The public health risks associated with wild and feral swine

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Summary
Wild swine populations (*Sus scrofa*) are present in many regions of the world. Large feral populations in North America and Australia are principally derived from introduced domestic pigs. In Europe, most wild boar are found in Germany and Poland. While wild swine are certainly a significant reservoir of infection for domestic swine diseases (for example, African swine fever virus in wild boar in Sardinia), these swine generally do not constitute a major public health risk. *Brucella suis* infections and trichinellosis are the most important zoonotic threats to public health.

Keywords

Introduction
Throughout the world, free-living swine are known by many names, reflecting their mixed ancestry: in English-speaking countries, for example, wild swine are known as wild hogs, feral swine or hogs, wild boar, and 'piney woods' rooters in the southern States of the United States of America (USA). The early feral populations were often 'improved' for hunting purposes by the introduction of the Eurasian wild boar (*Sus scrofa*) from which the domestic pig originates. For convenience, the term *wild swine* in this short review embraces feral and wild boar, as these are in fact the same species. No information could be found on the public health risks associated with meat from other species of swine, such as the warthog (*Phacochoerus aethiopicus*) and bush pig (*Potamochoerus porcus*). The peccaries of the Americas (collared peccary [*Tayassu tajacu*] and white-lipped peccary [*Tayassu albirostris*]), while of similar appearance to swine, belong to a different family (*Tayassuidae*).

The early European voyages of discovery introduced domestic pigs to new continents and islands. It was common practice for the early settlers to allow swine to roam freely and feral populations soon became established. For example, Spanish documents chronicle the voyages of Hernando de Soto, his landfall in Florida in 1539, and how swine were introduced and flourished. These populations, which collectively number in the millions world-wide, constitute major ecological problems on the continents of Australia and North America, and on islands such as those of the Galapagos and Hawaii. In Hawaii, several ground-nesting species of birds are in danger of extinction as a result of being preyed upon by wild swine. In Australia, which has a unique flora and fauna, the wild swine population is regarded by ecologists as a major pest and one which should be eradicated.

Rural communities in areas where wild boar are not indigenous, however, often have an ambivalent attitude to these feral populations. Over centuries, the swine have become interwoven into the fabric of society; sometimes as a source of food, but more often for recreational hunting. In areas such as North America, sport hunters long ago introduced the European wild boar into these feral populations to improve the phenotype for hunting. For ecological reasons, such introductions into North America would find few supporters today. Paradoxically, the importation of wild boar in recent years into restricted hunting preserves in the United Kingdom (a country in which European wild boar were present in medieval times) has now resulted in the accidental release into the countryside, thus re-establishing the presence of this species in the British countryside. Nevertheless, the presence of these swine is not welcomed by members of the veterinary profession (1).

This short review of the public health significance of wild swine must therefore be viewed against the wider background. The ecological problems associated with the
presence of wild swine in areas of the world where the Eurasian wild boar is not indigenous are generally considered to be far more important than the health risks these animals present to human populations. Within the context of zoos, wild swine and peccaries are not considered an important source of zoonotic diseases (6).

International and national movement of game meat

Game meat, once the main source of food for man, now plays a relatively small role in total meat consumption in most parts of the world (9). Partly due to concerns over both animal welfare and the disease risks associated with domestic animal production (e.g., the spongiform encephalopathies), game meat production in some European countries, such as Germany, is rising. Game farming and ranching, particularly for deer, is supplementing hunted game, and some countries, such as New Zealand, have a regulated export trade. There is a world-wide trend towards increasing meat production from game farming, but the market is still projected to remain relatively small within the context of the global meat trade.

The global trade in pork and products derived from domestic pigs (and, where applicable, wild swine) is strictly regulated because of concerns over foot and mouth disease, African swine fever and other pathogens of economic importance to the sophisticated pig-meat production systems now present in many developed and developing countries of the world. (This topic is addressed in the preceding volume of the Office International des Epizooties Scientific and Technical Review.) Surprisingly, countries which are predominantly Islamic, such as Indonesia, can still be significant exporters of pork and pork products.

