



# Barriers and gaps in utilization and coverage of mass drug administration program against soil-transmitted helminth infection in Bangladesh: An implementation research

Tilak C. Nath<sup>a,c,\*</sup>, Retna S. Padmawati<sup>b</sup>, Elsa H. Murhandarwati<sup>b</sup>

<sup>a</sup> Special Program of Implementation Research on Tropical Diseases, Faculty of Medicine, Universitas Gadjah Mada, Indonesia

<sup>b</sup> Faculty of Medicine, Universitas Gadjah Mada, Indonesia

<sup>c</sup> Department of Parasitology, Sylhet Agricultural University, Bangladesh

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## ABSTRACT

**Background:** Bangladesh has implemented school-based mass drug administration (MDA) bi-annually since 2008 aimed to control soil-transmitted helminth (STH) infection. Despite several rounds of MDA, the government is still facing challenges to achieve the target coverage and utilization of the intervention. This study was done to explore and explain the barriers and gaps that hinder the utilization and coverage of MDA for STH.

**Methods:** This research was a mixed method study, was conducted in two selected districts of Bangladesh. A total of 160 questionnaire surveys, 12 in-depth interviews, 8 focus group discussion, and 2 key-informant interviews were done among 238 study participants which included school-age children with relevant parents, school teachers, health workers, community leaders and MDA program managers. Descriptive statistical analysis was used to analyze the quantitative data while thematic analysis was applied for the qualitative data.

**Results:** It was revealed that the participants have positive attitudes towards MDA but they pointed out the limitations in reaching all target population especially non-school going children. The level of knowledge regarding STH and MDA were found different among the study population. The evaluated coverage of MDA was also found lower than that reported. Some major barriers associated with MDA coverage found in this study were drug distribution policy, accessibility to schools, poor record keeping, follow-up, and information dissemination. Inadequate information about population dynamics and rumors about side effects of MDA drugs adversely affected the compliance of the intervention. Insufficient training of drug distributors and poor motivation among stakeholders also added to the barriers.

**Conclusion:** There is the need to re-strategize drug distributing methods and create effective policies to include all targeted population. Use of local channels for community sensitization, adding local distribution points, regular monitoring and follow-up and promotion of health education can possibly enhance both treatment coverage and program infrastructure.

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## Introduction

Soil-transmitted helminth (STH) infection is one of the major public health problems in several developing countries including Bangladesh. The number of people who are at risk for STH infection globally is over 4.5 billion and most morbidity is seen in pre-

school age children (Pre-SAC) and school-age children (SAC). All 64 districts of Bangladesh are endemic with 78 million infected with roundworm, 51 million people infected with hookworm and almost 66 million people infected with whipworm [1]. According to the World Health Organization (WHO), mass drug administration (MDA) to the susceptible populations, including Pre-SAC and SAC, is the central strategy to control the continued occurrence of STH infection. More than 47 million children (SAC and Pre-SAC), residing high-risk areas of Bangladesh need preventive chemotherapy against this disease [2]. The strategy adopted by WHO and World Health Assembly (WHA) for the control of STH by the year 2025, this

\* Corresponding author at: Special Program of Implementation Research on Tropical Diseases, Faculty of Medicine, Universitas Gadjah Mada, Indonesia.

E-mail address: [tilak.parasitology@sau.ac.bd](mailto:tilak.parasitology@sau.ac.bd) (T.C. Nath).

is to achieve 85% coverage of the anthelmintic drugs in the disease prevalent area. The government of Bangladesh has implemented school-based MDA of mebendazole (500 mg) to control STH infection in schools biannually since 2008 [1]. After eight (8) years of STH control exercise, records available from several studies indicated that the prevalence of STH infection, especially among SAC and Pre-SAC still remains higher in many areas of the country [3–6]. Based on the available data of previous studies, in the case of school going children, while the national report published very high levels of coverage, the actual ingestion or intake of distributed drugs by the children is lower than that reported. The gap is most evident in the case of non-school going children (11.4–14.3%) where the coverage of MDA is lower compared to school going children (63.0–65.3%) [1,7]. Therefore, this study was done to explore the barriers and gaps that impeded utilization and coverage during MDA for STH.

## Materials and methods

A mixed method convergent study was done between the periods of January to July 2017. Mixed methods research is an approach to research in the social, behavioral, and health sciences in which the investigator gathers both quantitative (close-ended) and qualitative (open-ended) data, integrates the two, and then draws interpretations based on the combined strengths of both sets of data to understand research problem [19]. In this study, qualitative research approaches named focus group discussion (FGDs), in-depth interviews (IDIs) and key informant interviews (KIIs) were used which is suitable for exploring ideas needed to appropriately address issues that create barriers to the utilization and coverage of any control intervention. The qualitative study demonstrated participants' views on contact existing MDA, factors influencing effective implementation and also identify barriers and gaps related to implementation outcomes. The quantitative research approach was used a semi-structured close-ended questionnaire and was administered to school age children (both schools going and non-school going) as study participants. The quantitative study investigated respondents' level of knowledge, attitude and practiced towards STH and MDA.

