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Community Perspectives on Worm Infections in a Peri-Urban Area of Lusaka, Zambia

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Authors' contributions

This work was carried out in collaboration among all authors. Author HH designed the study, wrote the protocol, collected the data, conducted the analysis and wrote the first draft of the manuscript. Author OH participated in data collection and author ML managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Soil transmitted helminths (STH) known as worm infections are more than a technical or biomedical problem. They can be linked directly to specific human behaviour in relation to sanitation and hygiene practices. Although these infections are prevalent in Zambia, There is paucity of data on community perceptions and beliefs with respect to STH infections. Therefore, this study sought to understand this aspect from a peri-urban point of view. Qualitative interviews were conducted on fifty-seven participants from Ngombe compound; a peri-urban area within Lusaka, Zambia. The study was carried out between August and December 2015 using semi-structured interviews and analysed by means of question analysis. Wide spread knowledge about the various types of worms was found in the community, although most of it was generally folk knowledge. However, this did not mean that the study population recognized STH as serious health problem as some participants considered having worms as normal. While consumption of food was commonly cited as cause of STH, most participants failed to give empirical evidence

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linking soil or faecal contaminated food items as direct cause of STH. Although the findings cannot be generalized, the study provides informative reference in understanding beliefs and perceptions regarding STH in Zambian peri-urban communities. There is need for concentrated efforts that are bio-medically relevant as well as beneficial to the targeted population.

Keywords: Neglected tropical diseases; perceptions; beliefs; soil transmitted helminths; qualitative; Zambia.

1. INTRODUCTION

The existence of many diseases affecting humans today such as HIV/AIDS, hypertension, typhoid/cholera, and several others is highly associated with behaviour [1]. More often than not, it is specific human behaviour, with respect to sexual practices, diet and activity patterns that predisposes individuals to acquiring certain diseases [2,3,4]. For instance, in Africa, soil transmitted helminth (STH) infections which are commonly referred to as worm infections, are more than a technical or biomedical challenge [5]. They can be linked directly to specific human behaviour in relation to sanitation and hygiene practices [6,7]. Like many other developing countries, Zambia's sanitation has, until the recent past, received little attention in national and sub-national programs to enrich health and well-being of communities [8,9,10].

According to recommendations by the World Health Organisation (WHO), control efforts of STH must include drug treatment, improved sanitation and health education [11,12]. Effective health education and vigorous advocacy campaigns have the potential to bring about behavioural change. However, such campaigns should encompass and address public beliefs, perceptions and attitudes about diseases as these tend to affect compliance [6,13]. While there is not necessarily a link between increased knowledge and change of behaviour, the possibility of any disease control program succeeding is highest in cases where the target population considers the disease as a health problem and is aware of the risk factors influencing the disease [11,14].

Research has shown some consistent patterns of beliefs across divergent cultures regarding the causation and symptomology of STH infections. Most theories of causation are often related to food intake, but may not be specifically linked to soil contaminated food items. On one hand, studies have revealed that a significant proportion of the population frequently has no biomedical information about causality of STH infections, in Africa, Asia and Brazil [15,16] On the other hand, other studies demonstrate that more than adequate biomedical knowledge was present on causes and prevention of STH infection [6,17-20]. However, biomedical knowledge does not always translate to expected healthy behaviour. Lay knowledge, cultural beliefs and practices could exist in populations that could be a hindrance to health promotion initiatives.

Although, STH infections are endemic in most parts of Zambia, there is paucity of data on community perceptions and beliefs with respect to STH infections, and how this could impact control efforts. Therefore, this study explored the community perspectives on worms to answer the questions - how do community members rank STH infections in relation to other prevailing illnesses? Are community members aware of the different types of worms? What are the perceived causes and symptoms of worm infections?

2. METHODS

2.1 Study Site and Population

The study was carried out in Ngombe compound located in Lusaka, the capital city of Zambia. As a peri-urban area, Ngombe is characterized with high population density, inadequate sanitary facilities that warrant unsafe human faecal disposal systems, inadequate safe water supply, and poor road network. As such, the compound has a high prevalence of STH infections in Lusaka. The people have different ethnic backgrounds, coming from the 73 tribes of Zambia. The majority of the residents have low in-come, with a household income of between ZMK 380 (US$ 21) and ZMK 1,900 (US$ 105) per month, as reported during the study. Their occupation varies from casual workers in companies and homes, house cleaners, small scale businessmen, selling in the market, street vending, baby-sitting, and house wives for women. The compound is bordered by Ngwerere stream on the eastern and part of the northern end. The other part of the northern end shares a

boarder with a farm. The southern end and part of the western end shares a boarder with a low density township. Another stream runs in the middle of the compound supplying water for domestic use to many residents, together with the boarder stream. Medical services in the compound were provided by a government clinic. Records at the clinic have showed that the number of STH cases dealt with ranked fourth after malaria, diarrhoea and Respiratory Tract Infections (RTI) respectively, for both the under-five and school age children. Even if there are three basic schools in the community, more than 50% of school age children are not enrolled in school because of lack of places. This means that the deworming campaigns carried out at the schools annually only carters for less than 50% of the target group. In addition to the clinic, a number of traditional healers are found in the community who offer medication to a wide range of illnesses including STH infections. Also present are community drug vendors at the open market.

