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The Impact of the School Based Deworming Program on Education in the Kwahu West Municipality of Ghana

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Abstract
Soil transmitted helminthic (STH) infections harm the health and cognitive development of school aged children and limit their ability to both access and benefit fully from the educational system. This study sought to assess the impact of the school based deworming program undertaken in the Kwahu West Municipality of Ghana by examining the impact of the program on absenteeism, measuring soil transmitted helminthic re-infections and ascertaining the prevalence of STH among school aged children in the municipality. Two hundred and eighty six participants were selected from seven beneficiary basic schools which were chosen from each of the seven circuits in the municipality. Stool samples from these pupils were collected and analyzed using the Kato-Katz microscopy procedure to determine STH infections among the participants. School attendance records and registers were also examined for all the participating pupils to ascertain school attendance and absenteeism among them. From the study, it was realized that 17 out of the 286 participants were infected with STH. Eleven pupils had been infected with *Ascaris lumbricoides* representing 64.7% of the total STH infections. Four pupils (23.5%) were infected with *Trichuris trichiura*. Three *Ancylostoma duodenale* infections were also recorded representing 11.8% of the total infections. From the school attendance records, it was observed that there was an 8% decrease in absenteeism among the participants of the study from 23.7% in the first term to 15.7% in the second term. All 17 infected participants had missed more than one school day in the second term. STH prevalence among school aged children was calculated as 6%. The study concluded that there was a positive impact of the deworming on school attendance and participation. Proper education on hygienic practices and provision of basic sanitation facilities can help to reduce the rate of STH infections.
Keywords: deworming, absenteeism, soil transmitted helminth infections, prevalence, education

1. Introduction

Educational policies are important methods and systems through which governments promote human capital investment and economic growth. School based deworming is an effective, inexpensive and easy to implement anti-poverty program.

Soil transmitted helminthiasis (STH) is a term referring to a group of parasitic diseases caused by nematode worms that are transmitted to humans by fecally contaminated soil. The soil transmitted helminths of great importance to humans are *Ascaris lumbricoides, Trichuris trichiura, Necator americanus* and *Ancylostoma duodenale.* The most current World Health Organization (WHO) estimates indicate that more than 2 billion people are infected with these parasites. The highest prevalence occurs in areas where sanitation is inadequate and water supplies are unsafe, notably in sub-Saharan Africa (World Health Organization 2012). Soil transmitted helminth infections are associated with poverty and underdevelopment and are most prevalent in the poorest communities of the developing world (Montressor *et al*. 1998; WHO 2002).

According to the 2010 Deworm the World Report, over 400 million school aged children worldwide are infected with parasitic worms. These infections harm their health and cognitive development, and thus limit their ability to both access and benefit fully from the educational system. Soil transmitted helminthic infections may also negatively affect class participation of school aged children (Berhe *et al*. 2009). More significant are the physical growth retardation, cognitive and educational impairments caused by heavy chronic infections, which have led to calls for school-based periodic antihelminthic drug deworming programs (Hotez *et al*. 2003).

School aged children exhibit the greatest prevalence of infection and the highest infection intensity (Luong, 2003). These are due to a combination of exposure and immunological factors. Children are continuously exposed to contaminated soil and water and often lack the awareness of good personal hygiene (Taylor *et al*. 1999; Montressor *et al*. 1998).

In 2001, the World Health Organization set the goal of treating 75% of school aged children at risk of infection by the year 2010. However, by the fall of 2006, only 10% of these children were receiving treatment. In 2010, only

about a third of children requiring treatment had access to antihelminthic medicines and two thirds had not been reached. The burden of disease from soil transmitted helminths is mainly attributed to their chronic and insidious impact on health and quality of life of those infected.
All districts in all the ten regions of Ghana are known to be endemic for soil transmitted helminthic infections although no definitive studies have been done (Ministry of Health 2008). According to the WHO country profile, about 104,675 pre-school children and 357, 203 school aged children require deworming for soil transmitted helminths in Ghana. This is a very serious phenomenon which needs urgent attention if Ghana is really poised to attain the reduction of the burden of soil transmitted helminthic infections by 2015.

