

ECONOMIC LOSSES RESULTING FROM FOOD-BORNE PARASITIC ZOOSES

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Abstract. Economic losses resulting from food-borne parasitic zoonoses are difficult to assess. Estimating the global economic impact of these diseases is handicapped by inadequate information on the prevalence and public health importance of parasitic zoonoses for most countries. However, the economic losses caused by certain zoonoses has been estimated for some regions and in these instances the costs are significant. In Mexico, for example, porcine cysticercosis is responsible for a loss of more than one-half of the national investment in swine production and for more than US\$17 million annually in hospitalization and treatment costs for humans with neurocysticercosis. For all of Latin America, porcine cysticercosis accounts for an economic loss of US\$164 million. In Africa, losses of one to two billion dollars per year due to bovine cysticercosis have been reported. Human toxoplasmosis in the United States is estimated to be an annual economic/public health burden of more than US\$400 million. The implication from these examples and others are discussed. A set of recommendations is presented for obtaining the necessary information needed to permit assigning to food-borne parasitic zoonoses their appropriate priority within each country's complex economic and public health problems.

INTRODUCTION

For the consumer the issue of food safety is highly complex and is not weighed simply by economic cost or risk. Recent well-publicized food safety issues underscore the fact that the public has little concern with the anticipated high costs for producing "zero risk" food (Gold, 1990). Hence, the requirement that the food industry provides safe food is fundamental to holding consumer confidence (Stenholm and Waggoner, 1989). Estimates of the economic costs resulting from animal and human infections with food-borne parasitic zoonoses, while instructive, are not necessarily decisive in government decision-making on food safety programs. The following review of the economic impact of the major food-borne parasitic diseases will illustrate, however, that the burden these diseases place on society, whether fully appreciated by the latter or not, are not trivial.

For nearly all countries, assessment of the economic impact of food-borne parasitic diseases on productive agriculture and public health is handicapped by inadequate information on the preva-

lence and clinical significance of most of these zoonoses. Systematic, comprehensive studies are badly needed, particularly for developing countries which must balance a myriad of demands on their public health and food production sectors. These countries must develop their economic capabilities in a highly competitive global market, a market which is increasingly sensitive to food safety issues. Although there are insufficient data for a global assessment, a few studies are available which can provide a sense of the potential economic importance of some of the major zoonoses. The reader will have to judge how far an extrapolation from these limited studies to other regions is prudent. Note that in most instances cost estimates are expressed in US dollars; estimates prior to 1985 were adjusted to July 1990 levels using the Consumer Price Index.

DISEASE GROUPS

Taeniasis and cysticercosis

More effort has been made to estimate the economic impact of taeniasis and cysticercosis than

Table 1

Unit loss estimates determined by various authors for animal cysticercosis.

Host species	Unit	US\$ loss*	Authors
Bovine	Whole	234 (Industrialized nations)	Pawlowski and Shultz (1972)
	Carcass		
	Whole	78 (Developing nations)	Pawlowski and Shultz (1972)
	Carcass		
Bovine	Kilo	2.43	Abdussalam (1975)
Porcine	Partial	48.60	Abdussalam (1975)
	Carcass		
Porcine	Kilo	1.72	Schenone (1975)

* Updated by author to 1990 US\$ prices.

Table 2

Economic loss estimates due to animal cysticercosis.

Region	Infection rate	Annual loss (US)*	Authors
Latin America			
Bovine and porcine combined	2.0%	428 million	Abdussalam (1975)
Porcine	1.9%	164 million	Schenone (1975)
Porcine (Mexico only)	1.6%	68 million	Acevedo-Hernandez (1982)
Africa - Bovine only			
Continent	7.0%	1.8 billion	Mann (1983)
Kenya	19.6%	4 million	Grindle (1978)
Botswana	7.7%	2 million	Grindle (1978)

* Updated by author to 1990 US\$ prices.

for any other food-borne parasitic zoonoses. As shown in Table 1, devaluation of beef or pork due to the presence of cystercerci varies somewhat according to the stage of a country's economic development. Some authors have also attempted to distinguish between whole carcass loss (due to condemnation) and partial loss (Abdussalam 1975; Grindle, 1978). In the United States, the epizootic nature of bovine cysticercosis makes it difficult to measure its impact on food production. However, Dewhirst (1975) reported that a large outbreak in one beef feedlot resulted in a 10% carcass condemnation rate, and a multi-million dollar loss to the operator.

Although a worldwide loss due to food animal cysticercosis cannot be calculated because of insufficient data, the regional losses exhibited in

Table 2 underscore the enormous potential economic risk of animal cysticercosis in livestock production. When public health costs are also included (Table 3), it is clear that cysticercosis and taeniasis are significant food safety problems worldwide.

Toxoplasmosis

The public health burden of toxoplasmosis in the United States has received recent attention. The analyses carried out by Roberts (1985) are perhaps the most thorough and comprehensive. Table 4 presents that analyses of the long-term care and treatment costs for the estimated 3300 children born each year in the US with congenital infections. Recently, Schantz (1991, this volume) reported that the annual cost of caring for the esti-

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Table 3

Economic burden of human taeniasis and cysticercosis: medical costs and wage losses.

