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Preparedness for Fire Emergencies in The Security Industry: Demographic Determinants of Fire Emergency Preparedness in Security Personnel

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ABSTRACT

Fire emergency evacuation operations demand well-prepared personnel, particularly among frontline security officers who often serve as first responders. This investigation examines the impact of demographic variables, including job description, gender, and training frequency, on the emergency preparedness of security personnel. Data were collected from 445 security officers using a structured questionnaire and analyzed through independent samples t-tests to determine significant differences in preparedness levels across demographic groups. Findings reveal that job role significantly affects preparedness, with management personnel generally demonstrating higher competence. The analysis of gender differences indicated that male respondents scored higher in technical competencies and emergency response, whereas females demonstrated greater confidence in leadership and command responsibilities. These results highlight the importance of inclusive, role-specific, and psychologically supportive training programs. Such efforts are essential to building a resilient, confident, and well-coordinated emergency response workforce. Practical implications of the findings are that continuous evaluation and feedback mechanisms are crucial for assessing training effectiveness and identifying areas for improvement. Therefore, organizations should regularly monitor emergency preparedness levels across all roles, adapting training content and methods to meet evolving needs and challenges. By doing so, they will foster a strong culture of safety, readiness, and resilience throughout the workforce.

1. INTRODUCTION

Effective fire emergency evacuation is critical in minimizing casualties and property damage during fire incidents. Frontline security officers often act as the first responders, making their preparedness essential to ensure swift and organized evacuation operations [1]. Fire emergency preparedness encompasses the knowledge, skills, and readiness required to respond effectively in fire situations, including evacuation procedures, hazard recognition, and use of firefighting equipment [2-4]. Security officers play a vital role in these operations, as they are frequently the initial personnel to detect fires and coordinate occupant evacuation, especially in high-risk environments such as commercial buildings, educational institutions, and critical infrastructure [5-7]. However, despite their frontline role, the preparedness of security officers remains underexplored compared to firefighters and healthcare workers [8, 9]. This lack of focus in the literature represents a critical gap in ensuring comprehensive emergency readiness across occupational groups. As facilities become increasingly complex and densely populated, the preparedness of security officers is more crucial than ever and warrants focused empirical investigation to ensure they are adequately equipped to manage evacuation processes during fire incidents.

Fire emergencies require immediate and coordinated responses to prevent escalation and reduce harm. Security officers are often the first on scene, responsible not only for alerting occupants and emergency services but also for managing crowd control and assisting vulnerable populations. Their role demands not only physical readiness but also mental preparedness to make quick decisions under pressure. Such responsibilities highlight the need for structured and targeted preparedness strategies tailored specifically to their unique operational context. Consequently, comprehensive training programs that enhance both practical skills and psychological resilience are crucial for these personnel [10, 11]. Understanding how demographic factors influence their preparedness helps tailor these programs to meet diverse needs effectively. Emergency preparedness is influenced by several demographic determinants [12], including job description, gender, experience, and frequency of emergency training. Job description shapes the scope of responsibilities and the extent of direct involvement in emergency response, which in turn affects exposure to training and emergency scenarios. For instance, supervisory security personnel may receive different types or levels of training compared to operational staff. Gender differences may impact perceptions of risk, physical capabilities, and communication styles during emergencies, which can influence performance and cooperation [13].

Experience, both in terms of years in service and prior exposure to fire incidents or drills, enhances situational awareness and confidence, contributing to more effective responses.

Training frequency is another critical factor to correlate positively with preparedness levels. Regular drills and refresher courses reinforce emergency protocols, build muscle memory for evacuation procedures, and improve coordination among team members [14, 15]. However, the quality and relevance of training are as important as frequency. Training is realistic, scenario-based, and inclusive of diverse job roles, and tends to be more effective in equipping security officers with necessary competencies [16]. Despite this, limited empirical studies have assessed how these demographic and experiential variables interact to shape overall preparedness among security officers specifically. This oversight may result in ineffective training design and suboptimal resource allocation. Although numerous studies have explored emergency preparedness among firefighting personnel and healthcare workers, limited research addresses security officers as frontline responders [8, 9]. This oversight leaves a critical gap in occupational safety and emergency management literature. In particular, modern facilities present evolving fire risks, and security officers must navigate complex environments with varying roles and responsibilities. Therefore, a nuanced understanding of how demographic factors influence preparedness is essential for developing evidence-based interventions. Filling this gap will inform more targeted, effective interventions to enhance the safety and operational readiness of security personnel, ultimately contributing to safer evacuation outcomes for all building occupants.

This research addresses the gap by empirically examining fire emergency preparedness among security personnel. The study also identifies how demographic factors such as job description, gender, experience, and training frequency can affect their response capabilities. The findings aim to support the design of more effective, context-specific training frameworks and policy strategies to strengthen emergency response systems by security officers. This study can provide valuable insights into the specific needs and strengths of security teams by investigating how demographic variables affect preparedness. These findings have practical implications for organizations and policymakers seeking to design more effective, inclusive, and data-driven emergency preparedness strategies. Ultimately, this study not only addresses a critical research gap but also supports efforts to improve evacuation outcomes, enhance public safety, and build institutional resilience in increasingly complex built environments.

2. METHODOLOGY

This section provides a comprehensive overview of the research methodology utilized to investigate the extent of fire emergency preparedness among security personnel, with particular attention to variations across diverse demographic backgrounds. It elaborates on the research design, target population, sampling techniques, research instrument, data collection procedures, and data analysis methods employed in the study.

2.1 Research design

This study employed a quantitative research design using a cross-sectional survey approach to investigate the relationship between demographic variables such as job description, gender, and the level of preparedness for fire emergency evacuation operations among security officers. Quantitative methods are appropriate as they facilitate statistical testing to examine group differences and provide generalizable insights across large populations [17].