In Ghana, school based deworming program is organized in basic schools for school aged children. There is the periodic administration of Mebendazole and Praziquantel to these school aged children in order to treat or prevent worm infestations among these children. The Kwahu West district in the Eastern Region of Ghana organized this exercise in which 20, 676 out of 24, 075 school aged children were treated which represented 85.9% of the total number of children from the register.

This study was therefore carried out to assess the impact of the school based deworming program in the reduction of absenteeism among beneficiary schools, to assess the prevalence of soil transmitted helminthic infections among pupils and to determine the extent of possible re-infection with STH after the deworming exercise among beneficiary school aged children.

1. Methodology

2.1 Study site

The Kwahu West Municipality is one of the twenty six districts in the Eastern Region of Ghana. The coordinates are 6^0 33' N 0^0 46' W, covering an area of about 414 square kilometers. The Municipality capital, Nkawkaw is located about 241 kilometers North-West of Accra, the national capital. The Kwahu West lies within the semi-deciduous forest zone.

2.2 Study Population

The study population consisted of school aged children in the upper primary and Junior High school. These groups of pupils were chosen for the study because worm intensity has been established to be higher among them than other school aged children. The total number of school aged children in the municipality that benefited from the school based deworming program was 14711. It consisted of 7905 boys representing 53.7% and 6808 girls (46.3%).

2.2.1 Inclusion Criteria

The schools and pupils chosen for the study were only from schools that benefited from the deworming exercise. School aged children in the beneficiary schools selected were chosen from the upper primary and Junior High school because worm intensity is known to be more profound in this group. The schools were also selected from lowland areas which are ideal for STH prevalence.

2.2.2 Exclusion Criteria

Schools from highland areas were left out of the study because STH prevalence is best found in lowland areas. The study also excluded pre-school and school aged children in the lower classes.

2.3 Sampling technique

Seven schools in the Municipality were chosen randomly from among the beneficiary schools in the Municipality. The names of the various schools were written on pieces of papers and clustered according to the 7 circuits in the Municipality and placed in 7 different bowls (A, B, C, D, E, F and G). A total of about 50 pupils were selected from each school which consisted of both boys and girls. Pieces of papers with YES and NO were passed round. All pupils who picked YES were chosen to be part of the study. A total of 350 pupils were used for the study. However, in the collection of stool samples, 286 pupils brought their stool samples for laboratory analysis. The circuits for the study were Awenade, Nkawkaw A, Nkawkaw B, Nkawkaw C, Fodoa, Asuboni Rails and Kwahu Nsaba. Ethical clearance was sought from the Directors of Education and the parents of the children.
School attendance records and registers were also examined for all the participating pupils to ascertain school attendance and absenteeism among them.

2.4 Laboratory analysis of stool samples

Wide-mouthed corked sterile bottles were given to the participants for the collection of their stool samples, which were properly labelled and transported to the Parasitology Laboratory for processing.

Stool specimens were examined using the method described by Katz *et al.* (1972) for eggs of *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms (*Necator americanus* and *Ancylostoma duodenale*). Between 20mg to 50mg of stool specimen was first sieved to remove coarse particles such as fibres, and then placed in a template on a microscope glass slide. The template was then carefully removed leaving a plug of stool on the slide. The stool cast on the slide was cleared by covering with a cellophane cover slip (25mm x 35mm) impregnated with 50% (v/v) glycerol in water containing 3% malachite green. The slide was turned upside down on a flat surface and pressed gently but firmly to spread the stool specimen evenly under the cellophane and then examined using the light microscope (Olympus CX21) for helminth infections. Any identified intestinal worms were counted and recorded.

$$\text{Prevalence} = \frac{\text{Number of people infected} \times 100\%}{\text{Total number of people tested}}$$

3 Results

3.1 Prevalence of STH

A total of two hundred and eighty six (286) stool samples of school aged pupils were analyzed in all the seven circuits in the Kwahu West Municipality. Out of this number, 17 of the samples were infected with STH while 269 were not infected. The prevalence of STH among the sample population was calculated to be 6 cases per 100 (Table 1).