### Study setting

The study was conducted in selected areas of the Dhaka and Sylhet districts of Bangladesh. Dhaka is the capital city, located in central Bangladesh at 23°42'N 90°22'E. Sylhet is in the north-eastern administrative district of Bangladesh, located at 24.89°N 91.88°E. Both of the areas experience a humid tropical climate most of the year. Sylhet and Dhaka were selected due to population size, good accessibility and also it was among the division in Bangladesh with a history of high prevalence of STH [3,4]. Dhaka contains a population of roughly 16 million, and Sylhet a population of 2.5 million inhabitants. Both districts have consistently conducted bi-annual MDA for STH since 2008. Although, school-aged children in those areas were receiving MDA drugs regularly, high STH prevalence indicated that MDA is failed to reach the target in these areas [3,6]. Thus, the inclusion of Dhaka and Sylhet districts in this study covers proper representation of the program.

### Study population and sampling

A total of 238 participants including school-aged children (age ranges between 5 to 15 years old) either school going (SGC) or non-school going (non-SGC), parents of school-age children, school teachers (ST), community health workers (CHW), community leaders (CL) and local MDA program managers (MDA-PM)

were involved in the study. Mixed sampling approach, including both convenience purposive and simple random sampling technique was used to recruit the study population. Participants from school going children were selected by simple random sampling approaches. Four schools from each area was chosen for the study. From each area, two primary schools, one kindergarten and one madrasah (the Madrasah Education System of Bangladesh centers around religious instruction, teaching all the basics of education in a religious domain) were included. The institutions were selected according to the permission and referral from the Upazilla Education Office (UEO). Institutions from both rural and urban areas were included. The research team informed the head of the school/institution about the study and the head of the school/institution allocated the most convenient time based on their class schedule. For quantitative survey, ten students from each school/institution were recruited by simple random sampling technique. By following inclusion and exclusion criteria, participants from non-school going children were recruited by convenience purposive sampling approaches based on referrals from local community leaders. Parents of school-age children were nominated based on referrals from school teachers. The others research participants (school teachers, community health workers, community leaders and MDA program manager) were selected based on their presence at their working places.

### Instruments of data collection

Twelve IDIs were conducted among twelve school teachers, four community health workers and four community opinion leaders. Eight FGDs were conducted among thirty-two school-age children and twenty-four parents of school-age children. Two key informant interviews (KIIs) were conducted with the MDA program managers. Quantitative data were collected through a semi-structured questionnaire. One hundred sixty face-to-face interviews were conducted among eighty schools going and another eighty non-school going children to obtain relevant information. Prior to the actual data collection, pretesting of questionnaires and interview guides was done. The English version of the questionnaire and interview guides were prepared first, which was then translated into local language (Bangla) version. Translation into Bangla was verified with the help of research assistants who is competent in both Bangla and English and further checked by the authors. The Bangla version questionnaire and interview guides were back-translated into English once the pilot testing was completed to establish the reliability and validity of the translation. Pretesting of questionnaires and interview guides were done to evaluate the time required to complete each interview and to establish the accuracy of questions. The final pilot tested Bangla version questionnaire and interview guides were used for data collection. Interviews with school going children was conducted at school and interviews with non-school going children was conducted at their home. All IDIs and FGDs were conducted in the selected quiet place (Sylhet Agricultural University, Sylhet and Gazipur Community Centre, Dhaka)

### Data management and analysis

#### Qualitative data

In this study, all FGDs, IDIs and KIIs data were recorded using digital voice recorders (wave pad sound editor and sony digital voice recorder). All of the interviews were conducted by researcher along with the two trained research assistants from the Department of Pathology, Shaheed Suhrawardy Medical College & Hospital, Dhaka, Bangladesh and Department of Parasitology, Sylhet Agricultural University, Bangladesh. Both research assistants were trained prior to carry out the interviews basically on the research tools,