2.2 Methodological Foundation

This study was carried out between August and December of 2015, following an earlier study conducted in the same community [21]. It relied on qualitative interview methods (individual interviews). In trying to understand health beliefs the methodological approach was based on "Focused ethnography" [22-24]. Using this approach the topic was selected before data collection, the participants were linked by a common site, and interviews were generally limited to the selected topic and surrounding events, rather than classical ethnography where the topic and themes emerge during the data collection and analysis. The community analysis (single case) model, the primary focus in anthropology, was also adopted in order to highlight the ecological context of the subject matter. This gave greater attention to specific environmental, medical, social and other factors situated in the specific physical location, and thus further reinforced localization of research strategies [25].

In preparation for the field work, rudimentary descriptive conceptual frameworks for the transmission cycle and control strategies of STH at community level were developed based on review of information from previous studies in other areas [15,17, 19,20,26,27].

2.3 Recruitment of Participants

Participants were selected on the basis of what Glaser and Strauss [28] called 'theoretical sampling', choosing categories to study on the basis of their relevance to the research questions. A total of fifty seven participants were interviewed. The Key informants were the two nurses, the Head teacher and one official from the Residential Development Committee office, who were knowledgeable, articulate insiders possessing a unique perspective and insight, and thus provided us with information on what could not be experienced in the field [29]. The primary informants were eighteen mothers and eighteen school age children, who were key people in the life cycle of STH infections [25]. The secondary informants were eleven fathers, six school teachers, two community drug vendors and two traditional healers, who were used to confirm or refute the information provided by the primary informants, and to widen the data base [23]. Four gatekeepers (the zone leaders) walked the research team through the community to help identify the participants. The gatekeepers gave insight on the phenomena under study as they apply in different parts of the compound. The inputs of the gatekeepers did not control the findings by either blocking or shepherding the research team in one direction or another [30].

In order to meet the two principles that guide qualitative sampling, appropriateness and adequacy, as described by Morse [23], the different categories of informants were not used equally. Morse suggests that the use of several participants who represent different sectors and know only a part of the social problem is important in understanding the whole phenomena under study and helps verify information.

2.4 Data Collection

Data was collected using semi-structured interviews. Semi-structured interviews were used in the study to ensure that all information required was obtained (without forgetting a question), while at the same time gave the participants freedom to respond, elaborate on any issues as they felt like, or as the interviewers requested, and any other information on the subject that had not been asked for [23]. The interview guides were discussed by the project team and tested in a pilot study in another community. Ten people were interviewed in the

pilot phase, and necessary modifications were then made to the guides.

Two social scientists conducted the interviews. At the beginning of the data collection the study team spent some time walking across the study area in a meandering fashion. This made the study team familiar with the physical context of the study site and to assess faecal contamination in public environments. Spontaneous informal conversations were held with mothers at the hand pumps during these health walks. Field notes were jotted down on what was seen and discussed. This was not done in the presence of the informants during the discussions to avoid raising suspicion and also to keep the discussions as informal as possible. Appointments for the main interviews were made with each participant beforehand. On the day of the appointment a verbal explanation of the study and the study method was given to the informants and written consent was obtained. The key informants received a written summary of the research project and request for participation and gave written consent.

All interviews with mothers, fathers, School age children, traditional healers and drug vendor were conducted in Nyanja (a common local language), while interviews with nurses, head teacher, teachers, zone leaders and RDC official were conducted in English. Most of the participants understand English but the majority preferred Nyanja. The interviews lasting from 20 minutes to 90 minutes were tape recorded after informants granted permission to the researchers, except for one traditional healer who did not want to be tape recorded but agreed to have hand written notes taken.

In this study the aim was to learn from the people, i.e. to objectively report the perceptions of the participants in their settings and discover meaning and not measure the distribution of the attributes in the community. The role we took as researchers in the data collection was a marginal position, i.e. providing access to participant perspectives but at the same time minimizing the dangers of 'over-rapport' [31].

