



Knowledge, Attitudes, and Practices Regarding Household Fire-Hazard Detection Among Housewives in Makassar: A Sequential Explanatory Mixed-Methods Study

**Jumhur Salam¹, Muhammad Ridha Afdhal^{2*}, Astrid Pratiwi Rufaedah Amir¹,
Nurul Mawaddah Syafitri³**

¹ D-IV Occupational Safety and Health Program, Politeknik Kesehatan Megarezky, Makassar, Indonesia

² D-IV Health Promotion Program, Faculty of Sports Science and Health, Universitas Negeri Makassar, Indonesia

³ Undergraduate Medical Program, Faculty of Medicine, Universitas Pembangunan Nasional “Veteran” Jakarta

*Correspondence Address: muh.ridhaafdhal@unm.ac.id

Article Info

Article History

Received: Aug 20, 2026

Revised: Sep 10, 2026

Accepted: Sep 28, 2026

Keywords:

Household fire, fire hazard detection, housewives, disaster preparedness, preventive behavior.

ABSTRACT

Household fires remain an important public health concern, particularly in densely populated residential areas. This study aimed to assess housewives' knowledge, attitudes, and practices regarding early detection of potential household fire hazards and explore factors underlying preventive behavior. A sequential explanatory mixed-methods design was conducted in Karuwisi Utara, Makassar City, from March-July 2026. The quantitative phase involved 200 housewives selected through probability random sampling. Data were analyzed using univariate analysis and Chi-square tests. The qualitative phase included purposively selected housewives with extremely low or high preparedness scores, local community leaders or PKK cadres, and Fire and Rescue Service representatives as key informants. Participants were recruited until data saturation was achieved. Qualitative data were analyzed using NVivo-supported thematic analysis and triangulation. Most respondents had good knowledge (61.5%), while attitudes (69.5%) and practices (73.5%) were predominantly moderate. Educational attainment was significantly associated with knowledge ($p < 0.001$), as was employment status ($p = 0.037$), but neither was significantly associated with attitudes or practices. Qualitative findings highlighted personal experience, household routines, perceived risk, limited practical training, and contextual barriers as factors associated with the gap between knowledge and preventive practices. Practical, behavior-oriented, and community-based interventions are needed to strengthen household fire prevention.

INTRODUCTION

Domestic fires remain a serious and recurring threat, particularly in densely populated residential areas. In Indonesia, residential settlements are highly vulnerable to fire incidents due to factors such as electrical short circuits, unsafe electrical installations, liquefied petroleum gas (LPG) leaks, and limited public awareness regarding fire hazards. Previous studies have identified electrical faults as one of the dominant causes of residential fires in densely populated urban settlements (Rahmat et al., 2018; Rahmania et al., 2025).

Furthermore, national fire statistics indicate that residential buildings account for the largest proportion of fire incidents in Indonesia, highlighting the urgent need for improved fire prevention and safety measures in household environments.

Densely populated residential areas, including those in Makassar City, possess physical and social characteristics that increase fire risk, such as high building density, narrow access roads, and limited accessibility for emergency response vehicles (Sagala et al., 2014; Cvetković et al., 2022). Throughout 2025, Makassar City faced significant challenges in fire mitigation, with 209 fire incidents resulting in material losses of approximately IDR 65.8 billion and affecting 1,711 individuals. Data from the Makassar City Fire and Rescue Service (Damkarmat) indicated that residential buildings accounted for most fire incidents, with 184 housing units and 20 shops or kiosks affected, while fires also spread to industrial areas, warehouses, markets, and school buildings (Herald Sulsel, 2025). Furthermore, inadequate fire-safety knowledge, limited risk awareness, and insufficient preparedness practices have been identified as important contributors to residential fire vulnerability and may increase the likelihood of fire incidents and their impacts (Karemaker et al., 2021; Kurata et al., 2023).

From the perspective of Occupational Safety and Health (OSH) in the informal and domestic sectors, many residential fire incidents are associated with human factors, including unsafe acts and unsafe conditions. Common causes of household fires include electrical faults, unsafe cooking practices, improper use of LPG equipment, and inadequate maintenance of electrical installations. Previous studies have shown that fire risk in residential settings is strongly influenced by individual behavior, safety awareness, and preparedness practices, highlighting the importance of strengthening safety culture at the household level (Karemaker et al., 2021; Kurata et al., 2023; Haghani et al., 2024).