**Table 1**  
Number of study participants.

Number of participants (N = 238)									
Participants	Questionnaire		FGDs			IDIs		KIs	
	N	Area	No	N	Area	N	Area	N	Area
SGC	40	Sylhet							
Non-SGC	40	Sylhet							
SGC	40	Dhaka							
Non-SGC	40	Dhaka							
SGC			1	08	Sylhet				
Non-SGC			1	08	Sylhet				
SGC			1	08	Dhaka				
Non-SGC			1	08	Dhaka				
Parents (SGC)			1	08	Sylhet				
Parents (non-SGC)			1	08	Sylhet				
Parents (SGC)			1	08	Dhaka				
Parents (non-SGC)			1	08	Dhaka				
School teachers						2	Sylhet		
School teachers						2	Dhaka		
Health facilitators						2	Sylhet		
Health facilitators						2	Dhaka		
Community leaders						2	Sylhet		
Community leaders						2	Dhaka		
MDA program manager								1	Sylhet
MDA program manager								1	Dhaka

interviewing skills, data management and clarifications on ethical issues in research. Field notes were taken alongside during data collection. Softcopies of the voice recording was amplified using Audacity software and then the research team transcribed the interviews verbatim into Bangla. The transcription was made word-for-word from the audio tapes. At the point when experienced noise and interferences or unclear discussion while tuning into the audio recording during transcription, field notes were checked and converged with the translations to ensure data quality. After transcription, a two-phase validation of the transcription was done; first a different transcriber checked the transcriptions with the audio files, and this was done by the all three authors. The transcriptions yielded over sixty pages of text. The transcribed data then translated to English. In the meantime, the translated data were read, re-read, and then reviewed by the authors for familiarity with the data, to develop codes that identify important and common concepts related to the objectives of the study. The corresponding author and his research supervisors conducted the thematic analysis of the transcription according to the research objectives. "Open Code 4.03" software was used for sorting information, looking for patterns, similarities, differences or contradictions. Data analysis was mainly done based on the thematic approach that involves organizing from the collected information into the meaningful category. Categories and sub-categories were developed, modified and expanded and themes were identified. Each theme was then expanded into specific descriptors according to the conceptual framework. The data was analyzed simultaneously with data collection and write-ups. Field notes and original transcripts were looked upon when more information/clarity are needed during coding, analysis and write-up. For the analysis report, key themes relating to utilization and coverage was extracted along with illustrative quotes.

#### Quantitative data

Each filled questionnaires were double-checked for completeness and coded. Designed data entry screens using Microsoft Excel for Windows that were used by data entrants to translate the paper questionnaires into electronic data for analysis. Checks for errors and inconsistencies were done at all stages to ensure that the outcomes were factual. Data were analyzed using STATA 13 data

**Table 2**  
Response of school-age children regarding their knowledge about STH & MDA.

Response		SGC (n = 80)		Non-SGC (n = 80)	
		n	%	n	%
Heard about STH/intestinal worms	Yes	73	91.3	58	72.5
	No	07	8.9	22	27.5
Heard about MDA	Yes	70	87.5	51	63.7
	No	10	12.5	29	36.3

analysis software. Descriptive statistics were used to tabulate and describe the data.

#### Research ethics

This study was approved by the Ethical Committee of the Faculty of Medicine, University of Gadjah Mada, Yogyakarta, Indonesia and Sylhet Agricultural University, Bangladesh. Permission to conduct the study at schools was also obtained from the local upazilla education office, Bangladesh. All respondents completed an informed consent form before the interview. In case school-age children, consent was taken from their parents or local guardians. Local language (Bangla) was used during all levels of data collection.

#### Results

A total of seventy-eight (78) participants were interviewed for qualitative stand while 160 participants were interviewed for quantitative study. The present study revealed that stakeholders associated with the implementation of MDA programs experienced a variety of factors some of which were identified as barriers to coverage and utilization of the intervention. Some of these factors were related to contextual characteristics of the community where the programs were implemented and the perceptions of the community people about the program which was implemented (Tables 1–5).

#### Knowledge, attitude and practices towards MDA for STH

Of the total of 80 school going children, 73 (91.3%) respondents stated that they have heard about STH/intestinal worm and 70

**Table 3**  
School aged children behaviors towards anthelmintic drugs.

Response	Total (n = 160)		SGC (n = 80)		Non-SGC (n = 80)	
	N	%	N	%	n	%
No idea/forgot	40	25	09	11.3	17	21.3
Take medicine (once in year)	32	20	08	10	30	37.5
Take medicine (twice in year)	62	38.8	60	75	04	5
Not take any medicine	26	16.2	03	3.7	29	36.2

**Table 4**  
Coverage and consumption of drug in last MDA.

Response	SGC (n = 80)		Non-SGC (n = 80)	
	n	%	N	%
Receive drug in last MDA	70	87.5	49	61.3
Do not receive drug in last MDA	10	12.5	31	38.8
Drug received and consumed	64	80	45	56.2
Drug received but not consumed	06	7.5	04	5

**Table 5**  
Responses of school-age children regarding not to participate last MDA.

Reasons	Total (n = 51)		SGC (n = 16)		Non-SGC (n = 35)	
	N	%	n	%	n	%
Lack of information	13	25.5	03	18.7	15	42.9
Unable to attend school/health clinic	04	7.8	02	12.5	04	11.4
Mobility	01	1.9	00	0	02	5.7
No facility	18	35.3	05	31.3	10	28.6
Was sick	03	5.9	02	12.5	01	2.9
Parents did not allow	07	13.7	04	25	03	8.6

(87.5%) respondents heard about MDA. On the other hand, among non-school going children, 58 (72.5%) respondents said they heard about the STH and only 51 (63.7%) children heard about MDA.

