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Community Engagement to Reduce Soil-Transmitted Helminth Infections Among Mobile and Migrant Populations in Southeast Asia

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ABSTRACT Soil-transmitted helminths (STHs) are neglected tropical diseases that disproportionately affect mobile and migrant populations (MMPs). With a high burden on low-and middle-income countries, especially in Southeast Asia (SEA), STH infection is associated with a lack of access to improved water, sanitation and hygiene (WASH) and is often treated with mass drug administration (MDA) of anthelmintic medications. This introduces challenges for addressing STH infections in MMPs whose unpredictable mobility, potential distrust in established healthcare systems due to their unfamiliarity, and limited access to services result in low healthcare utilization. Community engagement (CE) is necessary to address the high burden of STH infection in MMPs in SEA. It is characterized by participatory research and the integration of community voices, needs and interests through self-governance and utilization of community assets. However, there is a paucity of evidence assessing the effectiveness of CE in STH interventions for this specific population. We conducted a literature review to contextualize MMPs in SEA, illustrate the epidemiology of STH infection in this population, highlight how CE has historically been incorporated in STH interventions and identify future directions for CE. The review found a significant lack of research involving CE in STH interventions for MMPs in SEA but indicates potential for CE in MDA, surveillance programs, school-based control programs and STH research based on its success in other geographical and health contexts. CE can address MDA non-compliance and non-participation among MMPs, be incorporated into formal and informal education systems and mobilize individuals within MMPs to disseminate knowledge. Our findings illustrate that leveraging and integrating the voices and participation of MMPs through CE in integration with STH interventions may improve community support for these efforts, effectively reducing STH morbidity among MMPs in SEA.

KEY WORDS soil-transmitted helminths, mobile and migrant populations, Southeast Asia, community

INTRODUCTION

Soil-transmitted helminths (STHs) infect over 1.5 billion people worldwide, which make up about a quarter of

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the world population[1]. The main STHs are roundworm, whipworm and hookworm, mainly caused by the species Ascaris lumbricoides, Trichuris trichiura, Necator americanus and Ancylostoma duodenale, respectively. STH infection rates are highest among resource-limited communities that lack access to improved water, sanitation and hygiene (WASH), as transmission occurs through contaminated human feces[1, 2]. STHs are considered a neglected tropical disease (NTD), which is a classified group of infections that disproportionately impact low- and middle-income countries (LMICs) in tropical climates[3]. STH infections have detrimental health effects, including malnutrition, anemia as a result of intestinal blood loss, impaired growth and development, as well as acute symptoms such as stomach pain, diarrhea, reduced appetite and weakness[1].

Because of their similar diagnoses and responses to treatment, STHs are often addressed collectively by public health interventions in LMICs[1]. A common intervention to combat STH morbidity and mortality is mass drug administration (MDA) of albendazole and mebendazole, which are regularly used oral anthelmintic medications recommended by WHO as essential medicines that treat the main STH species[1]. However, there are major concerns for deworming MDA programs because many tend to only reach school-aged children, have inconsistent monitoring and do not address potential resistance against anthelmintic drugs[4, 5].

The United Nations High Commissioner for Refugees (UNHCR) reports that by the end of 2022, 108.4 million people were forcibly displaced worldwide due to conflicts that include but are not limited to persecution, violence and human rights violations[6]. Past literature indicates that refugees, migrants and internally displaced persons (IDPs) are at higher risk of contracting STHs, and may have also formerly resided or currently reside in areas where STH infections are endemic[7, 9]. For the purpose of this paper, the term "mobile and migrant populations" (MMPs) is used as an umbrella term encompassing refugees, migrants, asylum seekers and IDPs. Social determinants of health are shaped and exacerbated by MMP status, in which MMPs may experience adverse health outcomes or poor access to healthcare in their areas of transit due to their unpredictable mobility[10].

