Original Research Article

Prevalence and Associated Risk Factors of Soil-Transmitted Helminthiases among Primary School-going Children in Rarieda, Siaya County-Kenya

ABSTRACT

Soils Transmitted Helminthiases, abbreviated as STH, are a group of chronic infections, typically very common or endemic in low income countries and are classified as Neglected Tropical Diseases (NTD). Despite the World Health Organization (WHO) laid down control strategies and goal to eradicate these infections by the year 2020, these infections continued to dominate in Sub-Saharan countries. This problem necessitated the need for this study. The primary objective was to assess prevalence of, and associated risk factors of STH among the school going children in Rarieda, a sub-county in Siaya County of Kenya. The study was expected to contribute to the overall theme of "Research for Better Health in East African Region". The study population comprised of primary school going children, aged between seven and fifteen years old. A total sample size of three hundred pupils was randomly sampled from five primary schools across Rarieda. Data were collected between September and October 2018 and cross sectional study design was used. Before commencement of data collection exercise, ethical approvals were obtained from all the relevant authorities and pre-testing was done at Ruma primary school. Data was collected using structured questionnaires, Key Performance Indicators (KII) and Focused Group Discussions (FGD). The study established that there was high prevalence of STH among the school going children in Rarieda, with prevalence rate of 27.3 percent. The prevalence rate varied with socio-demographic characteristics of the pupils. It was high in boys than in girls, high in lower classes than in upper classes and high in Uyoma than in Asembo communities. It was also established that the knowledge level of the

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Comment [HBN2]: Which problem!

Comment [HBN3]: Level of magnitude

pupils on STH was 43.02. The pupils were 46.2 percent at risk of STH with a great variance noted between health practices at schools verses at homes.

Keywords

- Prevalence
- Associated Risk Factors
- Soil-Transmitted Helminthiases
- Primary School-going Children
- Neglected Tropical Diseases
- Rarieda-Kenya

1.0 INTRODUCTION

1.1 Study Background

Soil-Transmitted Helminthiases abbreviated as STH, refer to the intestinal worms infecting humans and are usually transmitted through contaminated soil, and, this type of helminth infection or helminthiases is caused by different species of roundworms, such as ….[1,3]. It is usually referred to as Soil-Transmitted Helminthiases because it is caused specifically by those worms which are transmitted through soil contaminated with faecal matter [1]. The main types of STH include the *ascariasis*, hookworm, whipworm and *Strongyloides stercoralis,* with the first three types being the most distinguished. STH is categorized as a Neglected Tropical Diseases (NTD) which was launched in 2012 to be eradicated by 2020 in the world [1]. Epidemiological distribution of STH is worldwide with approximately a third of the global population infected with STH [1]. This means that about two billion people of the world total population are infected, and about another four billion are at risk of being infected [1]. Infections are widely distributed in tropical and subtropical areas, with the greatest numbers usually occurring in China, America, East Asia, and sub-Saharan Africa, Kenya included [2]. Over 267 million preschool-age children and over 568 million school-age children live in areas where these parasites are intensively transmitted, and are in need of treatment and preventive interventions[3]. Generally, the infections are endemic in developing and low income countries [1]. STH is transmitted by eggs that are passed in the faeces of infected people [1, 3]. Adult

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worms live in the intestine of human beings where they produce thousands of eggs every day. In areas with poor adequate sanitation, the eggs contaminate the ground. Hookworm eggs hatch in the soil, releasing larvae that mature into a form that can actively penetrate the skin. People become infected with hookworm majorly by walking without shoes on contaminated soil [1]. There is no direct transmission of these worms between persons, neither is there infection from fresh feaces [3]. The degree of negative symptoms is directly in relation to worm burden. Symptoms are evident and noticeable when infection is high and severe [1]. Soil transmitted infections may cause several health issues such as abdominal pains, diarrheal, rectal prolapsed, physical and cognitive growth retardation and protein loss to the infected [3]. Hookworms are major cause of chronic intestinal blood which causes anaemia in most cases. Soil-transmitted helminths also cause appetite loss leading to reduction of nutritional intake in the body and physical unfitness in human beings and in particular, *T. trichiura* can mostly causes diarrheal and dysentery. They also contribute and prevent affected children and/or persons from going to school, work, or fully participating in community development activities, thereby contributing to stigma and poverty [1, 3].For basic diagnosis, specific helminths can generally be identified from the faeces, and their eggs microscopically examined and enumerated using faecal egg count method [2]. Control and prevention strategies involve regular treatments, improving of sanitation, and health education and promotion [1, 3].

