

# Determinants of Soil Transmitted Helminthiasis Control Practices at the Household Level in Bondo Sub County in Siaya County

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**Abstract** Background: Soil-transmitted helminths (STH) refer to the intestinal worms infecting humans that are transmitted through contaminated soil (Cdc; 2022). STH infections are common infections worldwide and affect the poorest communities, especially pre-school and school aged children. WHO's strategy for control of STH infections is through the periodic mass drug administration treatment with dewormers. Objective: The general objective of this study is to find out the determinants of soil transmitted helminthiasis (STH) control practices at the household level. Methods: This was a cross-sectional study conducted in Bondo subcounty, Siaya county in Kenya. 530 households were randomly selected and include in the study. A Questionnaire was administered to respondents at the household level and an FGD guide was also used to gather more insights on the subject. Results: The result of this study indicates that 28.3% of respondents were able to correctly identify at least one of the three types of STH. 40.3% and 78.4% of respondents were able to correctly identify transmission routes and control practices respectively. The most reported practice in the control of STH was deworming (38.1%); household factors found to be significantly associated with STH control practices were as follows, Maternal education, Mother's Occupation, Participation in previous programme, Household income, availability of handwashing facilities. Conclusions: The knowledge and practices of STH control was found to be low despite the socio-economic status of the study area being medium. Most homesteads reported to have above minimum wage income, high literacy level, adults in gainful income generating activities, latrine in the homestead, houses of concrete finished floors and good access to water. Our findings suggest that to effectively develop an STH control program, maternal, household socio-economic and WASH factors need to be put into consideration.

**Keywords** Determinants, Soil Transmitted Helminthiasis, Control, Household

## 1. Background

Soil-transmitted helminths (STH) refer to the intestinal worms infecting humans that are transmitted through contaminated soil (Cdc; 2022). They are transmitted by eggs present in human feces which in turn contaminate soil in areas where sanitation is poor (Who; 2022). The main species of STH are the roundworm (*Ascaris lumbricoides*), the whip-worm (*Trichuris trichiura*) and hookworms (*Necator americanus* and *Ancylostoma duodenale*). (Cdc; 2022). According to WHO, more than 1.5 billion people, or 24% of the world's population, are infected with soil-transmitted helminth infections world-wide. Almost 70% of STH infections occur in Asia with a high proportion of total individuals infected with one or more STH residing

in the People's Republic of China (18%) and India (21%). In sub-Saharan Africa, the three most populous nations (Nigeria, Ethiopia, Congo DRC) in total account for only 8% of global STH infections. In Kenya STH infection is prevalent in 66 sub-counties endemic for both STH in four regions (Western, Nyanza, Rift Valley and Coast) (Mwandawiro et al.; 2019). In 2011, a National School Health Policy and National Multi-Year Strategic Plan for the Control of NTDs were developed and called for treatment to be administered to all SACs, including those out of school, based on the prevalence and intensity of STH and schistosome infections in the 66. Research shows that after five years of MDA implementation, Coast Region had the highest reduction in STH infection at 87.6% followed by western region which had 60.6% then, Nyanza had 59.4% and only managed 27.5% reduction and remains the region that harbors majority of STH infections. Additionally, the report indicate that after five years of MDA, four counties (Kericho, Kisii, Narok and Vihiga) still had prevalence of any STH infections ranging between 20% and < 50%,

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another four counties (Bomet, Busia, Homa Bay and Nyamira) had prevalence ranging between 10% and < 20%, while seven counties (Bungoma, Kakamega, Kilifi, Kisumu, Kwale, Migori and Mombasa) had their prevalence range between 1% and < 10%, and only Taita Taveta County recorded prevalence below 1% (Mwandawiro *et al.*; 2019), (Ng'ang'a *et al.*; 2016).

