Buletin Kedokteran & Kesehatan Prima
Vol.4 No.1 (2025)
DOI: 10.34012/bkkp.v4i1.6530

ORIGINAL ARTICLE

Counseling students to improve fire safety knowledge and preparedness

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ABSTRACT

This research investigates the effectiveness of counseling methods, incorporating seminar models and PowerPoint presentations, in enhancing students' knowledge and preparedness for fire emergency response at Universitas Prima Indonesia. A quantitative approach with a quasi-experimental, one-group pretest-posttest design was employed, involving 78 students from the Public Health Bachelor Program. The intervention comprised four counseling sessions covering basic fire knowledge, preparedness steps, emergency actions, and the use of firefighting equipment. Data was collected through questionnaires administered before and after the intervention, assessing students' knowledge of fire extinguishers, hydrants, fire alarms, assembly points, emergency exits, and emergency stairs. The results indicated a significant positive impact, with post-test scores for both knowledge and preparedness substantially higher than pre-test scores ($p < 0.001$). Before the intervention, only 25.6% of participants demonstrated good knowledge, while after the intervention, 97.4% achieved this level. Similarly, preparedness levels significantly increased, with 97.4% of participants feeling ready after the intervention compared to only 19.2% before. The study underscores the effectiveness of the implemented counseling methods and supports the recommendation for continuous fire safety education to ensure sustained preparedness.

Keywords: college students, fire safety awareness, fire safety education

Introduction

Fires are abrupt and unpredictable events, resulting in potentially devastating consequences. The timing, cause, scope, and impact of a fire are often uncertain, leading to significant material damage, disruption of business activities, environmental harm, and risks to human life. Scientifically, fire is a rapid oxidation process of a material, known as fuel, that releases heat and light.[1] This exothermic reaction produces flames and various reaction products. The National Fire Protection Association (NFPA) highlights that fire requires three essential components: a combustible fuel, an oxidizing agent such as oxygen, and heat.[2]

Fire safety knowledge and preparedness is crucial for university students, especially in public health contexts like universities, because it extends beyond compliant fire doors and safety systems; the human

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element, particularly student engagement, plays a crucial role in creating a safe campus environment.[3] Universities should strengthen fire safety education because fire accidents can cause huge losses to life and property, and college students' weak awareness of fire safety can put a strain on university fire safety.[4]

To protect college students from fires, it is important for them to understand the risks and take appropriate safety measures.[5] Students should be encouraged to report any potential fire hazards and take an active role in maintaining a safe environment on campus. Incorporating fire safety education into orientation programs, distributing informational materials, and conducting awareness campaigns are strategies for promoting fire safety awareness among students.[6] Educational initiatives play a vital role in fostering a culture of fire safety within the campus community. Quality fire protection for universities and colleges should incorporate fire safety awareness programs into orientation sessions, academic curricula, and residential life activities.[7,8]

While some studies have identified fire safety knowledge among students as a potential concern, educational interventions have proven effective in improving it. Numerous studies demonstrate the positive impact of these interventions on students' fire safety knowledge, attitudes, and practices. For example, a study at SMAN 1 Gebog showed that fire safety education, delivered through presentations and simulations, significantly improved student knowledge.[9] Further evidence for the efficacy of educational interventions comes from research at Universiti Islam Pahang Sultan Ahmad Shah (UniPSAS), which revealed that over half of the participants demonstrated good knowledge, positive attitudes, and appropriate practices regarding fire safety systems and preparedness.[10] Another study, focusing on Grade 12 STEM students, emphasized the importance of safety awareness encompassing pre-fire, during-fire, and post-fire periods, including proper disposal of combustible waste and correct use of electrical equipment.[11]