FGDs among community members revealed inadequate knowledge about the disease and its prevention. Although some stated that they did not know much about the causes of STH, they took measures without knowing the relation with STH. As stated:

“...Soil-Transmitted Helminthiasis. I haven't known much about it. I know a few people are aware that the disease is caused due to going latrines without shoes...” (FGDs, Parents of Non-SGC, Sylhet)

“...The only drug administration I have heard is the Polio but I have not heard of the Soil-Transmitted Helminthiasis. (FGDs, parents of Non-SGC, Sylhet)

Some participants also had misconceptions about the causes of STH infection. Respondents from FGDs mentioned that STH infections were caused due to eating sugar or eating fish or punishments from God for stealing other's property.

“...I believe there is an eating habit aspect of worm infection because the information I have come across is, as expressed ‘if anyone eats more sugar or more fish, he or she has been infected by intestinal worm’”. (FGDs, Parents of non-SGC, Sylhet)

Out of the 160 participants, 94 (58.8%) took anthelmintic drugs at least once in a year. Sixty-eight (85%) school attending children and 34 (42.5%) non-school attending children mentioned that they took anthelmintic drugs either once or twice last year.

#### Evaluated coverage and utilization of last MDA

The coverage was found acceptably high among school going children in comparison among non-school going or informal

school attending children. The present study revealed that 87.5% school going children receives anthelmintic drugs during last MDA whereas only 61.3% non-school attending children received the drugs. Out of those receiving drugs, 7.5% school going children and 5% non-school going children did not consume the received drugs.

Respondents from parents of school-aged children blamed that school teachers did not distribute drugs among out-of-school children. Although health workers mentioned that they distributed drugs in community health centers, participants from FGDs mentioned that the community health center was found closed most of the time. The following utterance explained:

“...My children are not enrolled in school. Last time, when I visited the school for collecting drug with my children, teachers did not give me drugs. They told that they have drugs only for their students... (FGDs, parents of non-SGC, Sylhet)

“...Last time, when I visited health center for collecting drug for my children, the center was closed. I visited again next day, but the health worker was absent at that time. After that, I did not visit there again for drug” (FGDs, parents of non-SGC, Sylhet)

However, participants with school teachers mentioned that they are also not properly instructed about distributing drugs among children who are not enrolled in school.

“...we actually had no instruction to give drugs to outside children. We received drugs according to the number of our students. They didn't give us extra drugs or any kind of instruction to distribute drugs among out-of-school children...” (IDIs, ST, Dhaka)

Participants from IDIs among school teachers and community leaders stated that some educational institutions in their areas did not receive drugs during the last MDA program. Some school-age children also mentioned that their school did not distribute any drugs. As illustrated:

“...There is some temporary school for poor children which are operated by local NGOs and university students. A good number of children from slum and poor areas are attending there. As per I know, these kinds of schools didn't get MDA drugs...” (IDIs, CL, Sylhet)

“...My friends who study in schools got free drugs. I study in madrasah and our madrasah did not give us any drugs... (FGDs, non-SGC, Sylhet)

Concerning the reasons for non-participation, no facility of MDA and lack of information was found as the major reason especially for non-school going children. Unable to attend school and consent from parents also mentioned by a good number of children as reason for non-participation in last MDA.

Regarding participation of MDA, interviews with parents of non-school going children illustrated that they were not much informed about MDA for STH. They also mentioned that the publicity regarding distribution of drug was not well enough and adequate for them. As quoted:

“...Me? Health workers did not talk about the MDA. I know govt. sometimes gives free drugs but I don't know where and when I should need to send my child to collect this drug... (FGDs, parents of non-SGC, Dhaka)

“...The publicity outside the school, is deficient. No notices were sent to the community and no publicity by the authority. How can we understand the program and send our children to take the drug?” (IDIs, parents of non-SGC, Sylhet).