## 2. Methods

This was a cross-sectional study conducted in Bondo subcounty, Siaya county in Kenya. 530 households were randomly selected and include in the study. A Questionnaire was administered to respondents at the household level and an FGD guide was also used to gather more insights on the subject. It was the most preferred data collection instrument because of its anonymity. The questions were closed and coded for easier analysis. The instrument was key in collecting data on the determinants affecting STH control at the household level and at the school level as well as collecting data from key government officials on the existing national efforts employed in STH control. The responses were coded and no data identifying participants (names) were collected. All households in Bondo Sub County with headed by an adult who has a sound mind of ages 18 – 59 and 60 years or older were included in the study. To systematically explore the determinants of STH control practices among the SAC, the study aimed to collect data on the following variables (occupation of care giver, type of floor, household income, access to water, access to sanitation, hygiene practice, knowledge of STH infections, knowledge of STH control measures and deworming). Data collected were summarized in frequencies, tables for illustrative purposes. At univariate level Chi square tests were performed to identify the statistical significance of the relationship between the variables.

Variables which were significant at univariate analysis were taken further for multi-variate analysis using multiple regression to determine the strength of association between the independent variables and STH control practices. After finding the strength of association at multi variate level, bi variate analysis using logistic regression were used to determine statistical association exists between independent variable and STH control practices.

## 3. Results

### Socio-demographic characteristics of respondents:

A total of 538 households were enrolled in this study. 74.2% (n=399) of the respondents were female and 25.8% (n=139) were male. Most of the respondents, 94.2% (n=507), were Christians, 5.2% (n=25) confessed to be members of the traditional African religions and 0.6% (n=5) indicated they were Muslims. 93.7% (n=504) of the respondents indicated that their households had a mother present while 76.0%

(n=409) of the respondents indicated that their households had a father present. 4.6% (n=25) of the households reported having mothers without any formal education, most mothers, 54.8% (n=295) had primary school level education, 27.9% (n=150) had a high school level education and only 6.3% (n=34) had a tertiary level education. Only 1.5% (n=8) of the households reported having fathers who had no formal education, most fathers, 36.4% (n=196) had primary school level education, a further 27.9% (n=150) of them had a high school level education and 10.6% (n=57) of fathers were reported to have a tertiary level education. 74.0% (n=398) of the households were male-headed households.

**Factors that influence transmission of Soil Transmitted Helminths (STH) at the household level in Bondo:** A bivariate analysis was carried out to determine the factors associated with STH Control practices at household level in Bondo. Seven variables were found to be associated with STH Control practices at household level at bivariate analysis. They included: household income ( $X^2=34.10$ ); mother's level of education ( $X^2=15.49$ ); father's level of education ( $X^2=11.69$ ); mother's occupation ( $X^2=13.36$ ); father's occupation ( $X^2=16.56$ ); respondents' knowledge of STH ( $X^2=12.08$ ); and participation in previous STH control campaigns ( $X^2=22.95$ ).

**Table 1.** Table showing summary of the results

	$X^2$	P Value
SEX	3.83	0.050
Religion	0.95	0.630
Mother's Level of Education	15.49	0.002
Mother's Occupation	13.36	0.044
Father's Level of Education	11.67	0.020
Father's Occupation	16.56	0.013
Sex of Household Head	0.08	0.927
Household income	34.1	0.000
Type of floor	1.94	0.562
Type of Sanitation	6.65	0.068
Knowledge on STH Control Measures	12.08	0.001
Participated in Previous MDAs	22.95	0.000

All the variables that were associated with STH Control practices at bivariate analysis were included into the multivariate analysis. A Wald test was used to test for significance of each variable into the model. Those that were noted to be insignificant at the first step of inclusion into the model were dropped and only those determined to be significant were included into the second step of analysis. Four factors were found to be significantly associated with STH control practices. These were Mother's level of Education (Wald=13.07); Mother's Occupation (Wald=12.81); Participation in previous control programme (Wald=19.92); and Household income (Wald=23.09).

**How access to water, sanitation and hygiene practices influence the control of STH at the household level in Bondo?**

95.2% of the households indicated that they spent less than 30 minutes to fetch water for household use. 57.1% of the households used an improved sanitation facility, 37.4% of the households used a basic sanitation facility while 1.3% of the households had no sanitation facility present. Most of the households (94.8%) had their sanitation facilities located within their own compounds. 38.8% of the households reported to be sharing their sanitation facilities with other households. 68.8% of households were found to have no handwashing facilities with water and only 15.2% of the households were reported to have soap for handwashing.