Despite these positive findings, research has also identified areas needing improvement. A study of Nigerian college students indicated a knowledge gap regarding basic fire prevention and protection measures, including awareness of fire emergency numbers, fire exits, escape routes, and muster points.[12] Similarly, the UniPSAS study revealed a lack of knowledge concerning the use of fire control measures in the event of a fire. Furthermore, while the majority of UniPSAS students expressed confidence in their ability to respond appropriately during a fire emergency (67.5%), a significant proportion (30.6%) were unsure. A similar uncertainty was observed regarding familiarity with the campus fire safety plan and evacuation procedures, with 25.5% of students uncertain despite 58.0% claiming familiarity.[10]

This research is motivated by the lack of public knowledge and preparedness in dealing with fire emergencies, particularly among students. Insufficient knowledge of emergency response equipment and procedures can impede efforts to protect oneself and others during a fire. A preliminary survey of 15 students revealed varying levels of knowledge regarding fire emergency response equipment and procedures. While most students (73%) were familiar with fire alarms, emergency exits, and fire escapes, knowledge of hydrants and assembly points remained limited, with only 33% and 40% of respondents, respectively, demonstrating understanding. The lowest level of knowledge pertained to the use of portable fire extinguishers (APAR), with only 20% demonstrating proficiency. This study aims to analyze the effectiveness of counseling methods, incorporating seminar models and PowerPoint presentations, in enhancing students' knowledge and preparedness for fire emergency response at Universitas Prima Indonesia.

Method

Study design

This study employed a quantitative approach with a quasi-experimental, one-group pretest-posttest design. This design was selected to compare measurements taken before and after the intervention, allowing for an accurate assessment of the treatment's effect. The research was conducted within the Public Health Bachelor Program at Prima Indonesia University from February to March 2024. The study population comprised all students from the Public Health Bachelor Program in semesters 2, 4, and 6, totaling 346 students (semester 2: 97; semester 4: 149; semester 6: 100). A random sample was drawn from each semester, resulting in a total sample size of 78 students (semester 2: 22; semester 4: 34; semester 6: 22).

Intervention

This study began with observations of the environment and existing counseling materials. Subsequent steps included selecting appropriate counseling resources, reviewing relevant research, defining the research population and sample, and obtaining necessary research permits. Students completed pre-test questionnaire

to assess their baseline knowledge of fire safety and preparedness. The researchers then provided fire safety counseling, which included an introduction to active and passive fire protection systems, a demonstration of fire extinguisher use, and guidance on appropriate actions during a fire.

Counseling sessions were held four times over one month, on Saturdays, to avoid conflicting with scheduled learning activities. The counseling was delivered in a seminar format using PowerPoint presentations. The counseling comprises several stages. First, we provide an introduction outlining the objectives and emphasizing the importance of knowledge and preparedness for fire emergency response. Next, we present material covering basic fire knowledge, preparedness steps, emergency actions, and the use of firefighting equipment. To illustrate the relevance of knowledge and preparedness regarding fires, we include case studies or concrete examples relevant to the campus environment and students' daily lives. The final stage is a question-and-answer discussion, where students can ask questions and further discuss the presented material.

After the counseling sessions, students completed a post-test questionnaire to evaluate changes in their fire safety knowledge and preparedness. The pre-test questionnaire was administered during the first week, according to the following schedule: 2nd-semester students (09:30-10:20), 4th-semester students (12:20-13:00), and 6th-semester students (13:10-14:00). The post-test was administered at the end of the fourth week. Data from the pre-tests and post-tests were systematically analyzed using SPSS.

Data collection

Primary data for this study were collected through questionnaires administered to students before and after they received information on fire extinguishers, hydrants, fire alarms, assembly points, emergency exits, and emergency stairs. Fire emergency response knowledge refers to an individual's ability to anticipate fire hazards and understand their potential to cause physical, material, and even psychological harm. Effective preparedness for fire emergencies relies on a solid foundation of knowledge coupled with adequate facilities. This variable will be measured using a questionnaire assessing students' knowledge of various aspects of fire emergency response, including fire extinguishers, hydrants, fire alarms, assembly points, emergency exits, and fire escapes. Each question uses a nominal scale with two answer choices: "Know" or "Do Not Know." The questionnaire results will provide an overview of the students' level of knowledge regarding each aspect of fire emergency response.

