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Community Education and Health Examination on the Prevention of Intestinal Parasite Infections among Waste Collectors

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ABSTRACT
Background: Waste collectors are at a higher risk of contracting intestinal parasites due to direct contact with waste.
Purpose of the Study This community service activity aimed to educate waste collectors on the use of personal protective equipment (PPE), promote Clean and Healthy Living Behavior (CHLB), and conduct health examinations to prevent intestinal parasitic infections.
Methods: Community education was conducted through lectures, along with pre-tests and post-tests, followed by interviews to assess healthy living behaviors, the use of PPE, CHLB, and history of intestinal parasite infections. Health and stool examinations to determine intestinal parasites among waste collectors.
Results: The stool examination revealed the presence of the genus Blastocystis parasite. Educational interventions effectively improved awareness and hygiene behavior among waste collectors, supporting infection prevention and occupational health protection.

Keywords
Waste collectors; Personal Protective Equipment; Clean and Healthy Living Behavior; Intestinal parasites infection; Good Health and Well-being

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Introduction

Waste collectors pick up household waste every day and transpot to the landfills. They face a higher risk of contracting intestinal parasites due to direct or indirect contact with waste that may be contaminated with intestinal parasites (Fajri et al, 2024). The use of personal protective equipment (PPE) is essential for ensuring occupational safety and health (Rusmini, 2015). Healthy and clean living behavior (HCLB) is an important aspect of health that aligns with the Sustainable Development Goals (SDGs), specifically Goal 3: Good Health and Well-being (Farhud, 2017; Weeks et al, 2023), which is to ensure a healthy and prosperous life for all individuals (WHO, 2025).

Intestinal parasitic infections remain a persistent public health concern in many developing countries, particularly among populations with poor sanitation and limited access to health facilities (Alelign et al, 2024). Waste collectors are one of the high-risk groups due to frequent exposure to organic waste and contaminated environments. Their working conditions often involve direct contact with materials containing infectious agents, yet their awareness of occupational health and hygiene practices tends to be low (Abib et al, 2024). In addition to helminth infections, several intestinal protozoa also play a role in public health and hygiene-related conditions in tropical settings. One protozoa that can also be found in healthy individuals is Blastocystis. This organism is frequently detected in humans and various animals, with a global prevalence ranging from 10% to 60%, depending on sanitation levels and living conditions (Andersen & Stenvold, 2016). Although often considered a commensal, Blastocystis infection has been associated with poor hygiene and exposure to contaminated environments, such as waste handling areas Its presence in both asymptomatic and symptomatic individuals makes it a useful indicator of intestinal hygiene and public health status in at-risk communities (Wawrzyniak et al., 2013).

Previous studies have demonstrated that education and training on the proper use of PPE significantly improve workers' safety behavior, compliance, and risk perception, particularly among waste collectors and sanitation workers. Continuous health education has been shown to reduce exposure to occupational hazards and increase adherence to protective practices in similar high-risk setting (Rajapaksha et al., 2017). Similar community-based health promotion programs have reported improved PPE compliance and reduced infection risk after structured education and supervision (Yeon & Shin, 2020).

This community service activity was conducted in Sememi Sub-district, located in the Benowo District of Surabaya City, East Jawa Province, Indonesia. Some residents of this sub-district who do not have permanent jobs work as waste collectors. They collect household waste and transport it to a Temporary Storage Site (TPS), where city government trucks later transport the waste to the Final Disposal Site (TPA) in Benowo (Pemerintahan Surabaya, 2025).

A preliminary survey conducted among 18 waste collectors at the Sememi Temporary Storage Site (TPS) revealed three main problems: (1) most workers did not use complete PPE, (2) knowledge about intestinal parasitic diseases and their prevention was limited, and (3) participation in regular health check-ups was low. Approximately 70% of the respondents were found not to use full PPE while handling waste, 60% were unaware of intestinal parasite transmission routes, and nearly half had never undergone stool or health examinations in the previous year. These findings indicate poor awareness of occupational safety and the need for targeted intervention.