This research project was necessitated by high prevalence of STH among the school going children, and the burden caused by these worms among the pupils. The primary purpose of this research project was to provide statistical and epidemiological understanding of the ~~prevalence~~ occurrence and risk factors of soil-transmitted Helminthiases in Rarieda, Siaya County. In justifying the need for the study, the researcher noted that there was a serious need to carry out a study on STH with the primary school going children as the study population because of the public health effects associated with these infections [1, 3], the vulnerability of pupils to STH infections [3], and also because of the fact that these infections have been neglected [1]. In this study, new data were generated on the prevalence and risk factors of STH in Rarieda. This in turn helped in better understating and decision making on the most appropriate prevention and control strategies of soil transmitted worms.

With regular deworming, health education and promotion, and maintenance of hygiene and sanitation, we shall indeed eradicate Soil-Transmitted Helminthiases from our Rarieda community ~~Rarieda~~, from our

Country Kenya, and even from the rest of East Africa as a whole. Public Health Officers (PHO) must take a fore front role in appropriate policy formulations, implementations, and enforcements and lead all other health care workers and the society at large in this noble exercise.

The primary objective of the study was to assess prevalence and associated risk factors of Soil Transmitted Helminthiases among primary school going pupils in Rarieda, Siaya. Two important research questions included: 1. what was prevalence and risk factors of soil-transmitted Helminthiases among the primary school going children in Rarieda? 2. What was the level of knowledge on Soil-Transmitted Helminthiases among the primary school going children in Rarieda?.

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2.0 METHODOLOGY

2.1 Study Population and Area

This study was carried out in Rarieda. Rarieda is one of the six sub-counties of Siaya County, in the former Nyanza province in the southwest part of Kenya [4, 5]. Siaya County covers a total area of 2,496.1km^2 with a total population of 842,304 as per the 2009 Kenya population census [6]. Siaya county boarders Busia, Kakamega, Vihiga, Kisumu and Homabay counties. Apart from Rarieda, the other five sub-counties in Siaya include Bondo, Ugenya, Alego, Gem and Ugunja [7]. The main economic activities in the area include food and cash crop farming, cattle rearing mostly in small scales, and fishing. Rarieda Sub-County is made up of two communities namely Uyoma and Asembo. The sub-county is sub-divided into five administrative areas, referred to as "wards" under the new Kenyan constitution promulgated in 2010 [7]. During the time of the study, Rarieda had approximately one hundred and thirteen primary schools with a total pupil's population of about thirty-four thousand. The study population comprised of primary school going children in Rarieda aged between seven and fifteen years old [7].

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2.2 Study Design and Sample Collection

Descriptive cross-sectional study design was used in this study. Sample size was determined and calculated using the Fisher's Formula (1998). Three hundred school-going children, comprising of one hundred and fifty boys and a similar number of girls were sampled for the study.

During the sampling, the study site (Rarieda) was first divided into five strata. These five strata were the five administrative wards, three in Uyoma and two in Asembo[7, 10]. One school was then sampled randomly from each of the five wards. Sixty pupils in total, twelve per classes three to seven, were then sampled from each of the five sampled schools.

2.3 Stool Examinations

Single stool samples were collected from each of the sampled pupils and analysed for STH eggs and larvae by wet mounts. Kato-Katz technique was used for quantification of the worms. The selected pupils

were given a screw capped plastic sterile container bearing an inscription with name and age of child, to collect the early morning stool on the day of selection into the study and explained regarding stool collection which was to be at least two grams. The stool sample collected was then subjected to microscopic evaluation[12, 13, 14]. The direct wet smear was prepared by mixing a small amount of stool (about 2 mg) with a drop of 0.85% NaCl; this mixture was to provide a uniform suspension under a 22- by 22-mm cover slip[13]. This was the cost effective routine microscopy examination of stool undertaken in the study in the community. The laboratory analysis of the stools was done at Pap-Kodero Health Centre. The health centre is owned and managed by the county government of Siaya.