Community participation, particularly that of women and primary household caregivers, is considered essential for fire prevention and the early identification of household fire hazards. Previous studies have shown that household fire-safety interventions, community-based education, and preparedness programs can improve safety awareness, preparedness behaviors, and the adoption of preventive measures within households (Amberson et al., 2024; Waring et al., 2025). Because housewives are often responsible for cooking activities and the operation of household appliances, they may play an important role in the implementation of fire-safety practices within the household (Karemaker et al., 2021; Sagala et al., 2014).

However, existing disaster mitigation approaches often remain focused on emergency response and may not fully incorporate community participation, including the active involvement of women in preparedness activities. Previous studies have highlighted that community engagement, social support, and educational interventions play important roles in strengthening household disaster preparedness and risk reduction (Amberson et al., 2024; Cisternas et al., 2024). Women, particularly housewives who are directly involved in daily household management, possess valuable knowledge of household conditions and therefore have considerable potential to contribute to early hazard identification and fire-prevention practices (Sagala et al., 2014; Karemaker et al., 2021). Limited opportunities for participation and preparedness training may reduce the effectiveness of early detection efforts, increasing the likelihood that fire hazards remain unnoticed until they develop into larger and more difficult-to-control incidents (Haghani et al., 2024).

Nevertheless, the specific role of housewives in the early detection of potential household fires remains underexplored, particularly in densely populated residential areas in Indonesia. Previous studies have shown that fire-safety education, practical training, and community-based interventions can improve knowledge, preparedness, and fire-prevention behaviors among community members (Hsieh et al., 2023; Waring et al., 2025). However, these studies generally targeted the broader community and did not specifically focus on housewives, despite their central role in managing daily household activities involving cooking, LPG use, and electrical appliances. Consequently, evidence regarding the effectiveness of educational interventions in improving housewives' knowledge and preparedness for early fire detection remains limited. To the best of our knowledge, no published study has specifically evaluated fire-safety education programs targeting housewives in densely populated residential communities in Indonesia.

Therefore, this study aims to evaluate the effectiveness of an educational intervention in improving housewives' knowledge regarding the early detection of potential household fires. Specifically, the study assesses changes in knowledge before and after the intervention and examines whether the program contributes to increased awareness and household-level fire-prevention preparedness.

METHODS

Study Design and Setting

This study employed an explanatory sequential mixed-methods design, consisting of a cross-sectional quantitative survey followed by a qualitative descriptive study. In the first phase, quantitative data were collected through a cross-sectional survey to assess the level of household fire preparedness among housewives and to statistically describe preparedness levels based on preparedness scores. In the second phase, qualitative data were collected through in-depth interviews to further explain and elaborate on the quantitative findings, particularly regarding the factors influencing preparedness levels and the cultural, social, and technical barriers encountered by housewives in identifying potential household fire hazards.

The study was conducted in Karuwisi Utara Subdistrict, Makassar City, South Sulawesi, Indonesia. The study site was purposively selected based on data from the Makassar City Fire and Rescue Service indicating a high incidence of fires in densely populated residential areas. Karuwisi Utara Subdistrict is characterized by high residential density and a relatively high history of fire incidents in Makassar City. The study was conducted from March to July 2026, including the preparation phase, quantitative data collection, qualitative data collection, data analysis, report writing, monitoring and evaluation, and dissemination of research findings.

Ethical approval was obtained from the Health Research Ethics Committee of Institut Nani Hasanuddin (Approval No. 237/INSTITUT-NH/KEPK/III/2026). Received ethical approval on 16 March 2026.

Participants

For the quantitative phase, the study population consisted of 1,654 households in Karuwisi Utara Subdistrict, Makassar City, based on the 2023 population registry. Assuming one housewife represented each household, the target population comprised 1,654

housewives. The sample size was calculated using the Lemeshow formula with a 95% confidence level and a 5% margin of error, resulting in a minimum sample of 200 respondents.

A simple random sampling technique was used to select respondents from the study population. Eligible participants were housewives aged 18 years or older, residing in Karuwisi Utara Subdistrict for at least six months, and willing to participate in the study. Respondents who were unable to complete the questionnaire or provided incomplete responses were excluded from the study.

For the qualitative phase, participants were selected using purposive sampling based on the quantitative survey findings. Informants were chosen to represent different levels of preparedness and included housewives, community representatives, Family Welfare Empowerment (PKK) leaders, and personnel from the Makassar City Fire and Rescue Service. A total of five informants participated in the in-depth interviews. Data collection continued until sufficient information was obtained to explain and enrich the quantitative findings.