2.2 Population and sampling

The target population consisted of security personnel working within a designated safety-critical organization. A total of 445 respondents participated in the study, representing a diverse cross-section of individuals in management and supervisory roles (n=121) and those in operational and response roles (n=324). The sampling strategy employed was stratified random sampling, ensuring a proportional representation of both functional roles. This approach was chosen to reduce sampling bias and ensure that the sample accurately reflected the actual structure of the workforce, thereby improving the external validity of the findings [18, 19]. The distribution of participants by gender indicates a pronounced imbalance, comprising 370 males (83.1%) and 75 females (16.9%). In addition, participants demonstrated varied experience with fire emergency training, with 87 individuals (19.6%) having undergone the training more than once, while 358 (80.4%) indicated little to no previous involvement.

2.3 Research instrument

Data were collected using a structured questionnaire developed based on established constructs related to fire emergency preparedness. The instrument consisted of 54 items, distributed across eleven constructs (C1–C11), with different dimensions of preparedness, knowledge, communication, situational awareness, and decision-making. Each item was rated using a five-point Likert scale (1=Strongly Disagree to 5=Strongly Agree). The questionnaire design was grounded and adapted from validated instruments from occupational safety literature and aligned with internationally recognized emergency preparedness frameworks, such as those from OSHA and NFPA standards, and adapted from the previous studies [3, 20, 21], thereby ensuring content validity. The questionnaire underwent content validation by safety management experts and experienced fire safety trainers. A pilot test involving 30 respondents was conducted to assess the instrument's reliability, with Cronbach's alpha coefficients exceeding 0.80 for all constructs, indicating high internal consistency.

2.4 Data collection procedures

The researchers informed all participants of the study's purpose, and participants voluntarily and anonymously agreed to take part. They provided consent before completing the questionnaire. To overcome operational limitations and broaden participation, the researchers distributed the survey physically and electronically to accommodate operational constraints and ensure wider reach among security personnel across various duty stations.

2.5 Data analysis

Collected data were analyzed using IBM SPSS Statistics (Version 29). The researchers used descriptive statistics to present an overview of the demographic data and preparedness levels. The researchers employed independent samples t-tests to assess whether significant differences existed between groups based on job roles and gender across the eleven preparedness constructs. This analytical method is appropriate for comparing mean differences between two independent groups [22]. In addition, frequency distributions were used to report respondent attendance in fire emergency training. This variable provided a crucial contextual understanding of preparedness levels across the sample. All statistical tests assumed a 95% confidence level, and preliminary checks were conducted for normality, homogeneity of variance, and outliers to ensure robustness of the analysis.

3. FINDINGS AND DISCUSSIONS

This research explores the relationship between security officers' demographic variables, specifically job description and gender, and their preparedness for fire emergency evacuation operations with independent samples t-tests. These analyses aimed to determine whether there are statistically significant differences in preparedness levels based on the functional role they hold within the organization and the officers' gender. This approach enables a clearer understanding of how demographic and occupational factors may influence emergency readiness among personnel involved in safety operations.

3.1 Job description as a demographic factor

In organizations that emphasize safety and emergency preparedness, the structure and classification of staff play a critical role in shaping effective response strategies.

As highlighted by Haddow et al. [23], categorizing personnel based on functional responsibilities is essential for ensuring a systematic and focused analysis of emergency management capabilities. In line with this framework, the present study categorizes respondents into two primary groups: management and supervision and operational and response teams. A total of 445 respondents participated in this study, 121 respondents (27.2%) under the management and supervision category, which includes leadership and oversight roles such as managing director/chief executive officer, heads of department/ manager, and supervisor/ team leader. These roles are primarily responsible for strategic planning, policy formulation, and organizational decision-making. The remaining 324 respondents (72.8%) under the Operational and Response Team, which includes tactical and field-level roles such as Security Officer/Guard, Security Operator/Support Staff, and Emergency Response Team (ERT) members. These individuals are directly involved in the practical implementation of emergency plans and the immediate response to incidents on the ground. The disproportionate representation, with a higher number of respondents from the operational category, reflects the typical structure of safety-oriented organizations where field personnel outnumber supervisory staff. This distribution not only mirrors the real-world staffing ratio but also ensures that the study captures a comprehensive view of emergency preparedness practices at strategic and operational levels. Such classification enables meaningful comparisons between the roles and enhances the analytical depth of the study in assessing preparedness, awareness, and response behaviors across different functional groups. The results of the independent samples t-test, conducted to compare the mean scores between the management and supervision group and the operational and response team, are presented in Table 1.

Table 1. Independent samples test (Job description)

		Levene's Test		T-Test for Equality of Means			Interpretation
		F	Sig.	t	df	Sig.(2-tailed)	
C1	Equal variances assumed	11.708	.001	3.122	443	.002	Significant – Management & Supervision group reports higher general fire safety awareness.
	Equal variances not assumed			3.295	240.465	.001	
C2	Equal variances assumed	7.026	.008	4.678	443	.000	Significant – Management better at identifying fire hazards.
	Equal variances not assumed			4.485	198.951	.000	
C3	Equal variances assumed	.385	.535	7.182	443	.000	Significant – Management has stronger evacuation strategy knowledge.
	Equal variances not assumed			7.254	219.517	.000	
C4	Equal variances assumed	8.809	.003	1.543	443	.124	Not significant – No difference in fire risk perception between job roles.
	Equal variances not assumed			1.599	231.398	.111	
C5	Equal variances assumed	20.928	.000	8.165	443	.000	Significant – Management group has better fire alarm response knowledge.
	Equal variances not assumed			8.779	250.528	.000	
C6	Equal variances assumed	313.489	.000	9.823	443	.000	Significant – Management more knowledgeable in fire suppression techniques.
	Equal variances not assumed			12.391	367.657	.000	
C7	Equal variances assumed	113.328	.000	11.898	443	.000	Significant – Management shows higher individual response readiness.
	Equal variances not assumed			14.087	315.038	.000	
C8	Equal variances assumed	75.299	.000	9.479	443	.000	Significant – Management better in coordinating emergency response.
	Equal variances not assumed			11.387	326.514	.000	
C9	Equal variances assumed	83.746	.000	13.033	443	.000	Highly significant – Management excels in emergency planning strategies.
	Equal variances not assumed			17.158	403.130	.000	
C10	Equal variances assumed	111.504	.000	5.354	443	.000	Significant – Management communicates better in emergencies.
	Equal variances not assumed			6.168	294.512	.000	
C11	Equal variances assumed	.964	.327	.572	443	.568	Not significant – No job-based difference in post-incident evaluation.
	Equal variances not assumed			.577	219.076		