2.4 Pre-testing

Pre-testing of the data collection tools was done at Ruma Primary school one week prior to the actual data collection exercise. Data collection tools included the structured questionnaires for the primary school going children, Focused Group Discussions (FGD) and Key Informant Interviews (KII). Pre-testing also involved sample stool collection, examination and analysis.

Comment [HBN6]: What is the importance of this qualitative technique!

2.5 Statistical Analysis

Data collected were entered into an excess sheet for analysis and correction of any errors. The first step in quantitative data analysis was to identify the levels or scales of measurement as nominal, ordinal, interval or ratio. This was to help determine how best to organize the data. The data was typically entered into a spread sheet to check for the accuracy and any errors, and organized or "coded" in some way that gave meaning to the data. They were then analyzed from the excel sheet and by use Statistical Package for Social Science (SPSS- Version 20) [15]. The next step involved use of descriptive statistics to summarize the data. ~~The descriptive statistics that were used included the frequencies, percentages, mean, median, minimum and maximum values, and range.~~

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3.0 RESULTS AND DISCUSSION

3.1 Results

3.1.1 Prevalence of SHT among the Primary School Going Children in Rarieda

Prevalence of Soil-Transmitted Helminthiases among the primary school going children in Rarieda was 27.3 percent. Boys had a higher prevalence of STH (29.3 percent) than females ~~that had prevalence of~~(25.3 percent). Boys tested positive of the STH from class three to seven were 12, 10, 8, 6 and 8 respectively while the total number of girls tested positive from class three to seven were recorded as 8,7,8,8, and 7 respectively.

In terms of prevalence by classes, and ages, it was determined that the prevalence in class three to seven were 33.3 percent, 28.3 percent, 26.7 percent, 23.3percent and 25.0 percent respectively. The prevalence therefore reduced with a rise in age and class. (Fig. 1)

In terms prevalence of STH by wards, it was noted that the prevalence of STH was highest in South Uyoma ward (38.3 percent). It was followed by West Uyoma with a percentage prevalence of 33.3 percent, East Asembo (25 percent). West Asembo ward recorded the least prevalence with a percentage of 16.7 percent while North Uyoma had a prevalence of 23.3pecent. The mean prevalence in Uyoma was 31.7 percent whereas prevalence in Asembo was 20.8 percent.

151 **Table 1: Prevalence of STH by Ward, Type, and Class**

Variables	Frequencies	Percentages	Chi-square (X^2)	p-values
Class				
Standard 3	20	33.3		
Standard 4	17	28.3	1.293	0.86262
Standard 5	16	26.7		
Standard 6	14	23.3		
Standard 7	15	25.0		
Gender				
Males	44	29.3	0.439	0.50759
Females	38	25.3		
Community				
Uyoma	57	31.7	3.091	0.0787
Asembo	25	20.8		
Ward				
West Uyoma (Akuom)	20	33.3		
North Uyoma (Ochieng'a)	14	23.3	6.415	0.17025
South Uyoma (Ramoya)	23	38.3		
West Asembo (Mabinju)	10	16.7		
East Asembo (Ong'ielo)	15	25.0		
Type of STH				
Hookworms		53		
Roundworms		39		
Whipworms		8		

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3.1.2 Knowledge among the Primary School Going Children

The calculated average knowledge for the pupils was 43.02 percent. As far as each school was concerned and as noted from table 1 above, the calculated level of knowledge on STH among the primary school going children in Mabinju, Akuom, Ramoya, Ochieng'a and Ong'ielo primary schools were 43.9,37.3,30.4,48.2, and 34.6 respectively. The figure presented below showed that Ochieng'a primary school pupils were the most knowledgeable on average on matters or questions asked related to STH. Their average knowledge on STH was 48.2 percent. Average knowledge for primary school going children in Mabinju primary school was 43.9% percent, Akuom primary (37.3%), Ong'ielo primary (34.6%) and Ramoya primary school at 30.4 percent (Table 2).

Analysing by specific knowledge indicators and based on the figures above, most pupils had heard about STHs at 73.7 percent. However, very few pupils, 36.4 percent, were able to demonstrate an understanding of the prevention and control measures, tell the signs and symptoms (31.2 percent), causes and risk factors (34.7 percent) or even tell the mode of transmission of STH (18.5 percent).