Some respondents mentioned that the news/rumors of side effects in the past rounds and other regions during the same round, discouraged many children from consuming the tablets in this



round. Some participants specified that they had trust in quality but they were worried for the storage and management of drugs when it distributed in schools. Receiving blame from parents if the child experiencing adverse effects whether it was from the drug or not was a common concern expressed by school teachers and health workers. As illustrated:

*“... We allow our children to swallow the drugs, but suspicion is there. Most of the TV channels and newspapers saying children in some areas were becoming sick after swallowing the drug. How will we allow our children...?” (FGDs, Parents of SGC, Dhaka)*

*“... And also, sometimes some children got problems by other reasons that were not related to the drugs but parents of those children blame drugs. It is very difficult to convince them and it also made other parents confused...” (IDIs, ST, Dhaka)*

Interviews with health workers stated that there were instructions to ensure all students ingest drugs in front of distributors but some school teachers allowed students to bring tablet in home. Compliance to MDA decrease in that cases. As pointed out from the quotes:

*“... In some schools, teachers give tablet to the children and ask them to consume in home. Some children put off or lost tablet and some children not want to swallow it...” (IDIs, CHW, Sylhet)*

However, participants from IDIs among school teachers revealed a common concern they did not know enough about the diseases, preventive management and MDA drugs as they didn't receive any training. As stated:

*“... We did not attend any training for MDA. As we know very little about the disease and also the treatment, we were always afraid about any inquiry from our students and also from their parents...” (IDIs, ST, Sylhet)*

Some participants from parents of school-age children admitted that they have no idea to whom to ask information about MDA. Participants from community leaders blamed that health workers or MDA officials had no communication or meeting in their community before drug distribution.

*“... The way they plan this intervention is not okay at all, especially for working children. At least 15% of children of these areas are reported as non-school attending. So I think that's the major problem-trying to catch children who are not going to school, to know how to catch them and to ensure that they receive the drugs...” (IDIs, CL, Sylhet)*

Monitoring was identified as a necessary measure to ensure that all the children received and ingested the distributed tablets; however, there was disagreement about who held this responsibility. No organized method of data recording and management in school was found during this study. Health workers mentioned that they distributed drugs in community health centers also, but no record was found in the community health centers nor in the upazilla health office regarding distribution of drugs in outsidings of schools. In the central STH elimination office, no record was found regarding coverage of MDA among out-of-school children. As stated:

*“... We did record keeping. We had 99% coverage among school-attending children, but I have no data about the coverage rate of MDA among non-school going children...” (KIs, MDA-PM, Dhaka)*

The participants from both FGDs and IDIs, however, indicated that the present process of school-based drug distribution was good although they felt that there was a need to involve community members and to promote health education before MDA. This was captured with a quote:

*“... I think the particular emphasis needs to give on community involvement to ensure that they understand the importance of participating MDA. They can arrange some meeting in village market or mosque. Officials in charge of MDA can easily do it with the help of community group or students...” (IDIs, CL, Dhaka)*

## Discussion

As STH control strategy in Bangladesh is chiefly based on MDA, there is the need to comprehend factors which influence the different implementation stages: acceptability, coverage, and compliance. Identifying and assessing all of these related factors which influence implementation outcomes is crucial to achieving successful implementation of any control intervention.

Though the knowledge of school going children found higher in this study, more than one-third of the non-school going children had poor knowledge about STH and MDA. This may contribute to parents' poor knowledge regarding STH and may be due to the fact that non-school attending children had no lectures or demonstrations about STH or MDA by their parents or community. Several studies reported low level of knowledge among the target population became important obstacles for any control intervention. Lammie et al. reported that the knowledge gap with regard to the disease and prevailing attitudes and perceptions toward the control program is a major factor for lower compliance [9]. In this study, responses to the question of whether MDA was necessary for the community were not significantly different among respondents who thought that MDA was needed. This opinion was supported by a large majority of participants that they perceived the MDA for STH is needed but emphasized the importance of being educated more about the intervention. Measures to increase the knowledge, periodic demonstration of health-related programs, and subsequent use of available media like community meetings or religious gathering are essential and are in argument with other studies. It is important to identify local channels like community leaders, religious person or community youth groups within the communities that could be used to increase awareness about STH and MDA.

In this study, the coverage of last MDA amongst the study population in study areas was found 74.4%. The coverage was found high among those school-attending where almost 90% school going children have received drugs in the last MDA. But coverage is significantly lowered among non-school going, school leaving and children who are going to informal schools/madrasah. Hafiz et al. also reported a big MDA coverage difference between school going and non-school going children [7]. In this study, school enrollment status and type and location of the schools/educational institutes was found as a major factor for the coverage of ongoing MDA. Existing drug distribution policy of MDA in Bangladesh mainly is based on schools and most of the time, school attending children are the primarily focused. Outside of school, no organized policy was found for non-school attending children nor school leaving children or children who continue their study in informal schools. In Bangladesh, there are many kinds of primary educational institutions like govt. schools, private schools, madrasah, kindergarten, moktab, anondo schools and patshala. Some of those kinds of institutions even not listed in the local education office and did not receive drugs during MDA. Authorities of some of those institutions had no idea whether their students were receiving drugs or not. Moreover, around 5 million children between the ages of 5 and 12 – mostly from poor families, urban slums, and hard-to-reach areas remain out-of-school [7,8]. It will not be possible to achieve real impact of MDA without collaborating with the neglected proportion of children. Studies from Mali and Gambia revealed that drug distribution centers at local level and distribution timing, which subsequently affected the planning and implementation of MDA