To address these problems, the community service program was designed to implement three key interventions: (1) education and demonstration on the proper use of PPE, (2) promotion of Clean and Healthy Living Behavior (CHLB) focusing on hygiene practices and environmental sanitation, and (3) health and stool examinations to detect intestinal parasites and provide early awareness of infection status.

This study aimed to educate waste collectors on the use of PPE, promote CHLB, and inform them about intestinal parasitic infections, with a particular focus on prevention and transmission, so they can effectively prevent these infections while performing their duties. Through these integrated activities, the program is important to increase knowledge, promote safer behavior, and contribute to achieving Sustainable Development Goal 3 — Good Health and Well-Being.

Method

The proposed solutions for the problems identified during the preliminary survey were implemented through three main stages. The first stage was educational intervention through lectures and demonstrations on the proper use of PPE. The second stage focused on promoting CHLB related to hygiene, sanitation, and infection prevention. The third stage consisted of health and stool examinations to identify intestinal parasites and to raise participants' awareness of their infection status. These interventions were designed as a comprehensive approach to address the occupational and health challenges faced by waste collectors.

Participatory Planning

The activity adopted a participatory design. Waste collector representatives joined early planning discussions to determine the schedule, site, and participant list, ensuring relevance to their working conditions.

Educational and Examination Activities

Education on PPE, CHLB, and parasite prevention was delivered through lectures and an interactive question-and-answer session. A pre-test was administered before the lecture, followed by a post-test after the lectures were completed. Interviews were conducted to assess participants' habits and infection histories. Health examinations included an anmnesis, physical checks, and stool analysis.

Stool Collection and Microscopy Examination

The pot containers for stool samples were distributed to waste collectors a day before sample collection. They received instructions for proper stool sampling. Stool samples were then transported to the Laboratory of Parasitology Faculty of Medicine Universitas Airlangga in a cool box for the microscopy examination. A wet mount method with Lugol's iodine and 0.9% NaCl at 1000× magnification under immersion oil was used to examine the stool sample. Examinations were conducted by two experts in parasite identification to ensure accurate results. The identification of parasites relied on their morphological characteristics, supplemented by guidance from the CDC website (CDC, 2019)

Visual Framework

The sequential project of community service activities is outlined in the following framework (Figure 1). Firstly, a preliminary survey was conducted on-site to gather information about the practices of waste collectors regarding the use of PPE and the implementation of community health and livelihood best practices (CHLB) during their duties. This involved observing their activities and conducting brief interviews about their use of PPE and adherence to CHLB guidelines. Secondly, planning and coordination took place for community education and

health examinations. The next phase involved the implementation of the program, followed by reporting the results and monitoring the application of knowledge regarding the use of PPE and CHLB to prevent intestinal parasite infections.

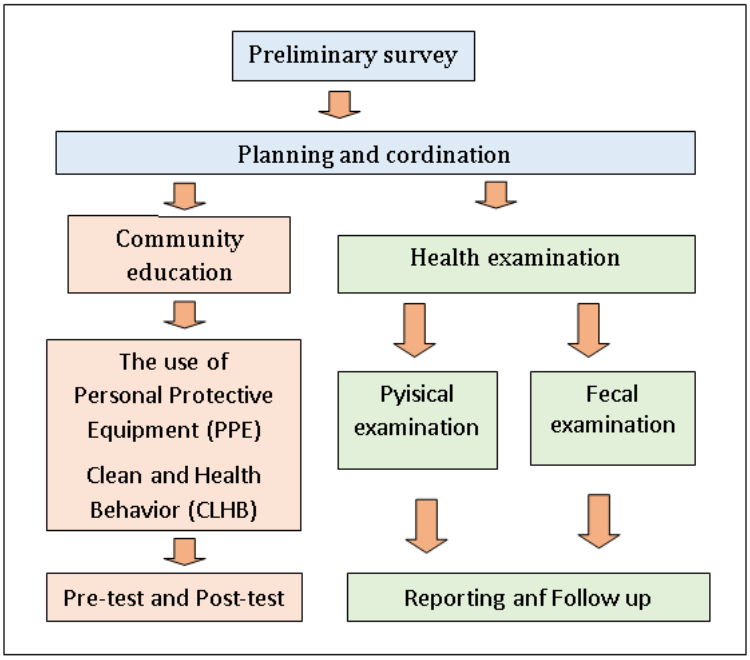

Figure 1. Visual framework of the Community Service Program conducted in Sememi Sub-disctrict, Benowo District, Surabaya City