Preparedness for fire emergency is defined as a series of activities undertaken to anticipate disasters through organized, appropriate, efficient, and effective measures. This variable was measured using a questionnaire that assessed student preparedness for fire emergencies, covering the same aspects as the knowledge variable. These aspects are preparedness in using fire extinguishers, hydrants, fire alarms, assembly points, emergency exits, and fire escapes. The scale and answer choices were the same as those in the knowledge questionnaire. The results of this questionnaire will illustrate the level of student preparedness for fire emergency situations in each aspect.

Data analysis

In this study, univariate analysis was employed to describe the sample characteristics and the variables under investigation, including gender, age, semester level, knowledge, and preparedness, both before and after the intervention. Categorical variables are presented as proportions, while numerical variables are presented with their means, medians, standard deviations, and ranges (minimum and maximum values). Bivariate analysis was conducted to determine the differences in knowledge and preparedness between the treatment and control groups before and after the intervention. Paired t-tests, with a 95% confidence interval (CI), were used for this purpose. If data were not normally distributed, the Wilcoxon signed-rank test was used instead. A p-value less than 0.05 was considered statistically significant.

Results

Table 1 presents the characteristics of 78 students, categorized by age, gender, and semester level. The majority of students (79.5%, n = 62) are between 18 and 20 years old, which is typical for college students. The remaining students (20.5%, n = 16) are between 21 and 23 years old, suggesting the presence of older students who may be taking additional courses or are transfer students. Female students make up a significantly larger proportion of the sample (87.2%, n = 68) compared to male students (12.8%, n = 10), indicating a female-dominated student population. The distribution of students across semester levels is fairly

even. Semester 4 includes the largest group of students (43.6%, n = 34), followed by Semester 2 and Semester 6 (28.2%, n = 22 each). This demonstrates that the study participants come from various points in their academic programs.

Table 1. Student characteristics by age, gender, and semester level (n = 78)

Characteristic	n	%
Age		
18-20 years	62	79.5
21-23 years	16	20.5
Gender		
Male	10	12.8
Female	68	87.2
Semester level		
Semester 2	22	28.2
Semester 4	34	43.6
Semester 6	22	28.2

In summary, the data depicts a student profile characterized by a majority aged 18-20, a predominantly female population, and representation from various semester levels, with the highest concentration in Semester 4.To assess the antidiabetic potential of gelagah stem extract, an experimental study was conducted using male white rats.

Table 2 shows the differences in knowledge and preparedness before and after the intervention (n = 78). Before the intervention, only 25.6% of participants (20 people) demonstrated good knowledge; the majority (62.6%, 41 people) had sufficient knowledge, while the remaining 21.8% (17 people) had limited knowledge. After the intervention, a significant increase in knowledge was observed. A substantial majority, 97.4% of participants (76 people), demonstrated good knowledge, with only 2.6% (2 people) exhibiting sufficient knowledge. No participants had limited knowledge after the intervention.

Table 2. Differences in pre- and post-knowledge of preparedness (n = 78)

Variable	Pretest		Postest	
	n	%	n	%
Knowledge				
Good	20	25.6	76	97.4
Fair	41	62.6	2	2.6
Poor	17	21.8	-	-
Preparedness				
Prepared	15	19.2	76	97.4
Almost Prepared	57	73.1	2	2.6
Not Prepared	6	7.7	-	-

Similar improvements were observed in the level of preparedness. Before the intervention, only 19.2% of participants (15 people) felt ready, 73.1% (57 people) felt almost ready, and 7.7% (6 people) felt unprepared. After the intervention, a large majority of participants, 97.4% (76 people), felt ready, while only 2.6% (2 people) felt almost ready. No participants felt unprepared after the intervention. These data indicate that the intervention was highly effective in increasing the knowledge and preparedness of participants.

