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An Indian multicriteria-based risk ranking of foodborne parasites

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ABSTRACT

While there are many (potentially) foodborne parasites, these are often neglected infections, with relatively little attention devoted to their surveillance, prevention, and/or treatment, and policy makers are unclear as to where interventions should be targeted. Different parasite–food matrix combinations have different implications for public health in different global regions.

We conducted a risk ranking of foodborne parasites in India as part of a One Health workshop held in Chandigarh, India for postgraduate medical and biomedical students. This exercise followed a similar procedure to an analogous exercise conducted by the Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) in 2012 when foodborne parasites were ranked from a global perspective according to various criteria with different weightings.

Although both the Indian and global ranking exercises placed *Taenia solium* as the most important foodborne parasite, probably due to the severe disease associated with cysticercosis, other parasites were ranked differently in the two ranking exercises. In particular *Cryptosporidium* and *Ascaris* were ranked more highly in the Indian risk ranking. These differences probably reflect parasite occurrence in India, eating habits (lack of consumption of raw meat and fish), and potential severity of infection.

Risk ranking also assists in highlighting data gaps; in this exercise some data gaps, particularly on the prevalence of different foodborne parasites in India, were found to be very large and should be filled in order to provide a more solid basis for such an exercise that will enable understanding of where control should be targeted.

1. Introduction

Awareness of foodborne parasites is increasing (Robertson, van der Giessen, Batz, Kojima, & Cahill, 2013). This is probably largely due to community-wide outbreaks of foodborne parasitic infections in recent years. However, for largely epidemiological reasons, many foodborne parasitoses, the vehicle of infection is never identified; as many foodborne parasitoses have a relatively long incubation period before symptom onset (days or weeks to months or years, depending on parasite), possible vehicles of infection have often been consumed or discarded before the diagnosis is made. In addition, for several parasitoses clinicians may not consider the possibility of foodborne transmission and, even if it is realized, the patient may be unable to remember what they have consumed within the infection period. Furthermore, for many foodborne parasites, our tools to analyse food matrices for contamination are inadequate, and often only epidemiological associations can be made. This may be sufficient in outbreak situations, but not when only a couple of sporadic cases are involved. Factors such as globalization and climate change may further exacerbate distribution and prevalence of some foodborne parasites (Robertson, Sprong, Ortega, van der Giessen, & Fayer, 2014; Utaaker & Robertson, 2015).

Following a request from Codex Committee on Food Hygiene (CCFH) "to provide the CCFH with advice and guidance on the parasite–commodity combinations of particular concern", the World Health Organization (WHO), together with the Food and Agriculture Organization (FAO) of the United Nations, held a seminar in 2012 in which experts in foodborne parasites participated, with an expert in risk-ranking assisting the experts in conducting the exercise. The result was that 24 foodborne parasites, considered of greatest significance, were ranked according to perceived importance with respect to global risk (FAO/WHO (Food and Agriculture Organization of the United Nations/World Health Organization)., 2014). It was noted that similar regional exercises could be conducted and would probably produce differing outcomes. Such regional rankings might be more useful at area levels, with respect to local decision-making, targeting of appropriate interventions, and as a driver of national policies.

To our knowledge, no such exercises at regional or national levels have been conducted. This may reflect lack of opportunity or resources, but also may be due to a deficit of national independent experts who could usefully contribute to such an exercise.

During a workshop on zoonotic parasites held in Chandigarh, India during April 2014, a ranking exercise at the national (Indian) level

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was conducted for the same foodborne parasites as included in the FAO/WHO ranking, and using a similar approach. There were several reasons for conducting this exercise including: a) obtaining information about the relative risk associated with foodborne parasites in India and the use of risk ranking in this context; b) to inspire and encourage the participants to consider foodborne parasites seriously and teach them about ranking; c) to determine the extent to which information is lacking and whether there are knowledge gaps to be filled. Here we describe and discuss the results of this exercise. In order to differentiate between the two ranking exercises, the exercise described here and includes only India is referred to as the "ZooPa ranking" and the previous exercise, which had a global focus, is referred to as the FAO/WHO ranking.

2. Materials and methods

2.1. Workshop organization and delegates

A "One Health in Parasitology" workshop was held at the Postgraduate Institute of Medical Education and Research (PGIMER) in Chandigarh during April 2014, organized by the authors of this report.

There were 20 workshop participants, all medical/biomedical graduates undertaking further education in the field of human parasitology.

