Title: Fire Preparedness and Risk Awareness Among Islamic Boarding School Students in Indonesia: A Quantitative Citywide Survey in Jambi

Authors: Andi Subandi[1,*], Dwi Noerjoedianto[1], N Nurhusna[1], Yosi Oktarina[1], Riska Amalya Nasution[1]

1. *Faculty of Medicine and Health Sciences, Jambi University, Indonesia.*

To appear in: ***Health in Emergencies & Disasters Quarterly***

Received date: 2025/10/19

Revised date: 2025/12/29

Accepted date: 2026/01/04

First Online Published: 2026/02/02

Please cite this article as:
Subandi A, Noerjoedianto D, Nurhusna N, Oktarina Y, Amalya Nasution R. Fire Preparedness and Risk Awareness Among Islamic Boarding School Students in Indonesia: A Quantitative Citywide Survey in Jambi. Health in Emergencies & Disasters Quarterly. Forthcoming 2026. Doi: http://dx.doi.org/10.32598/hdq.2026.666.3

ABSTRACT

Background: Fire incidents in Islamic boarding schools (pesantren) in Indonesia continue to occur frequently due to structural vulnerabilities, weak safety protocols, and low student preparedness. However, empirical research specifically addressing fire readiness in pesantren remains limited.

Objective: This study examined levels of fire preparedness among pesantren students in Jambi City by assessing risk awareness, self-efficacy, participation in fire training, and involvement in the maintenance of safety facilities.

Methods: A cross-sectional quantitative survey was conducted with 1,857 students from 10 Islamic boarding schools using a 31-item Fire Preparedness Questionnaire developed for the pesantren context. Content validity was established through expert judgment (CVR and CVI), while construct validity was tested using exploratory factor analysis (EFA). Reliability was assessed using Cronbach's alpha. Data were analyzed descriptively to classify preparedness levels.

Results: Most students were classified as moderately prepared (59.1%), followed by unprepared (36.5%) and highly prepared (4.4%). Although general risk awareness was adequate, students demonstrated low confidence in managing emergencies and limited involvement in fire drills and equipment maintenance.

Conclusion: Fire preparedness in pesantren remains insufficient, particularly in practical readiness and self-efficacy. Strengthening simulation-based training, improving inspection routines, and integrating disaster education into the pesantren curriculum are urgently recommended.

Keywords: Islamic boarding schools; fire preparedness; disaster risk reduction; risk awareness; self-efficacy

Background

Fires in Islamic boarding schools (*pesantren*) pose a serious and recurring threat across Indonesia, claiming lives and causing substantial material loss each year. National disaster data indicate that only around 5% of nearly 497,576 educational facilities in Indonesia are classified as disaster-resilient, while tens of thousands of pesantren operate without standardized building safety permits, placing students at heightened risk during fire emergencies[1,2]. *Pondok Pesantren Al Mawaddah* in Ciganjur, South Jakarta, caused several students to suffer from smoke inhalation and required medical treatment, highlighting the direct health and safety consequences of inadequate fire preparedness[3]. The complexity of pesantren building structures characterized by dense occupancy, multifunctional rooms, and substandard electrical installations significantly heightens fire hazards[4]. This situation is aligned with the all-hazards theory, which highlights the importance of comprehensive preparedness for various threats, including fires, floods, and earthquakes[5]. Beyond structural vulnerabilities, pesantren face heightened risks due to limited risk awareness and the absence of a systematic safety management framework[6].

Previous studies have shown that children and adolescents, who make up the majority of pesantren residents, are among the most vulnerable groups during emergencies due to limited danger perception and insufficient response experience. Practical, hands-on safety education programs have proven effective in improving student preparedness[7]. Khan 2023 further confirms that integrating disaster education while involving teachers and firefighters can reduce school fire incidents by up to 25% across Southeast Asia[8,9]. Nevertheless, most programs primarily target formal schools, leaving pesantren outside the scope of systematic intervention.

Furthermore, Alim et al. demonstrated that a disaster education model based on local wisdom can improve community preparedness by up to 75%[10]. This approach is relevant for pesantren, where strong religious values, communal culture, and the leadership of kyai influence collective behavior. However, to date, no comprehensive study has specifically assessed fire preparedness in Indonesian pesantren. This gap indicates the urgent need for research that is not only descriptive but also capable of contributing to the development of a religious, community-based preparedness model.

Several field studies also highlight the weak implementation of safety protocols in educational institutions, including irregular fire extinguisher inspections, infrequent evacuation drills, and the lack of integration between active and passive protection systems[11,12,113]. Managerial constraints and limited budgets further aggravate these issues[14]. Thus, improvements in preparedness must address both technical components (facility improvements, functional equipment) and non-technical aspects (routine training, safety culture development, collaboration with fire departments).