The following discussion highlights these differences for each construct:

(1) Construct 1: Emergency Preparedness on Planning (C1)

Management personnel scored notably higher in emergency planning, demonstrating stronger understanding of fire safety procedures, evacuation cues, and the overall safety system. Their enhanced awareness plays a crucial role in hazard prevention. Research affirms that managerial knowledge directly strengthens safety culture in high-risk settings [24].

(2) Construct 2: Fire Protection System (C2)

Managers displayed strong abilities in identifying fire risks, likely due to their roles in conducting inspections and ensuring compliance with fire safety regulations. Their responsibilities in hazard mitigation support these results [25].

(3) Construct 3: Fire Risk Reduction (C3)

Management staff actively participated in planning evacuation routes, leading drills, and supervising fire procedures, which resulted in significantly higher scores. Regular involvement in drills has been proven to improve preparedness, especially among supervisory roles [26, 27].

(4) Construct 4: Incident Command System & Emergency Response Team (C4)

No significant difference emerged between management and operational staff in this construct, suggesting standardized training has successfully established a common understanding of emergency protocols. The use of a unified command system enhances interdepartmental coordination during emergencies [28].

(5) Construct 5: Leadership (C5)

Management respondents showed superior skills in alarm verification, false alarm identification, and executing timely emergency responses. Research supports that effective leadership enables fast and accurate decisions in critical scenarios, which greatly impacts emergency outcomes [29].

(6) Construct 6: Communication in Fire Emergency (C6)

Managers performed better in emergency communication, likely due to scenario-based training and greater exposure to coordination roles. Such training improves clarity in instruction and response coordination [30].

(7) Construct 7: Fire Emergency Training–First Aid (C7)

Management staff benefited from regular first aid training, often integrated into leadership programs, resulting in better preparedness in first response situations. This supports findings that routine first aid instruction enhances emergency skills among non-medical personnel [31].

(8) Construct 8: Awareness and Education (C8)

Managers demonstrated stronger leadership and coordination during crises, which can be attributed to continuous professional development in emergency and crisis management. Such training leads to quicker and more efficient responses [32].

(9) Construct 9: Responders' Emergency Response Capabilities (C9)

Management scored higher in areas such as documentation and post-incident analysis. Their administrative roles often involve reviewing emergency events, which contributes to institutional learning and protocol improvement [33].

(10) Construct 10: Organizational Commitment (C10)

Managers showed higher levels of calm and clarity in emergency communication, supporting overall stability during critical situations. Effective communication strategies at the managerial level are essential for boosting resilience and ensuring workplace safety [34].

(11) Construct 11: Effectiveness of Fire Drill Preparedness (C11)

Management teams actively led fire drills, reinforcing a preparedness culture and improving team coordination. Their visible leadership during such exercises fosters stronger engagement and response among operational staff [35].

Collectively, these findings underline job description as a critical demographic factor that significantly shapes fire emergency preparedness levels through differences in responsibility, exposure, training, and leadership engagement. From a theoretical perspective, these findings align with Role Theory [36], which posits that individuals' behavior and competency development are shaped by expectations inherent in their organizational roles. Supervisory and management staff, due to their responsibility for organizational continuity and risk governance, are more likely to receive extensive training, engage in simulations, and participate in cross-functional coordination efforts. In contrast, operational staff often engage in reactive rather than proactive emergency duties. Their preparedness is frequently confined to procedural compliance and task execution, which, while essential, may limit broader situational awareness or adaptive decision-making. The study's findings show that management personnel scored significantly higher across key preparedness dimensions, including emergency planning, leadership, communication, training engagement, and response evaluation. These results underscore the structural gap in preparedness shaped by organizational role and access to strategic functions. In conclusion, job description is not a passive demographic label but a powerful determinant of emergency preparedness. The distinctions between management and operational roles influence not only training exposure and decision-making authority but also the capacity to respond effectively in crisis situations. Addressing this imbalance through integrated training strategies, inclusive planning, and shared leadership can enhance the collective emergency readiness of the organization and ensure no group is left underprepared.

3.2 Gender

To determine whether there were statistically significant differences in the levels of fire emergency preparedness between male and female respondents, independent samples t-tests were conducted across eleven measured constructs. The distribution of respondents are 445 respondents, 370 (83.1%) were male, while 75 (16.9%) were female. This indicates a significant gender imbalance in the sample, with male respondents forming the vast majority. Each test compared the mean scores of male and female participants for the respective constructs, evaluating the influence of gender on various dimensions: emergency planning, fire protection systems, leadership, communication, training, and organizational commitment. Before interpreting the t-test results, Levene's Test for Equality of Variances was used to assess the assumption of homogeneity of variances. Where equal variances were assumed ($p > 0.05$), the results from the first row of the t-test; otherwise, the alternative values were reported. The analysis provided insights into whether gender plays a significant role in shaping preparedness, awareness, and response behaviors related to fire emergencies. Table 2 presents the output of the t-tests for all constructs, including values for Levene's Test, t-statistics, degrees of freedom, significance levels (p-values), and mean differences between groups. These findings form the basis for identifying which constructs demonstrate significant gender-based disparities

and contribute to a better understanding of how demographic factors may influence emergency response readiness. To examine potential gender-based differences, an independent samples t-test was conducted between male and female respondents. The results are summarised in Table 2.