Table 1: Circuits and their respective number of stool samples analyzed and number of infections

Circuit name	Number of stool samples analyzed	Number of Pupils infected with STH
Awenade	36	2
Nkawkaw A	47	2
Nkawkaw B	43	2
Nkawkaw C	38	1
Nsaba	39	3
Fodoa	42	4
Asuboni Rails	41	3
Total	**286**	**17**

Ascaris lumbricoides infections were found to be the highest among the participants with eleven (11) out of the 17 infected participants. This accounted for 64.7% of the overall STH infections.

Trichuris trichiura found from the study were four (4) out of the seventeen (17) infected participants. This was the second highest infection recorded from the study representing 23.5% of the overall STH infection.

Two *Ancylostoma duodenale* infections were also recorded from the study representing 11.8% of the total number of infections. No *Necator americanus* was recorded from the study (Table 2).

Table 2: STH infections and their respective percentages

STH	Number	Percentage (%)
Ascaris lumbricoides	11	64.7
Trichuris trichiura	4	23.5
Ancylostoma duodenale	2	11.8
Necator americanus	0	0
Total	17	100

3.2 School attendance records obtained from the school registers in the municipality

School registers for each of the selected schools were observed for total school attendance in the first and second terms of the 2012/2013 academic year. It was observed that basic schools were supposed to spend a total of 15 academic weeks (comprising 5 days in a week). In total, about 75 days were supposed to be spent in school for each of the two terms. In the first term, 3 schools in the circuits of Awenade, Nkawkaw C and Asuboni Rails recorded 69 days of school attendance out of the 75 days. Schools chosen from the circuits of Nkawkaw B, Fodoa, Nsaba and Nkawkaw A all recorded a total of 70 days of school attendance out of the 75 days. In the second term,

selected schools from Awenade, Nsaba, Nkawkaw C and Asuboni Rails all recorded a total of 55 days of school attendance. The other three circuits all recorded a total of 54 days out of the 75 days that were supposed to be spent in school.

Table 3: Number of participants who missed more than one school day in the first term

Circuit	Number of Pupils who missed school
Awenade	13 out of 36
Nkawkaw B	10 out of 43
Fodoa	14 out of 42
Nsaba	9 out of 39
Nkawkaw C	8 out of 38
Nkawkaw A	6 out of 47
Asuboni Rails	8 out of 41
Total	**68 out of 286**

From the review, it was realized that, 68 out of the 286 participants selected had missed more than one school day in the first term which represents 23.7% of the study population (Table 3).

Table 4: Number of participants who missed more than one school day in the second term

Circuit	**Number of Participants who missed school**
Awenade	8 out of 36
Nkawkaw B	6 out of 43
Fodoa	11 out of 42
Nsaba	5 out of 39
Nkawkaw C	5 out of 38
Nkawkaw A	4 out of 47
Asuboni Rails	6 out of 41
TOTAL	**45 out of 286**

The researchers went through the various school registers of the selected schools to observe the class attendance records of the participants of the study in the second term. The study revealed that 45 out of the 286 participants had missed more than one school day which represents 15.7% of the study population.

Table 5: Number of STH infected participants who missed more than one school day in the second term

Circuit	Number of Participants
Awenade	2 out of 2
Nkawkaw B	2 out of 2
Fodoa	4 out of 4
Nsaba	3 out of 3
Nkawkaw C	1 out of 1
Nkawkaw A	2 out of 2
Asuboni Rails	3 out of 3

The study further went through the registers once again after the Kato-Katz microscopy procedure had been completed to ascertain the attendance records of participants who had been found to be infected with STH. It was established from the primary records (the registers) that all the 17 participants who were found to be infected with STH had missed more than one school day.

