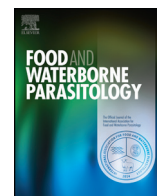




Contents lists available at ScienceDirect

## Food and Waterborne Parasitology

journal homepage: [www.elsevier.com/locate/fawpar](http://www.elsevier.com/locate/fawpar)

## *Echinococcus* across the north: Current knowledge, future challenges

Rebecca K. Davidson<sup>a,\*</sup>, Antti Lavikainen<sup>b</sup>, Sergey Konyaev<sup>c</sup>, Janna Schurer<sup>d</sup>, Andrea L. Miller<sup>e</sup>, Antti Oksanen<sup>f</sup>, Karl Skirnisson<sup>g</sup>, Emily Jenkins<sup>d</sup>

<sup>a</sup> Norwegian Defence Research Establishment, Kjeller, Norway

<sup>b</sup> University of Helsinki (FINPAR), Helsinki, Finland

<sup>c</sup> Institute Systematics and Ecology of Animals, Siberian Branch Russian Academy of Sciences, Novosibirsk, Russia

<sup>d</sup> University of Saskatchewan, Saskatoon, Canada

<sup>e</sup> Swedish University of Agricultural Sciences, Uppsala, Sweden

<sup>f</sup> Finnish Food Safety Authority EVIRA (FINPAR), Oulu, Finland

<sup>g</sup> University of Iceland, IEFP Keldur, Reykjavík, Iceland

### ARTICLE INFO

#### Article history:

Received 9 June 2016

Received in revised form 1 August 2016

Accepted 1 August 2016

Available online xxx

#### Keywords:

Alveolar echinococcosis

Arctic

Circumpolar

Cystic echinococcosis

Genotypes

### ABSTRACT

Zoonotic *Echinococcus* spp. cestodes are present in almost all circumpolar nations, and have historically posed a risk to health of indigenous as well as other northern residents. However, surveillance data on both alveolar (AE) and cystic (CE) echinococcosis remains incomplete throughout the circumpolar region: Russia, Fennoscandia, Iceland, Greenland, Canada and Alaska (USA). Prevalence of *Echinococcus* spp. varies considerably in definitive canid hosts, animal intermediate hosts and accidental hosts like humans. Yet despite the high prevalence reported in canids in some geographic locations, human AE and CE are much less common than in endemic Asian and central European countries. This paper explores knowledge gaps and future challenges posed by *Echinococcus* spp. in eight circumpolar countries, a region where rapid environmental and social change are rewriting the boundaries, transmission, and impact of many pathogens, including zoonotic *Echinococcus* spp.

Genotypes G6, G8 and G10 of *Echinococcus canadensis* are causative agents of human CE and have been identified in sylvatic (wild animal) and synanthropic (ecological association with humans) cervid-canine life cycles in the following northern regions: Alaska and northern Canada - G8 and G10; northern Russia - G6, G8, G10; and Fennoscandia - G10 in Finland - with no recent reports from Norway or Sweden. *Echinococcus multilocularis*, which causes AE, has been identified in a sylvatic arvicoline rodent-canine lifecycle in Alaska, Canada, Russia, Sweden and Svalbard (Norway). Asian, Mongolian, European and North American strains of *E. multilocularis* are found in Russia, with the North American N1 strain predominating in the north. The N1 strain is also found in Alaska, as well as Svalbard, whilst Asian strains have been identified in western Alaska. Central North American (N2) strain and European-type strains of *E. multilocularis* are present in Canada. Typing of the strain in Sweden is still pending. Individual human cases of AE with N2 and European-type strains are reported in North America, as well as multiple cases with Asian strains in Russia and historically on St Lawrence Island, Alaska (although genotyping of human cases was not available at the time). *Echinococcus* spp. have not been detected in Greenland and have been eliminated from Iceland.

The predominance of *E. multilocularis* N1 strain and *E. canadensis* genotypes, in regions with high prevalence in definitive hosts yet low incidence of human AE and CE, suggests that these genotypes have lower zoonotic potential and pathogenicity than European and Asian

**Abbreviations:** AE, alveolar echinococcosis; CE, cystic echinococcosis; DALY, Disability Adjusted Life Years; DH, definitive host; IH, intermediate host; NCR, Northern Central Region; NTZ, Northern Tundra Zone; OIE, World Organisation for Animal Health; SLI, St. Lawrence Island-Alaska; USA, United States of America

\* Corresponding author at: Protection and Societal Security Division, Norwegian Defence Research Establishment, Postboks 25, 2027 Kjeller, Norway.