Recent research emphasizes the importance of incorporating Disaster Risk Reduction (DRR) frameworks and the Sendai Framework into pesantren curricula[15,16,17]. his approach allows the integration of religious values, local traditions, and modern safety principles. Matharage et al. 2024 also argue that empowering communities is essential for sustainable preparedness[17,19] Meanwhile, Permana et al. 2025 stress that pesantren require empirical, data-driven evaluations to identify systemic weaknesses before designing effective interventions[18]. Given the increasing frequency of fires in Islamic boarding schools and the lack of comprehensive, data-based interventions, this study is both relevant and urgent. It aims to fill a critical gap in the literature

while providing empirical foundations for developing a structured, sustainable fire preparedness model tailored to the socio-religious context of pesantren. By analyzing risk awareness, self-efficacy, and student participation in safety training and facility maintenance[20,21], this research seeks to make a meaningful contribution to policy development and practical fire risk reduction in pesantren.

Methodology

1. Research Design

This study adopted a quantitative approach with a descriptive cross-sectional design, aimed at illustrating the level of fire preparedness among students in Islamic boarding schools (*pesantren*) in Jambi City. This design was selected to provide a realistic and systematic overview of preparedness conditions without manipulating variables or testing causal relationships. Descriptive quantitative designs are particularly appropriate for disaster preparedness research in educational and dormitory-based settings, where the primary objective is to identify patterns and levels of readiness rather than to infer causality[17,18,19].

2. Population and Sample

Based on data from the Ministry of Religious Affairs and supporting local records, the estimated number of Islamic boarding schools operating in Jambi City ranges from 20 to 30 units. However, discrepancies across data sources indicate that uniform and widely published official figures are not yet available. Therefore, this study defined its population as all actively operating and officially registered Islamic boarding schools within the administrative boundaries of Jambi City during the study period.

Ten Islamic boarding schools agreed to participate and met the inclusion criteria. While these ten institutions do not represent the entire estimated population, they include schools from different sub-districts, educational levels, and management types. As such, they provide substantial coverage of the operational diversity of pesantren in Jambi City, although this limitation is acknowledged and discussed in the limitations section.

n the context of descriptive quantitative research, coverage of approximately one-third to one-half of the total institutional population is considered acceptable for generating a citywide overview of preparedness conditions.

Therefore, the inclusion of ten Islamic boarding schools representing approximately 33–50% of the estimated total pesantren in Jambi City is considered sufficient for descriptive analysis, although this partial coverage remains a limitation with respect to broader generalization.

Sample and Sample Selection Method

This study involved 1,857 respondents as a sample, which was obtained through a stratified random sampling approach to ensure an equal representation of each level of education. The sample size was determined explicitly using Slovin's formula, not by assumption or approximation. Using Slovin's formula:

$$n = \frac{N}{1 + N(e)^2}$$

where *n* is the sample size, *N* is the population size, and *e* is the margin of error. With a margin of error of 5% (*e* = 0.05) and an estimated population of approximately 3,500–4,000 students across the ten participating Islamic boarding schools, the calculation yielded a minimum required sample size of approximately 1,750 respondents. The final sample consisted of 1,857 respondents, reflecting a high response rate during data collection. Thus, the sample size was statistically calculated using an established formula rather than derived from subjective estimation. A stratified random sampling technique was employed to ensure proportional representation across educational levels within the pesantren environment. Stratification was based on four educational strata:

(Table 1. Strata Four Levels of Education**)**

Islamic Primary School	570
Islamic Junior High School	698
Islamic Senior High School	552
Islamic Boarding College Student	37

Student enrollment lists were obtained from each participating pesantren through school administrators. Within each stratum, respondents were selected using simple random sampling. This approach ensured that differences in age, educational background, and boarding experience which may influence preparedness levels were adequately represented in the sample[20].

3. Research Instruments and Variables

The main instrument is a fire preparedness questionnaire tailored to the context of the pesantren, consisting of 31 statements in five dimensions: risk awareness, confidence, participation in fire drills, equipment maintenance, and attitude towards prevention. Each item was rated on a Likert scale of 1–5, with preparedness categories: Not Ready (31–72), Sufficiently Prepared (73–113), and Very Prepared (114–155), following common practices of Likert scale analysis (Fire Safety Awareness Scale, 2018; Likert Scale Examples for Surveys, 2021). The questionnaire was tested for validity and reliability (Cronbach's Alpha >0.70) through expert judgment and initial trials, referring to studies of fire preparedness in schools and educational communities[22,25].

The main instrument used in this study was a newly developed questionnaire specifically designed for the Islamic boarding school context. The development process consisted of six phases:

a. Identification of indicators from international fire safety education literature and national regulations on school fire safety.
b. Drafting of 40 initial items, which were refined to 31 items following expert review.
c. Content validity testing using the Content Validity Ratio (CVR) and Content Validity Index (CVI), involving three disaster risk reduction experts and two Islamic education experts.
d. Pilot testing with 120 students from non-sample boarding schools.
e. Construct validity testing through Exploratory Factor Analysis (EFA), which showed adequate factor structure (KMO > 0.70).
f. Reliability testing, resulting in Cronbach's alpha values >0.70 across all subscales.

