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Improving Public and Environmental Health Through Clean and Healthy Living Behavior Education and Bacterial Examination

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ABSTRACT

A major problem frequently faced by the public is clean and healthy living behaviors (PHBS). According to the Indonesian Ministry of Health in 2014, health can be achieved by changing unhealthy behaviors into healthy ones and creating a health-supportive environment. Effective measures include handwashing with soap and environmental inspections. This activity aims to increase public awareness of the importance of clean and healthy living behavior (PHBS), while also introducing the dangers of microbiological contamination that can occur on hands and water. Community service activities are carried out through the stages of pre-test, education, post-test, sampling, and sample examination. Of the 34 respondents, the majority experienced a significant reduction in hand bacteria, with 21 showing a reduction in hand bacteria of more than 70% and some reaching 99–100%. Well water examinations at several public facilities for Pekingan village residents showed the presence of Coliform bacteria exceeding the safe limits according to the Ministry of Health Regulation, indicating that the water is not suitable for direct consumption due to possible contamination by domestic waste, septic tank seepage, or poor environmental sanitation. The conclusion of this Community Service activity is that there is an increase in respondents' understanding and an increase in their ability to practice proper handwashing. Water sanitation in public facilities needs to be considered and improved because it should not be used for consumption.

Keywords: PHBS; Washing hand; Education; Coliform Bacteria; Well water

INTRODUCTION

The main problem frequently faced by the community is clean and healthy living behavior (PHBS). The implementation of PHBS was actually introduced by the Ministry of Health in 1996. However, implementation remains low. Therefore, the government issued Regulation of the Minister of Health of the Republic of Indonesia Number 2269/MENKES/PER/XI/2011, which contains guidelines for implementing PHBS. The guidebook explains that the level of public health is influenced by three main factors, namely environmental conditions, community behavior, and the health service system. Research shows that the low level of public health is mainly caused by an unhealthy environment and behavior that does not support health (Yuliarti & Wulandari, 2021).

According to the Indonesian Ministry of Health (2014), Health can be achieved by changing unhealthy behaviors into healthy ones and creating a health-supportive environment. One effective measure is handwashing with soap (CTPS). For CTPS to become a habit, support from all parties is needed. Washing hands with soap and running water has been proven to remove dirt and dust, and reduce the number of disease-causing microorganisms such as viruses, bacteria, and

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parasites. (Zuliyanti & Rachmawati, 2020). Using soap is crucial because it removes dirt and microorganisms from your hands. In addition to soap, the use of alcohol-based antiseptics is becoming increasingly popular. The most effective alcohol concentration as an antiseptic is 60–80%, as it has rapid bactericidal properties against gram-positive and gram-negative bacteria, some fungi, and non-enveloped viruses. The mechanism of action of alcohol is by denaturing proteins and damaging the cytoplasmic membrane in bacteria (Ratmaja et al., 2023).

Water is one of the most vulnerable media for disease transmission, so water consumption must comply with established standards. Many people still use groundwater, well water, or refilled water as their drinking water source. According to the Decree of the Minister of Health of the Republic of Indonesia Number 907/MenKes/SK/VII/2002 concerning water quality requirements and supervision, the permissible Most Probable Number (MPN) value is 0 per 100 ml of the tested water sample (Rusidah et al., 2021). The MPN test itself is conducted to assess the quality of various types of water, such as drinking water, clean water, surface water, public bath water, swimming pool water, and even PDAM water. The presence of coliform bacteria in food or beverages indicates the presence of enteropathogenic or toxigenic microorganisms that can be harmful to health (Fadila et al., 2023). Therefore, the public needs to understand the importance of knowing the quality of water that is suitable for consumption (Nurjannah et al., 2018).