Variables and Measurement

The study assessed household preparedness for the early detection of potential fire hazards using a Knowledge, Attitude, and Practice (KAP) framework. The questionnaire was developed based on concepts of community fire preparedness, household fire safety, and disaster-risk reduction recommended by the National Fire Protection Association (NFPA), the International Federation of Red Cross and Red Crescent Societies (IFRC), and household disaster preparedness frameworks commonly used in public health research.

The knowledge domain measured respondents' understanding of potential fire hazards, common causes of household fires, safe electrical use, LPG safety, and emergency response procedures. Knowledge scores ranged from 0 to 34 and were categorized as poor (0–18), moderate (19–25), and good (26–34).

The attitude domain assessed respondents' perceptions, awareness, and willingness to engage in fire-prevention behaviors. Attitude scores ranged from 16 to 80 and were categorized as poor (16–39), moderate (40–63), and good (64–80).

The practice domain measured the implementation of household fire-prevention measures, including electrical safety practices, monitoring of LPG equipment, emergency preparedness, and routine hazard identification. Practice scores ranged from 17 to 85 and were categorized as poor (17–42), moderate (43–67), and good (68–85).

Score categorization was adapted from Bloom's cut-off criteria, which classify scores into poor (<60% of the maximum score), moderate (60–79%), and good ($\geq 80\%$) levels. These criteria are widely used in Knowledge, Attitude, and Practice studies.

Prior to data collection, the questionnaire underwent expert review to assess content validity. Instrument reliability was evaluated through a pilot study conducted among respondents with characteristics similar to those of the study population. Internal consistency was assessed using Cronbach's alpha coefficients, with values of ≥ 0.70 considered acceptable for research purposes.

Data Analysis

Quantitative data were analyzed using SPSS statistical software. The analysis consisted of the following stages: (1) Univariate analysis, which generated frequency distributions and

percentages of respondents' characteristics and levels of early fire-detection ability, categorized as good, moderate, or poor; and (2) Bivariate analysis, using the Chi-square test to examine the association between educational level and employment status and the ability to detect potential fire hazards at an early stage.

Qualitative data were analyzed using NVivo software to organize, code, and visualize the data, supplemented by manual analytical techniques such as coding frameworks, mind maps, and thematic analysis guidelines. These approaches were used to identify patterns and themes emerging from the non-numerical data. The analysis consisted of three stages: (1) Data condensation, involving the selection, simplification, and focusing of interview transcript data; (2) Data display, involving the organization of findings into coherent narratives or matrices; and (3) Conclusion drawing, involving the interpretation and synthesis of the identified findings.

Data triangulation was conducted by comparing the quantitative and qualitative findings and subsequently synthesizing the results to provide a comprehensive answer to the research questions. The qualitative findings were examined to determine whether they supported, expanded upon, or contradicted the quantitative survey findings. The research data are presented in the form of tables and diagrams, accompanied by descriptive narratives.

RESULTS

Univariate Analysis

Table 1. Respondents Characteristic

Characteristic	Category	n	%
Age	< 25 years	8	4.0
	26 - 35 years	39	19.5
	36 - 45 years	57	28.5
	46 - 55 years	61	30.5
	> 55 years	35	17.5
Highest Education Level	Primary School	51	25.5
	Junior High School	42	21.0
	Senior High / Vocational School	84	42.0
	Higher Education	23	11.5
Employment Status	Full-time Housewife	181	90.5
	Part-time Worker	15	7.5
	Full-time Worker	4	2.0
House Type	Permanent	91	45.5
	Semi-Permanent	68	34.0
	Non-Permanent	41	20.5
Total		200	100.0

Source: Primary Data, 2026

As demonstrated in Table 1, the majority of respondents were aged 46–55 years (30.5%) and 36–45 years (28.5%), whereas those under 25 years constituted the smallest demographic

group (4.0%). In terms of educational attainment, the largest proportion of participants had completed upper secondary education (Senior High/Vocational School; 42.0%), followed by primary education (Primary School; 25.5%) and lower secondary education (Junior High School; 21.0%), with only 11.5% having pursued higher education. Regarding employment status, a substantial majority (90.5%) were full-time homemakers, while part-time and full-time external employment accounted for only 7.5% and 2.0%, respectively. Concerning housing type, most respondents resided in permanent (45.5%) or semi-permanent structures (34.0%), whereas 20.5% lived in non-permanent housing.

These demographic characteristics indicate that the study population is predominantly comprised of women ranging from productive age to early older adulthood, characterized by moderate educational levels and primary roles as homemakers. Consequently, investigating their knowledge, attitudes, and practices regarding early fire hazard detection is highly pertinent, given that these individuals spend the majority of their time within the domestic environment.