Prior to conducting a bivariate analysis, a normality test was performed on the residuals of the research data to evaluate their distribution. The Kolmogorov-Smirnov test was employed because of the large sample size (n = 78, > 50). The decision rule was: if the significance value (p) was greater than 0.05, the data residuals were considered normally distributed; if p was less than 0.05, the data residuals were considered non-normally distributed. The test results indicated a significance value of less than 0.001 ($p < 0.001$) for both pre-test and post-test variables. Therefore, we concluded that the data residuals were not normally distributed. Consequently, a non-parametric statistical analysis using the Wilcoxon Signed-Rank test was deemed appropriate.

Table 3. Effectiveness of counseling methods on knowledge and preparedness levels

Significance	Post Test - Pre Test

	Knowledge	Preparedness
Z	-7.323[b]	-7.417[b]
Asymp. Sig (2-tailed)	< 0.001	< 0.001

Table 3 demonstrates a statistically significant difference between pre-test and post-test scores for both knowledge and preparedness. Specifically, the negative z-scores indicate that post-test scores were significantly higher than pre-test scores, suggesting that the counseling methods effectively increased both knowledge and preparedness. Furthermore, the extremely low p-values ($p < 0.001$) strongly support this conclusion.

Discussion

The demographic data reveals key characteristics of the student population in the study. The vast majority of students are in the traditional college age range (18-20 years), but the presence of students aged 21-23 suggests some may be older due to factors like delayed entry, transfer status, or taking additional courses. The student population is heavily female-dominated. This gender imbalance could influence classroom dynamics, program focus, and the interpretation of intervention outcomes. The distribution across semester levels indicates that the study captured participants at various stages of their academic journeys. Semester 4 having the highest representation could be relevant if the intervention is linked to a specific curriculum point.

There's a significant shift from "fair" knowledge to "good" knowledge after the intervention. The intervention appears highly effective in boosting students' understanding. Similar to knowledge, the intervention dramatically increased the feeling of preparedness among students. This suggests the intervention not only imparts knowledge but also builds confidence. The intervention is successful in enhancing both the knowledge and preparedness of the participants. This could lead to improved performance, engagement, or other positive outcomes. Overall, the results suggest that the intervention had a substantial positive impact on the students' knowledge and feelings of preparedness. The statistical significance of the findings, combined with the magnitude of the changes observed, provides compelling evidence of the intervention's effectiveness.

Fire safety education and training programs significantly improve knowledge, preparedness, and overall outcomes. These programs enhance awareness of fire hazards, prevention strategies, and the proper use of fire safety equipment, promoting a deeper understanding of fire behavior, evacuation procedures, and emergency response protocols.[13] Fire safety knowledge is a crucial factor in effective emergency preparedness.[14] Disaster simulations offer a valuable tool for enhancing student preparedness for emergencies, potentially saving lives.[9] Effective emergency response hinges on proper training, enabling individuals to execute swift and safe evacuations, provide assistance to others, and utilize fire extinguishers effectively, thereby mitigating fire spread and minimizing injuries.[15]

Furthermore, fire safety education plays a significant role in reducing fire incidents. Educated individuals are more inclined to adopt preventive measures, such as maintaining electrical appliances and ensuring the functionality of smoke alarms. This education also cultivates an improved safety culture, fostering vigilance and proactive fire prevention.[16] A study has demonstrated that fire safety training promotes consistency in knowledge among participants, evidenced by a narrower post-test score distribution centered around a higher average compared to pre-test scores. To ensure the sustainable effectiveness of fire safety programs, continuous fire safety education in schools is strongly recommended.[9]

Conclusion

The intervention demonstrated a significant positive impact, substantially increasing both the knowledge and preparedness of the participants. Statistical analysis using the Wilcoxon Signed-Rank test confirmed these improvements with high statistical significance ($p < 0.001$). These findings align with existing literature, which emphasizes the importance of fire safety education and training programs in enhancing awareness, promoting preventive measures, and improving overall outcomes in emergency situations. The study underscores the effectiveness of the implemented counseling methods and supports the recommendation for continuous fire safety education to ensure sustained preparedness.

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