In contrast to well-defined laws regulating the international trade in pork, there are generally fewer restrictions on the movement of meat from wild swine within a country. History has established that transmission of disease through hunted meat is an occasional, but not extensive, public health issue. Regulations frequently forbid the sale of meat from hunted swine (some countries allow sale through licensed and separate, usually local, markets), but do not forbid the consumption of hunted meat. In Florida, for example, where approximately 100,000 wild swine are hunted or trapped each year, the meat cannot be sold openly, but can be given away and even shipped to other parts of the USA for human consumption (5). This approach is not viewed as unduly restrictive by hunters and trappers: the regulation encourages local consumption of the meat which reduces the risk of public health problems, since the individuals who prepare and/or consume the meat are more likely to protect themselves and others through local knowledge.

Zoonotic diseases associated with game meat from wild swine

The meaning of the above statement 'transmission of disease through hunted meat is an occasional, but not extensive, public health issue', needs to be clarified here. As with meat from any species, pork from wild swine is subject to post-harvest spoilage; this topic will not be addressed in this paper. The discussion which follows focuses on those diseases present in wild swine populations which are zoonotic and are transmitted through field dressing of the carcass and consumption of the meat.

The standard scientific literature and the less frequently cited popular and 'fugitive' literature (magazine articles, newsletters, etc., which warn the general public by publishing information from diagnostic laboratories, wildlife agencies, etc.) have been consulted to provide a concise and comprehensive review. Additional information is probably available elsewhere and may have been overlooked unintentionally.

Viral diseases

There are no zoonotic viral diseases which have been demonstrated to be transmissible from the meat of wild swine to humans.

Bacterial diseases

Brucella infections

Brucella suis infections occur in wild swine on several continents. Infections in domestic swine are usually chronic, characterised by abortion, infertility, orchitis, posterior paralysis and lameness. The clinical disease in wild swine has not been studied in detail, but is presumed to be similar. Infections with B. suis are common in wild swine in several States of the USA (12). A survey in Florida reported a prevalence of 23.4% of swine with serum antibodies (238/1,015 samples) (12). Symptoms of B. suis infections in humans are fever, chills, headaches and general weakness. Between 1974 and 1975, before the risk was widely recognised, six hunters contracted B. suis infections from field dressing wild swine in Florida (4).

Salmonella infections

Salmonella infections are common in many species of domestic and wild animals. Wild swine are no exception, and there are reports of the isolation of Salmonella from wild swine processed for human consumption in Australia (3).

Escherichia coli infections

Over the last 15 years, Escherichia coli O157:H7 has emerged as an important world-wide cause of foodborne disease. While there is published evidence that E. coli O157:H7 can
infect free-living deer in North America, there is no evidence that either domestic or wild swine are naturally infected with this variant of E. coli.

**Mycobacterium bovis infections**

Wild swine in the Northern Territory of Australia were recognised in the 1970s to be infected with *Mycobacterium bovis*. Since that time, an eradication campaign for *M. bovis* in cattle and water buffalo (*Bubalus bubalis*) in the Northern Territory has significantly reduced the level of infection in the wild swine population. In a recent survey, 2 of 790 necropsied swine yielded positive cultures of *M. bovis* (10), leading to the conclusion that the wild swine are an end-host for *M. bovis* and that the previous high prevalence of the infection was due to the close association between the swine and the large populations of infected cattle and water buffalo.

Wild swine may almost certainly become infected with other bacteria which represent a risk to human health but, as stated above, wild swine do not appear to be a major source of zoonotic disease.

**Parasitic diseases**

**Trichinellosis**

The larvae of several species of *Trichinella* are important pathogens of humans who ingest infected meat (7). Trichinellisis in humans is not an unusual event and is acquired through ingesting *Trichinella* larvae (generally *Trichinella spiralis spiralis*) present in uncooked or inadequately cooked meat from domestic swine, wild swine and other species. Recent reports identify the problem in Canada and in southern France (2, 8). The outbreak in Canada was caused by eating locally-processed, cold-smoked wild boar meat. The presence of larvae in wild swine may also be attributable to infection with other species of *Trichinella* acquired from other wildlife reservoirs (13). As cured meat is popular in several regions of Europe, domestic slaughtered swine are routinely examined for larval infection through trichinoscopy and digestion of muscle samples. This standard process has now been extended to the examination of wild boar meat (14).