4. **Data Collection Procedure**

Data collection was carried out through a structured questionnaire that was shared with the help of teachers and class coordinators. A total of 1,857 respondents from 10 Islamic boarding schools in Jambi City were analyzed, with the approval of the pesantren manager and parents for respondents under 18 years old. In addition to the structured questionnaire, non-systematic observations of fire safety facilities such as portable fire extinguishers (APAR), fire alarm systems, and evacuation routes as well as brief informal interviews with teachers and dormitory administrators were conducted. These observations and interviews were used solely to provide contextual understanding of the pesantren environment and to support the interpretation of quantitative findings. They were not intended for formal qualitative analysis and, therefore, are not reported as independent qualitative results in this study[18,23,24].

5. **Data Analysis Techniques**

Data analysis relies on descriptive statistics with the support of SPSS software version 25. This process involves calculating frequency and percentages to classify respondents' preparedness levels into three groups: Unprepared, Adequately Prepared, and Highly Prepared.

The results of the analysis are presented through a distribution table for each variable. Interpretation was carried out by referring to fire preparedness indicators in educational institutions, as well as comparing them with the results of relevant previous studies[21,25,27].

6. **Ethical Considerations**

This research obtained ethical approval from the University of Jambi, and participation was voluntary with informed consent. The research was conducted according to ethical principles, including confidentiality, voluntariness, and protection of respondents' identities. In addition, the research has received official approval from the Jambi Islamic Boarding School as well as recommendations from local education authorities.

Result

(Table 2. Distribution of Respondent Characteristics**)**

Characteristic	Group	
	Frequency	Percentage
Education Level		
Islamic Primary School	570	30.7%
Islamic Junior High School	698	37.6%
Islamic Senior High School	552	29.7%
Islamic Boarding College Student	37	2%
Gender		
Man	866	46.6%
Woman	991	53.4%
Age		
6 years	99	5.35
7 years	100	5.4%
8 years	77	4.1%
9 years	99	5.35
10 years	96	5.2%
11 years old	99	5.35
12 years	280	15.1%
13 years	488	26.3%
14 years	328	17.7%
15 years	154	8.3%
18 years old	8	0.4%
19 years old	17	0.9%
20 years	7	0.4%
21 years old	5	0.3%
Total	**1.857**	**100%**

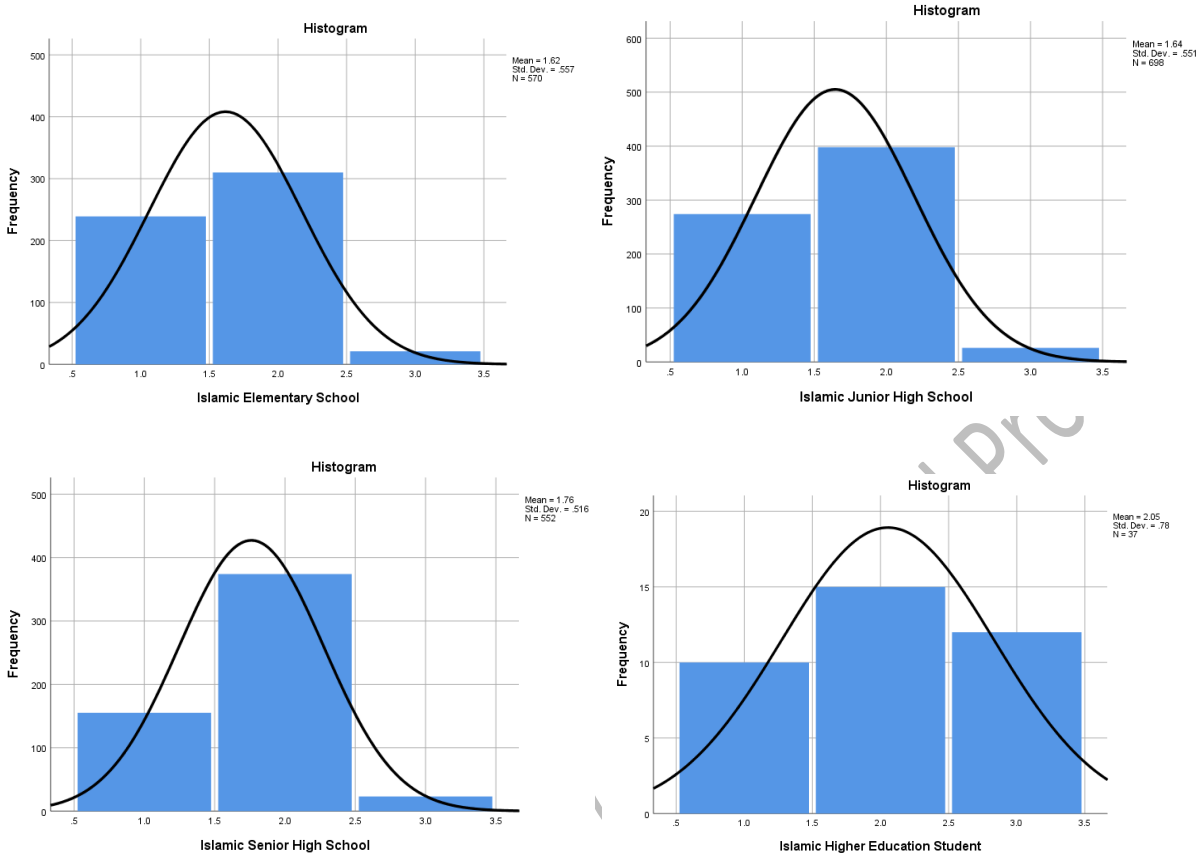
This study involved 1,857 respondents who were students from various levels of education at Islamic Boarding Schools, including elementary school (30.7%), MTs (37.6%), MA (29.7%), and Mahasantri (2%). Based on gender, respondents consisted of 866 males (46.6%) and 991 females (53.4%). Respondents ranged in age from 6 to 21 years, with the largest distribution in the 13–14 age group (44%). These characteristics show that most of the participants are in adolescence, i.e. a group that has a moderate level of risk understanding but still needs experiential learning to form effective fire response behaviors.