4 Discussion

4.1 Impact of school based deworming program on absenteeism

Miguel and Kremer (2003) opined in their research conducted in Kenya that deworming increased school participation in treatment schools by at least seven percentage points which ensured a one-quarter reduction in total school absenteeism. The findings of their research were also supported by other evidence from a randomized trial in India that showed that addressing anemia (a symptom of worm infection) had important impacts on schooling and health while a non-randomized study of intestinal worm eradication in the South of the United States found similar schooling benefits (Bleakley 2007). The findings of this research also supported these assertions since in all

the various circuits, there was an increased school attendance in the second term over the first term. This can be attributed in part to the deworming exercise that was undertaken in the schools at the end of the first term. As such, pupils were able to stay, participate and study in school more effectively and actively than the previous term. In the first term, 23.7% of the participants had missed more than one school day in the term. The second term recorded 15.7% of the participants who missed more than one school day. There was an 8% drop in the absenteeism rate among study participants in the second term over the first term. This could suggest that the school based deworming program carried out in the Municipality in December 2012 had a positive impact in reducing absenteeism rate among the participants. This study found that there was a direct relationship between absenteeism and STH infection. This is because all the 17 pupils who had been re-infected with STH were already suffering from the adverse effect of the re-infection which includes decreased school attendance and participation. Basic school attendance records gathered from the schools in the various circuits indicated that all 17 pupils who had been re-infected with STH had missed more than one school day in the school term.

4.2 Prevalence of STH among aged children

WHO (2010) stated that over 400 million school aged children worldwide are infected with parasitic worms. It is also estimated in the 2009 World Health Organization African Region report that about 104, 675 pre-school aged children and about 357, 203 school aged children in Ghana require preventive chemotherapy for soil transmitted helminths. The prevalence of STH was calculated to be 6%. This finding is not entirely different from the overall predicted prevalence of STH in Ghana as stated in the Wormy World Report (2011) which found the prevalence of STH to be 20% or more.

4.3 STH re-infection

Al-Mekhlafi *et al*. (2008) in their study conducted on the pattern and predictors of STH re-infections among Orang Asli school children in Malaysia concluded that there were high re-infection rates which necessitated frequent and periodic deworming among children to reduce parasitic loads, alleviate morbidity and reduce transmission. The findings of this study synchronize with this assertion because within a period between three and four months following the deworming exercise conducted in the Municipality, 17 pupils had been re-infected with STH. Norhayati *et al*. (1995) studied the re-infection of children in a hookworm endemic area. The finding was that, in the absence of any interventions the re-infection rate at 4-months post-treatment was 30%. In their study to determine the prevalence of STH among school aged children in three communities in Ghana, Addo *et al*. (2010), found the overall prevalence to be 6%. This agrees with the current studies. The only difference is that unlike Addo *et al.* (2010) which found only hookworm infections, the current studies found *Ascaris lumbricoides* (64.7%), *Trichuris trichiura* (23.5%), *Ancylostoma duodenale* (11.8%) and *Necator americanus* (0%). Primary evidence gathered from follow up visits to the various homes of those who were re-infected with STH revealed that most of these pupils lived under unhygienic conditions and did not have access to potable water supply. STH has been known to best thrive under these conditions of poor sanitation and water supply. Parents and guardians of some of these pupils had almost no knowledge about soil transmitted helminths and even their mode of transmission. Soil transmitted helminthic infections thrive very well in very humid conditions in lowland areas. The land geography of the Municipality is also mostly composed of lowland areas since it lies at the foot of the Odweanoma Mountain or the Kwahu Ridge. This makes STH thrive well in some of these areas.

5 Conclusion

There was a positive impact of the deworming exercise organized at the end of the first term on absenteeism in the Kwahu West Municipality. There was an eight percent reduction in absenteeism among participants of the study in the second term over the first term. All seventeen participants who had been infected with STH had missed more than one school day in the second term. This means that there is a direct relationship between STH infection, school absenteeism and participation.

The prevalence of STH among the school aged children was calculated as 6%. The study found out that seventeen participants had been re-infected with STH four months after the deworming exercise in which all the study participants had been treated.

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