Southeast Asia (SEA), a region of Asia where a majority of the countries are considered LMICs, has experienced recent turmoil in the past decades that has caused a significant influx of migration[11, 12]. In Myanmar, formerly known as Burma, minority Rohingya Muslims were declared stateless under the 1982 Citizenship Law, causing resettlement into many neighboring countries over the years[10]. The most common destinations are Bangladesh, which holds the largest refugee camp worldwide housing over 1.1 million refugees, as well as Malaysia and Thailand[8, 13]. Historical events of the mid-to late-20th century, such as the Vietnam War, the Cambodian genocide and waves of migration in search of industrial jobs, have also significantly increased resettlement among refugees and asylum seekers across SEA[12, 14]. As a region, SEA holds approximately a third of the global STH cases[14].

There is a growing need for more integrated approaches to reduce the global burden of STHs with an emphasis on incorporating greater community engagement (CE) into interventions that aim to reduce STH morbidity[8, 15, 16]. CE refers to a standard of ethical conduct that stresses collaboration in research and intervention development between community members, researchers and implementation partners to improve health outcomes, policy and service delivery with an emphasis on solidarity and participatory practices[17, 18]. CE can be described as bilateral, where there are sustained efforts between high-income countries (HICs) and LMICs to engage communities in research and programming, including LMIC researchers and community members who are representative of their greater communities[18]. Practices include direct involvement of community members in outreach and education initiatives, feedback and consultation, decision-making and participation in the research process, as well as bidirectional partnerships between researchers, community members and other stakeholders[19]. These practices should be characterized by risk management, respect through active listening and legitimization of the research through transparency and accountability[20].

Incorporating CE has proven potential in reducing STH infection among countries within the SEA region, including in school-based programs in the Philippines and Malaysia, as well as through mobilization of village health volunteers on the Thai-Burmese border to incorporate community participation[21-23]. Evidence has also shown effectiveness of CE among MMPs in SEA in psychosocial interventions to improve mental health, fecal sludge treatment programs in Rohingya camps and MDA of anti-malarials in Myanmar[24-26]. However, there is a paucity of literature specifically examining the role of CE to reduce STH infection among MMPs in SEA[8]. Even if CE is mentioned, it is rarely quantified, meaning little is known about the frequency, motivators or magnitude of participation among MMPs in SEA[24]. This paper seeks to contextualize MMPs in SEA, illustrate

STH infection and epidemiology among this population, highlight how CE has historically been incorporated in STH interventions and identify future directions for CE.

EPIDEMIOLOGY

Transmission Routes

STHs are transmitted through soil contaminated with helminth eggs found in human feces[1]. These eggs infest soil in areas that lack sanitation and can be ingested through multiple routes, including contaminated water sources, foods that are not carefully washed or cooked, walking barefoot and improper handwashing[1]. STHs do not reproduce within the host, but eggs or larvae can remain viable in the soil for weeks to months, especially in warm and humid environments[44, 45]. Due to the nature of their transmission, STHs can be prevented with improved access to WASH, which refers to safely managed water sources, sanitation services and practicing proper hygiene[46]. A component of improved WASH access is CE, where community members become involved in building water and sanitation infrastructure and delivering hygiene education.

Disease Burden

With a significant global burden, STHs are responsible for the loss of one point nine seven million disability-adjusted life years (DALYs) as of 2019, which is a decrease from previous years attributed to the increase of preventive chemotherapy in endemic countries[1]. However, integrated control programs for NTDs that are supported by WHO or national governments frequently exclude displaced populations[44]. Co-infection with other NTDs can exacerbate the health impact and complicate treatment efforts, as these diseases share risk factors and epidemiological patterns, including lack of access to WASH, tropical climate worsened by climate change and geographic location, especially in conflict zones or inaccessible areas[3, 47]. Furthermore, co-infection with multiple STHs is also a common problem of concern in endemic areas [48].