Result

Evaluation of the community service activities showed a positive impact on participants' knowledge, hygiene practices, and awareness of intestinal parasite infections. The improvement observed in pre-test and post-test results, combined with feedback from discussions and observations during the sessions, confirmed the effectiveness of the interventions in addressing the three major issues identified earlier.

Evaluation of the knowledge of PPE and CHLB

Total number of waste collectors participated in this study was 21. During sessions, participants actively engaged, asked questions, and shared work experiences. Afterward, many reported wearing gloves and boots and washing hands with soap, demonstrating positive behavioral change. The evaluation of waste collectors' knowledge concerning the use of PPE, the CHLB, and intestinal parasitic infectious diseases was assessed through Pre-test and Post-test results. The assessment consisted of 10 questions. Comparison between pre- and post-tests showed improved knowledge on PPE use, CHLB, and parasite prevention (Figure 2).

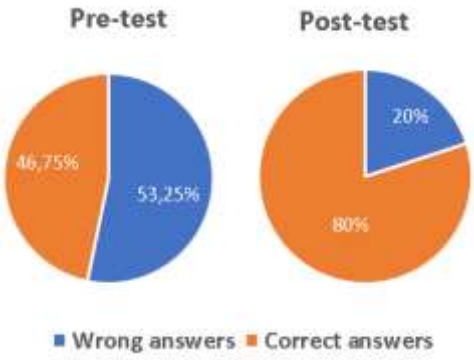

Figure 2. The comparison of correct and incorrect answers in the Pre-test and Post-test regarding socialization, education on the use of PPE, CHLB, and knowledge of intestinal parasitic infectious diseases

The results showed a clear improvement in participants' knowledge and awareness following the educational and health examination activities. Based on the pre-test and post-test scores, most participants demonstrated better understanding of intestinal parasites, hygiene practices, and the importance of using PPE. After the intervention, participants were able to correctly identify the function of each PPE item and the potential health risks of not wearing it during work.

Clean and Healthy Living Behaviors (CHLB)

Based on the interview regarding the CHLB, the results are including the use of water for daily activity, habit on defecation and washing hands, and the nail clealiness. Most participants used PDAM water and washed hands before meals. All defecated in toilets, but only 76.19% used soap after defecation. Nail hygiene varied, indicating room for improvement.

Table 1: Clean and healthy living behavior (CHLB) based on the water source used and hand washing habits

Water source n(%)		**How to wash hands n (%)**			**Washing hands before meals n(%)**	
PDAM* 20(95%)	Rain water 1(5%)	Tap water 17(80.95%)	Using a dipper 3(14.29%)	Using a bucket 1(4.76%)	Yes 21(100%)	No 0(0%)

*PDAM is the water source served by the government for daily use.

Table 2: CHLB based on the defecating habit and washing hands after defecating

Defecation in the toilet n(%)		**Washing hands with soap after defecating n(%)**		
Yes 21(100%)	No 0(0%)	Yes 16(76.19%)	Sometimes 1(4.76%)	No 4(19.05%)

Table 3: CHLB based on the nail condition

Nail condition n(%)			
Short and clean 9(42.86%)	Short. a bit dirty 6(28.57%)	Short and dirty 5(23.80%)	Long and dirty 1(4.76%)

Health examination

The results of anamnesis regarding the history of intestinal parasite infection are presented below.