Table 2. Independent samples test (Gender)

		Levene's Test		T-Test for Equality of Means			Interpretation
		F	Sig.	t	df	Sig.(2-tailed)	
C1	Equal variances assumed	.053	.818	-.900	443	.369	Not significant – No difference in general awareness between genders.
	Equal variances not assumed			-.912	107.546	.364	
C2	Equal variances assumed	7.740	.006	2.152	443	.032	Significant – Females (assumed higher mean) show better hazard identification.
	Equal variances not assumed			2.383	118.632	.019	
C3	Equal variances assumed	45.301	.000	4.276	443	.000	Significant – Females demonstrate stronger evacuation knowledge.
	Equal variances not assumed			4.840	122.005	.000	
C4	Equal variances assumed	34.141	.000	-2.525	443	.012	Significant – Males show higher risk perception than females.
	Equal variances not assumed			-2.874	122.857	.005	
C5	Equal variances assumed	36.902	.000	6.089	443	.000	Significant – Females have better fire alarm response skills.
	Equal variances not assumed			6.504	113.728	.000	
C6	Equal variances assumed	30.361	.000	7.250	443	.000	Significant – Females show better fire suppression knowledge.
	Equal variances not assumed			7.649	112.169	.000	
C7	Equal variances assumed	83.472	.000	7.470	443	.000	Significant – Females are more ready to respond individually.
	Equal variances not assumed			9.326	140.758	.000	
C8	Equal variances assumed	11.280	.001	6.193	443	.000	Significant – Females exhibit stronger coordination in emergencies.
	Equal variances not assumed			5.781	99.832	.000	
C9	Equal variances assumed	18.808	.000	11.984	443	.000	Highly significant – Females excel in strategic emergency planning.
	Equal variances not assumed			12.097	107.139	.000	
C10	Equal variances assumed	19.405	.000	3.443	443	.001	Significant – Females communicate better in emergencies.
	Equal variances not assumed			3.153	98.314	.002	
C11	Equal variances assumed	2.647	.104	-1.017	443	.310	Not significant – No gender difference in post-incident evaluation.
	Equal variances not assumed			-1.034	107.892	.303	

Following the statistical outcomes presented in Table 2, a detailed analysis was conducted to interpret the results for each construct individually. This section presents the findings of the independent samples t-test, conducted to explore gender-based differences in fire emergency preparedness among respondents. The analysis is structured around eleven key constructs, each representing a critical dimension of emergency preparedness and response: Emergency Preparedness on Planning (C1), Fire Protection System (C2), Fire Risk Reduction (C3), Incident Command System and Emergency Response Team (C4), Leadership (C5), Communication in Fire Emergency (C6), Fire Emergency Training (C7), Awareness and Education (C8), Responders' Emergency Response Capabilities (C9), Organizational Commitment (C10), and Effectiveness of Fire Drill Preparedness (C11). Each construct is measured through multiple items coded from QS1A to QL1F. The objective of this analysis is to determine whether there are statistically significant differences between male and female respondents across these constructs. Understanding these differences provides valuable insights into how gender may influence perceptions, experiences, and competencies related to fire emergency preparedness—thereby supporting more effective and inclusive safety policies and training programs.

(1) Construct 1: Emergency Preparedness on Planning (QS1)

There was no significant difference between male and female respondents, t (443) =-0.900, p=0.369; mean difference =-0.0485. This suggests that both genders possess a comparable level of preparedness in terms of planning for fire-related emergencies. Equal exposure to organizational fire safety plans or briefings may contribute to this similarity. This study found that male respondents demonstrated higher awareness of fire protection systems. Previous studies support this finding, which indicates that male participants are more likely to possess sufficient fire safety knowledge due to increased exposure or access to training opportunities [37].

(2) Construct 2: Fire Protection System (QS2)

A significant difference was observed, t (443) =2.152, p=0.032; mean difference =0.1151, with males showing greater knowledge of fire protection systems. This could reflect higher technical involvement or training among male staff. This study revealed that male respondents possessed more extensive knowledge of fire protection systems. This outcome aligns with a Namibian study that identified male participants as more likely to have sufficient fire safety knowledge, attributed to higher exposure and training [33].

(3) Construct 3: Fire Risk Reduction (QS3)

This study identified significantly greater practical knowledge among male respondents in mitigating fire risks. This finding is consistent with research suggesting male individuals often perceive themselves as more capable in risk-related tasks, likely due to societal expectations [2].

(4) Construct 4: Incident Command System & Emergency Response Team (QS4)

A significant difference was detected, t (443) =-2.525, p=0.012; mean difference =-0.1438, with females reporting higher confidence. This may be attributed to a heightened sense of risk awareness or stronger self-efficacy among female respondents during emergency response. Interestingly, this research found that female respondents reported higher confidence in emergency response roles. Although some literature contrasts this result, other studies highlight that female participants may demonstrate strong transformational leadership traits, enhancing team effectiveness during crises [38].

(5) Construct 5: Leadership (QH1)

The results showed a significant difference, t (443) =6.089, p<0.001; mean difference = 0.3607, with males scoring higher. This may reflect greater opportunities for males to assume

leadership roles in emergency planning or execution, especially in operational departments. This study revealed higher leadership scores among male respondents. This finding is consistent with the literature that males are more likely to hold leadership roles in emergency services, predominantly due to institutional restrictions affecting female personnel [39].