**Prevention and control of transmissible diseases from wild swine to humans**

Most wild swine are hunted or trapped for recreation rather than as a source of food. If the hunting of wild swine in Florida (where the estimated population of wild swine is 500,000) is representative, the numbers of hunters injured through vehicular and gunshot accidents greatly exceed the number of people who became severely ill through contact with, or consumption of, the meat of wild swine (5).

As most meat from wild swine is consumed locally and is not inspected by health authorities, the most effective way to prevent transmission of disease is to ensure that appropriate education is given to the hunter, the person who prepares the wild swine meat for food and the consumer, regarding the risks associated with hunting and eating hunted meat.

To use Florida as an example once again, the State Game and Fresh Water Fish Commission widely distributes leaflets informing the hunter of the risks and of how to seek further information. These leaflets are distributed and posted at the entry to State-controlled hunting areas. The United States Department of Agriculture also distributes leaflets which describe the ‘hidden dangers’ of wild swine as a source of infection for humans and for domestic swine (11). The advice given in this leaflet to minimise the risk of hunters becoming infected with *Brucella suis* applies equally to the other infectious agents which may be present in the carcass, namely:

a) Always wear disposable plastic or rubber gloves when dressing and cleaning wild swine

b) Avoid direct contact with blood and reproductive organs

c) Wash hands with soap and hot water as soon as possible after dressing wild swine

d) Burn or bury gloves and remains from dressed wild swine

e) Cook meat from wild swine thoroughly.

Clearly, this advice applies equally to the person who receives meat for preparation as human food and to the person responsible for feeding the meat to other domesticated animals (such as hunting dogs), if this is permitted.

**Conclusion**

Meat is an international commodity: while substitution does occur, the international trade in field-dressed meat is closely regulated. The general public can be considered to be adequately protected and informed of the risks associated with food products from wild swine originating in other countries.

Within a country, the widespread availability of refrigeration and the interest in 'new' and 'regional' foods increase the risk that the consumer may be unknowingly exposed to infection with several agents which may be present in wild swine meat. However, increased awareness through extensive press coverage of the risks associated with eating any meat, whether derived from domestic farming and regulated slaughter or from hunting, partly offsets this risk. In most developed countries, regulations also exist to minimise the risks by
geographically restricting rather than prohibiting the sale and consumption of meat from hunted animals. In the opinion of the author, this policy of risk assessment is correct as it measures disease risk against the importance of hunting and trapping in the local society, and the rights of the individual within a democracy.

Risques pour la santé publique associés aux suidés sauvages ou retournés à l’état sauvage

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Résumé
Les suidés sauvages (Sus scrofa) sont présents dans de nombreuses régions du monde. En Amérique du Nord et en Australie, l’introduction de porcs domestiques dans le passé a été suivie par un retour massif de ces populations à l’état sauvage. En Europe, les sangliers sont le plus nombreux en Allemagne et en Pologne. Les suidés sauvages constituent certainement un important réservoir d’infections pouvant affecter les porcins domestiques (c’est le cas, notamment, de la peste porcine africaine qui sévit parmi les sangliers de Sardaigne), mais, dans l’ensemble, ces suidés ne constituent pas un risque majeur pour la santé publique. Les infections à Brucella suis et la trichinellose sont les principales zoonoses auxquelles les porcins sauvages sont sensibles.

Mots-clés

Riesgos de salud pública ligados a los cerdos salvajes y asilvestrados

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Resumen
Muchas regiones del mundo albergan poblaciones de cerdo salvaje (Sus scrofa). Las grandes poblaciones de cerdos asilvestrados de América del Norte y Australia provienen esencialmente de la introducción de cerdos domésticos. En Europa, los jabalíes se encuentran sobre todo en Alemania y Polonia. Aunque los cerdos salvajes forman sin duda un importante reservorio de infecciones que afectan a los cerdos domésticos (por ejemplo, el virus de la peste porcina africana en jabalíes de Cerdeña), esos animales no plantean en su conjunto ningún riesgo significativo en materia de salud pública. Las zoonosis más importantes a las que son sensibles los cerdos salvajes son las infecciones por Brucella suis y la triquinelosis.

Palabras clave
References