Table 2. Distribution of Knowledge, Attitudes, and Practices

Variable	Category	Score Range	n	%
Knowledge	Good	26–34	123	61.5
	Moderate	19–25	53	26.5
	Poor	0–18	24	12.0
Attitude	Good	64–80	60	30.0
	Moderate	40–63	139	69.5
	Poor	16–39	1	0.5
Practice	Good	68–85	28	14.0
	Moderate	43–67	147	73.5
	Poor	17–42	25	12.5

Source: Primary Data, 2026

Table 2 presents the distribution of respondents' knowledge, attitudes, and practices regarding the early detection of potential household fire hazards. Most respondents demonstrated good knowledge (61.5%), while 26.5% and 12.0% were categorized as having moderate and poor knowledge, respectively. Regarding attitudes, the majority of respondents were classified in the moderate attitude category (69.5%), whereas 30.0% demonstrated good attitudes and only 0.5% demonstrated poor attitudes. Similarly, most respondents reported moderate preventive practices (73.5%), while 14.0% and 12.5% were categorized as having good and poor practices, respectively. These findings indicate that although respondents generally possessed good knowledge regarding household fire hazards, attitudes and preventive practices remained predominantly at a moderate level.

Bivariate Analysis

Bivariate analysis presented in Table 3 reveals a statistically significant association between educational attainment and respondents' level of knowledge ($p < 0.001$), with the proportion of good knowledge being higher among individuals with secondary education, particularly senior high/vocational school graduates (Senior High / Vocational School; 30.0%).

Conversely, educational level showed no statistically significant association with either attitude ($p = 0,819$) or practices ($p = 0,461$). These findings indicate that while formal education plays a critical role in enhancing cognitive understanding regarding early fire hazard detection, educational background alone is insufficient to drive shifts in attitude and practical implementation. Consequently, alternative strategies such as experiential learning and practical training are essential to foster meaningful behavioral change.

Table 3. Association Between Level of Education and Knowledge, Attitudes, and Practices

Highest Education Level	Knowledge						Total	P-Value
	Good		Moderate		Poor			
	(n)	(%)	(n)	(%)	(n)	(%)		
Primary School	28	14.0	21	10.5	2	1.0	51 (25.5%)	<.001
Junior High School	25	12.5	12	6.0	5	2.5	42 (21.0%)	
Senior High/Vocational School	60	30.0	15	7.5	9	4.5	84 (42.0%)	
Higher Education	10	5.0	5	2.5	8	4.0	23 (11.5%)	
Attitude								
Primary School	13	6.5	37	18.5	1	0.5	51 (25.5%)	0.819
Junior High School	14	7.0	28	14.0	0	0.0	42 (21.0%)	
Senior High/Vocational School	26	13.0	58	29.0	0	0.0	84 (42.0)	
Higher Education	7	3.5	16	8.0	0	0.0	23 (11.5)	
Practice								
Primary School	8	4.0	36	18.0	7	3.5	51 (25.5%)	0.461
Junior High School	7	3.5	31	15.5	4	2.0	42 (21.0%)	
Senior High/Vocational School	10	5.0	60	30.0	14	7.0	84 (42.0%)	
Higher Education	3	1.5	20	10.0	0	0.0	23 (11.5%)	

Source: Primary Data, 2026

Table 4. Association Between Employment Status and Knowledge, Attitudes, and Practices

Table 1: Association Between Employment Status and Knowledge, Attitudes, and Practices								
Employment Status	Knowledge						Total	P-Value
	Good		Moderate		Poor			
	(n)	(%)	(n)	(%)	(n)	(%)		
Full-time Housewife	116	58.0	45	22.5	20	10.0	181 (90.5%)	0.037
Part-time Worker	4	2.0	7	3.5	4	2.0	15 (7.5%)	
Full-time Worker	3	1.5	1	0.5	0	0.0	4 (2.0%)	
Attitude								
Full-time Housewife	53	26.5	127	63.5	1	0.5	181 (90.5)	0.772
Part-time Worker	6	3.0	9	4.5	0	0.0	15 (7.5%)	
Full-time Worker	1	0.5	3	1.5	0	0.0	4 (2.0%)	
Practice								
Full-time Housewife	24	12.0	133	66.5	24	12.0	181 (90.5%)	0.570
Part-time Worker	4	2.0	10	5.0	1	0.5	15 (7.5%)	
Full-time Worker	0	0.0	4	2.0	0	0.0	4 (2.0%)	

Source: Primary Data, 2026

As shown in Table 4, employment status demonstrated a statistically significant association with respondents' level of knowledge ($p = 0.037$), even though the majority of participants were full-time homemakers. Conversely, no statistically significant association was found between employment status and either attitude ($p = 0.772$) or practices ($p = 0.570$).