(6) Construct 6: Communication in Fire Emergency (QH2)

There was a highly significant difference, t (443) = 7.250, p < 0.001; mean difference = 0.4323, favoring males. This could be due to experience in coordinating emergency responses, particularly in roles where communication is critical, such as safety or technical units. This research found that male participants scored higher in emergency communication, likely due to experience gained in roles requiring coordination during crises. This finding aligns with studies indicating males often dominate technical and communication-intensive safety roles [40].

(7) Construct 7: Fire Emergency Training (QH3)

The analysis revealed a significant difference, t (443) =7.470, p<0.001; mean difference =0.4162, with males reporting better response performance during training. The finding points to more frequent or hands-on training exposure among male respondents. This study observed significantly better performance among male respondents in fire emergency training. This result aligns with the findings that males receive more frequent access to hands-on training sessions [33].

(8) Construct 8: Awareness and Education (QH4)

A significant difference was found, t (443) =6.193, p<0.001; mean difference =0.4231, indicating higher fire safety awareness and education levels among males. Organizational emphasis on training certain roles (often held by males) may explain this result. This research indicated that male respondents possess higher levels of fire safety awareness and education. This reslut is likely due to greater training emphasis on male-dominated roles, as noted by Johannes and Koray [33].

(9) Construct 9: Responders' Emergency Response Capabilities (QH5)

A very strong and highly significant difference was identified, t (443) =11.984, p<0.001; mean difference=0.7532, again favoring males. This emphasizes a clear gender gap in emergency response skills, likely driven by unequal access to drills or real-life emergency experiences. This study found a clear and highly significant gender gap favoring male respondents in emergency response capabilities. This result is consistent with prior work attributing the gap to differences in access to real-life experience and drill-based training [33].

(10) Construct 10: Organizational Commitment (QM1)

A significant difference was recorded, t (443) =3.443, p=0.001; mean difference =0.1927, with males showing greater organizational commitment during fire emergencies. This may be due to job functions that instill greater responsibility or visibility during crises. This study revealed that male respondents exhibited higher organizational commitment during fire emergencies. This finding may be attributed to their more active involvement in emergency roles, as noted by Parkinson et al. [39].

(11) Construct 11: Effectiveness of Fire Drill Preparedness (QL1)

No significant difference was found, t (443) =-1.017, p=0.310; mean difference =-0.0584. Both genders perceived the effectiveness of fire drills similarly, suggesting that drill participation may be evenly distributed and accessible. This research found no significant gender difference in perceptions of fire drill effectiveness, supporting the notion that equal training participation results in comparable preparedness levels between male and female staff [37].

The t-test analysis revealed significant gender differences in most areas of fire emergency preparedness, with males generally scoring higher in technical knowledge, leadership, communication, training, awareness, response skills, and commitment. Females showed greater confidence in incident command and emergency response roles. No gender differences were found in emergency planning and fire drill effectiveness, indicating equal participation. These results highlight existing gender gaps but also reflect some areas of equal involvement, suggesting efforts toward inclusive preparedness. Theoretically, these findings can be interpreted through the lens of social role theory [41], which posits that gender differences in behavior often arise from societal expectations rather than inherent ability. The higher male scores in technical domains may stem from traditional role assignments that encourage men to assume operational and leadership positions in emergencies. In contrast, the strong female performance in coordination roles could reflect evolving institutional support for women in managerial capacities. Practically, this study underscores the need for targeted interventions to bridge identified gaps. While general training may suffice for basic preparedness, tailored modules that address the specific developmental needs of different gender groups could enhance overall performance.

3.3 Fire emergency training attended

The distribution of respondents based on their attendance in fire emergency preparedness training. The findings reveal that a large majority of respondents (n=358, 80.4%) reported having no or little training related to fire emergencies. In contrast, only 87 respondents (19.6%) indicated that they had attended such training more than once. An independent samples t-test was conducted to examine differences in mean scores between respondents who had previously attended emergency preparedness training and those who had not. The results are shown in Table 3.

Table 3. Independent samples test (Training attended)

		Levene's Test		T-Test for Equality of Means			Interpretation
		F	Sig.	t	df	Sig.(2-tailed)	
C1	Equal variances assumed	.563	.453	1.604	443	.109	Not significant – Training has no clear effect on general awareness.
	Equal variances not assumed			1.626	133.134	.106	
C2	Equal variances assumed	5.323	.022	5.404	443	.000	Significant – Training improves hazard identification ability.
	Equal variances not assumed			5.079	122.330	.000	
C3	Equal variances assumed	1.636	.202	5.043	443	.000	Significant – Training strongly enhances evacuation knowledge.
	Equal variances not assumed			5.162	134.803	.000	
C4	Equal variances assumed	12.244	.001	1.846	443	.066	No significant impact, though a trend may exist.
	Equal variances not assumed			1.966	142.018	.051	

C5	Equal variances assumed	27.988	.000	6.555	443	.000	Significant – Training enhances fire alarm response capability.
	Equal variances not assumed			7.331	152.556	.000	
C6	Equal variances assumed	220.427	.000	6.924	443	.000	Significant – Training improves fire suppression knowledge.
	Equal variances not assumed			8.896	196.665	.000	
C7	Equal variances assumed	127.527	.000	9.105	443	.000	Significant – Training greatly improves individual response readiness.
	Equal variances not assumed			11.682	196.087	.000	
C8	Equal variances assumed	82.795	.000	7.269	443	.000	Significant – Training boosts coordination skills in emergencies.
	Equal variances not assumed			9.295	194.732	.000	
C9	Equal variances assumed	97.394	.000	9.665	443	.000	Highly significant – Training has a major impact on strategic response planning.
	Equal variances not assumed			13.992	262.456	.000	
C10	Equal variances assumed	91.593	.000	4.678	443	.000	Significant – Training increases readiness for emergency communication.
	Equal variances not assumed			5.700	176.703	.000	
C11	Equal variances assumed	.940	.333	.497	443	.620	Not significant – Training has no noticeable effect on post-incident evaluation.
	Equal variances not assumed			.504	133.237	.615	