The workshop lasted three days; the first day covered background and the concept of ranking, the second day included weighting and initial ranking of parasites (in groups), and the third day involved reviewing results and reaching consensus.

2.2. Independent ranking exercise

On the first day the participants were introduced to the concept of ranking with an exercise in which they ranked the prestige associated with 12 different listed careers and professions.

2.3. Background information

The workshop proceeded with a series of presentations and formal discussion and question-and-answer sessions about various concepts regarding foodborne parasites, including different specific examples; the importance of zoonoses (in general) and zoonotic foodborne and waterborne parasites (in particular); the "One Health" concept; hazard analysis and critical control points (HACCP); and other relevant topics. All participants were asked to record the foodborne parasite they considered at that time point (prior to the ranking exercise) to be of most importance in India.

2.4. Weighting of criteria

The next section of the workshop was to weight the different criteria used in determining "importance" for the ranking exercise; the criteria used were the same as those in the FAO/WHO ranking (FAO/WHO (Food and Agriculture Organization of the United Nations/World Health Organization)., 2014). However, in order to simplify the procedure, the different aspects of morbidity were combined into a single morbidity criterion (see Table 1); the minimum allowable score for a single criterion was 5% (0.05) and for each participant the total score for all criteria had to be 100% (1). The data from each participant, working independently, were entered into a spreadsheet and subsequently displayed for group discussion on why different weightings had been selected by different participants for the various criteria. Individual participants were encouraged to discuss and defend their own weighting choices, and also to understand that this was a fluid exercise, with no "right" and "wrong" answer; they were able to change their weighting distribution should they be convinced by the arguments of their fellow participants.

Table 1
Criteria weighting according to both FAO/WHO experts and the ZooPa workshop participants.

Criteria	Average weighting from FAO/WHO "experts"	Average weighting from ZooPa workshop participants
C1: Number of foodborne illnesses	0.24	W1: 0.30
C2: Distribution	0.15	W2: 0.13
C3: Morbidity (severity of acute and chronic diseases)	0.23	W3: 0.14
C4: Case fatality rate	0.16	W4: 0.15
C5: Potential for increase in illness	0.06	W5: 0.12
C6: Trade relevance	0.06	W6: 0.07
C7: Impact on economically vulnerable communities	0.09	W7: 0.08

2.5. ZooPa ranking exercise

For the ZooPa ranking exercise itself, the participants were divided into four groups of five people. The groups were arranged such that each contained a range of competence and experience. The groups worked independently from each other, but were in the same room. One workshop organizer (LR) was continuously present to answer questions.

The approach for the ZooPa ranking was conducted as for the FAO/WHO ranking, with a single page form (score sheet) to be completed for each of the 24 parasites, in which the parasite in question was assigned a "bin" for each criterion. The format of the score sheet was almost identical to that of the FAO/WHO ranking, being slightly modified to cover only India and somewhat simplified in some sections (see Supplementary Information 1). In addition, each group was provided with a separate brochure, prepared specifically for this workshop, which provided additional information, including the regions of India (as derived from information provided in Wikipedia), morbidity assessment definitions (as derived from the WHO table of disability weightings; WHO. The Global Burden of Disease, 2004), and a simple sheet (one or two pages of A4) of information for each parasite including lifecycle, pathology, etc. The participants also had free access to any other available information on the Internet or elsewhere in the parasitology department at PGIMER.

Initially each group was allocated 12 parasites to rank, distributed such that each parasite would be ranked by two different groups, but no two groups had an identical list of parasites. As each score sheet was completed it was handed in, and, having been checked for missing data or errors in understanding, the information entered into a database.

When all four groups had completed their ranking of each of their allotted 12 parasites, the data accumulated was displayed in open forum and examined. Attention was paid to discrepancies (especially large discrepancies of two or more points) between bins assigned by different groups for particular criteria, and parasites that seemed to have been ranked particularly highly for some criteria. Following discussion around each point, the sheets were returned to the groups for adjustment. Again it was emphasized that this exercise was fluid; if a group had been convinced by the arguments of another group over their own initial judgments, they could alter their original ranking accordingly.

The revised data were then displayed, and score sheets for the remaining 12 parasites not covered in the initial round distributed to each group. In order to maximize the data, the groups were asked to prioritise completion of forms for those parasites that had been most controversial in the first ranking and those that seemed to have been ranked most highly. Thus, each parasite was ranked by at least two groups, but most parasites were ranked by four groups (see Table 2).

The final data set was displayed to the group and discussed, again particularly discrepancies between groups, before adjustments were made and the data finalized in the spreadsheet.