168 **Table 2: Knowledge on STH**

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School	Had heard about STH n=60		Knowledge on Signs and Symptoms n=120		Know mode of transmission n=120		Understand the causes and Risk Factors n=120		Understand Prevention and Control Measures n=180		Calculated Percentage Averages
	Numbers	Percentages	Numbers	Percentages	Numbers	Percentages	Numbers	Percentages	Numbers	Percentages	
Mabinju	48	80.0	45	37.5	29	24.2	47	39.2	70	38.9	**43.9**
Akuom	44	73.3	35	29.2	24	20.0	40	33.3	55	30.6	**37.3**
Ramoya	36	60.0	23	19.2	13	10.8	34	28.3	61	33.9	**30.4**
Ochieng'a	52	86.7	50	41.7	27	22.5	52	43.3	84	46.6	**48.2**
Ong'ielo	41	68.3	34	28.3	18	15.0	35	29.2	58	32.2	**34.6**
Percentage Average		**73.7**	**31.2**		**18.5**		**34.7**		**36.4**		**43.02**

3.1.3 Risk Factors associated with STH Infections

It was determined that the primary school going children in Rarieda were 46.2 percent at risk of being infected with STH. The risk factors varied across the schools whereby Mabinju, Akuom, Ramoya, Ochieng'a and Ong'ielo primary schools were 41.0, 50.7, 55.3, 37.9, and 45.9 at risk of STH respectively. Pupils of Ramoya primary school were at the most risk of STH with a percentage of 55.3 percent. They were followed by Akuom primary (50.7%), Ong'ielo primary (45.9%), Mabinju primary (41.0%) and at Ochieng'a primary at 37.9 percent (Table 3).

Comment [HBN8]: Which rirk factors!

177 **Table 3: Risk Factors on STH**

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School	Lack Toilets N=60				Inadequate Hygiene & Sanitation Practice N=60				Lack of Health Education and Promotion N=60		Lack of Regular Deworming N=60		Calculated % Averages		**Percentage at Risk**
	At school		At home		At school		At home								
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	
Mabinju	54	90.0	26.5	44.2	39	65.0	19.5	32.5	44.5	74.2	29	48.3	212.5	59.0	**41.0**
Akuom	45	75.0	23	38.3	38	63.3	20	33.3	33.5	55.9	18	30	177.5	49.3	**50.7**
Ramoya	41.5	69.2	18.5	30.9	31.5	52.5	16.5	27.5	37.5	62.5	15.5	25.9	161	44.7	**55.3**
Ochieng'a	55	91.7	30.5	50.8	44.5	74.1	24.5	40.8	38	63.3	31	51.7	223.5	62.1	**37.9**
Ong'ielo	51.6	84.3	27	45.0	38.5	64.2	21	35.0	35	58.3	22.5	37.5	194.6	54.1	**45.9**
% Average	82.0		41.8		63.8		33.8		62.8		38.7		53.8		**46.2**
% at Risk of STH	**18.0**		**58.2**		**36.2**		**66.2**		**37.2**		**61.3**		**46.2**		

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The risk factor indicators included inadequate/lack of the following: toilets, hygiene and sanitation practice, health education and promotion and deworming.

The greatest risk factor was that the pupils did not observe adequate health hygiene practice while at home (66.2%). Lack of regular deworming programs followed as the second common risk factor at 61.3 percent while poor toilets coverage especially at homes was a third risk factor with a percentage of 58.2 percent. Lack of adequate health education and promotion and poor hygiene practice at school came fourth and fifth with percentages of 37.2% and 36.2% respectively. The least risk factor recorded was in regards to adequate toilets and pit latrines in schools. This was recorded at only 18 percent. The 18 percent was attributed to inadequate toilets compared to pupils population and the hygienic conditions of some of the toilets. (Fig. 2).

Correlations between prevalence of STH and knowledge on STH and between prevalence of STH and STH associated risk factors were calculated using the Pearson Correlation formula,

Correlation r,

$$r = \frac{N\varepsilon xy - \varepsilon(x)(y)}{\sqrt{[N\varepsilon x^2 - \varepsilon(x^2)][N\varepsilon y^2 - \varepsilon(y)^2)]}}$$

The calculated R values for correlation between prevalence of STH was knowledge on STH was R = -0.7518, while the calculated R values for correlation between prevalence of STH and STH associated risk factors was R = +0.8985. Figure 3 gives an illustration of correlation between risk factor and prevalence of STH. There was therefore, a strong negative correlation between prevalence of STH and level of knowledge on STH.