Based on data from the March 2023 Susenas (National Socioeconomic Survey), the morbidity rate for Mojokerto Regency residents in 2023 was 11.36 percent. This means that for every 1,000 residents of Mojokerto Regency, approximately 114 residents experienced serious health problems that disrupted daily activities such as work, school, and other activities within the past month. The morbidity rate in Mojokerto Regency decreased by 2.8 percent in 2023 compared to the previous year. One factor influencing morbidity is Clean and Healthy Living Behavior (PHBS). The decrease in morbidity rates in 2023 shows that the people of Mojokerto Regency have implemented better PHBS (Badan Pusat Statistik Kabupaten Mojokerto, 2024).

The Community Service Program (PKM) program targets residents of Sumbersono Village, Mojokerto Regency. Sumbersono Village is a village in Dlanggu District, Mojokerto Regency. The northern boundary of Sumbersono Village borders Jrambe Village, the east with Mojokarang Village, the south with Segunung Village, and the west with Sambilawang Village. Village potential profile data on the livelihoods of the Sumbersono Village community shows that most of the residents are farmers/farm laborers/laborers/private sector. Meanwhile, a small portion are civil servants, traders, village officials, police/military personnel, and retirees. The number of elderly residents is recorded at 478 people. Sumbersono Village has four hamlets: Sumbersono Hamlet, Sumbersari Hamlet, Pekingan Hamlet, and Selorejo Hamlet. Based on information obtained from the village head and local residents, most villagers use well water to meet their daily water needs. Furthermore, there is no regular collection system for household waste, so residents burn the waste they produce every day.

LITERATURE OR CONCEPTUAL REVIEW

Clean and healthy living behaviors (PHBS), particularly proper handwashing, are the most effective way to prevent infectious diseases. Handwashing with soap or an alcohol-based antiseptic (60–80%) has been scientifically proven to rapidly reduce the number of microorganisms on hands through protein denaturation and cell membrane damage (Lo et al., 2022). Its effectiveness depends on technique and duration, with the WHO six-step method lasting 20–30 seconds giving the best results (Price et al., 2022). PHBS education accompanied by hands-on practice has been shown to increase community knowledge and adherence to hygiene behaviors. Studies show that behavior-based and participatory interventions are more effective than one-way counseling (Prasad et al., 2025).

Water quality is also a crucial factor in maintaining public health. According to Indonesian Minister of Health Regulation No. 492 of 2010, the maximum limit for total coliform in drinking

water is 0 MPN/100 mL. However, numerous studies have shown that community well water remains contaminated due to the proximity of septic tanks and poor environmental sanitation. (Rahman & Iqbal, 2025). Finding well water with an MPN value > 0 MPN/100 mL indicates the need for improved sanitation and water disinfection before use.

MATERIALS AND METHODS

The community service activity was carried out on July 11, 2025, at the Pekingan Hamlet Hall, Sumbersono Village, Mojokerto Regency, targeting adults and the elderly. The activity stages included a pre-test, PHBS educational counseling, a post-test, bacterial sampling on hands, and examination of well water bacteria. Education was provided using posters and leaflets containing handwashing steps according to WHO standards using soap and 70% alcohol. Hand bacterial samples were taken using sterile transport swabs before and after washing hands with 70% alcohol, then stored in an ice box and examined at the Microbiology Laboratory of Nahdlatul Ulama University, Surabaya. Hand bacterial examination was carried out using the total plate count method.

Well water samples were taken from five different locations (prayer rooms and residents' homes) using 250 mL sterile glass bottles and stored in a cool box at ±4°C. The examination was conducted using the Most Probable Number (MPN) method to detect Coliform. The MPN value was compared with the drinking water quality standard according to the Indonesian Minister of Health Decree No. 907/MENKES/SK/VII/2002, which is ≤ 0 MPN/100 mL

RESULTS AND DISCUSSION

Participants in this Community Service program were residents of Pekingan Hamlet, Sumbersono Village, Mojokerto Regency. The data on respondents who participated in this activity is listed in the following table 1:

Table 1. Age and Gender Distribution Data of Respondents to Community Service Activities