STH infections have been found to be one of the main reasons for illnesses among impoverished communities, including MMPs[49]. In investigating intestinal parasitic infections among SEA migrant workers in varying industries, researchers found that the prevalence of intestinal parasitic infections doubled since previous studies done over the last decade, specifically A. lumbricoides (43.3%) and hookworm (13.1%). This prevalence is likely due to poor living conditions, a lack of sanitation, poor drainage, unplanned urbanization, unhygienic practices, a lack of health awareness exacerbated by poor CE and low socioeconomic status, which call for a further need for hygiene, sanitation and cleanliness[49]. Therefore, a lack of access to safe WASH, resulting in increased STH prevalence in the environment, increases the likelihood of reinfection[2, 50, 51]. Inadequate sanitation services, such as lack of private toilets, latrines or functional sewage systems, are often the result of temporary housing created out of necessity by displaced populations[38, 44].

Prevalence of STH infections among migrant workers may be affected by the region's temperature, humidity, and geography, which all influence helminth reproduction as NTDs primarily affect tropical areas. According to a cross-sectional study conducted in northeast Thailand, 22% of 600 Burmese migrant workers in the study were infected with STHs, most prominently hookworm[52]. Researchers found high variability in STH infections according to the workers' region of origin, poor sanitation—specifically in migrant camps—and amount of interaction with the soil due to the nature of their work.

Disease burden is especially high in women and children of MMPs due to exacerbated difficulties in accessing healthcare[16]. Pregnant women, specifically in the third and second trimesters, are defined as people at high risk of STH infections[1]. Researchers identified that twenty-one percent of a sample of 12,742 pregnant women refugees and migrants on the Thailand-Myanmar border, had either one or multiple STH infections[9]. In an anthropometric study investigating 416 young and adolescent children residing in an FDMN camp in Bangladesh, the prevalence of STH infection was 91.7% at baseline, with co-infections existing to some extent[11]. Furthermore, researchers saw increases in local inflammatory responses that could be linked to STH infection and may have contributed to stunting in school-aged children of FDMNs. Thus, prevalence of STH infection remains high among MMPs, especially women and children, and underscores the necessity of better incorporating the voices of this community when it comes to intervention development and implementation.

Treatment

MDA plays an essential role in the treatment of STH infections, as STHs do not induce a strong acquired immune response; however, MDA cannot prevent STH reinfection[50, 51]. The likelihood of reinfection is correlated with pre-treatment infection status based on egg count, as well as overall exposure to STH eggs and larvae, which

is influenced by the rate of migration of individuals[42, 53]. Researchers found that six months post-treatment, the prevalence of infections decreased by about half[53]. Yet, about 12 months later, the prevalence was similar to pre-treatment levels. The frequency required for MDA is dependent on the rate and intensity of transmission[42]. Additionally, there are concerns about inadequate drug efficacy, which may be attributable to growing drug resistance in certain STH species[5]. There is a need for frequent access to quality drug administration, targeting those that are commonly reinfected, as well as an emphasis on other prevention strategies such as education and sanitation complemented by CE to address the transmission and burden of STH infections[50, 53].

COMMUNITY ENGAGEMENT

Despite the importance of CE in mobilizing behavioral change and influencing existing systems and the stressed need for community-directed strategies for STH research, intervention development and implementation, little research exists examining the impact of CE on STH infection in SEA, particularly in MMPs[8, 54]. We argue here that CE is a necessary component in the ethical development and implementation of interventions that address STHs in this population. In terms of research, CE emphasizes participatory practices, incorporating community members into the framework of the research study and thus creates a collaboration between the study population and the researchers[17]. When health research and healthcare initiatives do not consider community needs and interests, it can result in reduced intervention and policy efficacy[55]. Although many health initiatives claim to incorporate CE, efforts are sometimes symbolic and marginalizing, ultimately leaving the community left out and disconnected. Improving accessibility to information, including improving access to public decision-making spaces and collaboration between community members and leaders are some layers to incorporate effective CE[56, 57].

According to WHO, four levels of approaches to CE exist: community-oriented, community-based, community-managed and community-owned[58]. At each subsequent level, involvement increases to the point where the community is completely equipped to self-govern, develop and implement interventions and work with partners. To achieve this level of CE, researchers must be flexible, establish trust with community leaders, clarify the objectives, risks and benefits of research studies and programs, operate on the community's timeline and consult with stakeholders[58]. Implementation of these approaches should be centered around understanding factors such as MMPs' historical experiences, cultural perspectives and relationships with existing healthcare systems[26].