On the other hand, there was a strong positive correlation between prevalence of STH and associated risk factors, hence a conclusion that the prevalence of the STH was directly proportional to the level of risk factors associated with it.

Most pupils were keen to practice health hygiene while at school than when they were at home. In all the five schools, the level or percentage of health hygiene and sanitation practice was high while the pupils were in schools than when they were at home. Using the Pearson's Correlation Formula, the value of R

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was calculated as + 0.9675. There was therefore, a strong positive correlation between hygiene practice at school and at home.

3.2 Discussion

3.2.1 Prevalence of Soil-transmitted Helminthiases

82 out of the total 300 pupils tested for STH infections were tested positive. This translated to prevalence of 27.3 percent. The prevalence was found to be high in lower classes compared to upper classes with class three, four and five having prevalence of 33.3 percent, 28.3 percent and 26.7 percent, respectively. Standard seven had a prevalence of 25 percent while standard six had the least prevalence of 23.3 percent. This agrees to the research done in Ogun state in Nigeria which showed that the younger age groups were more infected by STHs than older age groups [13]. According to this research done in Nigeria, children of age group 5-7 had a prevalence of 33.3 percent whereas age group 14 years and above had a prevalence of 26.8 percent [13]. Similarly, a research done in Nepal showed that prevalence of STH ranged from 3.3 to 51.5percent with the highest prevalence of 51.4 percent recorded from Khokana community. Rapid Assessment of Soil Transmitted Helminth (STH) Infections among School Girls in Odisha reported that the prevalence of STH I girls was 29.3 percent [9].

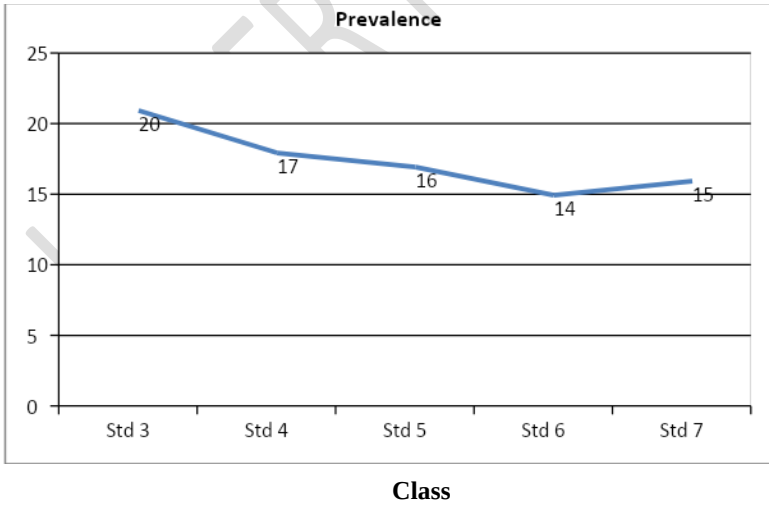

Figure 1: Prevalence of STH by class

As far of prevalence by community was concerned, 57 out of 180 pupils in Uyoma community had STH infections translating to 31.2 percent whereas only 25 out of one 120 pupils (20.1 percent) in Asembo were infected. Even though the difference between the two communities was not statistically significant, p-value of .0787, it meant that STH prevalence in Uyoma was high than in Asembo. Chi-square tests and calculations showed that the difference in prevalence of STH among the five schools were not statistically significant, p-value of .17025. Similarly, there was no statistical significance on prevalence of STH between the boys and girls with p-value calculated at .50759. However, it was noted that the prevalence in boys (29.3 percent) was high than the prevalence in girls with a percentage difference of four percent. This finding did not corroborate to the study done in Nepal in which it was found that the prevalence in females was higher than the prevalence in males [8]. The difference in the finding of the two studies was attributed to the fact that the study in Nepal included females and males of all age groups. It attributed the high prevalence of STH to be high in females than boys due to the high roles paled by females in the fields and gardens compared to males. However, this study in Rarieda only included boys and girls of the primary school age, mostly between age groups of seven and fourteen. With a p-value of .86262 the difference of prevalence among the classes was however, not statistically significant. High prevalence of STH on boys than girls in the sampled pupils was also attributed to their behaviours and responsibilities brought by gender. Boys mainly walk and play barefoot, compared to girls. Boys are also mainly responsible for looking after the animals in the open fields, and due to the area type of soil, mainly clay soil in most areas, walking on shoes especially during rainy seasons is a big problem. On the other hand, girls' main chores involve mainly working within their home compounds hence exposing them to lesser risk of STH than boys. Low prevalence of STH among pupils of upper classes compared to lower classes colleagues was attributed to two factors: maturity and learning pressure in upper classes. Interventions for the control and prevention of STH must therefore, among other measures, focus on health promotion and education, and must also focus on behaviour change such as encouragement of the pupils wear shoes always when outdoors, washing of hands after toilets visitation, and even washing of fruits before eating them.