History of parasite infection	n (%)
Never suffered infection	15 (71.43%)
Infected during childhood	5 (23.81%)
A worm emerged last year	1 (4.76%)

Clinical symptoms of intestinal parasitic infections, such as abdominal pain, diarrhea, nausea, vomiting, and bloating were not found.

Physical examination resulted in the data below.

Body temperature	36.6-37.4°C
Blood preasure	109-180/70-98 mm/Hg
Skin observation	Normal, 17 (80.95%)
	Itching due to allergies, 4 (19,05%)

Most waste collectors had normal blood pressure. Among them, two (9.52%) had high blood pressure, while three (14.29%) had a history of high blood pressure. Meanwhile, clinical symptoms of intestinal parasitic infections, such as abdominal pain, diarrhea, nausea, vomiting, and bloating were not found.

Fecal examination

The results of microscopic examination of feces resulted in 12 fecal samples (57.14%) were positively containing parasites from the genus of *Blastocystis* (Wawrzyniak et al., 2013). while 9 fecal samples (42.86%) were negative. Images of these parasites are shown in Figure 3. The presence of *Blastocystis* in asymptomatic waste collectors, highlighting the relevance of continuous monitoring even among individuals who appear healthy. These findings strengthened participants' motivation to maintain personal hygiene and PPE use to prevent future infections.

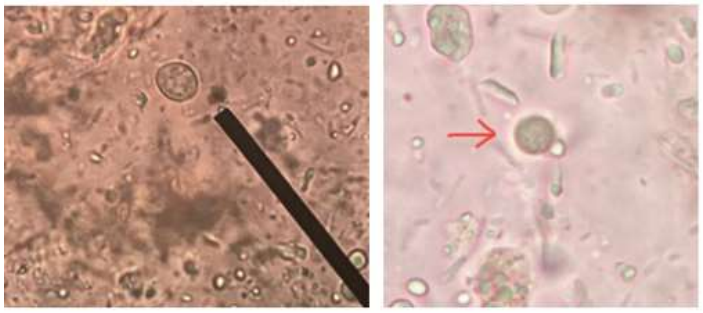

Figure 3. The genus of *Blastocystis* is the only parasite found during stool examination

Treatment and follow-up

Treatment was not necessary for the waste collectors whose feces contained *Blastocystis* because this parasite is considered a commensal organism, which forms a symbiotic relationship with the intestinal flora, which does not harm healthy hosts. Health examinations revealed no clinical symptoms of a *Blastocystis* infection. The results have been reported to the head of Sememi Sub-district as well as the explanation regarding the uneccesary treatment administration. On

seven days later, no clinical symptoms of *Blastocystis* infection were found during the follow-up examination on seven days post examination, which revealed no obvious intestinal parasitic infection.

Observable behavioral changes were noted during and after the sessions, with most participants consistently wearing gloves and boots while handling wet waste by the program's end. Participants also began reminding peers to use PPE and avoid eating near waste piles, demonstrating increased awareness and responsibility towards occupational health. These changes were attributed to the program's participatory and contextualized approach, which emphasized two-way communication and local examples. This method fostered ownership and made educational messages relatable, transforming passive learning into active behavioral change.

Rewards

At the end of the activity, goody bags containing PPE, including boots, gloves, and masks, were distributed to waste collectors to wear during work to prevent parasitic infections and work-related accidents.

Discussion

Overall, the results demonstrate that the educational and health examination interventions successfully improved participants' knowledge and hygiene practices while fostering greater awareness of occupational health risks. These outcomes provide the basis for further discussion on how behavioral change occurred among participants and how these findings align with existing theories of health education and preventive behavior.

Knowledge improvement

The results of post-test compared to pre-test indicated the increased of the knowledge of the waste collectors about the importance of using PPE, the CHLB as well as the intestinal parasitic infectious diseases. This result indicated the successful of socialization and education regarding the above topics. A pre-test and post-test can be a valuable tool for evaluating the success of an educational or enlightenment or intervention (Arianti, 2024). During this enlightening session, participants were enthusiastic in listening and asking questions, demonstrating their curiosity about intestinal parasitic infections.