E-mail address: [rebecca.davidson@ffi.no](mailto:rebecca.davidson@ffi.no) (R.K. Davidson).

<http://dx.doi.org/10.1016/j.fawpar.2016.08.001>

2405-6766/© 2016 The Authors. Published by Elsevier Inc. on behalf of International Association of Food and Waterborne Parasitology. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Please cite this article as: Davidson, R.K., et al., *Echinococcus* across the north: Current knowledge, future challenges, Food and Waterborne Parasitology (2016), <http://dx.doi.org/10.1016/j.fawpar.2016.08.001>

strains of *E. multilocularis* and livestock genotypes of *E. granulosus sensu stricto*. The continued monitoring of the emergence of *Echinococcus* genotypes within definitive and intermediate hosts, as well as people, is needed to assess the impact on public health risk, since the introduction of other genotypes could have serious repercussions. Lastly, determining risk factors and source attribution for human cases, including the possibility of food and waterborne transmission and the likelihood of autochthonous transmission, remain challenges.

© 2016 The Authors. Published by Elsevier Inc. on behalf of International Association of Food and Waterborne Parasitology. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

## Contents

1.	Introduction . . . . .	0
2.	<i>Echinococcus canadensis</i> . . . . .	0
2.1.	Distribution, hosts and genotypes . . . . .	0
2.1.1.	Russia . . . . .	0
2.1.2.	Fennoscandia . . . . .	0
2.1.3.	Iceland . . . . .	0
2.1.4.	Greenland . . . . .	0
2.1.5.	North America . . . . .	0
2.2.	Surveillance activities and human CE . . . . .	0
2.2.1.	General common to all regions . . . . .	0
2.2.2.	Russia . . . . .	0
2.2.3.	Fennoscandia . . . . .	0
2.2.4.	Iceland . . . . .	0
2.2.5.	Greenland . . . . .	0
2.2.6.	North America . . . . .	0
3.	<i>Echinococcus multilocularis</i> . . . . .	0
3.1.	Distribution, hosts and genotypes . . . . .	0
3.1.1.	Russia . . . . .	0
3.1.2.	Fennoscandia . . . . .	0
3.1.3.	North America . . . . .	0
3.2.	Surveillance activities and human AE . . . . .	0
3.2.1.	Russia . . . . .	0
3.2.2.	Fennoscandia . . . . .	0
3.2.3.	North America . . . . .	0
4.	Current challenges and future needs for <i>E. canadensis</i> and <i>E. multilocularis</i> in the north . . . . .	0
4.1.	Reporting- surveillance. . . . .	0
4.2.	Transmission . . . . .	0
4.3.	Control methods. . . . .	0
5.	Conclusions . . . . .	0
	Acknowledgements . . . . .	0
	References . . . . .	0

## 1. Introduction

Eight countries transcend the Arctic Circle currently at 66°33'46.2", and/or the 10° July isotherm, the meteorological definition of Arctic. These are Russia, Finland, Sweden, Norway, Iceland, Greenland, Canada and the State of Alaska (United States of America, USA). These very diverse countries range from having large metropolitan areas to remote small populations, some with indigenous people practicing a “traditional” lifestyle. Traditional activities such as hunting, fishing, and gathering (e.g. berries, mushrooms) are important culturally, economically, and nutritionally in indigenous peoples in all eight countries, and are also popular in non-indigenous ethnic groups. Untreated surface water is often used as a potable water source in northern communities in these countries. Some remote communities also have limited access to modern health care, such as medical imaging and sensitive and specific diagnostic tests, or veterinary services (Hotez, 2010). These multiple factors combine to contribute to a higher risk of exposure to zoonotic parasites, and more severe health consequences if infected. Tuberculosis screening campaigns in reindeer herders/indigenous people during the mid-20th century incidentally found many cystic echinococcosis (CE) cases in Fennoscandia, northern Canada and Alaska. Alveolar echinococcosis (AE) has been observed in people in western Alaska and Russia. In this paper we explore the two species of the *Echinococcus* that have been identified in northern wildlife and in human populations in these seven countries and Alaska as a whole, not just restricted to the regions north of the Arctic Circle.

Download English Version:

<https://daneshyari.com/en/article/5546260>

Download Persian Version:

<https://daneshyari.com/article/5546260>

[Daneshyari.com](https://daneshyari.com)