Comment [HBN12]: Insert this figure in the Results section

Comment [HBN13]: How do you or can you explain such a difference!

Comment [HBN14]: GOOD discussion and explanation

Based on the type soil transmitted helminthiasis, it was established that infestations by hookworms were the highest at 53 percent followed by roundworms at 39 percent whereas infections by whip worms were the least at only eight percent. These results were similar to the study in Nigeria, in which it was found that *A. lumbricoides* was the most common STH at 29.3 percent while *T. trichiura* had the least prevalence at 2.3percent [4, 8]. This implied that interventions for control and prevention of STH among the community as much as it should focus on all types of worms, should pay much specific attention in *A. lumbricoides*. This is because if *A. lumbricoides* alone can be eradicated, the prevalence of STH would reduce by more than fifty percent.

High prevalence of STH in Rarieda was attributed to the climatic conditions in the area. According to Akinola et al (2018), STH are prevalent in areas with favourable climatic and environmental conditions [4]. The unhygienic eating habits, poor water supply, poor sanitation and personal hygiene conditions which facilitate the transmission of STH could also have been a contributing factor for the high prevalence of these worms [13]. The study findings were better than those reported by Osazuwa et al. in Nigeria in 2010 where parasitic infection was reported at nearly 80% and hookworm being 75 %. In an Indian study done at Vellore in 2010 among school children in 6-14 years age STH prevalence was noted much less, that is, 7.8 percent, though hookworm rates were highest, that is, 8.4 percent. In that study residing in hut (Katcha house) and open field defecation emerged as major risk factors for STH. This indicated that STH was a pending public health preventable problem which is mainly because of food and hygiene habits. School going children should be made conscious of these and appropriate health programs like Iron-Folic Acid (IFA) and deworming should be rightly and stringently being implemented with regular monitoring to address the problem of not just STH but associated problems of anaemia and underweight [9].

Comment [HBN15]: YES

3.2.2 Risk Factors

It was established that the pupils in Rarieda were 46.2 percent more likely to get infected with STH. In terms of the individual risk factor indicators, it was established that 66.2 percent of the pupils did not take seriously hygiene practices while at homes. This was quite high compared to only 36.2 percent of the pupils who did not practice hygiene while at schools. On the issues of the toilets, 58.2 percent of the pupils did not have access to good functioning toilets while at homes. This meant that the pupils were

Comment [HBN16]: Which ones?

most at risk of STH while at homes than while in schools. Only 62.9 percent of the pupils indicated that they received average health education and promotion programs. On deworming, only 38.7 percent received regular deworming as recommended by the WHO. This meant that up to 61.3 percent of the pupils in Rarieda were at risk of STH due to lack of deworming programs in schools.