[9,10]. To attain an effective control program, it is very crucial to ensure coverage among entire target aged children. It is important to identify all relevant institutions and ensure participation of national deworming program. There is also need to look into alternative ways of targeting these group of children especially out-of-school children and who engaged in income-generating activities that impact on their ability to participate in MDA. Alternate drug delivery strategies like additional use of masjid, temples and local markets, besides school-based MDA campaign, also needs to be explored as alternative drug delivery channels to target non-compliers of MDA to achieve the target coverage. Findings of the results emphasized that the combined effort by school teachers, health workers, local administration, mass media and involving religious and village leaders in the community offered collateral benefits for improved MDA coverage.

#### *Factors enabling MDA coverage and utilization*

Respondent who was knowledgeable about the mode of spread and prevention of STH have consented to MDA in this study. Findings from the present study also showed that present methods of information dissemination about STH and MDA failed to reach all population in the community. It was found from previous research that community knowledge and perception about the disease have been shown to motivate uptake of MDA [4,10]. For information dissemination of MDA for STH, use of locally appropriate media like demonstration in village market or religious places, short documentation, community talks and announcements by loudspeakers are needed to be assessed. An integrated health promotional program with national immunization program or vitamin A campaign should need to be done to reach all targeted population of the endemic communities.

The fear of side effects, lack of consent from the parents and low trust on distributed drugs were found as a challenge to the achievement of the target coverage in this study. According to study participants, these concerns might discourage them from allowing their children to swallow the drugs during MDA. In this study, respondents who expressed these fears none had experienced such a problem. While teachers admitted to being concerned about side effects and adverse reactions, none stated they were reluctant to contribute in MDA. Several studies revealed that taste and size of drugs, rumor and previous experience of side effects adversely impact on the uptake of mass treatment [11,12]. Nevertheless, the source and spread of rumors, and how to address them need to be contextualized. Successful MDA programs should have well-established plans for any adverse effects during implementation. Dissemination of adequate information through community leaders and faith-based community organizations should need to be incorporated to make the community aware of the possible side effects of MDA drugs and why these side effects occur. Skilled health workers could be directed not only the drug distributors but also be there for on-site management of any adverse reactions if arise after ingestion of drugs.

Availability of appropriate data and population dynamics were also found to be an important factor for the coverage and acceptability of MDA in this study. Lack of appropriate data about the primary educational institutions and also the actual number of target children hampered the implementation of MDA. A large number of children of those areas are engaged in various occupations from a very early age and are not going to school or sometimes attended in informal schools. Implementation of MDA in these cases was especially challenging because of the lack of clear information about the areas, as well as lack of community identities and health committees to facilitate community engagement and participation. This finding is in agreement with several studies which identified children in the poor and slum areas to have a high susceptibility to

the disease and a high need for the drugs due to their low and unhygienic living conditions [13]. A number of studies also have suggested the need to monitor population dynamics when planning MDA for STH [11,14]. Thus the need to continuously target those who are not going to school or attending informal/unregistered schools and also engage with work sites in a special way during the MDA program to ensure that despite their mobility, they are not missed during the MDA. This suggests the need for careful planning in areas where a number of non-school going children or working children is high.

In this study, communication and information gaps between health workers, school teachers and community peoples were found as a barrier to the utilization and coverage of MDA for STH. Information gaps existed among the school teachers about record keeping, roles of publicity and even distributing drugs to children who do not enroll in schools. Controversy statements of health workers and community peoples also found about the process of distributing drugs among non-school going children. Furthermore, there were instructions to ensure all children have to ingest drugs in front of distributors but in this study, it was found that some of the school teachers allowed children to bring tablets home. Lack of communication always creates gaps on acceptance of any control program and to ensure full community participation in an intervention, proper guidelines, exchange of information, continued interaction, and communication with all stakeholders are crucial [12]. Quality training to the drug distributors about communication skills is needed to ensure which would help them to develop a good rapport as well as answer all questions with confidence about the program raised by the communities confidently. Provision of clear guidelines and encouragement of professional behavior among drug distributors through training is needed to create a positive experience for the communities.

