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Transactions of the Royal Society of Tropical Medicine and Hygiene

journal homepage: <http://www.elsevier.com/locate/trstmh>

Short Communication

Helminth transmission in simple pit latrines

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ARTICLE INFO

Article history:

Received 1 December 2011
 Received in revised form 2 August 2012
 Accepted 6 August 2012
 Available online 30 August 2012

Keywords:

Soil-transmitted helminths
 Pit latrines
 Sanitation
 Tanzania

ABSTRACT

Simple pit latrines often represent the cheapest form of sanitation for poor communities. However, simple latrines lack a concrete slab and are therefore classified as an unimproved form of sanitation. This study collected soil samples in simple pit latrines and analysed them for the presence of helminth eggs; 71% of all collected samples were positive for eggs. The absence of a roof from the latrine was the only factor associated with lower egg concentrations. The findings support the classification of simple pit latrines as an unimproved form of sanitation.

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1. Introduction

It is estimated that 2.6 billion people world-wide lack access to basic sanitation, putting them at risk of diarrhoeal disease and helminth infection. Access to sanitation can significantly reduce morbidity from helminth infection. However, it is unclear which form of sanitation technology is the minimum required to protect health.¹ Simple pit latrines are one of the cheapest forms of sanitation; they consist of a dug-out pit covered with wooden branches and soil, and a squathole allowing for the disposal of faeces. When using a simple pit latrine, the user must stand on the exposed soil around the drop-hole.

Poor management, and the lack of a cleanable covering slab, could turn these pit latrines into focal points of infection, and especially of hookworm transmission. Although simple pit latrines are classified as an unimproved form of sanitation by the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, there is little published evidence to support this classification.

2. Methods

In the period June to July 2010, soil from 72 simple pit latrines in the village of Sululu, Tanzania, was collected and analysed for the presence of helminth eggs. The village is situated in the Morogoro region of Tanzania, where an estimated 95% of people rely on simple pit latrines. The latrines chosen for sampling were selected purposefully so that what were considered to be key risk factors were equally represented; these factors were identified as: number of users, shared vs household facilities, absence or presence of a roof. Three soil samples of approximately 10 g each were collected in each latrine, and combined into a single composite sample. Samples were collected from around the drop hole, especially where the feet would be placed.

Helminth eggs and larvae were extracted from the soil samples by a combination of centrifugation and flotation.² An environmental assessment was used to assess possible risk factors, such as absence or presence of a roof over the latrine, number of users, soil temperature, pH and moisture content. A household questionnaire was carried out for each sampled latrine to assess household risk factors, such as material used for anal cleaning and number of people using the latrine.

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3. Results

A latrine was on average used by 5.1 people, and just over half of the 72 latrines (51%) had a roof. Soil temperature in a latrine ranged from 22.5 °C to 40.8 °C, with a mean of 29.4 °C. All households used water for anal cleansing, and in 51 latrines (71%) water for anal cleansing was available. Out of the 72 latrines sampled, 51 (71%) were found to be positive for at least one helminth species. Hookworm was found to be the most common helminth, present in 43 samples (60%), followed by *Ascaris* spp. in seven (10%) and *Taenia* spp. in five (7%). The mean number of eggs and larvae found per gram of soil was 1.5 (95% CI=0.3–2.8). Helminth concentrations were as follows: hookworm 0–38 ova+larvae/g, *Ascaris* spp. 0–0.2 egg/g and *Taenia* spp. 0–0.3 egg/g. Soil samples from latrines without a roof were found to have significantly lower egg concentrations than those from latrines with a roof (0.47 eggs/g vs 2.52 eggs/g, $p=0.045$). None of the other environmental or use variables showed a significant association.

4. Discussion and recommendation

The findings of this study support the JMP classification of a simple pit latrine as an unimproved form of sanitation, as it seems unable to effectively separate faecal material from human contact. Our results also suggest that the absence of a roof could reduce the risk of helminth transmission.

The mean egg concentration for latrines in the present study was higher than that found in a similar study in Brazil (1.5 vs. 0.6 egg/g).³ No direct correlation can be made between the concentration of helminth eggs in soil and the risk of infection; however, the egg concentrations found in Sululu exceeded the limit set in WHO guidance for the safe use of excreta in agriculture.⁴ This guidance states that the maximum permissible helminth egg concentration is <1 egg/g, while a study on the use of wastewater in agriculture suggested a stricter limit of 0.1 eggs/g when children are exposed.⁴ Of the 72 selected latrines in the present study, 12 (17%) exceeded the <1 egg/g guideline, while 36 (50%) exceeded the stricter limit. The mean egg concentration that we found in Sululu is probably a conservative estimate as samples were collected during the dry season, when conditions for egg survival are harsher than during the rainy season.

The present study did not collect soil samples in other forms of sanitation. The basic pit latrine represents one of the most common forms of sanitation, and the lowest rung on the sanitation ladder. The next rung up is a pit latrine with a concrete slab, which is considered an improved form of sanitation by the JMP. Helminth eggs cannot survive on a concrete slab, and a slab is much easier to clean than a soil floor. Our findings further showed that sun-exposed latrines were less likely to be positive for helminth eggs. This is in line with previous studies, which

have shown soil protected by trees from sunlight to have higher concentrations of helminth eggs than soil exposed to sunlight.^{3,5} The removal of latrine roofs is unlikely to be acceptable to all households, as roofless latrines will provide less privacy and protection from the elements, while the construction of a concrete slab in a pit latrine would significantly increase the cost of a latrine. There is therefore a need to continue looking at cheap alternatives that could upgrade basic pit latrines or improve the hygienic status of simple pit latrines.

Authors' contributions: SMB and JHJE designed the study; SMB conducted the fieldwork and analysed the data; SMB and JHJE interpreted the data and drafted the paper. JHJE is the guarantor of the paper.

Acknowledgements: We thank Faraji Abilahi for translating and administering questionnaires and John Williams for providing support in the development of the soil analysis technique.

Funding: This research received financial support from the Sanitation and Hygiene Applied Research for Equity (SHARE) consortium funded by the UK Department for International Development (grant no. P04990) and from the Bill and Melinda Gates Foundation. SMB received a travel grant from the London School of Hygiene and Tropical Medicine Trust Fund. Funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: None declared.

Ethical approval: This study was approved by the London School of Hygiene and Tropical Medicine (no. 009/361 and no. 5659), and the Ifakara Health Institute (14-2010). Meetings were held with the village leaders of Sululu to introduce and seek approval for the study. Written informed consent was obtained from the heads of households.

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