2.5 Data Management and Analysis

To minimize losses of the data, first due to transcription and then translation from Nyanja to English, the recorded interviews were transcribed and coded in the original language, and then translated into English for the interviews conducted in Nyanja. Since the data was generated from semi-structured interviews, the 'Question analysis' method was used to analyze the data, defined by Morse [23]. By this method the interviews were first sorted by item number. From this initial sort many careful readings were done and then content analysis was carried out on them, analyzing the topics and segmenting them into sub-categories. The sub-categories were coded by labelling the major theme within each paragraph or line and the descriptive codes were written in the margins. The categories were initially few, broad and overlapping. As more data were analyzed the major categories were sorted out into smaller categories. When each category was reasonably full, descriptive paragraphs were written about the categories.

During the interviews a lot of data were generated which were not solicited for on which question analysis could not be applied. Content analysis was instead directly used, where careful readings were done and categories identified, refined and descriptive codes given to them. The transcriptions, translations and coding was done independently by two researchers and then cross checked to produce the final schemes.

3. RESULTS

3.1 Perceived Health Problems in the Community

The significance of certain infections as health problems may become overshadowed by the emergence of infections that present themselves as sudden acute crises. This is particularly likely to occur in STH infections which do not have sudden acute crisis but tend to be chronic afflictions (with very few exceptions) when they occur in areas where infections like malaria are endemic. In order to get an indication of how people in Ngombe rank STH infections with the other prevailing illnesses the informants were asked to give a list of the common and known health problems in children of Ngombe. A list of common health problems in children obtained from the clinic contained five illnesses - malaria, diarrhoea, RTI (pneumonia and TB), worms and Bilharzia. When lay people were asked to give a list of common health problems, the reported illnesses and frequencies were: malaria (22), STH (12), Diarrheal (11), coughing (10), schistosomiasis (6), Ringworm (5), stomach pains (4), headache (3) and fever (3).

When we asked specifically if worm infections were a major health problem for the children in the community, ten participants who had not included worms in their list of illnesses said the worms were actually among the major problems. Three mothers went further and said worms were the number one problem. Some mothers said they were so used to them in the village where they lived before, such that they did not perceive them as a health problem. From the fifty-seven people asked, thirty-two of the sample agreed affirmatively that worms were a major health problem in children. They regarded worms a serious infection because they make the child to lose appetite, just like malaria did. The child also lost weight and did not look healthy because of worms. The mothers who gave these accounts had their children infected in the past. Two children said worms were a problem because they bite the inside of the stomach resulting into abdominal pain.

Conversely, nine of the respondents believed worms were not a serious health problem for children. This was a common belief among people who have lived in the village for some time, and those who had infections in their childhood. One father who had lived in the area for more than ten years had seen several children reported to have worms play and go to school like any other child. This meant a child with worms still had good health and was strong, unlike one who had malaria who could neither play nor go to school. A mother who had four children and moved from the village four months before the beginning of the data collection has had all her children infected at one occasion. "No medication was given to them, but they are all fine ..." she said. From her experience it meant all children would be infected at one time in life and the infections would go on their own. She said all children in the village had worms time and again, but were fine.

To some respondents an infection was considered as serious if it resulted in hospitalization of the child. This came out when we were chatting informally with four mothers at a communal tap. One of them said her young sister aged 5 was admitted at the clinic because of malaria.

> *Mother 1: "... my young sister Mwanga (reconstructed) was admitted at the clinic for 3 - 4 hours two days ago because of malaria ..."*
> *Mother 2: "... well, malaria is such a bad illness, this moment the child is playing, the next moment she is in hospital ... if you don't take quick action the child is dead..."*
> *Researcher: "but how do you look at these infections, sokanda (worms) that are becoming common in children? Are they a serious infection as well?*
> *Mother 2: "... I really don't think so, you'll never hear of a child being admitted in hospital or dying because of worms ..."*

Some of the respondents did not know whether worms were harmful to health or not. One mother who grew up in the village and only came to the city when she got married said she used to see worms 'everyday' and they were not a problem. But when she moved to town she found that people take their children to hospital because of worms. "... I don't know whether they are a problem here in town or the worms are different from those in the village." she said. Others did not know because some people told them that worms were a problem, while others said they were not.

From the interviews it appeared worms were well known to the respondents as they were mentioned as one of the common illnesses in children by twenty-two of the fifty-seven respondents. But were the respondents talking about the same illness when they referred to worms?

