



Knowledge, Attitude, and Behavior of Disaster Volunteers towards Preventing Asbestos Exposure in Disasters

Anna Suraya^{2*}, Charles Putra Ricardo¹

¹⁻²Occupational Health and Safety Study Program, Faculty of Health Sciences and Technology, Binawan University, Jakarta, Indonesia

anna.suraya@binawan.ac.id

Abstract. Asbestos is a material commonly used in various sectors, particularly in building construction. However, asbestos exposure poses serious health risks, including lung diseases, mesothelioma, and cancer. This study aims to assess disaster volunteers' knowledge, attitudes, and behaviors regarding asbestos exposure prevention during disaster response. The study population includes all active disaster volunteers or individuals who have previously participated in disaster management efforts in Indonesia. The sampling technique employed accidental sampling, yielding a total of 500 volunteer respondents. Data were analyzed using univariate analysis. The majority of respondents were male (73%), aged under 30 years (58.2%), held a college degree (56%), and did not possess a volunteer certification (63.4%). Most respondents (91%) were aware that asbestos is commonly used in buildings and infrastructure. However, only 60% recognized asbestos as a hazardous material capable of causing severe lung diseases. More than 60% of respondents felt prepared to protect themselves from asbestos exposure during disasters. However, 12.5% expressed uncertainty, and 24% felt unprepared. Regarding the use of personal protective equipment (PPE), 42% reported always using appropriate PPE, 12% occasionally used PPE, and 45% never used PPE when interacting with materials potentially containing asbestos. These findings highlight the urgent need for a structured asbestos awareness and prevention program for disaster relief volunteers in Indonesia. Given the limited knowledge of asbestos hazards and inconsistent preventive behaviors, volunteers remain at significant risk of exposure, which may lead to long-term health consequences. To mitigate these risks, comprehensive training, improved access to PPE, and regular health risk assessments are essential.

Keywords: knowledge, attitudes, behavior, prevention of asbestos exposure.

1 Introduction

Indonesia is an archipelago consisting of thousands of islands stretching from Sabang in the west to Merauke in the east. The archipelago is located at the intersection of four tectonic plates: the Eurasian, Indo-Australian, Pacific, and Philippine Sea plates [1]. The archipelago is famous for its beauty because it is located near the sea and mountains, but it is also known to be very vulnerable to natural disasters [2]. Preparedness in facing disasters is a must to minimize the impact that occurs when disasters strike, because disasters often cause damage to buildings, homes and other infrastructure.

One of the hazardous materials in building collapse is asbestos. Asbestos is a natural mineral that has been used for many years in various industries because of its insulating properties [3]. There are two categories of asbestos fibers based on their shape and mineralogical characteristics. Serpentine fibers, of which chrysotile is the principal commercial type, are long, curly strands, while amphibole fibers (crocidolite, amosite, tremolite) are long, straight, and needle-like in structure [4–6].

Asbestos is a material that is often used in various sectors, including in building construction. Although it is known that exposure to asbestos can cause serious health problems, such as lung disease, mesothelioma, and cancer, many people are still unaware of the dangers of this material [6–10]. In disaster situations, such as earthquakes, hurricanes, or floods, damaged buildings often contain asbestos material that is destroyed and dispersed into the air. This condition increases the risk of asbestos exposure for volunteers involved in post-disaster rescue and recovery efforts [11]. During post-disaster clean-up operations, there is a risk of releasing large amounts of asbestos fibers, especially if heavy equipment such as excavators are used to demolish damaged structures and load debris into vehicles [11].

In the last decade, Indonesia became in the top five countries that processed the largest asbestos raw materials in the world. Along with the increasing number of countries that prohibit the import and use of asbestos such as countries in Europe, the import and use of asbestos in Indonesia has actually increased sharply over the past two decades, where more than 100,000 tons of asbestos were imported annually between 2010-2019 [4]. With the fact that asbestos roofs are still the favorite roofs of more than 13% of Indonesian households and asbestos-containing goods are also found in various consumer goods, the risk of people being exposed to asbestos is getting bigger. Indonesia's position on the ring of fire of disasters increases the risk many times over. Damage to asbestos-containing products that occurs during a disaster has the potential to release asbestos dust into the air from its bonds, then inhaled by people around it, and increase the risk of developing diseases due to asbestos[12,13].

In a disaster situation, one of the important and significant roles in handling a disaster is the disaster volunteer team. Volunteers can be simply defined as someone who volunteers their time to provide goodness to others without expecting financial or monetary gain. A volunteer still benefits from their activities because they feel a positive influence on their well-being, such as self-satisfaction and social interaction with the community [14–16]. In carrying out their duties, volunteers must have

sufficient provisions to protect themselves, the community, and the environment from various hazards including asbestos exposure. This study aims to evaluate the level of knowledge, attitudes, and behavior of disaster volunteers in preventing asbestos exposure, so that the results are expected to be used as a basis for developing training programs and occupational safety policies for disaster volunteers on duty in the field.