Qualitative Analysis

Five informants participated in the qualitative phase, consisting of three housewives (HW-01, HW-02, and HW-03), one Family Welfare Empowerment (PKK) representative (PKK-01), and one officer from the Makassar City Fire and Rescue Service (FRS-01). Thematic analysis identified five major themes related to household fire preparedness and early fire-hazard detection.

Awareness of Common Household Fire Hazards

The qualitative findings indicated that respondents generally recognized common household fire hazards, particularly those related to electrical equipment, LPG cylinders and gas stoves, cooking activities, overloaded electrical connections, damaged cables, and improper use of electrical appliances. This finding is consistent with the quantitative results, which showed that 61.5% of respondents had good knowledge of early fire-hazard detection.

One housewife described:

"Saya biasanya memperhatikan kabel yang sudah terkelupas atau colokan yang terlalu banyak dipakai sekaligus karena itu sering dianggap biasa padahal berbahaya." (HW-01)

Similarly, a Fire and Rescue Service officer stated:

"Kasus yang paling sering kami temui berasal dari korsleting listrik dan kebocoran gas yang tidak terdeteksi." (FRS-01)

However, hazard recognition was not always accompanied by systematic inspection or preventive action, as respondents tended to rely on familiarity with daily household activities and visible warning signs, such as unusual odors, smoke, sparks, or abnormal electrical conditions, indicating that fire-hazard identification remained largely reactive rather than based on a structured risk-assessment approach.

The Gap Between Knowledge and Preventive Practice

The interviews revealed a discrepancy between respondents' understanding of household fire hazards and their preventive practices. Although respondents generally recognized electrical appliances, LPG, and cooking activities as potential fire hazards and reported preventive measures such as checking gas stoves, switching off electrical appliances, and avoiding overloaded connections, these practices were not consistently implemented and were often influenced by routine activities, perceived risk, and personal awareness.

One participant explained:

"Saya tahu kalau kabel yang rusak harus segera diganti, tetapi kadang ditunda dulu karena masih bisa dipakai." (HW-02)

Another participant stated:

"Kebanyakan ibu-ibu sudah tahu bahayanya, tetapi belum tentu melakukan pengecekan rutin di rumah." (PKK-01)

This finding helps explain the predominance of moderate preventive practices (73.5%) despite a relatively high level of knowledge (61.5%), indicating that knowledge alone is insufficient to establish consistent fire-prevention behavior and must be supported by habitual practices and sustained risk awareness.

Influence of Personal Experience and Household Routines

Personal experience and household routines influenced respondents' perceptions and preventive behaviors toward fire hazards. Previous exposure to gas leaks, electrical sparks, overheated appliances, or minor fire incidents appeared to increase awareness and caution, whereas routine activities such as cooking, using electrical appliances, and managing LPG were not always accompanied by conscious risk assessment.

One participant shared:

"Pernah ada kabel yang mengeluarkan percikan api di rumah, sejak itu saya lebih sering mengecek kondisi listrik." (HW-01)

Another participant noted:

"Setelah mengalami kebocoran gas kecil, saya jadi lebih berhati-hati saat memasang regulator." (HW-02)

The Fire and Rescue Service officer similarly observed:

"Warga yang pernah mengalami kejadian kebakaran biasanya lebih cepat mengenali tanda-tanda bahaya dibandingkan yang belum pernah mengalaminya." (FRS-01)

One participant, however, stated that preparedness should not depend solely on previous experience:

"Menurut saya, meskipun belum pernah mengalami kebakaran, kita tetap harus waspada." (HW-03)

Consequently, fire prevention tended to be integrated into routine domestic activities rather than perceived as a specific safety practice. This finding may explain the predominance of moderate attitudes, with 69.5% of respondents classified as having moderate attitudes and 30.0% as having good attitudes, indicating that although respondents recognized the importance of fire prevention, such awareness had not consistently developed into proactive safety behavior.

Limited Practical Fire-Safety Education and Training

The interviews indicated that respondents obtained fire-safety information from various sources, including personal experience, family members, community activities, media, and informal sources. However, such exposure was not consistently accompanied by practical training in household fire-hazard detection and response.