3.2 Knowledge of Different Types of Worms

The respondents were asked to give the names or descriptions of the different types of STH they knew. The interviews indicate that the knowledge of roundworm was predominant. Forty-three of the individuals knew about roundworms as specific entities, but only seven knew of hookworm and four about Strongiloides. The roundworm was readily identified by the respondents as 'Njoka za mumala' (snakes of the stomach) or Sokanda, and was described as the white snakes children harbor in the stomach. Mothers reported having seen them in their children, from friends' children and relatives, and from themselves during their childhood. The school age children reported having seen them in their friends, brother or sister, or having had the worms themselves. The knowledge of roundworms predominated because these worms were clearly visible in stool or when vomited.

Four mothers and three fathers identified hookworms as worms that sacked blood in the body, but did not know what it was called. Some of the indications given to identify hookworm were that it was the worm that could not be seen in the stool but that fed on human blood. One mother said she was taught about hookworm at the clinic the time she was pregnant (about a year earlier), and was told that it was dangerous for pregnant women as it reduced the amount of blood in the body. Three mothers identified Strongiloides as Namutokonya (itchy worm at the anus) and said it was a common thing in the village where they came from. These three mothers all grew up in the village. Some of the respondents could give the names of the different worms but said they did not know much about them, "it's just the names we hear" they said. The most frequently mentioned worm in this category was hookworm. However, others went as far as mentioning ringworm and earthworms as STH.

Some participants were aware that different types of worms existed in addition to roundworm. The greatest number of worms identified was three consisting of roundworm, hookworm and *S. stercoralis*. On the other hand, some children reported no knowledge of any type of worm. Of the 47 who reported knowledge of at least one type of worm, twenty-six believed roundworms presented the worst threat to health because they made the infected child lose weight, vomit, lose appetite and become frail. Eight mothers thought hookworm was the worst type due to the danger of anaemia it paused to pregnant women. Three mothers said strongiloides was the most nuisance rather than a threat to health because of the itching it caused on the anus. Incidentally, these two mothers grew up in the village and one did not consider worms in general as a harmful infection while the other one was not sure whether they were harmful to health or not.

3.3 Signs and Symptoms of Infection

The categorization of signs of infection presented here is derived solely from the responses from the participants, rather than from a set of categories developed a priori. Participants were asked to describe the symptoms they associated with worm infections. The signs reported by the participants fell in four categories: eating habits; physical appearance of the child; actual appearance of the worms and other signs.

3.3.1 Symptoms relating to eating habits

The most common answer in this category was that worm infections were associated with eating too much. Some mothers, a female school teacher and school children reported that once infected the child started to eat much more food than usually done in order to get satisfied. One mother went further to say their infected children had started to eat as much as twice the usual quantity in order to get satisfied. The mothers and female school teacher who reported this symptom had seen this phenomenon in their own children, while the school children had seen it either in their siblings at home or their friends. The female teacher added to say sometimes the child would eat the normal quantity of food but would soon after feel hungry again. Other participants reported that the child ate a lot of food but never got satisfied.

Another aspect reported in this category was vomiting after eating. It was said a child infected with worms usually vomited the food immediately after eating it. One mother believed that the vomiting was a direct reaction of the worms in the stomach to the food eaten. In addition, lack of appetite was believed to be another indication of worm infections. The infected child ate very little food or completely refused to eat on several occasions. Several explanations were given for their belief. One mother said the loss of appetite and vomiting was as a result of lack of space in the stomach to accommodate food due to the presence of worms. Another mother said the loss of appetite was as a result of the vomiting. "... if someone vomits he'll lose appetite for any food." she said. A community drug vendor said the loss of appetite was just an indication that something was wrong in the body. These symptoms were all believed to affect the physical appearance of the child.

3.3.2 Physical appearance of the infected child

The primary physical symptom reported in this category was the child's distended abdomen. Several explanations were given as to what caused the abdomen to enlarge. One explanation was that the swelling was the result of the large quantities of food eaten by the child. Another explanation was due to reactions in the stomach between the worms and the body; some substances (not known) were produced which remained in the stomach and made it to swell. This account was given by one traditional healer who said his medicines could destroy these

substances. A schoolboy believed that the worms were caused by witchcraft, i.e. Witches sent the worms to the children, and they caused the swelling. One mother said the swelling of the abdomen was as a result of the soil eaten which either accumulated in the stomach or caused perpetual constipation which in turn caused the swelling. She said the same soil was the source of infection.

Other than abdominal swelling, pallor was also reported as a sign of infection. They said the infected children's eyes looked "white" and sunken, and the palms looked pale (whitish). The underlying cause of pallor was attributed to insufficient quantities of food in the body due to lack of appetite and vomiting.

3.3.3 Discharge of actual worms

Majority of the participants in the third category (four mothers, one father, one teacher and one school age child) acknowledged that it was difficult to know if a child had worms. Three of the mothers and one father said the only sure way of identifying infection was seeing the actual worms in stool or vomit. Some respondents said they had no idea how the worm infections can be identified.