Country	Infection	Cost category	Annual loss (US\$)	Authors
United States	Taeniasis	Treatment	100,000 (111/patient)	Roberts (1985)
Mexico	Neurocysticercosis	(1) Treatment	17,000,000*	Velasco-Suarez <i>et al</i> (1982)
		(2) Wage losses	345,000,000*	Velasco-Suarez <i>et al</i> (1982)

* Updated by author to 1990 US\$ prices.

Table 4

Lifetime cost for special services for 3,300 children with congenital toxoplasmosis born in the United States each year (Roberts, 1985).

Services required	% Utilization	Cost of services (US\$)
Yearly ophthalmologic follow-up care	78.0	4 million
Special schooling for visually handicapped	14.2	68 million
Special schooling for moderately retarded	7.1	23 million
Institutional or state-supported foster care for severely retarded	15.1	301 million
Aid to totally disabled	2.4	33 million
	Total	429 million

Table 5

Projected economic benefits from the elimination of *Trichinella spiralis* from United States pork supply.*

Industry profits could increase US\$493 million annually through:

1. Increased consumer confidence and demand.
2. Up to one-third increase in exports.
3. Elimination of the cost of pork certification procedures and government enforcement of regulations.
4. Reduced public health costs.

* Department of Energy, 1983.

mated 2,500 AIDS patients suffering from toxoplasmosis is about US\$32 million; as the number of cases of AIDS related toxoplasmosis increases, this cost will also rise.

For livestock, toxoplasmosis is a major cause of economic loss, especially due to abortion losses (Dubey and Kirkbride, 1989). Although the actual frequency and economic impact of ovine

toxoplasmosis in the US is not yet clear, *Toxoplasma gondii* is recognized worldwide as a major cause of abortion in sheep (Dubey and Kirkbride, 1989; Blowett and Watson, 1984; Beverly, 1974; Calamel, 1982). Beyer and Shevkunova (1986) estimate that ovine infection not only decreases lambing rates but also reduces wool and meat production. Studies are now underway in the United States to determine the public health risk

of infected pork; a significant risk would have serious implications for swine producers.

Trichinellosis

Although the incidence of trichinellosis has generally declined in developed countries during this century, its economic impact remains at an appreciable level because of the necessity to maintain inspection efforts and the regulation of ready-to-eat pork product production. Over the period 1968 to 1980, trichinellosis outbreaks accounted for nearly 15% of all meat- and poultry-borne outbreaks in the United States. An effort has been made to determine the economic burden of trichinellosis to the American swine industry (Table 5); the results suggest that decreased consumer demand for pork, losses in exports, efforts to meet federal regulations for processing pork, etc, costs the industry more than US\$400 million annually (US Department of Energy, 1983). Medical costs in the United States may add another 1.5 to 2.2 million dollars per year (Roberts, 1985). The medical costs in countries with relatively frequent outbreaks (eg, Yugoslavia, Thailand, and France) are probably comparable. Research is particularly needed in Latin America where infection rates in swine are reportedly high although human infections are infrequently reported.

Fish-borne parasites

With the exception of *Opisthorchis viverrini* in Thailand, little has been reported on the economic consequences of fish-borne parasitic zoonoses. Given the increasing frequency of human infection reports, and surveys that reveal high human prevalences of nematode and trematode infections, it can be assumed that the burden on public health resources is significant. Loaharanu and Sornmani (1991, this volume) recently reported their analyses of the economic impact of *O. viverrini* infections in Northern Thailand; medical care (US\$72 million) and lost wages (US\$48 million) yield a total economic burden of US\$120 million annually. Because of the diversity of fish and invertebrate-borne parasitic zoonoses, and their often high prevalence in many areas of the world, especially Southeast Asia, efforts to assess the economic impact of these zoonoses should be encouraged.

DISCUSSION

It is obvious that data on the prevalence and clinical significance of food-borne parasitic zoonoses, for most countries and regions, is inadequate for the task of assessing their overall economic impact. Such information will be needed, however, if national and international agencies are to make intelligent decisions on how to allocate resources to enhance food safety and agricultural profitability. Faced with many competing demands, it will not be easy for governments and international organizations to place this need high on their already crowded agendas. It is incumbent upon those with knowledge of and interest in food-borne parasitic diseases to exploit every opportunity to educate and assist these decision-makers. This task can be facilitated by adopting a more holistic approach to food-borne disease. Because many of these diseases share common epidemiological features, ie, transmitted by fish or meat, these parasitic zoonoses should be viewed as a complex rather than as a collection of individual zoonoses. From a food safety perspective, parasitic zoonoses are frequently associated with other hazards, such as microbial contaminants. For example, animal husbandry practices that increase the risk of parasitic infection often increase the risk of microbial contamination or residue hazards. Recognition of such commonalities was the stimulus for a recent National Research Council recommendation on meat and poultry inspection which urged the US Food Safety and Inspection Service to intensify its efforts to develop a comprehensive disease surveillance and eradication program at the farm level (NRC, 1985). This was also reflected in the recommendation that inspection technologies be made more rapid and capable of detecting a broader range of food safety hazards. Adoption of a comprehensive strategy for the control of all food safety hazards, whether parasites, bacteria, virus, mycotoxins or chemical residues, will require marked improvements in our understanding of the epidemiology of food-borne diseases and in the technologies required to detect them.

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