(Table 3. Preparedness Distribution**)**

Education Level	Category	Frequency	Percentage	Mean	SD	CI	
						Lower	*Upper*
Islamic Primary School	Not Ready	239	41.9%	1.62	0.557	1.57	1.66
	Quite Ready	310	54.4%				
	Highly Prepared	21	3.7%				
Islamic Junior High School	Not Ready	274	39.3%	1.64	0.551	1.60	1.69
	Quite Ready	398	57%				
	Highly Prepared	26	3.7%				
Islamic Senior High School	Not Ready	155	28.1%	1.76	0.516	1.72	1.80
	Quite Ready	374	67.8%				
	Highly Prepared	23	4.2%				
Islamic Boarding College Student	Not Ready	10	27%	2.05	0.78	1.79	2.31
	Quite Ready	15	40.5%				
	Highly Prepared	12	32.4%				
	Total	**1857**	**100%**				

Based on Table 3, the level of fire preparedness varied across educational levels. Students at the Islamic Primary School level showed a mean preparedness score of 1.62 (SD = 0.56; 95% CI: 1.57–1.66), indicating that preparedness was generally in the "quite ready" category, although a substantial proportion remained not ready. Similarly, Islamic Junior High School students had a mean preparedness score of 1.64 (SD = 0.55; 95% CI: 1.60–1.69), suggesting a comparable preparedness profile with slightly higher consistency. At the Islamic Senior High School level, preparedness was relatively higher, with a mean score of 1.76 (SD = 0.52; 95% CI: 1.72–1.80), indicating a descriptive trend of higher preparedness scores at higher educational levels, with a mean score of 2.05 (SD = 0.78; 95% CI: 1.79–2.31). However, the wider confidence interval reflects greater variability within this group, likely due to the smaller sample size.

(Image 1. Distibusi Histogram of Preparedness of Education**)**



As shown in Figure 1, the distribution of preparedness across education levels tends to be close to normal patterns, suggesting that most respondents have a level of preparedness that is sufficiently prepared but can still be improved through further training and education programs.