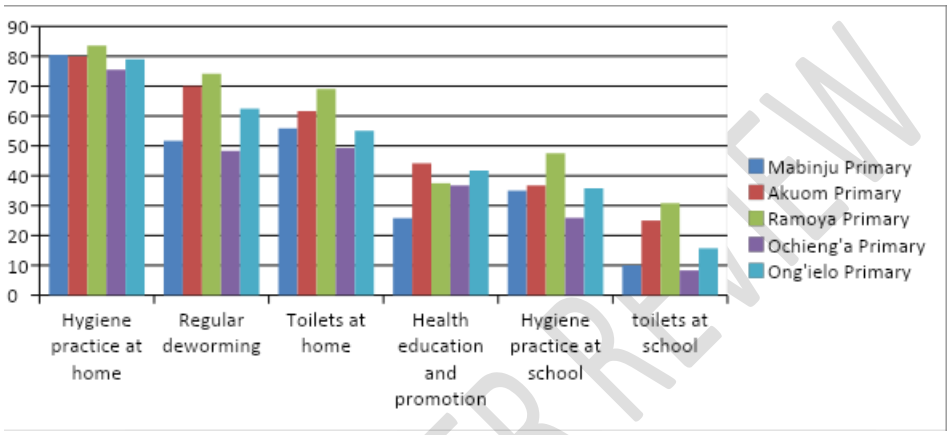

Figure 2: Associated Risk factor of STH

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~~Calculations on correlation between risk factors associated with STH and prevalence of STH showed that there was a strong positive correlation, R = + 0.8983, between risk factors and the prevalence. This implied that any intervention that reduces the risk factors would definitely result in to the reduction of STH in the area, Rarieda Sub-County.~~

There were poor toilets and/or latrines coverage in Rarieda. Only 41.8 percent of the pupils sampled had access to toilets in their homes, implying that majority of them at 52.2 percent were at risk of STH infections due to lack of toilets. Most of the pupils, and their parents as well, did feasicate in open fields. This situation was made worse by the fact that most pupils did not wear shoes to schools.

Comment [HBN18]: Please, discuss and do not repeat the results

The results on the risk factors were in agreement with results from other studies previously done on the same or closely related topic. For example, ~~Multivariable logistic regression analysis in the study of~~

Prevalence and risk-factors of soil-transmitted helminth infections in Nepal revealed that not using soap for hand-washing was a significant risk factor for the prevalence of roundworm, hookworms and whipworm [4, 8]. Similarly, not using sandals or shoes outside was a significant risk factor for the prevalence of roundworm and hookworms [4, 8.] A study in Anhui Province in central China indicated that labouring barefoot in farmlands was one of the risk factors for *A. lumbricoides* infection among local residents [9, 20]. Moreover, as one of the poor hygiene behaviours, not wearing shoes outside or walking barefoot also were the main risk factors for IHI among local population in poor communities in Nepal, Vietnam and Ethiopia [8, 20]. An evaluation for the control program of STH infections in rural Malaysia and a systematic review for STH infection around the world showed that wearing shoes outside was associated with reduced odds of infection with any STH [20]. Similarly, exposure to dirt, soil and improper hand washing could cause the intensity of infections related to roundworm, hookworms and whipworm [15]. Health education and promotion, regular deworming programs and even support from Non-Governmental Organizations (NGO) and Community Based Organizations (CBO) was therefore necessary to support the needy pupils acquire pair of shoes, and even support the families to build toilets.

Comment [HBN19]: Be careful! Not the same study group or population

Level of knowledge of the pupils was determined to be 43.02 percent and it was also determined that there was a strong negative correlation, Pearson's correlation, R of negative 0.7518, between knowledge about STH and prevalence of STH. This information implied that inadequate knowledge on STH was also a risk factor. Interventions geared towards empowering the pupils with knowledge on STHs will have a positive impact of reducing the prevalence of STHs in the Rarieda sub-county [14, 19].

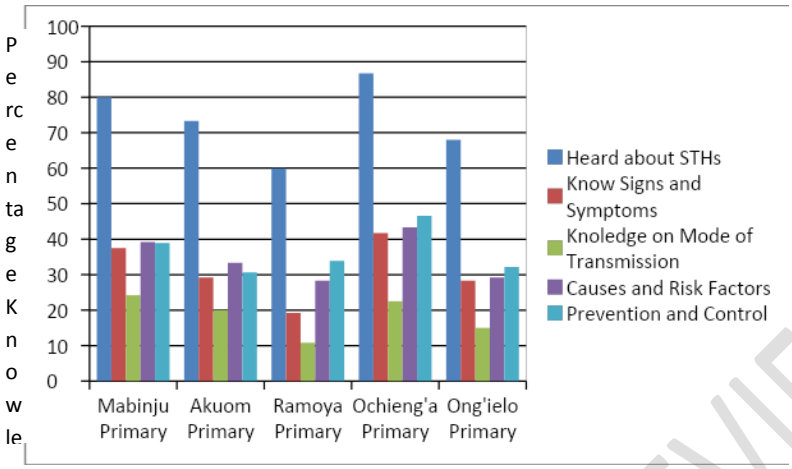

Figure 3: Knowledge on STH

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A limitation of the study was that this study being an academic research, there was time limitation as the study had to be completed within the stipulated academic duration. However, this was minimised by strictly working within the set time lines. Cooperation with my academic supervisors was highly adhered to.

