Veterinary Parasitology 251 (2018) 63–67

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Short communication

Taenia solium from a community perspective: Preliminary costing data in the Katete and Sinda districts in Eastern Zambia

Emma C. Hobbs[a,b,c,*], Kabemba E. Mwape[d], Brecht Devleesschauwer[e], Sarah Gabriël[c], Mwelwa Chembensofu[d], Moses Mambwe[f], Isaac K. Phiri[d], Maxwell Masuku[d], Gideon Zulu[f], Angela Colston[g], Arve Lee Willingham[a], Dirk Berkvens[b], Pierre Dorny[b,c], Emmanuel Bottieau[b], Niko Speybroeck[h]

[a] Ross University School of Veterinary Medicine, Basseterre, St. Kitts, Saint Kitts and Nevis, West Indies
[b] Institute of Tropical Medicine, Antwerp, Belgium
[c] Ghent University, Merelbeke, Belgium
[d] University of Zambia, Lusaka, Zambia
[e] Scientific Institute of Public Health, Brussels, Belgium
[f] Ministry of Health, Lusaka, Zambia
[g] Global Alliance for Livestock Veterinary Medicines (GALVmed), Nairobi, Kenya
[h] Université catholique de Louvain, Brussels, Belgium

ARTICLE INFO

Keywords:
Cost
Parasitic zoonoses
Pigs
Taenia solium cysticercosis
Zambia

ABSTRACT

The tapeworm *Taenia solium* is endemic in Zambia, however its socioeconomic cost is unknown. During a large-scale interventional study conducted in Zambia, baseline economic costs of human and porcine *T. solium* infections were measured.

Questionnaire surveys were conducted within three neighbourhoods in Zambia's Eastern province in 2015 and 2016. A human health questionnaire, capturing costs of clinical symptoms commonly attributable to human cysticercosis and taeniasis, was conducted in randomly selected households (n = 267). All pig-keeping households were administered a pig socioeconomic questionnaire (n = 271) that captured pig demographic data, costs of pig-keeping, and economic losses from porcine cysticercosis.

Of all respondents 62% had reportedly experienced at least one of the surveyed symptoms. Seizure-like episodes were reported by 12%, severe chronic headaches by 36%, and vision problems by 23% of respondents. These complaints resulted in 147 health care consultations and 17 hospitalizations in the five years preceding the study, and an estimated productivity loss of 608 working days per year.

Of all pigs 69% were bought within villages. Nearly all adult pigs were sold to local traders, and tongue palpation for detection of cysticerci was commonly performed. Reportedly, 95% of pig owners could not sell tongue-positive pigs, while infected pigs fetched only 45% of the normal sale value.

These preliminary costing data indicate that human and porcine *T. solium* infections substantially impact endemic areas of Eastern Zambia. A full socioeconomic burden assessment may enable improved *T. solium* management in sub-Saharan Africa.

1. Introduction

Taenia solium results in substantial public health and economic consequences globally. Endemic across much of sub-Saharan Africa, Asia and Latin America, it was ranked the most important parasite contributing to the global burden of food-borne diseases (WHO, 2015b).

Humans are the final host having the adult tapeworm (taeniasis, TS). Scavenging pigs ingest infective eggs present in human faeces, and develop porcine cysticercosis (PCC). Humans also develop cysticerci following accidental ingestion of eggs (human cysticercosis, HCC). Neurocysticercosis (NCC) occurs when cysticerci develop in the host's central nervous system, and can cause neurological disorders (Carabin et al., 2011). NCC is the leading cause of preventable epilepsy in the developing world (WHO, 2015a). Studies in the Eastern Province of Zambia confirmed the region is hyper-endemic for *T. solium* (Mwape

* Corresponding author at: Institute of Tropical Medicine, Kronenburgstraat 25, Antwerp 2000, Belgium.
E-mail address: emmaclarehobbs@yahoo.com.au (E.C. Hobbs).

https://doi.org/10.1016/j.vetpar.2018.01.001
Received 31 August 2017; Received in revised form 23 December 2017; Accepted 1 January 2018

et al., 2015; Phiri et al., 2002).

Socioeconomic burden assessments of TS/CC remain largely lacking in literature. HCC costs include medical bills and loss of income and resources for affected families. Annual costs of inactivity in symptomatic HCC patients, unable to attend work or school, totalled over 8 million Euro in West Cameroon alone (Praet et al., 2009). Social stigmatisation of people with epilepsy (PWE) can markedly decrease quality of life. PCC may reduce the value of pigs and pork meat by up to 50% (Trevisan et al., 2015), reducing income for smallholder farmers, and further jeopardizing food safety and security in these communities.

This paper presents the first (preliminary) Zambian socioeconomic *T. solium* burden analysis.