(Table 4. Frequency Distribution of Preparedness Sub-Dimension**)**

No	Question Items	Frequency (n) Percentage (%)				
		STS	**TS**	**SRR**	**S**	**ST**
Fire Risk Awareness						
1	There is a chance that I will have a fire at school.	387 (20.8%)	711 (38.3%)	270 (14.5%)	353 (19%)	136 (7.3%)
2	There is a chance that I will face a fire while at school.	462 (24.9%)	865 (46.65%)	281 (15.1%)	140 (7.5%)	109 (5.9%)
3	Fires can occur at my school due to machinery or electronic equipment.	386 (20.8%)	576 (31%)	356 (19.2%)	306 (16.5%)	233 (12.5%)
4	Fires can occur in my school due to the activities of students/teachers.	392 (21.1%)	637 (34.3%)	392 (21.1%)	216 (11.6%)	220 (11.8%)
5	A fire can occur at my school due to the negligence of another party.	321 (17.3%)	689 (37.1%)	420 (22.6%)	246 (13.2%)	181 (9.7%)
6	Fires can occur at my school as a result of intentional actions (e.g. vandalism).	748 (40.3%)	543 (29.2%)	196 (10.6%)	154 (8.3%)	216 (11.6%)
7	I think my school is at risk in terms of fire.	731 (39.4%)	673 (36.2%)	171 (9.2%)	106 (5.7%)	176 (9.5%)
Confidence						
8	I can stay calm in case of a fire at school.	712 (38.3%)	700 (37.7%)	143 (7.7%)	108 (5.8%)	194 (10.4%)
9	In the event of a fire, I can ensure my own safety.	632 (34%)	686 (36.9%)	205 (11%)	100 (5.4%)	234 (12.6%)
10	In the event of a fire, I can help my friend with a cool head	534 (28.8%)	831 (44.7%)	164 (8.8%)	131 (7.1%)	197 (10.6%)
11	I can get out of the school building safely in the event of a fire.	486 (26.2%)	781 (42.1%)	248 (13.4%)	88 (4.7%)	254 (13.7%)
12	I want to play an active role in the school fire emergency response team.	525 (28.3%)	846 (45.6%)	135 (7.3%)	105 (5.7%)	246 (13.2%)
Fire Training Overview						
13	All students and teachers at my school should receive fire training.	375 (20.2%)	610 (32.8%)	508 (27.4%)	99 (5.3%)	265 (14.3%)
14	Receiving fire training makes it easier to deal with fires at school.	491 (26.4%)	726 (39.1%)	220 (11.8%)	111 (6%)	307 (16.5%)
15	Receiving fire training can prevent fatalities in schools.	497 (26.8%)	641 (34.5%)	299 (16.1%)	98 (5.3%)	322 (17.3%)
16	Receiving fire training can reduce material losses due to fires in schools.	576 (31%)	537 (28.9%)	292 (15.7%)	141 (7.6%)	311 (16.75)
Fire Prevention Awareness						
17	Fires are preventable situations.	516 (27.8%)	676 (36.4%)	256 (13.8%)	126 (6.8%)	283 (15.2%)
18	It is easier to prevent a fire than to extinguish it.	447 (24.1%)	544 (29.3%)	395 (21.3%)	135 (7.3%)	336 (18.1%)
19	The cost of fire prevention is lower than the loss due to fire	621 (33.4%)	617 (33.2%)	142 (7.6%)	138 (7.4%)	339 (18.3%)
Confidence						

20	Fire training in schools should be conducted regularly.	461 (24.8%)	549 (29.6%)	407 (21.9%)	100 (5.4%)	340 (18.3%)
Refreshment and Mindfulness Training						
21	Fire training should be refreshed periodically.	508 (27.4%)	762 (41%)	125 (6.7%)	118 (6.4%)	344 (18.5%)
22	Evacuation exercises are essential to deal with fires in schools.	377 (20.3%)	726 (39.1%)	200 (10.8%)	168 (9%)	386 (20.8%)
23	All school residents must know the location of the fire alarm.	259 (13.9%)	710 (38.2%)	367 (19.8%)	230 (12.4%)	291 (15.7%)
24	All school residents must know the emergency exit at school.	385 (20.7%)	575 (31%)	500 (26.9%)	142 (7.6%)	255 (13.7%)
25	Before major activities (e.g. exams or school events), evacuation routes must be ensured to be open.	353 (19%)	832 (44.8%)	267 (14.4%)	130 (7%)	275 (14.8%)

In the dimension of fire risk awareness, around 70% of respondents were aware of the potential for fires due to electricity or human error, although only 20% believed the risk was high, indicating immature perceptions and lack of preventive urgency[22,24,25]. Meanwhile, confidence was low in 56% of respondents for evacuation or the use of fire extinguishers (38% doubted), due to the lack of simulation, which can be improved through training.

Training participation showed that 60% were aware of the importance of training, but few participated in immediate evacuation due to a lack of regular programs, a common phenomenon in developing countries that requires repetition for retention procedures. Finally, equipment maintenance awareness is weak, with 50% stating inspections are not routine and only 45% confident they are functioning, highlighting structural deficiencies that are crucial for fire control.

These findings are in line with Alim 2019[10] which described a gap between risk awareness and mitigation practices in boarding educational institutions. This emphasizes the need to strengthen the DRR policy at the pesantren level as stipulated in Jambi Provincial Regulation Number 9 of 2022 concerning Facilitation of the Implementation of Islamic Boarding Schools.

Implication

The findings of this study really highlight the urgency of implementing a holistic fire risk management strategy in the pesantren environment, where things such as fire training through simulations carried out regularly, consistent monitoring and maintenance of Light Fire Extinguishers (APAR), and the formation of a safety culture through the full involvement of students, teachers, and pesantren managers are crucial elements. These measures will not only strengthen the overall level of preparedness, but also build more resilient community resilience in the face of fire threats, in order to safeguard the lives and well-being of all parties involved.