2 Method

This study employed a quantitative descriptive method and was conducted from June to August 2024. The study population consisted of disaster volunteers who were either actively engaged or had previously participated in disaster management efforts in Indonesia. A non-probability sampling method, specifically Accidental Sampling, was utilized, in which participants were selected based on spontaneity and availability, provided they met the inclusion criteria. The required sample size was determined using the Raosoft Sample Size Calculator, applying a 95% confidence level, a 5% margin of error, and an assumed 50% response distribution. A total of 500 respondents met the eligibility criteria, which included being active or former disaster volunteers willing to complete the questionnaire. Volunteers who declined to complete the questionnaire were excluded from the study.

The research questionnaire comprised multiple sections, including items assessing volunteer characteristics as well as core variables related to knowledge, attitudes, and behaviors concerning asbestos exposure prevention. The knowledge domain included questions regarding the use of asbestos-containing materials (ACM), asbestos hazards, methods for identifying ACM, and previous exposure to asbestos-related information. The attitude domain assessed respondents' readiness to protect themselves when working with ACM and their perceived need for capacity-building initiatives to enhance health protection. The behavioral domain was measured through questions on personal protective equipment (PPE) usage, avoidance of asbestos contact, personal hygiene practices (such as handwashing and body cleansing), and engagement in risk assessment procedures.

Data collection was conducted through online surveys, with respondents completing Google Forms circulated via social media platforms. Data were analyzed using univariate analysis to describe the distribution of key study variables. Ethical approval for this study was obtained from the Ethics Committee of Universitas Binawan.

3 Results

A total of 500 respondents was obtained, the majority of whom were male (86%) and aged between 20-30 years (48%). The majority of volunteers had a bachelor's degree. However only 36.6% volunteers hold a certificate as a volunteers (Table 1).

Table 1. Respondent Characteristics

Variables	Frequency	Percentage (%)
Gender		
Man	365	73.0
Woman	135	27.0
Age (years)		
<30	291	58.2
30-50	147	29.4
>50	62	12.4
Education		
Senior High School	180	36.0
S1	280	56.0
S2	90	18.0
Certificate as a volunteer		
Yes	183	36.6
No	317	63.4

3.1 Volunteers' Knowledge of Asbestos Exposure

The disaster volunteer knowledge questionnaire consisted of six questions designed to assess volunteers' understanding of asbestos exposure, awareness of asbestos-related risks during disasters, and ability to identify asbestos-containing materials (ACMs). The majority of volunteers (44.5%) demonstrated a good understanding of asbestos exposure, while 27.5% had a moderate level of knowledge, and 28.0% had limited knowledge.

As shown in Table 2, the majority of respondents (91%) were aware that asbestos is commonly used in buildings and infrastructure. However, only 60% recognized asbestos as a hazardous material that can cause serious lung diseases. Furthermore, only 31% of volunteers had received information regarding the dangers of asbestos, and 30.5% were aware of how to identify asbestos-containing materials. With regard to occupational exposure, only 51.8% of volunteers understood that residential and workplace environments could serve as potential sources of asbestos exposure.

Table 2. Volunteers' Knowledge of Asbestos Exposure

No.	Question	Answer	
		Yes Amount (%)	No Amount (%)
1	Is asbestos a material that is often used in infrastructure buildings?	455 (91.0)	45 (9.0)
2	Is asbestos dangerous for health?	300 (60.0)	200 (40.0)
3	Can asbestos cause serious lung disease if inhaled in large amounts?	310(62.8)	190 (37.2)
4	Have you ever received information regarding the dangers of asbestos in disasters?	155 (31.0)	345 (69.0)
5	Do you know how to identify materials containing asbestos?	155 (31.0)	345 (69.0)
6	Does exposure to asbestos in the home and workplace increase the risk of developing asbestos-related diseases?	259 (51.8)	241 (48.2)

3.2 Volunteers' Attitudes About Asbestos Exposure

The disaster volunteer attitude questionnaire comprised five questions designed to assess attitudes related to readiness to protect oneself from asbestos exposure, willingness to improve health, concerns about asbestos exposure, and the desire to receive training on asbestos exposure prevention. The majority of volunteers (64.6%) exhibited a positive attitude toward asbestos exposure, while 25.2% remained neutral, and 10.2% held a negative attitude.