One participant stated:

"Pernah ada penyuluhan tentang kebakaran, tetapi hanya berupa penjelasan tanpa praktik." (HW-01)

The PKK representative similarly reported:

“Kegiatan edukasi lebih banyak berupa sosialisasi. Pelatihan langsung masih jarang dilakukan.” (PKK-01)

The Fire and Rescue Service officer added:

“Program pelatihan belum dapat menjangkau seluruh warga karena keterbatasan sumber daya.” (FRS-01)

Respondents were more familiar with general preventive measures than with systematic household risk assessment, recognition of early warning signs, and the appropriate use of fire-extinguishing equipment. This finding is consistent with the quantitative results showing a significant association between educational attainment and knowledge ($p < 0.001$), but not with attitudes or practices, suggesting that formal education may enhance fire-safety knowledge, whereas practical training and direct experience are needed to facilitate the translation of knowledge into routine preventive behavior.

Perceived Barriers to Early Fire-Hazard Detection

The qualitative findings indicated that consistent early fire-hazard detection was constrained by competing household activities, the absence of routine safety practices, limited practical training, and reliance on personal experience.

One participant explained:

“Kadang saya terlalu sibuk mengurus rumah dan anak sehingga tidak sempat memeriksa instalasi listrik secara rutin.” (HW-02)

Another participant reported:

“Kalau ada kabel yang rusak, kadang menunggu sampai benar-benar rusak karena biaya penggantianannya.” (HW-01)

The Fire and Rescue Service officer observed:

“Sebagian masyarakat masih menganggap pemeriksaan instalasi listrik bukan kebutuhan yang mendesak.” (FRS-01)

A contrasting perspective was expressed by one participant who considered routine inspections manageable despite household responsibilities:

“Saya tetap meluangkan waktu untuk mengecek kondisi rumah karena lebih baik mencegah daripada memperbaiki setelah terjadi kebakaran.” (HW-03)

These barriers suggest that household fire preparedness is influenced not only by individual knowledge but also by behavioral habits and social and environmental contexts. Although respondents generally demonstrated an understanding of common fire hazards, this knowledge was not consistently translated into preventive practices, as reflected in the predominance of moderate attitudes and practices.

DISCUSSION

Main Findings

This study demonstrates that household fire preparedness among housewives is influenced by multiple interrelated factors, including knowledge, risk perception, previous experiences, routine household practices, and access to practical fire-safety education

(Karemaker et al., 2022; Kurata et al., 2023). Although most respondents demonstrated good knowledge of common household fire hazards, preventive practices remained only moderate, suggesting that awareness alone is insufficient to ensure preparedness. Qualitative findings revealed that hazards were often recognized only after potentially dangerous situations had occurred rather than through proactive risk assessment. These findings indicate that household fire preparedness extends beyond knowledge acquisition and is shaped by behavioral factors such as motivation, perceived risk, and the consistent application of safety practices in everyday life.

Interpretation of the Knowledge–Practice Gap

One of the key findings of this study was the gap between knowledge and preventive behavior. Although respondents generally demonstrated adequate knowledge of household fire hazards, this knowledge was not consistently translated into preventive actions (Karemaker et al., 2021; Karemaker et al., 2022). Qualitative findings indicated that participants were aware of risks related to LPG use, electrical appliances, and cooking activities, but preventive measures were often implemented only after previous incidents or visible warning signs. This discrepancy may occur because fire risks are embedded in routine household activities and are therefore perceived as less threatening. In addition, preparedness behaviors are influenced not only by knowledge but also by risk perception, self-efficacy, and confidence in performing preventive actions (Karemaker et al., 2022; Guo et al., 2022). These findings suggest that educational interventions should emphasize practical skills and risk awareness, rather than focusing solely on knowledge improvement.

Associations Between Education and the Outcomes

Educational attainment was significantly associated with knowledge levels but not with attitudes or preventive practices (Cvetković et al., 2022). This finding suggests that formal education primarily enhances understanding of fire hazards without necessarily promoting preparedness behaviors (Karemaker et al., 2022; Zaremohzzabieh et al., 2021). Individuals with higher educational backgrounds may have greater access to information and a better ability to comprehend safety-related messages. However, preparedness behaviors are also influenced by personal experiences, household conditions, social norms, and opportunities for participation in preparedness activities. Therefore, formal education should be regarded as an enabling factor rather than a sufficient determinant of fire preparedness. Practical training, community engagement, and repeated exposure to safety messages may be needed to translate knowledge into sustained preventive behavior.

Findings Regarding Employment Status After Reanalysis

The reanalysis showed that employment status was associated with knowledge but not with attitudes or preventive practices. Employment may increase access to information, social interactions, and learning opportunities that enhance awareness of fire hazards (Cisternas et al., 2024). However, preparedness behaviors appear to be influenced more by contextual and behavioral factors, such as previous experiences, household conditions, available resources, and participation in safety-related activities, than by employment status alone (Amberson et al., 2024; Cisternas et al., 2024). These findings suggest that employment status should not be considered a primary predictor of household fire preparedness.

