16.7)	1 (16.7)	
Romania	2 (66.7)			1 (33.3)	
Russia				1 (100)	
Spain	51 (89.5)	2 (3.5)		2 (3.5)	2 (3.5)*
Turkey	1 (100)				

*Not sufficient serum from two dogs, to analyze rabies titer.

Results for testing for antibodies or antigens against four infective agents are shown in Table 3. In addition to the five dogs positive for *Leishmania infantum* antibodies, two dogs from Spain and Greece, were concluded as doubtful and the owners were recommended to repeat the testing in six months.

Two dogs (2.8%) were positive for antibodies against *Anaplasma phagocytophilum/platys*; one was from Spain and the other was from Romania and no dogs were positive for antibodies against *Borrelia spp.*

Table 3. The number of dogs positive for antibodies or antigens against four infective agents with respect to country of origin.

Country of origin	No. positive (%)			
	<i>Leishmania infantum</i> antibodies	<i>Dirofilaria immitis</i> antigen	<i>Angiostrongylus vasorum</i> antigen	<i>Erlichia canis/ewingii</i> antibodies
Bosnia	0	0	0	0
Greece	0*	0	0	0
Hungary	0	0	0	0
Poland	0	0	0	0
Romania	0	0	0	1 (1.4)
Russia	0	0	0	0
Spain	5 (6.9%)*	1(1.4)	0	1 (1.4)
Turkey	0	0	0	0

*Two dogs, one from Spain and the other from Greece, were concluded as doubtful according to the manufacturer's instructions.

Discussion

The import of shelter dogs from other countries has increased following a change in import regulations in 2012. There is a potential for these dogs to bring with them infectious agents that are exotic to Norway, and in order to survey the situation, the NFSA initiated this surveillance project.

The majority of dogs (79%) sampled in 2017 came from Spain. This is in agreement with the impression that, for the last few years, Spain has been the main country of origin of shelter-dogs imported to Norway, which may be a result of activity of Norwegian dog rescue organisations in this country. However, the extent of dominance of this country was a surprise. The included dogs were identified at border control by the NFSA, and are presumed to accurately reflect the population of legally imported dogs to Norway. However, since there is no registry over imported dogs and their origin cannot be properly assessed. Both the NFSA and the NVI have warned about the potential risks to animal and public health in Norway that are associated with import of stray dogs. In addition, a study has shown that the majority of veterinarians in Norway would prefer a ban of import of stray dogs to Norway (3).

Although confirmation of rabies vaccination was lacking for four dogs, it is presumed that these dogs did have a valid pet-passport upon arrival and hence that they were vaccinated. Out of the 70 dogs with a result for rabies antibody measurement, 87% had an antibody level greater than 0.5 IU, which is considered sufficient for protection. The proportion of dogs with a sufficient antibody response is higher than findings from a study conducted on rescue dogs from Eastern Europe in 2012 (1) where only 47% of the dogs had titers ≥ 0.5 IU. One explanation could be that the majority of the imported dogs in the current surveillance program originated from well-organised shelters and rescue centres in Spain, while the majority of rescue dogs examined in 2012 came from Romania. Three dogs, with antibody levels between 0.2 and 0.5 IU, are likely to have been vaccinated against rabies but have a lower antibody level than expected. Four dogs (5.7%) had less than 0.1 IU which is considered negative and may suggest that they have not been vaccinated at all. One dog, with an antibody level between 0.1 and 0.2 IU was also dubious in this respect.

It is a concern that the antibody level detected in six (8.6%) of the dogs was so low that they might not be vaccinated at all, despite documentation of this in their pet passports. The prevalence of rabies in dogs in Europe is extremely low, and the likelihood of importing dogs with infection is considered to be very low. However, the consequences of importing an infected dog could be severe and it is of great importance that imported dogs are properly vaccinated. It is also worrying that more almost 9% of the imported dogs could be traveling with false documentation.

Antibodies against *Leishmania infantum* were detected in five dogs that originated from Spain. This parasite is found in the Mediterranean countries, and it was not a surprise, therefore, that it was detected in this investigation with such a large proportion of dogs from Spain. *Leishmania infantum* can give persistent and life-long infections and treatment is complicated. The sand fly vector, necessary for transmitting the parasite is not found in Norway, but recent reports have indicated a possibility for horizontal transmission of the parasite between dogs through bites (4, 5) blood transfusions (6) and mating (7, 8), and also vertical transmission from mother to offspring (7, 9). Hence, there is a potential for domestic infection of dogs in Norway following from import of infected dogs.