Discussion

The findings of this study illustrate that fire preparedness at the Jambi Islamic Boarding School is still quite prepared, with notable weaknesses in self-efficacy and involvement in training. This situation is similar to what Rahman 2022[20] reported, where disaster awareness among school students often does not translate into solid preparedness behavior. The lack of direct training makes students less trained to react quickly when an emergency arises. Zhang

2023[29] added that understanding theory alone, without repeated simulations, only results in superficial readiness. Therefore, building a safety culture in Islamic boarding schools should be focused on experiential learning, so that students can get used to facing the risk of fire directly.

The self-efficacy factor does play a crucial role in fire preparedness. The low confidence of students to use fire extinguishers or evacuate, as revealed here, is in line with Lee's 2021[12] results which found that simulation exercises can increase participants' confidence by up to 40% compared to ordinary teaching methods. Similarly, Nugroho 2023[30] noted that the simulated approach helps to form long-lasting practical skills, especially in disaster education in Indonesia. Therefore, fire training in Islamic boarding schools needs to be scheduled regularly, complete with practical assessments, so that progress can be measured clearly.

The lack of attention to the maintenance of safety facilities in the pesantren confirms what Kim 2022[31] found, that the success of the safety system is not only about the availability of tools, but also the routine of inspection and maintenance. Many educational institutions have extinguishing equipment, but they rarely check it regularly, so the benefits are reduced. To overcome this, the Jambi Islamic Boarding School is advised to develop standard operating procedures (SOPs) regarding inspection schedules, damage reporting, and those in charge of maintenance.

In the pesantren environment, Rofiuddin 2023[32] highlighted the importance of disaster education that is tailored to the context and religious values. Instilling Islamic principles such as trust and social responsibility can be a moral basis for forming a disaster response attitude. Meanwhile, Yulianto 2024[32] revealed that involving religious leaders in training can encourage student participation and strengthen motivation from within to maintain the safety of themselves and their surroundings. Thus, the active role of kyai and ustadz in the fire program will provide stronger legitimacy and encourage students to be fully involved.

In essence, this study emphasizes that improving fire preparedness in Islamic boarding schools requires collaboration between education, practical training, and the management of safety facilities. Through these steps, preparedness is no longer just a concept, but an adaptive habit inherent in the routine of students and pesantren administrators. The findings of this study directly address the research objective of identifying the level of fire preparedness among students in Islamic boarding schools and determining the aspects requiring improvement. The results indicate that preparedness scores tended to be higher among students at higher educational levels, reflecting differences in experience and exposure rather than statistically tested effects, with older students demonstrating better readiness. This aligns with Rahman and Islam 2024[9], who found that preparedness among adolescents increases with cognitive maturity and prior exposure to disaster education. The low level of self-efficacy observed in this study can be explained through several interrelated mechanisms. According to Bandura's theory, self-efficacy is primarily developed through mastery experiences; however, limited exposure to repeated fire simulations in the pesantren context restricts students' opportunities to build confidence in their emergency response abilities. This explanation is supported by Lee 2021[12], who reported that school-based fire simulations increased students' self-efficacy by up to 40% compared to conventional classroom instruction. Similarly, Zhang 2023[29] emphasized that theoretical knowledge alone, without continuous hands-on practice, results in superficial preparedness that does not translate into confident action during emergencies. Furthermore, the

effectiveness of disaster education in pesantren is closely linked to contextual adaptation. Incorporating religious values, local culture, and community leadership provides moral legitimacy and social reinforcement, which are essential for strengthening students' motivation and engagement. This perspective aligns with Rofiuddin 2023[31] and Yulianto 2024[32], who showed that the involvement of religious leaders such as kyai and ustadz enhances participation, internalization of safety norms, and sustained compliance with preparedness programs.

Conclusions and Recommendations

Conclusion

This study concludes that fire preparedness at the Jambi Islamic Boarding School is still quite prepared, although there are clear weaknesses in self-efficacy and active participation in fire drills. This situation illustrates that fire education programs in Islamic boarding schools tend to emphasize more on the imparting of knowledge, rather than the development of real practical skills.

The findings are in line with the findings of Katramee and Thanjangreed 2025[33], which prove that school-based preparedness education is able to significantly improve students' knowledge and response skills to fires. The success of that approach lies in the combination of hands-on simulation and experiential learning.

On the other hand, weaknesses in the maintenance of safety facilities indicate the urgency of a more organized fire management system. Hassanain 2022[34] explained that the effectiveness of the fire safety system in schools does not solely depend on the existence of the equipment, but also on the routine of inspections, audits, and continuous maintenance records.

In the social and religious environment of Islamic boarding schools, Duhung 2024[35] revealed that including emergency response modules and healthy behavior into the curriculum based on Islamic values can significantly strengthen the awareness and safety attitude of students. This confirms that disaster education in pesantren will be more successful if it is adapted to local culture and religious principles.

This research strengthens the idea that fire preparedness in pesantren can only be realized through practice-oriented education, sustainable facility management, and instilling Islamic values in disaster learning.