3.3.4 Other symptoms

The forth category labelled 'other symptoms' consisted of a wide range of symptoms reported. However, the majority of the respondents in this category mentioned coughing and stomach pains as symptoms. The coughing was reported by mothers, female teachers and a drug vendor, while the stomach pain was reported by school age children and female teachers. One of the mothers said if the child coughed and continued for several days she suspected that it was either tuberculosis (TB) or a worm infection. Another mother said a child with worms would complain of persistent stomach pains. The children who mentioned stomach pains as a symptom said they had experienced it when they were infected, and the pain went away after taking some medicine from the clinic which was believed to have expelled the worms.

The other symptoms reported were persistent diarrhoea, high body temperature (by one mother and one traditional healer), high temperature on the abdomen only (by a traditional healer) and the child being physically inactive and not playing (by one mother). Two teachers believe the appearance of ringworm in the head was an indication of the presence of worms in the stomach. At the end of the day, the general view on signs and symptoms of infection was that children were different and therefore the symptoms they manifested when infected also differed.

3.4 Perceived Causes

The respondents were asked to explain how children got infected with worms. The causal explanations given by respondents can be divided into three categories: (i) a broad set of causes involving consumption of food or non-food items; (ii) causes related to behaviour and (iii) congenital causes. However, seventeen of the fifty-seven respondents said they did not know what caused worm infections.

3.4.1 Consumption of food or non-food items

Consumption of food and non-food items was described as a cause of worm infections through four pathways: excessive consumption of certain foods, geophagy (eating of soil), consumption of contaminated foods and water and consumption of food with certain characteristics.

3.4.1.1 Excessive consumption of certain food items

In this group, it was believed that excessive eating of certain food items resulted into worm infections. Specifically, the participants singled out excessive consumption of vegetables as a cause of worm infections. On one hand, some respondents believed the cause of the infection were the vegetables themselves. On the other hand, one father believed it was the accumulation of the green stuff in vegetables (chlorophyll) in the stomach that caused worms. From their accounts none of them seemed to imply that the vegetables were acting as a carrier of infecting organisms. For instance one mother said that it was a common belief in the village that the fibres in the vegetables were the ones responsible for causing worm infections if taken too much. One father believed that excessive intake of uncooked vegetables (salads) would cause the child to have worms. It was also believed by several participants that eating any type of food over and over could cause worm infections. A traditional healer believed that everybody had something in the stomach that produced worms when the same type of food was eaten over and over. He said there were no

worms in the stomach or in the food, but there was something in the stomach that reacted with the food if eaten over and over to produce snakes (worms).

There were however, beliefs that were based on the presence of infecting organisms. This was the belief that milk when taken excessively over an extended period of time would cause worm infection in the individual. One mother and two school children believed that if milk was drunk frequently without boiling it would cause infection. The mother said the milk has some organisms, which if accumulated in large quantities could cause worm infections. Overall, as far as cause of infection was concerned, majority of the participants said they were not really sure of what they had reported, but it was just popular folk beliefs.

3.4.1.2 Consumption of soil

In this group the respondents believed that consumption of soil can cause worm infections. They said the soil was very dirty and could make one sick if eaten. On one hand, the soil being dirty was never associated with the presence of infectious organisms but rather the absence of cleanliness. On the other hand, there was a linkage made between organisms and worm infections. For instance, some mothers and children believed that because of the earthworms present in the soil, if eaten, the soil could cause worm infection in the stomach. In addition, a traditional healer, drug vendor and two mothers were not sure of what kind of organisms exactly caused worms but said the soil contained germs that caused worms in the stomach once eaten. When asked what type of soil caused worm infections, four types of soils were mentioned: anti-hill soil; wall or plaster soil; tree-back soil; and brown soil. Seven of the respondents named tree-back soil and anti-hill soil as the most infecting type. This is believed to be so because these soil types were considered the dirtiest, as ants made these two soil types from debris in the environment, including faeces of dogs and even of humans, they said.

3.4.1.3 Consumption of contaminated food and water

Three fathers reported consumption of food that was contaminated with germs as a source of infection. One of them believed any kind of food, as long as it contained germs can cause worms. The other one specified the food type saying the consumption of vegetables that were contaminated with human faeces caused infection. He went further to say some people in the community had worms because the vegetables they eat were grown near the sewerage plant, and were contaminated with faecal matter. Consumption of dirty food was reported as a cause of infection. The word dirty meant several things to the participants. Anything containing soil was believed to be dirty. Similarly anything not washed was said to be dirty. Several mothers believed that anything that was not washed had dirt, but they could not categorically specify what kind of dirt it was that could cause worm infections.