Only one of the dogs tested in this study was positive for heart worm (*Dirofilaria immitis*), but this parasite has also been detected in imported dogs previously (10). It is not unlikely that there are imported dogs in Norway that, unknown to the owner, are carrying infective adult stages of heart worm. The Norwegian Meteorological Institute has previously shown that the required medium temperatures for development of infective heart worm larvae in the intermediate host (mosquito) can be reached during summer in some areas of Southern Norway (11). For instance, in Oslo-Blindern, in the period 1981-2011, there was an average of 11 (0-52) days per year with possible transmission risk (based on calculated Heartworm Developing Units, HDU). Furthermore, potential intermediate host mosquitos (*Culex pipiens*, *Aedes vexans*, *Anopheles maculipennis*) are endemic in Norway.

All but six of the 68 (91.2%) dogs with information on immunisations had been given core vaccines (infectious canine hepatitis, canine parvovirus and canine distemper) in addition to the compulsory rabies vaccine. Although this was somewhat higher than expected, it should be an aim that all dogs imported to Norway are given core vaccines before traveling. Treatment against ectoparasites such as ticks, fleas and lice are also strongly recommended.

References

1. Klevar S, Høgåsen HR, Davidson RK, Hamnes IS, Treiberg Berndtsson L, Lund A. 2015. Cross-border transport of rescue dogs may spread rabies in Europe. *Vet Rec.* Jun 27; 176(26):672.
2. OIE. Rabies: Manual of Diagnostic Tests and Vaccines for Terrestrial Animals 2013 pp 1-26. http://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.01.13_RABIES.pdf
3. Dalum HS, Viken A. 2018. Veterinærers erfaring med gatehunder importert til Norge - en spørreundersøkelse. *Norsk vet. tidsskrift* Jan 1;10:16.
4. Karkamo V, Kaistinen A, Näreaho A, Dillard K, Vainio-Siukola K, Vidgrén G, Tuoresmäki N, Anttila M. 2014. The first report of autochthonous non-vector-borne transmission of canine leishmaniosis in the Nordic countries. *Acta Vet Scand.* Dec 10;56:84.
5. Naucke TJ, Amelung S, Lorentz S. 2016. First report of transmission of canine leishmaniosis through bite wounds from a naturally infected dog in Germany. *Parasit Vectors.* May 10;9(1):256.
6. Owens SD, Oakley DA, Marryott K, Hatchett W, Walton R, Nolan TJ, Newton A, Steurer F, Schantz P, Giger U. 2001. Transmission of visceral leishmaniasis through blood transfusions from infected English foxhounds to anemic dogs. *J Am Vet Med Assoc.* 2001 Oct 15;219(8):1076-83.
7. Naucke TJ, Lorentz S. 2012. First report of venereal and vertical transmission of canine leishmaniosis from naturally infected dogs in Germany. *Parasit Vectors.* 2012 Apr 1;5:67. doi: 10.1186/1756-3305-5-67.
8. Silva FL, Oliveira RG, Silva TM, Xavier MN, Nascimento EF, Santos RL. 2009. Venereal transmission of canine visceral leishmaniasis. *Vet Parasitol.* Mar 9;160(1-2):55-9.
9. Rosypal AC, Troy GC, Zajac AM, Frank G, Lindsay DS. 2005. Transplacental transmission of a North American isolate of *Leishmania infantum* in an experimentally infected beagle. *J Parasitol.* Aug;91(4):970-2.
10. <https://www.vetinst.no/nyheter/fremmed-parasitt-pavist-hos-hund-importert-fra-spania>
11. Mezghan A. 2013. Transmission risk of heartworm disease in Norway. *Met report no 16/2013.*

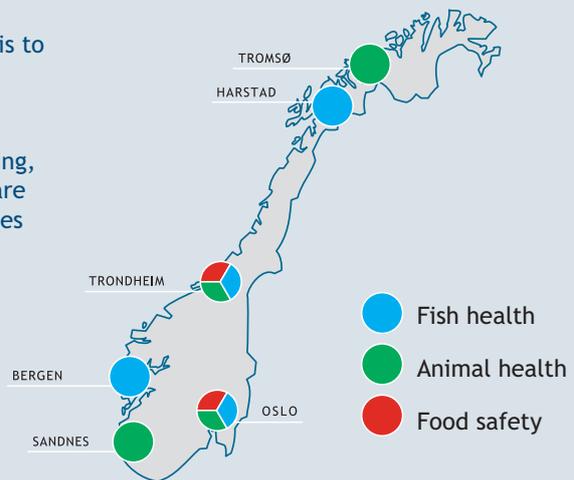
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