Community Perceptions of STH Treatment and Surveillance

Based on our review of the literature, we argue that understanding the perceptions of MMPs with respect to treatment and surveillance is needed to effectively mobilize CE. Properly recognizing community concerns allows for proposed interventions to be adapted in collaboration with trusted community leaders, thereby addressing specific needs[59]. In urban settings, where the flow of migrants in search of work or housing can be constant and one's neighbors are often strangers, it can be challenging to build trust and rumors spread rapidly[48]. Without customization of NTD control methods—such as MDA campaigns—to better align with the transient nature of MMPs, resonate with their cultural and personal beliefs and involve trusted individuals, there are significant barriers of non-compliance and non-participation[52, 61].

Community perceptions of drug effectiveness heavily influence MDA compliance[62]. If community members perceive the drugs as ineffective, they are less likely to participate in MDA, opting instead to self-medicate. In some instances, participation in MDA may only be perceived as necessary when an individual is symptomatic, when others in the community participate and support the program and when parents approve the program, particularly regarding school-based STH interventions[63]. Even when communities are more informed about treatment of STH infections, their perception of the drugs impacts the outcomes and uptake of MDA. Researchers found that participants within the community were able to correctly identify causes, symptoms and prevention methods, including hygiene improvement and usage of toilets, of STH infections[62]. However, doubts from the community about side effects and drug effectiveness will still determine the success of MDA programs[62]. Misconceptions about the safety of the drugs were prevalent among a community in Ogun State, Nigeria[64]. Participants believed that one had to be strong before taking the drug, resulting in parents discouraging their children from participating in school-based MDA due to lack of strength and the risk of developing side effects[64]. Long-standing cultural practices can further influence community perceptions and conflict with disseminated information, therefore inhibiting behavior change; a more historical paper suggests that some parents in the Philippines conclude that MDA of anthelmintic medication is not hiyang—compatible with an individual's physiology—with their child and will therefore be ineffective[65]. Both severe reactions to

the medication resulting in side effects and the emergence of dead helminths also lead parents to believe the medication is incompatible and ineffective[62]. Engaging trusted members of the community to provide culturally relevant information can help address misconceptions surrounding MDA[60].

Local understandings regarding surveillance, systematic data collection and data analysis also affect the community's willingness to participate. Despite the capabilities of these procedures to assess STH prevalence, identify communities for MDA and monitor progress towards reducing infection, researchers found non-participation in surveillance programs with a refusal rate of eight percent in Benin and India and thirty-eight percent in Malawi[66, 67]. Lack of recognition of benefits for the community, mistrust in the purpose of the stool sample, lack of information about privacy and shorter lengths of residing in the community were all related to reluctance in participating in surveillance[66]. This illustrates the need to better inform MMPs about the benefits of surveillance programs and mobilize community leaders to help survey their communities.

We argue that primary interventions to address STH infections like MDA, surveillance programs and other control methods like improved WASH access cannot be effective until community concerns are addressed, and in some cases, STH education is not sufficient to allay these concerns. We believe CE is necessary to provide community leaders with the tools to properly engage in the implementation of MDA and surveillance and reframe social norms. Our research indicates that incorporating community feedback and effectively mitigating any concerning side effects or adverse events will improve MDA, surveillance compliance and prevention of STH infections in both school settings and otherwise; if the community is not satisfied, they will be less likely to participate in MDA.

School-Based STH Programs

School-based programs are generally effective STH interventions, despite age-specific limitations, since they tend to be well-received by community members and establish partnerships between community members and educators[54, 68] Interventions based in school facilities may be effective in consideration of the fact that school-aged children in SEA experience higher infection rates with A. lumbricoides and T. trichiura[69]. Past literature indicates that MDA in schools is much more successful than in the community, with 75% participation compared to 25-65% participation[15]. A lack of CE in implementing community-wide MDA and concerns with MDA side effects may contribute to this discrepancy[15].