A bivariate analysis indicated that two water, sanitation and hygiene (WASH) variables were associated with the control of STH at the household level. These were availability of hand-washing facilities with water ( $X^2=6.40$ ) and sharing of latrines ( $X^2=20.01$ ). At multivariate analysis the two WASH variables were found to be significantly associated with STH Control practices. The results further indicate that households with hand-washing facilities had 4 times higher odds of practicing STH control measures and those sharing sanitation facilities had 0.15 odds of practicing STH control measures.

**Knowledge of STH levels among parents:** 81.76% of the respondents claimed to have good knowledge on STH. However, only 28.3% of respondents were able to correctly identify at least one of the three types of STH. 40.3% of respondents were able to correctly identify transmission routes of STH. Most respondents, 78.4% were able to identify symptoms of STH. This study found that only 17.7% of the respondent were able to correctly identify the STH, their transmission routes, their symptoms, and control measures.

**STH control practices employed by care givers at the household level, in Bondo Sub County:** The most reported practice in the control of STH by respondents was deworming (by 38.1% of the respondents); food hygiene (by 6.1% of the respondents); use of clean water (by 5.2% of the respondents); and wearing shoes (by 0.6% of the respondents).

## 4. Discussions

This study is important towards efforts in the control STH in a high prevalence. It established context-specific evidence on determinants of STH control practices at household level in Bondo Sub County in Kenya. This information is critical for policy makers in Kenya to improve control strategies of STH.

### Socio-demographic characteristics of respondents

Most households had parents with at least primary school level formal education. This indicates that the literacy level in this area is high. This high literacy level can be associated to the high proportion of people in gainful income generating activities in the study area. The high proportion of people in occupation can be attributed to the general lifestyle in the community. Most of the homes were found to have concrete floors and most homes had income above the minimum wage in Kenya with most respondents indicating that they never walked bare feet. A previous study by Anuonobi and others (2019), identified socio-economic factors such as poverty, lack of portable water, occupation, as determinants of STH distribution in endemic areas. This sentiment was a build up to another study by Halpenny and others (2013) who concluded that low relative household wealth and maternal education and infrequent latrine use were major contributing factor in *Ascaris* reinfection. Benjamin-Chung et al. (2019) concluded that in low resource settings where the floors of houses were not finished with concrete, there was an increase in the transmission of soil transmitted helminth. In the present study we note that most of the households had homes finished with concrete floors and this could explain why there is reported low level of STH control practice as residents appear to be of a relatively medium socio-economic status. Additionally, In the present study type of occupation was not a significant factor in the control efforts of STH at the household level.

Table showing summary of the results of univariate analysis using chi-square

Frequency Table			
		Frequency	Percent
SEX	FEMALE	399	74.2%
	MALE	139	25.8%
Religion	CHRISTIANITY	507	94.2%
	ISLAM	3	0.6%
	TRADITIONAL	28	5.2%
			0.0%
Parent present at household	Father	409	76.0%
	Mother	504	93.7%
Mother's Level of Education	No Education	25	4.6%
	Primary	295	54.8%
	Secondary	150	27.9%
	Tertiary	34	6.3%

Frequency Table			
		Frequency	Percent
Mother's Occupation	Artisan	38	7.1%
	Farmer	143	26.6%
	Gainfully Employed	22	4.1%
	Housewife	59	11.0%
	Other	29	5.4%
	Small Business Owner	198	36.8%
	Unemployed	15	2.8%
Father's Level of Education	No Education	8	1.5%
	Primary	196	36.4%
	Secondary	148	27.5%
	Tertiary	57	10.6%
Father's Occupation	Artisan	110	20.4%
	Farmer	102	19.0%
	Gainfully Employed	42	7.8%
	Other	44	8.2%
	Small Business Owner	96	17.8%
	Unemployed	15	2.8%
Sex of Household Head	FEMALE	140	26.0%
	MALE	398	74.0%
Household income	KES 1- KES 4999	21	3.9%
	KES 5000 - KES 9999	160	29.7%
	KES 10000 - KES 14999	199	37.0%
	KES 15000- KES 19999	88	16.4%
	KES >=20000	70	13.0%
Type of floor	CONCRETE	394	73.2%
	MUD	105	19.5%
	TILED	37	6.9%
	WOODEN	2	0.4%
Do you walk barefooted?	NO	374	69.5%
	YES	164	30.5%
Aware of Existing MDA	NO	132	24.5%
	YES	363	67.5%
Participated in Previous MDAs	NO	203	37.7%
	YES	335	62.3%