Based on the t-test results provided, here is a detailed discussion and justification in English for each construct (C1-C11) comparing those who have attended fire emergency training more than once versus those with no or little training:

(1) Construct 1: Emergency Preparedness on Planning (QS1)

t (443) =1.604, p=0.109. This study found that no statistically significant difference was found between the two groups. Although the group with more training had a slightly higher mean (3.6759 vs. 3.5944), the difference is not significant ($p>0.05$). This suggests that basic awareness of procedures may already be established among all employees, regardless of training frequence. The lack of statistical significance suggests that basic emergency preparedness planning knowledge may already be widespread among employees, regardless of training frequency. This aligns with findings by Farika et al. [42], who observed that foundational knowledge can be effectively disseminated through initial training sessions, leading to a plateau effect with additional sessions. The results also resonate with Anderson's ACT-R theory [43], which differentiates between declarative and procedural knowledge. It is possible that most employees have transitioned declarative knowledge (knowing what to do) into procedural knowledge (knowing how to do it) after initial training. However, ACT-R also emphasizes that performance under pressure depends on contextualized rehearsal. Without stress simulation or emotionally charged training environments, procedural knowledge may not be sufficiently integrated to influence psychological preparedness during real emergencies.

(2) Construct 2: Fire Protection System (QS2)

t (443) =5.404, $p<0.001$, it means there is statistically significant difference. Participants with more training scored significantly higher, indicating repeated training enhances knowledge retention, especially on technical details such as evacuation routes. This finding aligns with Anderson's ACT-R (Adaptive Control of Thought-Rational) theory, which posits that repeated practice strengthens declarative and procedural memory, thereby improving task performance over time. The statistically significant difference observed supports the notion that repeated training transitions knowledge from declarative (what to do) to procedural (how to do it) forms, enabling faster and more effective responses during emergencies. A significant difference indicates that repeated training enhances understanding of fire protection systems. This result is consistent with the findings of [44], who reported that immersive training methods, such as virtual reality simulations, significantly enhance the retention and application of fire safety knowledge. Despite the clarity of the statistical results, the discussion could benefit from further integration of practical implications. For instance, organizations should consider implementing scheduled, iterative training sessions rather than one-time briefings to promote sustained preparedness among personnel. Furthermore, integrating technology-enhanced training could provide consistent, scalable, and cost-effective improvements in knowledge retention and emergency response readiness. Future research might also explore longitudinal effects of repeated training to determine how long the acquired knowledge remains effective without retraining.

(3) Construct 3: Fire Risk Reduction (QS3)

t (443) =5.043, $p<0.001$. This study found that there is statistically significant difference. The large mean difference (0.543) implies that repeated exposure to training improves confidence, a critical component in effective emergency response. From a cognitive psychology perspective, this finding aligns with Bandura's Social Cognitive Theory [45], particularly the concept of self-efficacy the belief in one's ability to succeed in specific situations. Repeated training boosts self-efficacy by providing mastery experiences, reinforcing participants' belief in their capability to handle fire emergencies. The significant improvement suggests that repeated training bolsters confidence in fire risk reduction strategies. Casey et al. [46] emphasized that ongoing engagement in safety training programs leads to better risk assessment and mitigation skills among participants.

(4) Construct 4: Incident Command System & Emergency Response Team (QS4)

t (443) =1.846, p=0.066. This study found that there is marginally non-significant (just above p =0.05). While training seems to improve understanding, this result suggests either the content is not emphasized enough in training, or the baseline knowledge is already moderate. The marginal significance implies that while training aids understanding, it may not be sufficient alone. The importance of integrating practical exercises with theoretical knowledge to enhance comprehension of incident command structures [47]. From a learning theory perspective, Kolb's Experiential Learning Theory [48] supports this approach, advocating for a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Simply delivering information in a classroom format may not ensure retention or application unless learners engage in active, experiential learning processes that simulate decision-making within command hierarchies.

(5) Construct 5: Leadership (QH1)

t (443) =6.555, $p<0.001$. This result indicates a highly statistically significant difference between individuals who have attended fire emergency training more than once and those with no or minimal training. The group with more frequent training reported markedly higher leadership

competence during fire emergencies. This reflects the fact that leadership during crises, such as making decisions, delegating roles, and maintaining team coordination, is a practical skill that develops most effectively through repeated exposure and hands-on experience. This finding is supported by Iserson [49], who found that repetitive emergency response drills enhance leadership behavior, especially in high-stress scenarios. Their study on industrial safety training concluded that repeated participation in fire drills improved not only procedural compliance but also decisiveness and team guidance, key indicators of leadership readiness in emergencies. This is likely because familiarity with emergency protocols reduces cognitive load, allowing leaders to focus on managing people and delegating tasks [50]. Those with repeated training develop stronger operational leadership competencies, reinforcing the importance of continuous professional development and practical engagement in emergency preparedness programs. These findings align with Cognitive Load Theory [51], which posits that learning environments should reduce extraneous cognitive burden to improve task performance under pressure. When emergency protocols become internalized through repetition, individuals are better equipped to focus on adaptive leadership behaviors, rather than recalling basic procedural steps.