No	Cathagories	Frequency
1	Gender	
	Male	4
	Female	30
	Total	**34**
2	Age	
	Age between 30-50 years old	8
	Age between 51-70 years old	21
	Age between 71-80 years old	5
	Total	**34**

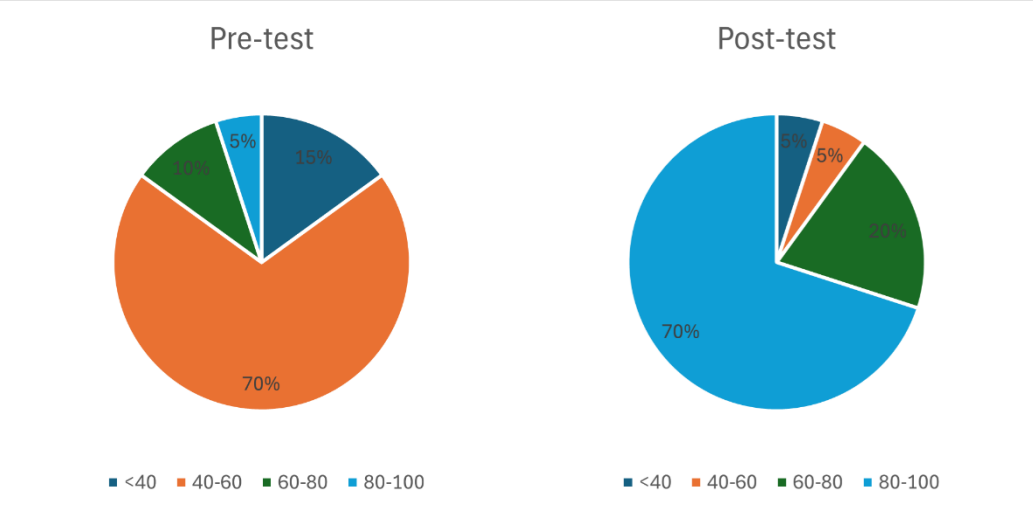

Figure 1. PHBS Education Score Results in Pre-test and Post-test

For evaluation of education activity, respondent were facing five question to answer before education of PHBS begins and after education activity. Figure 1 illustrate the evaluation on education of PHBS. Activity then continue to hand bacterial examination. Examination proceed 2 step which are taking hand bacterial sample before and after hand washing using alcohol. Bacterial reduction were illustrated in figure 2. For public facilities sanitation were checked on water sanitation using MPN methods. The result were tabulated in table 2.