The community drug vendor who reported soil as being dirt that could cause infection did not know what exactly in the soil caused infection, but was sure that food that had soil on it could cause infection. What was surprising was that he did not believe that eating soil (geophagy) could cause worms. He said "…children eat a lot of dirty food (food with soil) as they play, and they have worms, but my wife has been eating soil for many years but has no worms ..." Some participants also implicated drinking dirty water as a cause of infection. The qualification of dirty water, just like for dirty food, did not relate to the germ theory. For instance one mother said

> *"...any kind of dirt in the water can cause worms….if children are playing or bathing in the stream and someone drinks that water he will develop worms ... my children like swimming in the stream, and they have had worms ..."*

A schoolboy said his grandmother told him that drinking water that tasted bitter and had a bad smell could cause worm infections. However, one mother and two fathers explicitly pointed out that dirty water had germs that could result into worm infection if drunk. One of the fathers said the problem with people was that they didn't want to listen, health educators always told them to boil drinking water but most of them did not boil their water and as a result they suffered from diseases like cholera and worms. "If you boil the water the worms will die and the water will be safe", he said.

3.4.1.4 Consumption of food with certain characteristics

This theme consists of consumption of food items with different characteristics. First, it was

believed that feeding a child with food that has not been properly cooked, (i.e. undercooked) resulted in worms. Secondly, it was also believed that eating of vegetables that had been sprayed with pesticides and were not yet ready for consumption resulted in worms in the stomach. A man who grew up on a farm, where this notion was a common belief, reported this. He said they believed that the vegetables eaten prematurely after spraying would cause infection because they still contained some vegetable pests which were supposed to be eliminated by the pesticide, but were not. Apparently the pests talked about here were not the worms but any kind of vegetable pest found on the vegetables, which would turn into intestinal worms once in the stomach. Third, a traditional healer said that eating food that was not compatible with the body (allergy) could cause worms. He said occurrence of worms was sometimes an indication that the body had rejected the food.

3.4.2 Behavioural factors

This second category of causal explanations consisted of behavioural factors. Three fathers, one mother and one school child believe that playing in dirty water was one of the causes of infection. It appeared some of the respondents considered STH and schistosomiasis as one infection, as apparent from some of the responses:

> *"...if a child plays in dirty water he will get worms. If he is treated in good time the worms will come out through vomiting or faeces, but if not treated in good time they will enter the blood system resulting in bloody urine…..the bloody urine might lead to anaemia..." explained one father.*
> *"... if the child plays in dirty water, especially swimming, the child might swallow some water and then will have worms ....which will appear in the stool or urine as blood, depending on the body of the child ..." explained the school child.*

Other responses given by four school age children included playing in soil, walking outdoors without shoes on, and not bathing. Although not as a direct cause in itself, but a confounding factor, one woman identified 'not taking good care' of the children as one of the reasons why children get infected. She said:

> *"... I think sometimes that for one thing, its lack of care on the part of the mother by not giving the things that are not washed, not washing hands before feeding the child. ... The problem is that mothers are too busy and don't have enough time to walk around after their crawling or walking children that keep on picking up dirt and putting it in their mouths...."*

The direct causes brought out by this respondent are eating dirt, feeding child with dirty hands and eating dirty food. When the mothers were interviewed on hand washing practices only a few of them said they washed their hands before feeding the child.

3.4.3 Congenital causes

The third theme on causes consisted of the belief that children were born with worms. The two mothers who believed in this theory explained that these worms resided in the mother's womb and were transmitted to every child while still in the womb. One participant added to say it was dependent on the "strength" of the child. Children with strong bodies would not suffer from the worms and the worms would just remain in their bodies for the rest of their lives, but those with weaker bodies would suffer from the worms. It was a common traditional belief that different people had different susceptibility to infections. Children whose bodies were less susceptible and were able to fight disease were said to have strong bodies, while the more susceptible ones had weak bodies. Another explanatory theory was that under normal circumstances the worms lived in the abdomen and aided in digestion of food, but a serious and potentially fatal condition could arise when the worms were disturbed, left the stomach and travelled throughout the body. Eating the wrong type of food or the presence of another infection in the body was believed to cause this disturbance.