A total of 315 respondents (63%) reported feeling ready to protect themselves from asbestos exposure during disaster volunteer activities. However, 12.5% were uncertain, and 24% felt unprepared to protect themselves from asbestos exposure. Regarding the belief that asbestos exposure prevention can improve health, 65.5% of volunteers agreed, while 24% were undecided, and 8.2% disagreed. Similarly, 67% of volunteers expressed concerns about the health risks associated with asbestos exposure, while 24.8% were uncertain, and 10.5% disagreed. These concerns were reflected in volunteers' perceptions, as 66% agreed that asbestos has a negative impact on health, 25% were undecided, and 9% disagreed. Furthermore, 76% of volunteers expressed a need for additional training on asbestos handling, 24% were uncertain, and notably, no respondents disagreed with the need for further training.

Table 3. Disaster Volunteers' Attitudes Regarding Asbestos Exposure

No.	Statement	Response		
		Agree Number (%)	Undecided Number (%)	Disagree Number (%)
1	I am ready to protect myself from asbestos exposure during disaster relief activities.	315(63)	63 (12.5)	122(24.5)
2	Prevention of asbestos exposure can improve health care	328 (65.5)	120 (24.0)	52 (10.5)
3	I am concerned about the health risks of asbestos exposure.	335 (67.0)	124 (24.8)	41 (8.2)
4	I believe asbestos exposure can have negative impacts on health.	330 (66.0)	125 (25.0)	45 (9.0)
5	Volunteers need to receive further training on asbestos handling.	380 (76.0)	120 (24.0)	0 (0.0)

3.3 Volunteer Behavior Related to Asbestos Exposure

The disaster volunteer behavior questionnaire comprised five questions assessing practices related to the use of personal protective equipment (PPE) to prevent asbestos exposure, avoiding direct contact with asbestos-containing materials (ACMs), handwashing and personal hygiene, sharing knowledge about asbestos hazards, and evaluating the risk of asbestos exposure.

Overall, the findings indicate 45.5% volunteers have never implemented asbestos exposure prevention measures during their activities, 40.5% have always implemented, and the rest have not consistently implemented asbestos exposure prevention measures during their activities. Responses related to PPE usage revealed that 42% of respondents always used appropriate PPE when interacting with materials that may contain asbestos, while 12% reported using PPE occasionally, and 45% never used PPE.

Regarding avoidance of direct contact with ACMs, 38.5% of respondents always avoided contact, 21% occasionally avoided it, and 40.5% never took precautionary measures. The practice of handwashing and personal hygiene after potential asbestos exposure was consistently followed by 50% of respondents, while 7.5% occasionally engaged in this practice, and 42.5% never did so. Sharing information about asbestos hazards was reported by 35.5% of respondents as a regular practice, while 15% occasionally shared such information, and 49% never did. Finally, risk evaluation related to asbestos exposure was consistently conducted by 36% of respondents, while 15.5% occasionally engaged in risk assessment, and 48.5% never performed any evaluation.

Table 4. Asbestos Exposure Prevention Behaviors

No.	Statement	Response		
		Always Amount (%)	Sometimes Amount (%)	Never Amount (%)
1	I use Personal Protective Equipment (PPE) when interacting with materials that potentially contain asbestos.	213 (42.5)	62 (12.5)	225 (45.0)
2	I tend to avoid direct contact with materials suspected of containing asbestos.	192 (38.5)	105 (21.0)	203 (40.5)
3	I wash my hands and clean my body after being exposed to asbestos material.	250 (50.0)	38 (7.5)	212 (42.5)
4	I share knowledge about asbestos exposure with other volunteers.	177 (35.5)	78 (15.5)	245 (49.0)
5	I conducted a risk evaluation to determine whether there was a potential for asbestos exposure in the environment.	180 (36.0)	78 (15.5)	242 (48.5)

4 Discussion

Indonesia's geographic and tectonic position renders it one of the most disaster-prone nations in the world. Situated along the Pacific Ring of Fire and intersected by multiple tectonic plates, the country experiences frequent earthquakes, volcanic eruptions, and other natural hazards. These events not only pose direct threats to human life and infrastructure but also carry hidden risks, including exposure to hazardous materials released during structural collapse. One such material of critical concern is asbestos, a mineral once widely used in construction for its fire resistance and insulation properties, but now globally recognized as a carcinogen responsible for diseases such as mesothelioma, asbestosis, and lung cancer.

This study provides vital insight into the knowledge, attitudes, and behaviors (KAB) of disaster volunteers in Indonesia regarding asbestos exposure. As volunteers are often among the first to enter damaged buildings and initiate recovery efforts following disasters, their awareness and protective practices play a critical role in mitigating secondary health risks, both for themselves and the communities they serve

The study involved a sample of 500 respondents, primarily male (73%) and predominantly young adults under 30 years (58.2%). This demographic composition is significant, as younger populations are often involved in disaster relief and volunteer activities, aligning with findings that younger adults tend to engage in such high-intensity volunteerism[17]. Additionally, most respondents held a bachelor's degree

(56%), reflecting a trend where higher education levels correlate with increased volunteer participation[18].