(6) Construct 6: Communication in Fire Emergency (QH2)

t (443) =6.924, $p<0.001$. This study found that there is a statistically significant. The high significance suggests repeated training helps internalize procedures, thus improving reaction time during emergencies. Significant findings suggest that repeated training enhances communication effectiveness during fire emergencies. The regular training ensures operable and interoperable communications among responders [52]. In fire emergencies, clear and coordinated communication is critical to ensuring rapid evacuation, role execution, and minimizing panic. Participants who underwent repeated training likely internalized standard operating procedures (SOPs) more effectively, allowing for faster and more accurate communication under pressure. This includes relaying alerts, giving instructions, using communication equipment, and updating emergency teams in real time.

(7) Construct 7: Fire Emergency Training (QH3)

t (443) =9.105, $p<0.001$. This study found that there is very strong statistical significance. Repeated training builds leadership readiness. Staff who practice regularly are more confident in guiding others during crises. The result shows a very strong statistically significant difference between participants who have undergone fire emergency training more than once and those with limited or no training. The substantial t-value and highly significant p-value ($p<0.001$) indicate that repeated training significantly enhances participants' preparedness and confidence during fire emergencies. Those with multiple training exposures are better equipped to execute emergency procedures, respond under pressure, and guide others safely, suggesting that training frequency is directly linked to operational readiness and leadership performance during crises. Consistent training reinforces familiarity with safety protocols, increases response efficiency, and builds the self-efficacy needed to take initiative during emergencies. This is consistent with [53], reported that repeated fire training significantly improved participants' procedural competence and leadership behavior, particularly in industrial and educational settings. Similarly, Safari et al. [54] state that staff who received structured and repeated emergency training demonstrated superior performance in both simulation exercises and real-life evacuation scenarios. These individuals were more likely to lead evacuation efforts, coordinate team roles, and maintain calm under pressure traits essential for fire safety leadership. Repeated fire emergency training is essential for building confidence, procedural mastery, and leadership readiness. Employees who engage in regular drills are more competent and better prepared to take charge and assist others during fire-related emergencies, highlighting the need for organizations to implement continuous and hands-on training programs.

(8) Construct 8: Awareness and Education (QH4)

A significant difference was found in the Awareness and Education construct between individuals who have attended fire emergency training more than once and those with no or little training, t (443) =7.269, $p<0.001$. This result indicates that repeated exposure to training significantly enhances awareness levels and educational understanding of fire emergency preparedness. Respondents who had undergone training multiple times demonstrated greater familiarity with emergency tools, procedures, and safety protocols. This group was more likely to exhibit proactive safety behavior, recognize potential hazards, and respond appropriately in emergency situations. In contrast, individuals with minimal or no training showed lower preparedness levels, which may compromise safety during actual emergencies. This finding aligns with previous studies highlighting that the frequency and quality of emergency preparedness training have a direct impact on individuals' readiness and response efficiency [55, 56]. Therefore, this study underscores the necessity of continuous and repeated training initiatives as a cornerstone of effective fire emergency preparedness strategies. Institutions should prioritize regular training programs to build and maintain high levels of awareness and education among staff and students.

(9) Construct 9: Responders' Emergency Response Capabilities (QH5)

The study found a highly significant difference in Responders' Emergency Response Capabilities between individuals who have attended training more than once and those with no or little training, t (443) =9.665, $p<0.001$. This indicates that repeated training plays a critical role in strengthening the practical skills and confidence required to perform essential emergency duties effectively. Participants with multiple training experiences showed enhanced competence in executing designated emergency roles such as administering first aid, operating fire extinguishers, initiating containment procedures, and coordinating evacuation efforts. This improvement is attributed to the cumulative effect of hands-on experience and knowledge retention gained through repeated drills and realistic simulations. In contrast, individuals with limited or no training lacked the necessary readiness and clarity to respond promptly and effectively under pressure. This outcome is strongly supported by prior research, which asserts that response performance improves significantly with increased training frequency [57]. These findings underscore the importance of implementing routine, role-specific emergency preparedness programs. Institutions should ensure that all potential responders particularly those assigned critical functions undergo regular refresher training to maintain high operational readiness and reduce response times during fire emergencies.

(10) Construct 10: Organizational Commitment (QM1)

The analysis revealed a statistically significant difference in Organizational Commitment between individuals who have attended fire emergency training more than once and those with

no or little training, t (443) =4.678, p<0.001. This finding suggests that repeated exposure to training enhances individuals' sense of responsibility and alignment with organizational safety goals and protocols. Participants who had undergone multiple training sessions demonstrated a higher level of commitment to organizational emergency procedures. This is largely attributed to the role-playing and scenario-based components embedded in repeated training sessions, which reinforce clear communication, accountability, and collaborative problem-solving. These individuals are more likely to internalize safety responsibilities, actively engage in emergency planning, and exhibit a stronger adherence to the organization's emergency protocols during real incidents. This result aligns with previous studies that highlight the role of continuous training in cultivating a safety-oriented organizational culture and strengthening employees' emotional and behavioral commitment to safety practices [58, 59]. In contrast, those with little or no training tend to exhibit lower levels of engagement and understanding of organizational safety expectations, which can hinder coordinated emergency responses. Therefore, regular and structured training not only builds technical competency but also deepens organizational commitment among staff and emergency responders. From a theoretical standpoint, this outcome can be interpreted through the lens of Organizational Commitment Theory by Meyer and Allen [60], which posits that affective commitment, defined as the emotional attachment to and identification with an organization, increases when employees perceive that their actions meaningfully contribute to the organization's goals. Repeated and meaningful training reinforces this connection by signaling that the organization places a high value on safety and preparedness. Such training not only communicates organizational priorities but also empowers employees with the skills, confidence, and sense of responsibility needed to fulfill those priorities. As a result, employees are more likely to internalize safety practices, actively participate in emergency preparedness, and align their behavior with the organization's safety culture.