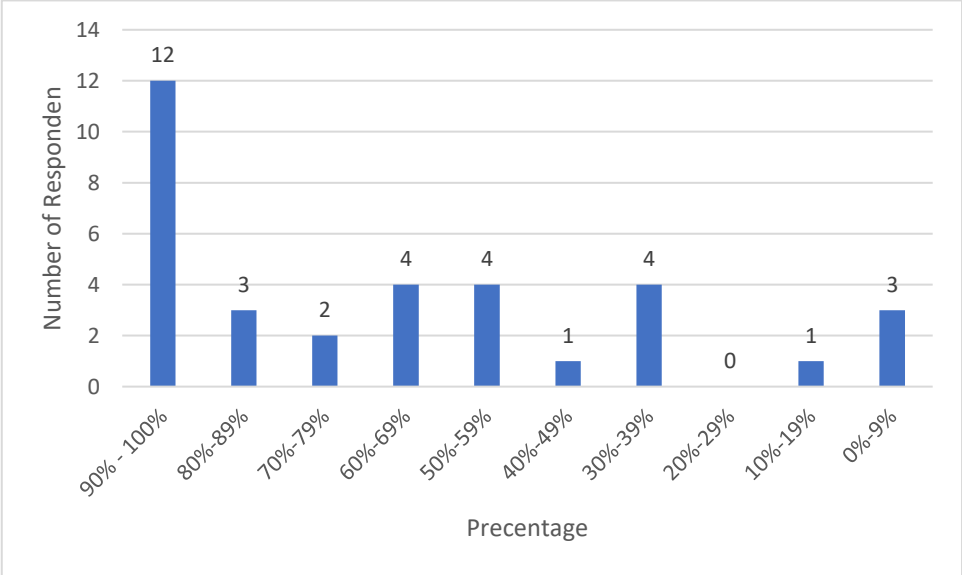

Figure 2. Percentage of hand bacteria reduction

Tabel 2. Results of Water Bacteria Testing in Village Public Facilities

No	Sample Identity	Result (MPN/ml)	Reference Value (MPN/ml)
1	Public facilities 1	0,03	0 (Permenkes No. 492/Menkes/Per/IV/2010)
2	Public facilities 2	0,03	
3	Public facilities 3	2,4	
4	Public facilities 4	0,21	
5	Public facilities 5	0,03	

DISCUSSION

This Community Service activity began with educational outreach to remind the public about the importance of maintaining a healthy environment and personal health. The educational material covered Clean and Healthy Living Behaviors (PHBS) as part of health education. Through this activity, health information can be conveyed directly to the community (Hartaty & Menga, 2022).

Prior to conducting outreach, a preparatory phase is carried out as an initial step to optimize the delivery of material to target participants. The selection of outreach media is crucial, as the type of media used can influence public interest in the topic being discussed. For this activity, we chose to use posters featuring various illustrations. This medium is expected to easily attract participants' attention to the material presented (Made et al., 2023).

The PHBS education program began with a question-and-answer session about daily activities related to PHBS, such as proper handwashing techniques. Handwashing is the act of mechanically removing dirt from both hands using soap and running water. Unclean hands can increase the potential for microorganisms to enter the body, which can trigger various diseases, including worms, diarrhea, acute respiratory infections (ARI), and others (Zuliyanti & Rachmawati, 2020).

The community service program was attended by adults and elderly residents of Sumbersono Village, Mojokerto Regency. The program also included free hand and well water bacterial tests. The outreach program, which was held in July, went smoothly and successfully, with 34 adults and elderly residents participating.

Figure 3. Activity Documentation of Education and Hand Bacteria Examination

The results of the community service, which included bacterial examinations on hands and well water, as well as PHBS education for residents of Pekingan Hamlet, Sumbersono Village, covered two aspects: the level of knowledge of residents with a pre-test and post-test, and the results of the examinations. The pre-test and post-test each consisted of five questions designed to assess residents' understanding before and after receiving the education.

The pre-test results showed that the majority of respondents (70%) were in the 40–60 score category, 15% in the <40 score category, 10% in the 60–80 score category, and only 5% achieved a score of 80–100. This indicates that participants' initial understanding of PHBS, especially related to handwashing practices, was still relatively low and needed to be improved. After the counseling activities, the post-test results showed significant changes. As many as 70% of respondents were in

the 80–100 score category, 20% in the 60–80 score category, and 5% each in the 40–60 and <40 scores. Overall, the number of respondents with good knowledge (60–80 and 80–100 score categories) increased from 15% in the pre-test to 90% in the post-test, meaning there was an increase of 75%. This increase illustrates that the educational activities provided were able to effectively increase participants' knowledge of PHBS.

The bacterial examination on hands began with sampling before and after handwashing with 70% alcohol. Prior to the sampling stage, respondents were educated on proper handwashing techniques according to WHO standards. Samples were collected using a transport swab, which was swabbed on the palms and between the fingers. The samples were then tightly sealed and placed in an ice box for further analysis in the laboratory (Kartika et al., 2017). Based on the results of calculating the number of bacterial colonies before and after handwashing, the percentage reduction varied among respondents. This difference may be influenced by several factors, such as the dominant hand used when scrubbing, the strength of the scrub, and differences in handwashing techniques. Vigorous scrubbing tends to increase the reduction in bacterial counts, while weak or uneven scrubbing results in a smaller reduction (Amin et al., 2023).