4. DISCUSSION

Although the current findings cannot be generalized as Masaku and co-workers [6] stated, yet they still provide informative reference in understanding beliefs and perceptions likely to be encountered with regard to worm infections in Zambian peri-urban communities. The study shows wide spread knowledge about the existence of different types of worms in the community. This further conforms to findings by Masaku and co-workers [6] in the coastal region of Kenya. As expected, the roundworm is the

most common worm [32] and distinctly identified by most of the participants as Sokanda. While strongiloides was pinpointed by two women as Namutokonya, no local name was given for hookworm. Also, no participant's description or identity seemed to imply knowledge of whipworm or any of the other STH. It was intriguing that two school teachers mentioned ringworm and earthworms as part of STH. Masaku and co-workers [6] also highlights perceptions that ringworms are amongst STH. Despite the wide spread knowledge expressed by study participants on the various types of worms, most of it is generally folk knowledge. All of the participants, except three, said they acquired the knowledge from either family members or friends. The three exceptions were a school child, a mother and a father, of which the school child was taught at school about worms, the father from the clinic and the mother from antenatal clinic.

Apparently, the folk sector is not just an important channel of information concerning worm infections in Zambia but also in Zimbabwe [11,12,33]. I personally remember being aware of the existence of worms as a child, even before it was taught in school. People usually talked of someone having worms if he or she ate a lot of food. Similarly, most of the participants in the study have become aware of worm infections through informal channels of communication. In agreement with Acka and co-workers [33], who acknowledge that 12 community social organizations act as intermediaries in delivering health education messages, the study also recognizes that the informal sector plays a significant role in disseminating health information at different levels: family, neighbourhood and community.

Therefore, several channels of information regarding worm infections need to be explored in peri-urban areas such as Ngombe compound. Schools should take advantage of the various existing clubs to share health matters including information about the different types of worms, their aetiologies and symptoms. In addition, community level health education can be strengthened through the already existing community organizations and groups, like the health neighbourhood watch, parent motherhood association, the different church organizations, community youth groups and local council health wing.

However, knowledge of a particular disease does not necessarily mean the population recognizes it as a health problem. The perceived seriousness of any health problem and its ensuing consequences play principle roles in ensuring compliance to public health campaigns [34]. As was observed by Midzi and colleagues [12], most of the study participants were aware of the existence of other diseases in Ngombe compound apart from STH. Specifically malaria that dwarfed the perception of STH infections as a health problem. Even if worms ranked second after malaria, many participants disregarded their influence as they don't result in hospital admissions or death like malaria does. Children still play even when infected with worms, unlike with malaria where the child is grounded; parents cannot leave work in order to take a child with worms to the clinic during opening hours, unless it was malaria. All these accounts show how malaria affects the perceptions on severity of other diseases, especially one like STH with non-acute episodes.

Additionally, the participant's previous experience with worms further affected their perception as a health problem. Majority of the participants with village background regard worms as normal or as part of everyday life. Having been pre-exposed to worms in the village, they believed that it's normal for every child to have worms at one time or the other. Some women also perceived worms in the abdomen as normal and aided in digestion. This notion corresponds with findings by Lu and co-workers [35] in rural China and Kamunvi and Ferguson [17] that worms are a natural thing. Geissler [36] found that children perceived worms as being necessary for life. "The good worms eat food and the bad ones neglect it". Green [37] described the widespread belief in eastern and southern Africa of the existence of an invisible internal "snake", a kind of force that moves around and can make one sick.

On the contrary, thirty-two respondents considered worms to be a serious health problem. They regarded them as a problem comparable to malaria because children lose appetite and weight, look pale and caused abdominal pain. This is evident from responses of participants who said the children lose weight and appetite just like in malaria. This agrees with study findings by Masaku and co-workers [6], Acka and co-workers [33] and Lu and co-workers [35] who report perceptions of worms being serious infection that suck blood, cause general body weakness and death in severe cases. Curtale [20] in his study also found that worms

were considered to be undesirable. These examples and the results clearly highlight the need for consideration of lay beliefs in intervention schemes. Awareness of health beliefs about STH is essential if education programs for these diseases are to be effective. Although there is not necessarily a link between increased knowledge and change of behavior, the possibility of any disease control program succeeding is greatest in cases where the target population considers the disease as a health problem and is aware of the risk factors influencing the disease [20,38]. Yet, the motivation to seek treatment may arise by the belief that worms are harmful to health, rather than a biomedical understanding of the infections. In a control strategy that relies on passive case detection, the community's perception of the disease is particularly important in ensuring its effectiveness, since perception does affect compliance.

The non-specific symptoms of STH mentioned such as eating too much, lack of appetite, enlarged abdomen, pallor, coughing, and stomach ache have also been shown in previous studies to be important indicators to both the folk and the professional health sectors [6,16,17]. Most of the symptoms cited in the current study can be associated to clustering of worms. Presence of worms in the stool provides evidence (to the participants) of infection, as well as efficacy of treatment if seen after treatment. Seven out of fifty-seven participants acknowledged the difficulty in confirming STH infections, citing the presence of actual worms in stool as the only sure way of diagnosis. Though of course this only applies to roundworms which are large enough and usually clearly visible in stool. Whipworm and hookworms are very small and are not easily seen in general examination of stool. Thus, education materials meant for lay people should clearly indicate the relative sizes of the different worms and which ones they can expect to see in faecal matter.