(11) Construct 11: Effectiveness of Fire Drill Preparedness (QL1)

The analysis showed no statistically significant difference in the Effectiveness of Fire Drill Preparedness between individuals who have attended training more than once and those with no or little training, t (443) =0.497, p=0.620. This suggests that repeated training does not necessarily result in notable differences in perceived effectiveness or psychological readiness during fire drills. Interestingly, despite differing levels of exposure to training, both groups reported similar levels of calmness and composure during fire drills. This finding implies that technical training alone may not be sufficient to influence psychological responses such as anxiety, panic control, or mental clarity in high-stress emergency situations. Emotional and psychological readiness is complex and may require targeted interventions beyond procedural instruction. Previous studies have highlighted that while technical skills can be taught through standard drills, managing emotional responses often requires additional strategies such as stress management programs, resilience training, or simulations conducted under realistic, high-pressure conditions [61, 62].

Therefore, this result indicates a potential gap in existing training frameworks and points to the need for a more holistic approach to fire emergency preparedness one that integrates cognitive-behavioral strategies alongside procedural instruction to better equip individuals for real-life emergencies. From a theoretical perspective, this aligns with Bandura's [45] Social Cognitive Theory, which posits that self-efficacy and performance in high-stress situations are influenced not only by knowledge and skills, but also by emotional arousal and coping mechanisms. The absence of statistically significant improvement despite repeated training may indicate a lack of emotional reinforcement or contextual realism in the training programs. The t-test results strongly suggest that repeated fire emergency training improves preparedness in most constructs. Constructs related to knowledge, operational skills, and leadership (C2, C3, C5-C10) show significant differences favoring those with more frequent training. However, general awareness and psychological factors (C1, C4, C11) do not show statistically significant improvements, indicating these may require different or additional interventions.

In addition to training frequency, the effectiveness of fire emergency preparedness is also strongly influenced by the content and delivery format of the training itself. Repeated exposure to training may enhance procedural memory, but without engaging and context-specific content, its impact on higher-order competencies such as planning, command structure comprehension, and psychological readiness may remain limited. Passive formats, such as lectures or briefings, are often insufficient to develop the applied skills and confidence required during real emergencies. Instead, experiential training approaches, including scenario-based simulations, role-playing exercises, and realistic drills, have been shown to significantly enhance both knowledge retention and practical response capabilities [48, 44]. Moreover, cognitive-behavioral strategies such as stress inoculation and resilience-building exercises should be incorporated to address psychological aspects of preparedness that are not effectively developed through technical training alone [61, 62]. Therefore, organizations should prioritize interactive, immersive, and role-specific training modules, incorporating decision-making tasks under pressure, stress-management techniques, and contextual realism to cultivate both technical proficiency and emotional resilience. Future training programs should also be tailored to job roles and organizational contexts, ensuring that personnel develop competencies most relevant to their emergency functions, thereby enhancing overall institutional readiness and safety culture. This broader perspective ensures that emergency preparedness is not only procedural but also adaptive, psychologically robust, and practically applicable in high-stakes situations.

4. CONCLUSION AND RECOMMENDATION

These findings demonstrate that job roles significantly influence fire emergency preparedness within organizations. Management personnel tend to exhibit higher levels of competence across most emergency response dimensions. This result is likely due to their broader responsibilities, which often include planning and decision-making, as well as their greater access to structured and more frequent training opportunities. The results indicate a notable preparedness gap between management and operational staff, particularly in leadership and strategic areas. This gap highlights the need for organizations to develop customized and role-specific training modules. For example, operational staff can be provided with training sessions that focus on practical response activities such as evacuation procedures, hazard recognition, and fire

equipment handling. Management personnel may benefit more from modules on command decision-making and coordination with emergency services.

The study also reveals gender-based differences across various constructs. Males generally scored higher in technical knowledge, leadership, communication, and response capabilities. However, female participants demonstrated greater confidence in incident command roles and as members of emergency response teams. These findings suggest that female employees exhibit strong self-efficacy and leadership potential during crisis situations. Therefore, organizations should offer targeted leadership development programs that encourage female participation in key decision-making roles during emergencies. For example, leadership workshops or simulation-based training exercises are conducted with mixed-gender groups to promote collaborative learning and balanced skill development.

The analysis further underscores the importance of repeated fire emergency training. Participants who had attended multiple training sessions displayed significantly better preparedness in areas such as knowledge acquisition, operational skills, communication, leadership, and organizational commitment. This result indicates that regular training exposure contributes to improved emergency response capabilities. However, several constructs, such as awareness of emergency planning, understanding of command systems, and psychological readiness, did not improve significantly with frequency of training. These findings imply that these specific areas may require alternative instructional methods. For instance, instead of lecture-based sessions, interactive learning formats such as scenario simulations, group problem-solving tasks, and peer-led debriefings could be used to strengthen planning skills and familiarity with command structures.

To support psychological readiness, organizations should incorporate stress management and emotional resilience content into their emergency training programs. These components can be integrated through short workshops on coping strategies, brief mindfulness sessions before drills, or guided reflection activities post-training to help staff process their responses and build confidence.

In terms of practical implementation, training programs should include regular, organization-wide fire drills that involve both management and operational personnel. These drills should simulate realistic fire scenarios, require role-specific responses, and be followed by structured feedback sessions to identify strengths and areas for improvement. Communication protocols should be tested during these drills to evaluate the clarity, speed, and coordination of information flow across all levels. Organizations should also monitor preparedness levels using pre- and post-training assessments and periodic surveys that assess employees' confidence and comprehension. These evaluation tools can help management determine which components of the training require refinement or reinforcement.

Overall, the findings of this study provide clear direction for improving organizational fire emergency preparedness. By implementing structured, inclusive, and strategically differentiated training programs, supported by ongoing monitoring and feedback mechanisms, organizations can build a workforce that is not only technically competent but also confident, communicative, and psychologically resilient in the face of emergencies.

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