Of the 34 respondents examined, most showed a significant reduction in the number of bacterial colonies, indicating that the handwashing steps using alcohol were carried out correctly. A total of 12 respondents experienced a reduction in hand bacteria of more than 90%, 3 respondents showed a reduction of 80-89%, 2 respondents showed a reduction in hand bacteria of up to 70-79%, 4 respondents showed a reduction in hand bacteria of up to 60-69%. These results indicate the maximum effectiveness of using alcohol in reducing the number of bacteria. However, there were also respondents who experienced a reduction of less than 50%, and some even experienced no reduction at all (0%). The other two respondents showed very low reductions (4% and 7%), which were likely caused by improper handwashing techniques or washing durations that were too short.

This situation demonstrates differences in handwashing effectiveness between individuals and underscores the importance of education on proper handwashing techniques, especially for the elderly, who dominated the activity's participants. This education is expected to raise awareness of the importance of hand hygiene and reduce the risk of contact-based disease transmission. Overall, this activity demonstrates that proper handwashing practices are effective in reducing bacterial counts on hands.

In addition to hand bacteria testing, the team also tested well water for bacteria. Samples were taken from several locations, including wells in public facilities such as prayer rooms and wells owned by residents. These tests aim to encourage greater public awareness of the quality of the water they use and foster habits of maintaining environmental sanitation, ensuring a clean, healthy village free from the risk of waterborne diseases.

Microbiological testing of well water is conducted using the MPN (Most Probable Number) method. MPN testing can be performed to check the quality of drinking water, clean water, body water, public bath water, swimming pool water, and to check the number of germs in PDAM water. The MPN method is carried out in three stages: a presumptive test, a confirmatory test, and a reinforcement test. Based on the Decree of the Minister of Health of the Republic of Indonesia No. 907/MenKes/SK/VII/2002 concerning the requirements and supervision of well water quality, where the Most Probable Number (MPN) value is 0/100 ml of the analyzed water sample. (Nurjannah et al., 2018).

The results of water tests at public facilities are summarized in Table 2. Test results indicate that all samples contained Coliform bacteria at varying levels, all exceeding the maximum allowable limit according to the Ministry of Health Regulation (0 MPN/ml). Therefore, water from all sampling points was declared unfit for direct consumption without treatment. The presence of Coliform indicates possible contamination from domestic waste, septic tank seepage, or poor environmental sanitation. Pathogenic bacteria such as coliform bacteria can cause microbiological contamination of clean water. If humans accidentally consume contaminated water, it can have a negative impact on their health. Microbiological contamination of water can be a primary means of transmitting diseases such as skin diseases, eye diseases, and stomach ailments. Therefore, it is crucial to use clean water

in all daily activities to protect the body from contracting diseases caused by pathogenic bacteria (Putri Windari & Purna, 2021).

Therefore, when delivering the results to the heads of the hamlets and residents who own well water samples, the community service team provided education on the importance of maintaining the cleanliness of water sources and environmental sanitation around the wells, as well as safe water treatment methods before using it for daily needs, such as suggesting that water from these sources be boiled first before consumption.

DISCUSSION

Bacterial examination of hands in Pekingan Hamlet, Sumbersono Village, showed that handwashing with 70% alcohol was effective in significantly reducing the number of bacterial colonies in the majority of respondents. The education provided also increased the percentage of respondents' knowledge by 75%, indicating its effectiveness in improving understanding of PHBS and correct handwashing techniques. Well water examinations showed that all samples contained Coliform bacteria exceeding the safe limit set by the Ministry of Health, requiring treatment before use. These findings demonstrate the importance of ongoing education on hand hygiene and environmental sanitation to prevent water- and hand-related diseases.

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Conflict of Interests

The authors declared that no potential conflicts of interest with respect to the authorship and publication of this article.

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