Promoting CHLB

Overall, the clean and healthy living behavior (CHLB) assessment among waste collectors showed relatively good hygiene and sanitation practices, although some gaps remain. Most participants (95%) used water supplied by the government (PDAM), and all reported washing their hands before meals, suggesting good awareness of the importance of hygiene before food consumption. All participants also reported defecating in toilets, indicating the absence of open defecation practices and reflecting access to proper sanitation infrastructure. The government of Surabaya City has provided clean water that was originally purified from the river and that can be used by all residents (Hikmah, 2020). The practice of using a toilet for defecation is a recommendation from the Surabaya City Government (Pemkot), which requires its citizens to have family toilets through regulations and programs that are being promoted, especially to achieve the target of being free from open defecation (Pemerintah Kota Surabaya, 2023).

Handwashing plays a major role in preventing the spread of diseases, such as intestinal parasites, virus, and bacterial infections (Sulistyani, 2025) However, only 76.19% of the workers

consistently washed their hands with soap after defecation, while 23.81% either did not or did so inconsistently. This inconsistency represents a potential route for fecal–oral transmission of intestinal parasites. Similarly, nail hygiene observation revealed that while 42.86% of workers had short and clean nails, the rest showed varying levels of dirt accumulation, and one individual (4.76%) had long and dirty nails. Since waste collectors handle filthy materials on a daily basis, their nails need to be cleaned. Fingernails are known reservoirs for microbial and parasitic contaminants, especially among workers who frequently handle organic waste (Stürchler, 2023). Nail hygiene is important to prevent infections, such as parasite infections, as well as other diseases like diarrhea caused by ingested dirt that present in the nail (Hajipour & Valizadeh, 2025). To prevent this, they have been advised to provide soap for washing their hands after defecation.

These findings suggest that although general hygiene awareness is satisfactory, critical aspects of personal hygiene, particularly handwashing with soap after defecation and nail cleanliness require improvement. The nature of sanitation work, involving constant contact with waste, increases the likelihood of pathogen exposure, making strict hygiene practices essential. Continuous health education, reinforcement of protective equipment use, and regular health monitoring are strongly recommended to minimize occupational infection risks and maintain optimal health status among waste management workers.

Health Examination

The physiological examination of waste management workers showed that body temperature ranged from 36.6°C to 37.4°C, which is within the normal range (Diamond et al, 2021). This finding suggests that none of the workers presented with fever or acute infection at the time of examination. Despite the outdoor nature of their work and exposure to high environmental temperatures, their stable body temperature indicates a good level of physiological adaptation and hydration maintenance during work activities.

Blood pressure ranged from 109/70 mmHg to 180/98 mmHg, showing a wide variation among the workers. Several individuals were found to have elevated blood pressure, which may indicate undiagnosed or poorly controlled hypertension. This condition could be related to physical workload, stress, dehydration, or lifestyle factors such as smoking or dietary habits (Yonis, 2025). Similar findings have been reported in sanitation workers, where occupational stress and exposure to heat contribute to increased cardiovascular risk (Wang et al, 2022). Regular health screening and education on healthy lifestyles are therefore recommended.

Skin examination revealed that most workers (80.95%) had normal skin conditions, while 19.05% reported itching due to allergies. This suggests a relatively low but notable incidence of occupational dermatitis or allergic reactions, likely caused by direct contact with waste materials or inadequate use of personal protective equipment (PPE) such as gloves (Health and Safety Executive, 2015). Previous studies have shown that sanitation workers are at risk of skin irritation and contact dermatitis due to exposure to organic waste, detergents, and microbial contaminants (PAHO, 2020). These findings highlight the importance of strict PPE use and hygiene training to prevent occupational skin diseases. Overall, the data reflect that while the general health condition of waste collectors appears stable, there are emerging risk, particularly hypertension and mild allergic symptoms, that require ongoing monitoring and preventive intervention.