Lack of record keeping, monitoring and follow-up after the MDA program was found as an important barrier for MDA for STH in this study. No data regarding distribution of drugs, participation rate or adverse events were found neither in school nor in community health centers. When program monitoring and follow-up was discussed, local health workers and officials mentioned their central authority was responsible for those aspects while the central authority said it was the responsibility of local health officials. This confusion can be avoided with the clear assignment of responsibilities to officials or departments involved in the program. Intensive monitoring and regular follow-up were reported as a major contributing factor to the success of MDA program [15]. Active supervision and monitoring of activities should be reinforced and centered around the usage of the drugs in compliance with the program. A greater feeling of ownership and responsibility for the program by all stakeholder groups involved could avoid the total burden of monitoring to fall on any one department and ensure accurate collection of program data. Surveillance for on-the-spot administration and adverse reactions of the distributed drugs can enhance both coverage and compliance rates. External agencies for monitoring the MDA activities should need to be involved to ensure that field team works properly.

While there has been great improvement in the control of STH in Bangladesh with more air-time assigned for preventive practices against the disease and promoting the MDA on radio and television, findings of the present study indicate that this information is failing to reach all target population. Alternative methods of awareness creation and information dissemination about MDA need to be explored in order to reach these groups. Therefore, the local NGOs and local religious organizations could be played the key channels for imparting health information to all target population in the community. Following the report of the WHO vision and strategy, which distinguishes integration as one of the strategic zones of work, connecting immunization to other public health

intervention has been featured in the global arena. An integrated health promotional activity with national immunization program or vitamin A campaign should need to be incorporated to reach all targeted population of the endemic communities.

In Bangladesh, reaching the 2025 national target for STH control will require multispectral collaboration. Nasr et al. highlight the role of partnerships in MDA for disease control activities by expressing that accomplices advocate and facilitate advance in operational research, programmatic improvement, capacity building, resource mobilization and monitoring [16]. By following these, reducing the difficulties to the implementation process of MDA for STH would require adopting a framework thinking approach. This approach might be pertinent on the grounds that it requests watchful thought of conceivable results of different interventions through cooperation and collaborative thinking by important stakeholders. Strategic partnerships and collaborations are essential for successful implementation of MDA programs because it requires sustained political commitment from local communities [17,18,20]. Key health systems components which could be considered include resources (health workers, finances, monitoring, follow-up and information), health service delivery systems, administration or governance and also community norms and values.

#### Research limitations

The study results should be interpreted with caution due to a potential recall bias, particularly in school-aged children, is a possible concern for the accuracy of the observed effect. Eight focus group discussions were conducted, however during the interview one or two people in the group dominated several discussions and this has an impact on the findings because some people chose to less talk during the discussion taking place. Ideally, the research team should have interviewed school going children and non-school going children according to the sample size calculator, which was not possible due to time and funding constraints. Only one hundred sixty (160) school-aged children were interviewed and therefore the results may not accurately represent the school-aged children's perspectives as a whole. Interviews and the questionnaire captured self-reported information and relied primarily on respondents providing the right information. Misreporting by respondents cannot be ruled out.

#### Conclusions

This study has explored various factors that have become barriers inhibiting coverage and utilization of MDA for STH. One of the major issues influencing coverage and compliance of MDA for STH identified in this study was that many people still did not recognize the benefits of the intervention which probably leads to the continued high prevalence rates of STH in study areas. The main barriers to coverage and compliance of MDA for STH identified in this study was inadequate planning for targeting all population, insufficient drug distribution policy, lack of supervision and follow-up, inadequate health promotion, and information dissemination gaps. Use of local channels for community sensitization, addition of local distribution points, appropriate training to the drug distributors, post-distribution follow-up and health education may increase the uptake of MDA within the community. These concerns should be adequately addressed for the successful implementation of MDA for STH with SDGs target of controlling STH infection from Bangladesh.

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#### Competing interests

None declared.

#### Ethical approval

Not required.

#### Availability of data

The datasets used during the current study available from the corresponding author on reasonable request.

#### Author contributions

The study was supervised by Elsa Herdiana Murhandarwati and Retna Siwi Padmawati while the design of the study, field experiments, data analysis, writing, revision and correction of the manuscript was performed by Tilak Chandra Nath. Elsa Herdiana Murhandarwati and Retna Siwi Padmawati contributed in method, auditing the data analysis, and writing process of the manuscript.