Recommendations

Islamic boarding schools are advised to strengthen fire preparedness through simulative training that is carried out regularly and the implementation of Standard Operating Procedures (SOP) for the maintenance of safety equipment. The integration of disaster education into a curriculum based on Islamic values can effectively increase students' awareness and sense of responsibility for safety. In addition, the use of interactive learning media adapted to the context of the pesantren is also recommended to enrich practical understanding and encourage more active involvement

Acknowledgments

The researcher expressed his deep gratitude and appreciation to the Institute for Research and Community Service (LPPM) of the University of Jambi, which has provided support and convenience in the form of facilitation during the implementation of this research. Not to forget, we also express our sincere gratitude to all caregivers, teachers, and students at the Jambi City

Islamic Boarding School, who enthusiastically participated and showed extraordinary cooperation throughout the data collection process.
In addition, we also express our high appreciation to all members of the academic team from the Faculty of Medicine and Health Sciences, University of Jambi, especially to our colleagues and students who have contributed to administrative matters, observations in the field, and data processing. The participation and cooperation of all parties is really the main foundation that supports the success of our research.

References

1. Sandi MR. BNPB: Hanya 5% Sekolah di Indonesia Berstatus Aman Bencana. 14 Oktober. Published 2025. https://news.okezone.com/read/2025/10/14/337/3176549/bnpb-hanya-5-sekolah-di-indonesia-berstatus-aman-bencana
2. Sendi MR. Cuma 50 Ponpes dari 42.000 yang Punya Izin Bangunan, BNPB: Waspada! 13 Oktober. Published 2025. https://www.inews.id/news/nasional/cuma-50-ponpes-dari-42000-yang-punya-izin-bangunan-bnpb-waspada
3. Putri LM. Kebakaran ponpes di Jaksel akibatkan sembilan santri sesak nafas. 10 Desember. Published 2025. https://www.antaranews.com/berita/5297530/kebakaran-ponpes-di-jaksel-akibatkan-sembilan-santri-sesak-nafas/
4. Guntur, R. A., et al. (2021). Fire risk in Indonesian boarding schools: A case study of pesantren infrastructure. International Journal of Disaster Risk Reduction, 58, 102-215. https://doi.org/10.1016/j.ijdrr.2021.102215
5. Paton, Douglas. 2013. "Disaster Resilient Communities: Developing and Testing an All-Hazards Theory." *IDRiM Journal* 3 (1): 1–17. https://doi.org/10.5595/001c.11702.
6. Aini, Q., et al. (2022). Vulnerability assessment of school buildings to fire hazards in developing countries. Safety Science, 150, 105-120. https://doi.org/10.1016/j.ssci.2022.105120
7. Wong, L. P., et al. (2020). Age-appropriate fire safety education for children: A global perspective. Children and Youth Services Review, 119, 105-512. https://doi.org/10.1016/j.childyouth.2020.105512
8. Khan, M. A., et al. (2023). Effectiveness of school-based fire safety education: A systematic review. Journal of School Health, 93(2), 150-162. https://doi.org/10.1111/josh.13245
9. Rahman, M., & Islam, R. (2024). Youth preparedness in school fire incidents: Evidence from Southeast Asia. Natural Hazards, 120(3), 2500-2518. https://doi.org/10.1007/s11069-024-06300-5
10. Alim, S., Haryanti, F., Subandi, A., & Prabandari, Y. S. (2019). Training on modified model of programme for enhancement of emergency response flood preparedness based on the local wisdom of Jambi community. *Jàmbá: Journal of Disaster Risk Studies*, *11*(1), 1-9.
11. Lee, S. H., et al. (2021). Implementation gaps in fire safety protocols in educational facilities: Empirical evidence from Asia. Fire Safety Journal, 122, 103-345. https://doi.org/10.1016/j.firesaf.2021.103345
12. Lee, S., Park, M., & Kim, H. (2021). Enhancing self-efficacy through experiential fire drills in schools. International Journal of Environmental Research and Public Health, 18(17), 9298. https://doi.org/10.3390/ijerph18179298
13. Érces, G., Rácz, S., Vass, G., & Varga, F. (2023). Fire Safety in Smart Cities in Hungary With Regard to Urban Planning. *IDRiM Journal*, *13*(2), 104–128. https://doi.org/10.5595/001c.91474
14. Sari, D. P., & Pratiwi, N. (2022). Managerial barriers to fire safety implementation in Indonesian schools. Journal of Risk Research, 25(7), 850-865. https://doi.org/10.1080/13669877.2022.2050000