Contribution of the Qualitative Findings

The qualitative findings provided important contextual insights that complemented the quantitative results. Participants frequently reported experiences involving gas leaks, electrical sparks, overheated appliances, and other near-miss incidents, which appeared to increase awareness and caution toward fire hazards (Karemaker et al., 2021). The interviews also revealed limited practical training in fire prevention and emergency response, resulting in uncertainty about appropriate actions during emergencies. In addition, routine activities such as cooking and the use of electrical appliances were often perceived as ordinary household practices rather than potential fire hazards. These findings help explain why adequate knowledge did not always translate into preparedness behavior and underscore the importance of experiential learning, practical training, and risk awareness in strengthening household fire preparedness (Haghani et al., 2024; Karemaker et al., 2022).

Public Health Implications

The findings suggest that household fire-prevention programs should move beyond information dissemination and adopt behavior-oriented approaches that emphasize practical skills, including safe LPG use, electrical safety, hazard identification, evacuation procedures, and basic fire-extinguisher use (Hsieh et al., 2023; Amberson et al., 2024). Community-based programs can further strengthen preparedness by providing opportunities for demonstrations, simulations, household risk assessments, and repeated practice (Waring et al., 2025). In densely populated urban areas, integrating fire-safety education into existing community health and disaster-preparedness activities may enhance household readiness and encourage the adoption of preventive behaviors.

Strengths and Limitations

A major strength of this study is the use of a mixed-methods approach, which enabled the integration of quantitative and qualitative findings to provide a more comprehensive understanding of household fire preparedness. While the quantitative data identified patterns and associations among key variables, the qualitative findings offered contextual explanations for the observed results.

Several limitations should be acknowledged. First, the cross-sectional design precludes causal inference. Second, the use of self-reported data may be subject to recall and social desirability biases. Third, the study was conducted in a specific community setting, which may limit the generalizability of the findings to other populations. Finally, the qualitative component involved a relatively small number of participants and may not fully represent the diversity of experiences within the broader community.

Future Research Agenda

Future research should employ longitudinal designs to better understand how knowledge, risk perception, and prior experiences influence household fire-preparedness behaviors over time. Studies evaluating the effectiveness of practical interventions, such as fire-safety training, evacuation drills, and community-based education programs, are also needed. In addition, further research should explore socio-cultural, environmental, and structural factors that may influence preparedness, including household decision-making processes, housing conditions, access to safety equipment, and community resources. Such evidence

would support the development of more targeted and effective fire-prevention strategies for vulnerable households.

CONCLUSION

This study concludes that housewives in Karuwisi Utara, Makassar, generally possess adequate knowledge of household fire hazards; however, this knowledge is not consistently reflected in preventive attitudes and practices. Educational attainment and employment status were associated with knowledge levels, but neither showed significant associations with attitudes or preventive behaviors. Qualitative findings revealed that personal experiences, routine household activities, perceived risk, limited practical training, and contextual barriers contribute to the gap between knowledge and preparedness behavior. These findings highlight the need for behavior- and community-oriented fire-prevention programs that emphasize practical training, household risk assessment, evacuation drills, early hazard recognition, and basic fire-extinguishing skills. Future research should evaluate the effectiveness of community- and household-based interventions in promoting sustained fire-prevention practices among housewives, particularly in densely populated residential settings.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Head of Karuwisi Utara Subdistrict, Makassar City, and the staff for their support and cooperation throughout the research process. The authors also extend their appreciation to all participants who generously contributed their time, provided valuable information, and participated in this study. The authors gratefully acknowledge all parties who provided support, both directly and indirectly, contributing to the successful completion of this research. The authors also express their sincere appreciation to the Ministry of Higher Education, Science, and Technology of the Republic of Indonesia (Kemdiktisaintek) for providing research funding through the BIMA Grant, which supported the implementation of this study.