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#### References

- [1] Rahman MM. Biannually school-based deworming by mebendazole 500 mg has reduced the worm load drastically in Bangladesh. *Adv Biotechnol Microbiol* 2017;3(4):3–4.
- [2] World Health Organization (WHO). Eliminating soil-transmitted helminthiasis as a public health problem in children; 2012. Available from: <http://apps.who.int/iris/handle/10665/44804>. [Accessed 24 September 2017].
- [3] Khair M, Khanum H, Hossain M, Alam MS. Prevalence, risk factors and comparative diagnosis of soil-transmitted helminths in children of slum areas of Dhaka and tea garden areas of Sylhet. The 12th Biennial Bangladesh Society for Parasitology (BSP) Conference 2016. Available <https://www.researchgate.net/publication/293250516>. [Accessed 24 September 2017].
- [4] Chung J, Nazneen A, Halder AK, Haque R, Siddique A, Uddin MS. The interaction of deworming, improved sanitation, and household flooring with soil-transmitted helminth infection in rural Bangladesh. *PLoS Negl Trop Dis* 2015;9(12):e0004256.
- [5] Hotez PJ, Herricks JR. Helminth elimination in the pursuit of sustainable development goals: a "Worm Index" for human development. *PLoS Negl Trop Dis* 2015;9(4):e0003618.
- [6] Banu SS, Ahmed B, Jubayer S, Banu SG, Ara K, Jamal KF, et al. Prevalence of soil-transmitted helminths (STH) infection among children aged 2–17 years in urban and rural areas of Dhaka district in Bangladesh. *Bangladesh J Med Microbiol* 2011;5(2):16–22.
- [7] Hafiz I, Berhan M, Keller A, Haq R, Chesnaye N, Koporc K, et al. School-based mass distributions of mebendazole to control soil-transmitted helminthiasis in the Munshiganj and Lakshampur districts of Bangladesh: an evaluation of the treatment monitoring process and knowledge, attitudes, and practices of the population. *Acta Trop* 2015;141(B):385–90.
- [8] Family Health International-360. Assessing progress in fighting STH in Bangladesh. Technical-brief; 2013. Available <https://www.fhi360.org/resource/>. [Accessed 24 September 2017].
- [9] Lammie PJ, Fenwick A, Utzinger J. A blueprint for success: integration of neglected tropical disease control programmes. *Trends Parasitol* 2011;22(7):313–21.

- [10] Dembele M. Implementing preventive chemotherapy through an integrated National Neglected Tropical Disease Control Program in Mali. *PLoS Negl Trop Dis* 2012;6(3):e1574.
- [11] Parker M, Allen T, Hastings J. Resisting control of neglected tropical diseases: dilemmas in the mass treatment of schistosomiasis and soil-transmitted helminths in north-west Uganda. *J Biosoc Sci* 2008;40(2):161–81.
- [12] Babu B, Satyanarayana K. Factors responsible for coverage and compliance in mass drug administration during the programme to eliminate lymphatic filariasis in the east Godavari district, South India. *Trop Doct* 2003;33(2):79–82.
- [13] Parikh DS, Totañes FIG, Tuliao AH, Ciro RNT, Macatangay BJC, Belizario VY. Knowledge, attitudes, and practices among parents and teachers about soil-transmitted helminthiasis control programs for school children in Guimaras, Philippines. *Southeast Asian J Trop Med Public Health* 2013;44(5):744–52.
- [14] Sunish IP, Rajendran R, Mani TR, Gajanana A, Reuben R, Satyanarayana K. Long-term population migration: an important aspect to be considered during mass drug administration for elimination of lymphatic filariasis. *Trop Med Int Health* 2003;8(4):316–21.
- [15] Linehan M, Hanson C, Weaver A, Baker M, Kabore A, Zoerhoff KL, et al. Integrated implementation of programs targeting neglected tropical diseases through preventive chemotherapy: proving the feasibility at national scale. *Am J Trop Med Hyg* 2011;84(1):5–14.
- [16] Nasr NA, Al-Mekhlafi HM, Ahmed A, Roslan MA, Bulgiba A. Towards an effective control program of soil-transmitted helminth infections among Orang Asli in rural Malaysia, part 2: knowledge, attitude, and practices. *Parasites Vectors* 2013;6(28). PMID: 23356968.
- [17] Okorie PN, Bockarie MJ, Molyneux DH, Kelly-Hope L. Neglected tropical diseases: a systematic evaluation of research capacity in Nigeria. *PLoS Negl Trop Dis* 2014;8(8):e3078.
- [18] Gyorkos TW. Monitoring and evaluation of large-scale helminth control programs. *Acta Trop* 2003;86:275–82.
- [19] Creswell J, Plano KA, Clark V, Smith K. Best practice for mixed methods research in the health sciences. Bethesda, MD: Office of Behavioral and Social Sciences Research, National Institutes of Health; 2013.
- [20] Nath TC, Padmawati RS, Alam MS, Das S, et al. Elimination of soil-transmitted helminthiasis infection in Bangladesh: knowledge, attitudes, and practices regarding mass drug administration. *J Glob Health Rep* 2018;2:1–10, <http://dx.doi.org/10.29392/joghr.2.e2018017>.