2. Methods

2.1. Ethical considerations

Approval was granted by the Ethical Committees of the University of Zambia and the University of Antwerp, Belgium, the Zambian National Health Research Authority, local district health authorities, village headmen, the area chief, and participants.

2.2. Study site

The study was conducted in Nyembe neighbourhood in Katete district, and Chimvira and Herode neighbourhoods in Sinda district, in Zambia's Eastern Province (Fig. 1). Over half the national pig population is reared in this province, largely under free-ranging conditions by subsistence farmers. Pig slaughter occurs informally with little to no meat inspection, although tongue palpation for detection of PCC is increasing thanks to ongoing education campaigns.

Studies in the area determined prevalence of active TS as 6.3–11.9%, of active HCC as 5.8–14.5%, and of PCC up to 64% (Dorny et al., 2004; Mwape et al., 2012; Mwape et al., 2013). In Katete district, 57% of PWE had NCC, making it the single most important cause of acquired epilepsy in this area (Mwape et al., 2015).

2.3. Study design

The study at hand is part of the CYSTISTOP project consisting of three study arms: one human- and pig-based 'elimination' intervention arm, one pig-based 'control' intervention arm, and a 'negative control' arm.

2.4. Data collection

Fifty percent of all consenting households (HHs) in the two intervention study arms were randomly selected for the human health questionnaire, conducted in March 2016. Respondents were asked about occurrence, frequency, duration and associated costs of tapeworm infections, and of three clinical symptoms commonly experienced by NCC-sufferers – seizure-like episodes, severe chronic headache (of two days' duration or longer), and vision problems – in the preceding five years.

All consenting pig-keeping HHs in the three study areas undertook the pig socioeconomic questionnaire in October 2015. Demographic pig herd data, pig-raising costs, and economic impacts of PCC were captured. A conversion rate of 10 Zambian kwacha to $1.00 USD was used.

3. Results

Overall, 267 and 271 respondents completed the human health and pig socioeconomic questionnaires, respectively.

3.1. Economic characteristics of respondents

Most respondents (95%) were livestock and/or crop farmers, and 24% of HHs owned pigs. Many respondents (61%) received no regular monetary income, and depend on crop harvests or livestock sales for cash flow (personal observation). Wage earners reportedly received $0.80-$340.00 USD per month.

3.2. Clinical features

Over 60% (166/267) of surveyed individuals reportedly experienced symptoms in the past five years; 66%, 30% and 4% of respondents reported one, two or three of the surveyed symptoms, respectively.

NCC-associated symptoms (seizures, headaches, vision problems) were reported by 56% of surveyed respondents. Of the 31 reported seizure-like symptoms, eight had also caused falls and/or burns. Severe chronic headache and vision problems were reported by 36% and 23% of total respondents, respectively. Tapeworm segments in stool were reportedly observed by 40 individuals (Table 1).

3.3. Health services utilisation

Medical attention was sought by 64% of the 166 reportedly symptomatic individuals, generating 147 medical consultations. Over half the consultations (59%) were for severe chronic headaches. More than 40% of seizure sufferers and over 60% of vision-affected patients did not seek medical attention during the self-reporting period. Nurses were the most commonly visited medical provider. Only six visits (4%) were to traditional healers (Fig. 2).

3.4. Direct costs

In Zambia, patients receive free primary public health care, so reported medical costs were usually $0 USD. One respondent reportedly spent $100 USD on a doctor's visit for seizures (Table 2).

3.5. Indirect costs

'Sick days' (days unable to perform normal duties because of surveyed conditions) were reported by 71 respondents, representing 43% of the symptomatic group and 27% of total respondents. Almost half of chronic headache sufferers reported taking sick days (Tables 2 and 3). The median numbers of sick days per symptomatic person per year were between 0.5–1 day for the three NCC-associated conditions, however three seizure sufferers each reported taking between 170 and 360 total sick days in the five year self-reporting period.

Twelve symptomatic respondents reportedly lost their jobs because of their conditions. Median durations of unemployment were between one and three weeks for all three NCC-associated symptoms; one seizure patient reported 1260 days of unemployment.

In total, the 267 surveyed respondents lost 608 productive days per year due to the surveyed complaints (excluding hospitalisations). Seizure conditions caused the most losses.

Transport time to and from medical visits was generally under one hour, but ranged to 26 h for one return journey. Walking was the usual mode of transport.

3.6. Hospitalisations

Seventeen reportedly symptomatic respondents were hospitalised within the five-year self-reporting period, representing 10% of symptomatic and 6% of total survey respondents. Nine hospitalisations were seizure patients, representing 29% of this group. Chronic headaches and vision problems caused six and two hospitalisations respectively, representing 6.2% (6/97) and 3.3% (2/61) of those symptomatic