Although school-based MDA, coupled with other school- and community-directed programs such as health education and school WASH development, has demonstrated success in improving local community health, it is important to acknowledge the limitations of such programs in the specific context of MMPs[54]. Thailand, Bangladesh, Malaysia and Indonesia are all countries hosting Rohingya refugees, among other school children of MMPs[70]. Due to government policy in Bangladesh, and the legal status of refugee children, they are denied the opportunity for a formal education[71]. More children who come from MMPs, including recent Rohingya refugees, are instead receiving education in the form of humanitarian aid[70]. Learning centers in refugee camps continue to be established and supported by UNICEF[71, 72]. Recognizing the distinction between formal and informal education systems for Rohingya children in refugee camps, there is an opportunity to incorporate CE in the planning, support and evaluation of education-based STH programs. This approach could strengthen health education interventions and increase behavior change regarding MDA compliance for this population[73].

CE through school-based delivery of MDA was demonstrated in a study examining the control methods of STH infection in school children located in the provinces of Western Visayas, Philippines[21]. The data showed a significant decrease in the prevalence of STH infections after multiple rounds of MDA, particularly for A. lumbricoides and T. trichiura[21]. A barrier to MDA is the possibility of reinfection for STHs and difficulty in getting people to return for treatment[15]. To mitigate this, the researchers engaged local government units and pharmaceutical companies to strengthen the health system through program expansion and increased funding support. Local government units encouraged community participation by collaborating with the Department of Education and Department of Health[21]. This cooperation allowed schools to be used as venues for MDA, which leveraged the existing infrastructure and workforce in the community. Engaging the Department of Education allowed teachers to be trained to administer anthelmintic drugs to students under the guidance of school nurses. As a result, MDA that incorporated CE practices led to improved nutritional status of the students and helped to enhance school performance[21].

A limitation of school-based programs is insufficient outreach to community members beyond the school-aged

population, and a pilot study comparing the effectiveness of community-based STH intervention programs to school-based MDA programs found that community-based programs coupled with school-based programs were more effective than school-based programs alone[74]. The study included six communities in Timor-Leste, with three communities only receiving school-based interventions and the other three receiving both school-based and community-based STH intervention programs. The study found that community-based interventions, such as increased latrine coverage, hygiene education conducted by WASH agency staff and MDA, resulted in reduced open defecation by roughly half and reduced odds of N. americanus among children by 88.2%[74]. These additional interventions could be utilized to address the current shortcomings of school-based programs for MMPs.

Health education initiatives in schools with an emphasis on CE also have the potential to reduce STH infection in children of MMPs. One study developed and evaluated a health education learning package that aimed to reduce STH infections among schoolchildren in Malaysia[22]. The process included deworming children before the intervention, community discussions with the children, teachers, parents and more. Teachers, children and parents were actively involved in developing the package, including interactive communication methods such workshops for the teachers, a guidebook on STH infections, comic books, music video and an aid kit. The researchers found that the monthly reinfection intensity and rates of those who received the package were significantly lower (70%) compared to those who did not receive the package (10.2%). Continuous follow-up and implementation in the communities, including an overview of STH infections, follow-up by the teachers in the classrooms and encouragement to educate their respective families, were well-received by the community[22]. Results from MDA administration and health education in schools demonstrate that they can serve as a hub for reducing STH infection among school-aged children, but there is a gap in research illustrating this level of effectiveness outside of students.

STH Research

Further research is needed to better understand STH infection and treatment in MMPs in SEA with a focus on solidarity through incorporation of CE[17]. Researchers examined the extent of CE in the research process in past health services literature on STHs across SEA[8]. Investigators scored ten papers published between 2008 and 2021 based on whether local stakeholders were involved in the idea development, methodology development, data collection and analysis, report writing and dissemination processes, and concluded that all papers received a moderate to low score. The researchers indicated that there currently lacks CE in research studying health interventions combatting STH infection in the Asia Pacific region, observing a lack of community members leading or collaborating at different steps in the STH research process[8].