Parasitological Findings

To complement the clinical assessment, parasitological analysis was also performed. Microscopic examination of fecal samples revealed that 12 out of 21 samples (57.14%) were positive for intestinal parasites belonging to the genus *Blastocystis*, while 9 samples (42.86%) were

negative. Despite the relatively high positivity rate, none of the workers reported gastrointestinal symptoms such as diarrhea, nausea, vomiting, or abdominal discomfort. This supports the hypothesis that *Blastocystis* infection is often asymptomatic and may represent a commensal colonization rather than a pathogenic infection in healthy individuals (Deng et al, 2021). *Blastocystis* is a common gastrointestinal protist in humans and animals, is increasingly seen as a commensal gut microbiome member, although its clinical significance is uncertain. Its role in gut health is debated; it may thrive in healthy guts without directly supporting them. While studies suggest a link between *Blastocystis* and gut microbiome (Aykur et al., 2024). An asymptomatic *Blastocystis* infection can become symptomatic, particularly due to a compromised immune system or genetic changes in the parasite (Mohamed et al., 2017), potentially causing gastrointestinal symtoms such as diarrhea, abdominal pain, bloating, nausea, and vomiting or extraintestinal symptoms include skin rashes (urticaria) and joint pain (Dagci et al., 2014).

The discrepancy between the high detection rate and the absence of clinical symptoms in waste collectors suggests a potential tolerance or adaptation of the host immune system to chronic exposure. Since *Blastocystis* transmission occurs primarily via the fecal–oral route (Pawelec-P˛eciak et al, 2025), the infection among these waste collectors is likely linked to occupational exposure to contaminated materials or suboptimal hygiene practices, particularly inconsistent handwashing with soap after defecation (observed in 23.81% of waste collectors) and the presence of dirty fingernails in nearly half of the waste collectors. Several studies have reported similar findings, indicating that sanitation workers and individuals with frequent environmental exposure to waste are at increased risk of *Blastocystis* colonization (Belleza et al., 2015; Hassanein et al., 2019). However, the clinical significance of *Blastocystis* remains controversial, as some subtypes are associated with disease while others may coexist harmlessly with the host gut microbiota (Aykur et al, 2024).

The observed improvement in knowledge and hygiene behavior confirms the success of the educational intervention. Using the Health Belief Model (HBM), behavioral change can be attributed to increased perceived susceptibility, perceived benefits, and effective cues to action during educational sessions (Raman et al, 2024). Participants recognized their risk of infection and the benefits of PPE and hygiene, motivating preventive actions. The detection of asymptomatic *Blastocystis* supports its commensal nature in healthy individuals. Continuous monitoring of intestinal parasite carriage, coupled with educational programs promoting hygiene and personal protective equipment (PPE) compliance, is therefore essential to minimize potential health impacts and prevent reinfection among waste management workers. The improvement in participants' awareness and use of PPE observed in this program is consistent with previous studies showing that targeted health education and training can effectively enhance safety behavior among waste handlers and sanitation workers (Yeon & Shin, 2020). The results reinforce the importance of continuous, context-specific education as a practical approach to reducing occupational health risks in similar communities.

In summary, the findings of this community service program highlight the importance of combining health education with practical examinations to achieve sustainable behavioral change among waste collectors. The positive outcomes observed in this study emphasize that continuous health education and monitoring are essential to maintain safe practices and prevent future infections, leading to the following conclusions.

Conclusion

This community service program improved the health and safety of waste collectors by combining education, health promotion, and health examinations. Interventions included training on PPE, promoting CHLB, and conducting stool examinations for intestinal parasites. Results showed enhanced PPE awareness and usage, demonstrating the effectiveness of educational

initiatives. The detection of Blastocystis in asymptomatic waste collectors highlights the necessity for continuous health monitoring and education in high-risk communities. Ongoing implementation of such programs supports infection risk reduction and contributes to Sustainable Development Goal 3 — Good Health and Well-Being.

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Conflicts of Interest

The authors declare no conflict of interest.

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