4.1 Knowledge Gaps Among Volunteers

Data from the survey indicates that most respondents (91%) were aware that asbestos is commonly used in infrastructure. However, only 60% understood that asbestos poses a serious health risk, with 63% recognizing its potential to cause lung disease if inhaled. This limited awareness is concerning, given the extensive evidence linking asbestos exposure to health complications such as asbestosis and lung cancer[8,10,19–21]. Alarming, only 31% had received information on asbestos risks, and an equal percentage (30.5%) knew how to identify asbestos-containing materials. Furthermore, only 52% understood that both household and occupational environments could be sources of asbestos exposure. This finding suggests that many volunteers may underestimate the risk in settings outside of heavy industry, despite the widespread use of asbestos roofing, insulation, and pipe materials in Indonesian homes and schools. This gap in knowledge could hinder effective risk management during volunteer activities, emphasizing the need for targeted asbestos awareness and education programs, particularly for volunteers in disaster settings[22].

4.2 Attitudes Indicate Receptiveness to Training

The survey on attitudes revealed a moderate readiness among respondents to protect themselves from asbestos exposure, with 63% expressing preparedness. However, 24% felt unprepared, indicating a lack of confidence or resources to manage such risks. Most respondents (65.5%) believed that asbestos exposure prevention could enhance health protection, aligning with studies highlighting the importance of preventive measures in occupational settings [22,23]^{22,23}. Furthermore, a majority (67%) expressed concern over asbestos exposure risks, which is supported by their belief (66%) in its negative health impacts. Notably, 76% agreed that additional training on asbestos handling was necessary, highlighting a strong willingness among volunteers to improve their preparedness through further education.

4.3 Behavior Patterns Show Inconsistent Implementation

In terms of preventive practices, the survey showed mixed results. Only 42.5% consistently used personal protective equipment (PPE) when interacting with potentially asbestos-containing materials, while 45% never used PPE, indicating a significant gap in preventive behavior. These findings align with the Theory of Planned Behavior, which suggests that awareness and attitudes influence individuals' protective actions[25]. Additionally, only 50% reported consistently washing after asbestos exposure, an essential preventive behavior[26,27]. The data also showed limited sharing of asbestos-related knowledge among volunteers, with only 35.5% actively doing so. This lack of knowledge dissemination may affect group safety and highlights the need for a collaborative learning environment within volunteer groups. Finally, only 36% conducted risk assessments for asbestos exposure, suggesting an area where

procedural improvements could be made to enhance overall safety during volunteer activities.

4.4 Implications for Policy and Training

The findings underscore a clear need for structured intervention at multiple levels. First and foremost, asbestos awareness and handling must be integrated into national and local disaster preparedness training programs. Training modules should cover the identification of ACMs, the health risks of asbestos, correct use of PPE, decontamination procedures, and safe demolition techniques [24]. Given that only 36.6% of volunteers were formally certified, the establishment of standardized training and certification systems that incorporate hazardous material management is essential.

Furthermore, disaster management agencies should ensure that volunteers are equipped with adequate PPE and that field protocols mandate risk assessments before entering potentially hazardous environments. Risk communication materials—posters, infographics, and mobile app alerts—could be employed during deployments to remind and reinforce safe practices .

In the longer term, government policies must address the continued import and domestic use of asbestos. Indonesia remains one of the world's top asbestos consumers, and disaster situations only magnify the public health risks. There is an urgent need to revise building codes, promote asbestos alternatives, and begin a phased ban on the use of asbestos products. Disaster response and reconstruction policies should mandate asbestos-safe procedures in debris clearance, disposal, and rebuilding efforts.

4.5 Limitations and Future Research

This study has several limitations. The use of non-probability sampling may limit generalizability, as respondents were selected based on availability and willingness to participate. Additionally, self-reported behavior may not fully reflect actual practice due to social desirability bias. Nevertheless, the findings provide a critical snapshot of current conditions and can inform targeted interventions.

Future research should explore qualitative aspects of volunteer experiences, motivations, and barriers to safe behavior. It would also be beneficial to conduct longitudinal studies examining the effectiveness of training programs over time and to evaluate exposure levels using environmental or biomarker-based surveillance in post-disaster zones.

5 Conclusion

The findings underscore the need for a structured asbestos awareness and prevention program for disaster relief volunteers in Indonesia. Given their limited knowledge of asbestos hazards and inconsistent preventive behaviors, volunteers remain at risk of

exposure, which may lead to long-term health consequences. To mitigate these risks, comprehensive training, improved access to PPE, and regular health risk assessments are essential. Governmental and non-governmental organizations should collaborate to develop targeted policies that address these needs, ensuring safer working environments for volunteers while aligning with global standards for asbestos management in disaster-prone areas.

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