A recent study determined risk factors and epidemiological features of intestinal parasitic infections in resource-constrained communities on the Thai-Burmese border with a significant infection prevalence[23]. In this study, village health volunteers played a significant role in data collection by administering a questionnaire survey addressing community-wide primary healthcare activities and administration of a One Health educational intervention, which resulted in a significant increase in knowledge of infections due to dissemination of knowledge through a peer-to-peer method rather than a top-down line of communication. The researchers recommend engagement and integration of community members and stakeholders in order to effectively circulate accurate information that will inform strong strategic planning to address intestinal parasitic infections in this MMP setting[23].

Community Engagement in Other STH Contexts

Insights from CE models implemented in other contexts provide valuable information for informing the implementation of CE in SEA. Researchers evaluated the role of 4.7 million trained community-directed distributors that carried out MDA, conducted home visits and liaised with community members in sub-Saharan Africa[75]. The study found that more community-directed directors per person resulted in greater therapeutic coverage, especially with more female directors[9]. Utilizing MMP community members to take on community health worker responsibilities, as well as strategies like program integration and cross-border coordination of control programs like MDA are also recommended in East African MMPs[76]. While these findings and perspectives cannot be translated directly to STH control among MMPs in SEA without consideration of multidimensional factors such as urbanization, varying reasons for migration and sociocultural barriers, they showcase the effectiveness of community-driven initiatives.

FUTURE DIRECTIONS FOR COMMUNITY ENGAGEMENT

We argue that taking a participatory approach to future research and mobilizing community stakeholders through CE are necessary steps to reduce the burden of STH infection across SEA. Participatory approaches can be incorporated into STH research through the identification of important community stakeholders and the utilization of existing workforces and infrastructure. Leveraging the voices of MMPs in research and program development will help improve community buy-in and insight on intervention strategies. Future school-based and community-based interventions that involve community members rather than simply inform them are highly recommended, and monitoring and evaluation should involve systems already in place, like schools and local government bodies. A multidisciplinary integration of these CE approaches with STH interventions and target strategies should be adopted to increase MMP participation in the research process. This will reduce the global burden of STH infection and inform future interventions, such as those illustrated in Table 1. Additional research should be conducted on best practices for the incorporation of CE in the specific context of MMPs due to cultural and language barriers, difficulty accessing long-term care and resource constraints. Currently, there is an absence of a structured framework for the integration of CE in this target population.

Action Step	Outcome
Leveraging the voices of community leaders to destigmatize treatment and surveillance.	Community perceptions of treatment options and surveillance are addressed in public spaces and mainstream media.
Utilization of existing spaces by community health workers and community leaders to discuss STH infection.	Workshops, screenings, or distribution of MDA are held at familiar and safe spaces, such as healthcare facilities, schools, or social and religious gatherings.
Involvement of community members in STH research and program development.	Outcomes may be more likely to improve and community members may be more likely to uptake the research and programming[7].
Development of health education addressing STH infection.	Transmission of STH knowledge from teachers to school-aged children[62].
Training of MMPs to become community health workers.	Cross-border coordination of control programs[65].
Implementation of community directed distributors (CDDs), particularly women, in refugee camps.	Collaborate with community members to carry out MDA and conduct home health visits[64].

Table 1. Future directions for community engagement to reduce soil-transmitted helminth infection burden in Southeast Asia.

CONCLUSION

STH infection is a public health threat in SEA and around the world that disproportionately affects MMPs and results in adverse health outcomes. The incorporation of CE in STH control measures, interventions, treatment and research is necessary to reduce the high disease burden in this population. However, the dynamic nature and often marginalized status of MMPs make it difficult to achieve sufficient CE. Reshaping community perceptions of STH treatment and surveillance, implementing interventions in spaces and facilities that are familiar to community members, taking a participatory approach to future research and mobilizing community stakeholders through CE are necessary steps to reduce the burden of STH infection across MMPs in SEA. Open dialogues with community members or observation of existing and well-received initiatives to implement community-specific practices will help understand community perceptions of STH infection and treatment in MMPs. Furthermore, leveraging the voices of MMPs in research and program development will improve community buy-in and insight on intervention strategies. CE can serve as a key tool for reducing and preventing STH infection in MMPs in SEA.

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