Comment [HBN21]: This can not be considered like a limitation because you had a research protocol with a schedule

4. CONCLUSION

From the study, it was concluded that the prevalence of STH among the primary school going children in Rarieda was high (27.3 percent). The pupils were 46.2 percent at risk of Soil-Transmitted Helminthiases. Lack of adequate knowledge on STH was also a risk factor for STH in Rarieda. Strong negative correlation between prevalence of STH and knowledge on STH and a strong positive correlation between prevalence of STH and associated risk factors of STH were noted.

Comment [HBN22]: Your conclusion is too short. Re-write by enlarging views, thoughts and perspectives

CONFLICT OF INTEREST

The authors have declared that no conflict of interest exits.

ASSENT, CONSENT AND ETHICAL APPROVAL

The researcher sought approval to carry out this research project from all the relevant authorities. Upon being cleared by the Mount Kenya University Schools of Public Health and Postgraduate studies; ethical approvals were also sought and obtained from the Mount Kenya University Ethical and Research Committee (MKU-ERC) , the National Commission for Science, Technology and Innovation (NACOSTI) and the County government of Siaya [6, 10]. The school heads of the selected schools, the area local Public Health and education officers and the area local chiefs had to be officially informed and their approvals sought before the start of the research. Since the study involved minors, that are pupils below eighteen years of age, their head teachers, parents or guardians signed a minor's assent form on their behalf after the pupils were fully informed of the all the information pertaining to the research, what was required or expected of them and any potential risk the research may have posed to them.

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OPERATIONAL DEFINITION OF KEY TERMS

Deworming : Refers to giving of an anthelmintic drug to a human or animal to rid them of helminths parasites, such as roundworm, flukes and tapeworm.

Health promotion: Refers to the activities of enabling people to take control and increase control over their health and the health determinant.

Hygiene and sanitation: This refers to a set of personal practices and activities that contribute and promote good health. It includes hand-washing, bathing and cutting hair and nails.

Neglected Tropical Diseases: Refers to a diverse group of tropical infections which are common in low-income countries of Africa, Asia, and the Americas.

Knowledge: Refers to the facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject.

Prevalence: A statistical concept referring to the number of cases of a disease that are present in a particular population at a given time.

Regular Treatment: Scheduled and continuous medical care given to a patient for an illness, injury.

Risk factor: Any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury (WHO, 2012).

Soil Transmitted Helminthiases: Refer to the intestinal worms infecting humans that are transmitted through contaminated soil and, is a type of helminth infection caused by different species of roundworms.

Comment [HBN23]: This schould be inserted in the methodological section

~~ACRONYMS AND ABBREVIATIONS~~

~~CBO~~	~~Community Based Organization~~
~~CHV~~	~~Community Health Volunteer~~
~~CHRN~~	~~Community Health Registered Nurse~~
~~FGD~~	~~Focused Group Discussion~~
~~NGO~~	~~Non-Governmental Organization~~
~~GVT~~	~~Government~~
~~IFA~~	~~Iron-Folic Acid~~
~~IEBC~~	~~Independent Electoral and Boundaries Commission~~
~~KII~~	~~Key Informant Interview~~
~~Km^2~~	~~Kilometer squared~~
~~Mg~~	~~Milligram~~
~~Ml~~	~~Milliliter~~
~~MKF~~	~~Mount Kenya University Foundation~~
~~MKU~~	~~Mount Kenya University~~
~~MKU-ERC~~	~~Mount Kenya University-Ethical & Research Committee~~
~~Mm~~	~~Milliliter~~
~~MoE~~	~~Ministry of Education~~
~~MoH~~	~~Ministry of Health~~
~~MUK~~	~~Makerere University-Kampala (Kampala, Uganda)~~
~~NaCl~~	~~Sodium Chloride~~
~~NACOSTI~~	~~National Commission for Science, Technology and Innovation~~
~~NTD~~	~~Neglected Tropical Diseases~~
~~PHT~~	~~Public Health Technician~~
~~PHO~~	~~Public Health Officer~~
~~RCO~~	~~Registered Clinical Officer~~
~~RF~~	~~Risk Factor~~
~~SPSS~~	~~Statistical Package for Social Science~~

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~~STH Soil Transmitted Helminthiases~~