Whereas, faecal matter provides empirical evidence for worm infestation, care must be taken to avoid hand contamination. A few mothers spoken to at the hand pump cited failure to wash hands before feeding the children as one of the causes for STH transmission. This is supported by Masaku and co-workers [6] who report that women were more at risk of STH due to their active role in child care as well as geophagy. Not until hand washing is taken seriously as alluded by Midzi and co-workers [12] and Acka and co-workers [33], the transmission of STH may not reduce.

Moreover, the findings on causes of STH suggest that lay beliefs with respect to consumption of food and non-food items are important sources of infections. Most participants cited excessive eating of vegetables and salads as the common cause of infection. Generally, the causal theories on consumption of vegetables, salads, soil, contaminated foods and water, and behavioural factors bear many similarities to biomedical ideas. Except that the exact mechanisms of disease upheld by lay beliefs may be quite different from those in biomedical literature. Masaku and co-workers [6] found a lack of adequate information amongst Kenyan participants regarding worm infections that is not linked to STH infections. According to historians of the mortality decline in Europe between the 18th and 20th centuries, personal hygiene and sanitary conditions did not improve because of widespread knowledge of the germ theory of disease, but rather due to change of taste and rising standards of living [39]. Thus, the lay belief that the consumption of food items and behavioural factors cause infections, must be embraced from a biomedical perceptive as a practical measure for preventing STH transmission.

The findings of the current study further indicate that there are considerable differences between the biomedical perspective and lay beliefs on causes of STH infections. For instance, beliefs that worm infections are as a result of allergic reactions from certain food items; eating vegetables containing pesticides and the congenital infection theory. Based on these responses, the type of measures that women are likely to undertake to prevent infection may fail to present an adequate treatment for worms from a biomedical perspective. The causal mechanism underlying the belief of congenital factors as determinants of whether a child will have an infection or not may be linked with biomedical ideas about susceptibility to illness, but there is little empirical evidence supporting such a link. This only includes the belief on "strong" and "weak" bodies, but not congenital infections. Preventive measures based on these beliefs are unlikely to have any effect on the transmission of STH. At this stage it is unclear whether these beliefs constitute a barrier to using biomedical treatment or not because some of the

participants who believe in these theories use biomedicines while others don't.

It was not surprising that some respondents do not know how to identify infection. Worm infections manifest themselves in non-specific symptoms that are common in other illnesses. For instance loss of appetite, stomach pains, fever, diarrhoea are symptoms that appear in other infections like malaria, enteric infections, etc. Most of the symptoms given are associated to round worm infections. Only in few instances are symptoms like anaemia (caused by hookworm infection) mentioned but this is also a general symptom that can be caused by other illnesses. The study suggests that local interpretation and beliefs have been developed and reinforced by experience. In this context, health education should focus on improving positive behaviour rather than knowledge.

5. CONCLUSIONS

The current study has revealed that knowledge of different types of worms was common, but based on local beliefs and interpretations. In terms of seriousness of the worm infections to health, the community members were divided – some considering them as a serious cause of morbidity while others thought worms were not a serious infection. Similarly, the perceived causes and symptoms were to a large extent based on lay knowledge and beliefs rather than biomedical facts. The worms were generally ranked low in terms of their public health importance compared to others more acute infections like malaria. This study highlights the need for continued community sensitizations about public health importance of such neglected diseases in the context of folk beliefs [40,41]. The combination of epidemiological studies with rapid assessment techniques focusing on local understandings and practices will enrich the understanding of behavioural risk and lead to more pragmatic recommendations for interventions. This is especially important in settings where resources are limited and STH control may have a low priority. Although advantageous, there is no guarantee that such interventions will be successful as many other factors are critical in changing local practices.

6. DATA AVAILABILITY

The main qualitative data used to support the findings of this study are included within the article. However, additional data used to support the findings of this study are available from the corresponding author upon request.

CONSENT AND ETHICAL APPROVAL

The research proposal was reviewed and approved by the University of Zambia Biomedical Research Ethics Committee. At the beginning of each interview and spot check an explanation of the study was given and consent to participation in the study was obtained. The participants were informed that they were not required to participate in the study; they could stop the interview at any time or refuse to answer any 5 questions. The participants were assured of anonymity and although some of the information they provided would be published, their name and identity would not be associated with the publication. Children were asked to give their assent after their parents consented.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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