15. Nugroho, A., & Wijaya, S. (2024). Integrating Sendai Framework into pesantren curricula for disaster literacy. Sustainability, 16(5), 2100-2115. https://doi.org/10.3390/su16052100
16. Hidayat, R., et al. (2023). Cultural adaptation of DRR programs in Islamic boarding schools (pesantren) in Indonesia. Disaster Prevention and Management, 32(4), 456-472. https://doi.org/10.1108/DPM-02-2023-0045
17. Matharage, S. S., Ishiwatari, M., & Aldrich, D. P. (2024). Empowering Communities: A Bottom-Up Approach to Disaster Risk Reduction. *Available at SSRN 4816738*.
18. Permana, D., et al. (2025). Empirical assessment of fire preparedness in religious boarding schools: A mixed-methods approach. International Journal of Environmental Research and Public Health, 22(1), 45-60. https://doi.org/10.3390/ijerph22010045
19. Mohai, A. Zs., Elek, B., & Kovács, M. (2024). Environmental Aspects of Using Fire Protection Systems With a Sustainable Development Approach. *IDRiM Journal*, *13*(2), 22–39. https://doi.org/10.5595/001c.92457
20. Rahman, M. S., Chowdhury, M. T., & Hasan, M. (2022). Evaluating the effectiveness of school-based fire safety programs in enhancing disaster preparedness. Safety Science, 148, 105674. https://doi.org/10.1016/j.ssci.2022.105674
21. Patel, R. K., Pamidimukkala, A., Kermanshachi, S., & Etminani-Ghasrodashti, R. (2023). Disaster Preparedness and Awareness among University Students: A Structural Equation Analysis. *International journal of environmental research and public health*, *20*(5), 4447. https://doi.org/10.3390/ijerph20054447
22. Pooley, K., Nunez, S., & Whybro, M. (2021). *Evidence-based practices of effective fire safety education programming for children*. *Australian Journal of Emergency Management*, 36(2), 34-41. DOI: 10.47389/36.2.34
23. Calamba, R. (2024). High School Students' Level of Awareness and Preparedness of Natural Disasters. *Available at SSRN 5126436*.
24. Seyedin, H., et al. (2020). Health, safety and education measures for fire in schools: A review. Journal of Education and Health Promotion, 9(1), 120–126. https://doi.org/10.4103/jehp.jehp_665_19
25. Andanar, M. W., & Erwandi, D. (2024). *Fire Protection Systems, Life-Saving Facilities, and Fire Management in Depok City in 2020: A Case Study*. *Indonesian Journal of Occupational Safety and Health*, 13(3), 301–310. DOI: 10.20473/ijosh.v13i3.2024.301-310
26. Krowa, Y. R. R., Meku, F. X., Beo, Y. A., & Eka, A. R. (2024). COMMUNITY-BASED NATURAL DISASTER PREPAREDNESS EDUCATION IN DIMPONG VILLAGE, NORTH RAHONG DISTRICT IN AN EFFORT TO REDUCE DISASTER RISK. *Lecturers: Journal of Student Service*, *8*(3), 1077-1083.
27. Fahmi, M., et al. (2023). Building resilient communities: Rapid response to a crisis through Nusantara Module's character education and social contribution initiative. Sustainability, 15(18), 13300.
28. Masocha, W., Takaidza, N., Manyani, A., & Mutseekwa, C. (2025). Disaster risk reduction integration into school curriculum: A global analysis..
29. Zhang, J., Li, X., & Lin, Y. (2023). School fire safety education and student evacuation behavior: An empirical study. International Journal of Disaster Risk Reduction, 91, 103716. https://doi.org/10.1016/j.ijdrr.2023.103716

30. Kim, S. Y., Lee, J. H., & Hong, Y. (2022). Fire safety inspection management in public facilities: A systematic approach. Sustainability, 14(12), 7176. https://doi.org/10.3390/su14127176
31. Rofiuddin, A., Rahmawati, L., & Fadhilah, N. (2023). Integration of disaster risk reduction education into Islamic boarding school curriculum. Sustainability, 15(8), 6582. https://doi.org/10.3390/su15086582
32. Yulianto, A., Nurhayati, N., & Lestari, D. (2024). Religious leaders' engagement in promoting disaster preparedness among students in Indonesia. Heliyon, 10(2), e25390. https://doi.org/10.1016/j.heliyon.2024.e25390
33. Katramee, A., & Thanjangreed, W. (2025). Effectiveness of a school-based fire preparedness program on the knowledge and skills for fire response among primary school students. International Journal of Occupational Safety and Health, 15(2), 120–128. https://doi.org/10.3126/ijosh.v15i2.64784
34. Hassanain, M. A., Aljuhani, M., Hamida, M. B., & Salaheldin, S. I. (2022). A Framework for Fire Safety Management in School Facilities. International Journal of Built Environment and Sustainability, 9(2), 115–129. https://doi.org/10.11113/ijbes.v9.n2.901
35. Duhung, J. R., Ibrahim, A., & Puyu, Y. (2024). Implementing Fire Emergency Response and Health Behaviour Modules to Elevate Islamic Student Knowledge in Boarding Schools. Diversity: Journal of Multidisciplinary Research, 5(1), 11–23. https://doi.org/10.24252/diversity.v5i1.50901