REFERENCES

- Amberson, T., Qureshi, K., & Sousa, R. P. D. (2024). Social support, educational, and behavioral modification interventions for improving household disaster preparedness in the general community-dwelling population: A systematic review and meta-analysis. *Frontiers in Public Health*, 11, 1257714. <https://doi.org/10.3389/fpubh.2023.1257714>
- Cisternas, P. C., Cifuentes, L. A., Bronfman, N. C., Repetto, P. B., & Castañeda, J. V. (2024). Household preparedness for multi-natural hazards in coastal communities. *International Journal of Disaster Risk Reduction*, 109, 104584. <https://doi.org/10.1016/j.ijdr.2024.104584>
- Cvetković, V. M., Öcal, A., Ivanov, A., Petrović, M. D., & Milošević, S. (2022). Household preparedness for disasters: Knowledge, attitudes and practices. *International Journal of Disaster Risk Reduction*, 76, 103018. <https://doi.org/10.1016/j.ijdr.2022.103018>
- Guo, J., An, Y., & Comes, T. (2022). The role of risk communication and information interaction in disaster preparedness: A conceptual framework and empirical evidence. *International*

- Journal of Disaster Risk Reduction*, 78, 103119.
<https://doi.org/10.1016/j.ijdrr.2022.103119>
- Haghani, M., Bode, N., & Sarvi, M. (2024) *Human behaviour in fire: Knowledge foundation and temporal evolution*. *Fire Safety Journal*, 144, 104085.
<https://doi.org/10.1016/j.firesaf.2023.104085>
- Herald Sulsel. (2025, October 10). *Sepanjang 2025, 209 kasus kebakaran terjadi di Makassar dengan kerugian Rp65,8 miliar*. Herald Sulsel. Herald Sulsel Article
- Hsieh, H. W., Wu, C. S., Tsai, C. C., Liao, Y. C., Chen, P. Y., Tseng, H. L., Huang, M. Z., & Chen, M. F. (2023). Comparing the effectiveness of board game-based and drill-based education programs in improving fire safety knowledge, attitudes, and behavior: A quasi-experimental study. *Nurse Education Today*, 129, 105919.
<https://doi.org/10.1016/j.nedt.2023.105919>
- Karemaker, M., ten Hoor, G. A., Hagen, R. R., van Schie, C. H. M., Boersma, K., & Ruiter, R. A. C. (2021). *Elderly about home fire safety: A qualitative study into home fire safety knowledge and behaviour*. *Fire Safety Journal*, 124, 103391.
<https://doi.org/10.1016/j.firesaf.2021.103391>
- Karemaker, M., ten Hoor, G. A., Hagen, R. R., van Schie, C. H. M., & Ruiter, R. A. C. (2022). *Social cognitive determinants of fire safe behaviour in older adults*. *Fire Safety Journal*, 134, 103667. <https://doi.org/10.1016/j.firesaf.2022.103667>
- Kurata, Y. B., Ong, A. K. S., Prasetyo, Y. T., Dizon, R. M., Persada, S. F., & Nadlifatin, R. (2023). *Determining factors affecting perceived effectiveness among Filipinos for fire prevention preparedness in the National Capital Region, Philippines: Integrating Protection Motivation Theory and extended Theory of Planned Behavior*. *International Journal of Disaster Risk Reduction*, 85, 103497. <https://doi.org/10.1016/j.ijdrr.2022.103497>
- Rahmat, A., Prianto, E., & Sasongko, S. B. (2018). Studi evaluasi model bentuk atap dan fenomena kebakaran penyebab listrik pada rumah tinggal menengah ke bawah di pemukiman padat. *Jurnal Arsitektur ZONASI*, 1(2), 112–122.
<https://doi.org/10.17509/jaz.v1i2.13560>
- Rahmania, R., Adriani, A., & Rohana. (2025). Analysis of potential fire due to short current in semi-permanent buildings at Tinumbu Street in Aisle 148–149 Makassar City. *ELKHA: Jurnal Teknik Elektro*, 17(1), 9–14. <https://doi.org/10.26418/elkha.v17i1.84748>
- Sagala, S., Wimbardana, R., & Pratama, F. P. (2014). Behavior and preparedness to fire hazard in high density settlements in Bandung. *Forum Geografi*, 28(1), 17–28.
<https://doi.org/10.23917/forgeo.v28i1.433>
- Waring, S. C., Fielding, K. S., & Thomas, M. (2025). Increasing home fire preparedness through a home visiting program: An evaluation of the American Red Cross Home Fire Campaign. *International Journal of Disaster Risk Reduction*, 129, 105802.
<https://doi.org/10.1016/j.ijdrr.2025.105802>
- Zaremohzzabieh, Z., Ahrari, S., Krauss, S. E., Samah, A. A., Omar, S. Z., & Steven Eric, K. O. (2021). Predicting household disaster preparedness: The role of socio-psychological factors. *International Journal of Disaster Risk Reduction*, 58, 102175.
<https://doi.org/10.1016/j.ijdrr.2021.102175>