### Factors that influence transmission of Soil Transmitted Helminths (STH) at the household level in Bondo

In the present study, there were efforts to understand socio- economic factors that influence STH control at household level. The findings point to a significant association between the mothers' level of education and STH control practice. The association between father's level of education and STH control was found to be insignificant. We have not found the reason for this disparity, but we assume that it is due to the mothers leading the control measures of STH at household level as they are mostly involved in taking care of homes in this community. This finding concurs with previous studies in Nigeria (Akinsanya *et al.*; 2021) and

South Africa (Socolo-Gwebu *et al.*; 2019) and Kenya (Gitaka *et al.*; 2019; Masaku *et al.*; 2017). These studies also noted as- sociation between education level and STH infection. As noted by Masaku and others (2017), low literacy levels lead to thriving of myths and misconceptions and can be a hinderance in efforts to prevent and control STH. It is no surprise that in the present study, some respondents on many occasions mentioned eating cold meals as one of the causes of STH infection.

### How access to water, sanitation and hygiene practices influence the control of STH at the household level in Bondo?

This study aimed to understand knowledge on types of

STH, the signs and symptoms of STH, the transmissions routes, and their control measures among parents in Bondo. This study provides invaluable insights into the self confidence that most respondents had on the mentioned knowledge. Most of them claimed to be aware of types of STH, their signs and symptoms, their transmissions routes, and their control measures. However, follow-up questions revealed that the respondents had very little knowledge on the issues. Similar aspects were also noted by one other previous study (Sacolo-Gwebu et al.; 2019). Sacolo- Gwebu and others reported that knowledge levels declined drastically with assessing the accuracy of the selfreported knowledge. This study noted significant higher levels of knowledge in STH transmission and STH symptoms but very low knowledge on the types of STH. We attribute the higher knowledge noted by respondents on STH transmission routes and symptoms to the fact that STH shares similar symptoms and trans- mission routes with other worms that are not necessarily STH that respondents mentioned as being types of STH. The down- side to this and as previously expounded by Sacolo-Gwebu and others (2019) is that communities may overestimate their health- related knowledge which may, in turn, hinder the effectiveness of treatment and control programs.

In this study, “Knowledge of STH” is the ability to correctly mention the type(s) of STH, correctly point out STH transmission routes and to correctly point out its symptoms. To this end, our study found out that this “Knowledge” was very low among the respondents (16.8%). Previous studies that have noted low knowledge on STH were in Kenya (Masaku et al.; 2017), Thailand (Narkkul et al.; 2022) and Bangladesh (Nath et al.; 2018). We attribute this low knowledge on lack of any STH awareness creation intervention in the community.

## 5. Conclusions

In our study area, the knowledge and practices of STH control was found to be low. The socio-economic status of the study area was found to be medium with most homesteads reported to have above minimum wage income, high literacy level, adults in gainful income generating activities; latrine in the homestead, houses of concrete finished floors and accessing water in less than 30 minutes. These important findings point to the need to consider developing STH control messaging that are context specific to such communities. We observed that STH control practices were generally associated with maternal level of education, maternal occupation, availability of handwashing facilities, sharing of la- trines, previous participation in STH programme and household income. Our results suggest that to effectively develop an STH control program, the following factors will need to be put into consideration: maternal education; maternal occupation; house- hold income; availability of water and handwashing facilities and availability of latrines at the household level.

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