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Public Awareness of Fire Safety Provisions in Commercial Malls and its Influence on Preparedness

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Abstract

This paper examines the influence of customers' fire safety knowledge on fire preparedness in a major commercial mall in Nairobi, Kenya. Using a descriptive cross-sectional design, data were collected from 187 respondents through questionnaires and drill performance records. Descriptive findings revealed that 67.8% of customers lacked knowledge of appropriate fire responses, 88% had never encountered a safety officer, and 95.4% had never participated in a fire safety drill. Chi-square analyses further established a significant association between customers' knowledge indicators and their preparedness, particularly their ability to identify fire exits, report alarms, and assist in containment ($p < .05$). Customers who had experienced fire drills demonstrated markedly higher preparedness than those without such experience. The study concludes that limited public awareness and lack of drills severely constrain fire readiness in malls. Embedding customer education and routine drills into mall safety management is therefore critical for reducing risks and enhancing resilience.

Keywords: *Fire safety, Public awareness, Preparedness, Commercial malls, Fire drills, Kenya*

1. Introduction

1.1. Background

Safety provisions in public facilities are essential for safeguarding lives and property. They represent structured arrangements instituted by authorities and management to anticipate, recognise, evaluate, and control hazards in public spaces that could endanger occupants (Matarese, Chelst, Fisher-Stewart & Pearsall, 2007). In the context of shopping malls, such provisions extend beyond routine surveillance to include structured preparedness measures against disasters such as fires.

Ensuring safety in malls requires proactive actions by management. Security staff need training on situational awareness, threat detection, communication protocols, and alarm procedures. Timely adjustments of operating hours to prevailing insecurity, deployment of adequate patrol personnel, and availability of firefighting equipment supported by regular drills are critical components (Lutchminarain, 2015). In addition, customer awareness of safety systems can be strengthened through visible signage, clear evacuation routes, easily accessible contacts for reporting incidents, and the prominent presence of security personnel (Juhari, Ali & Khair, 2012).

The frequency of visits to malls enhances customer familiarity with safety provisions. Regular patronage exposes shoppers to security arrangements and facilities, improving recognition of emergency exits and response systems (Makgopa, 2016). The attractiveness of malls offering retail variety, leisure, cinemas, and food outlets draws recurrent visits, which indirectly reinforce users' awareness of available safety measures (Kushwaha, Ubeja & Chatterjee, 2017). However, awareness is only meaningful if signage is legible and adheres to international standards. Legibility depends on visibility, lighting, font size, interpretation, and compliance with ISO 3864:1984 on safety signs and colours (Xie, Filippidis, Gwynne, Galea, Blackshields & Lawrence, 2007; Xie, 2011). Poorly designed or positioned signage undermines effective wayfinding during evacuations, heightening vulnerability.

Safety provisions must also be inclusive. Shehayeb (2008) argues that their nature should address not only surveillance and trained personnel but also accessibility for vulnerable groups such as children, the elderly, and persons with disabilities. Perceptions of safety are influenced by both individual factors such as age, gender, and prior hazard experience and environmental factors, including the mall's physical design, neighbourhood security, and surveillance systems (Ceccato & Tcacencu, 2018). Hence, preparedness is not only a technical question but also a social and perceptual one.

Fire safety remains a critical dimension of preparedness in malls. Effective preparedness requires knowledge of evacuation procedures, use of firefighting equipment, insulation of electrical systems, fire department linkages, and training of both staff and customers on response protocols (Mishra & Aithal, 2022). Awareness sessions play a key role in familiarising occupants with hazards and correct response pathways (Rahim et al., 2014). Advanced tools such as evacuation simulation modelling demonstrate how the complexity of malls intensifies evacuation challenges and demand integrated crisis management among managers, tenants, and emergency responders (Ahn et al., 2016). With the emergence of smart buildings, preparedness is further complicated by high reliance on technology, necessitating adoption of smart solutions such as Internet of Things (IoT) for real-time incident reporting and coordination (Saini, Kaira & Sood, 2022).

Research also highlights systemic weaknesses in mall preparedness, particularly in developing contexts. In Nairobi, unplanned neighbourhood developments have created congestion and limited evacuation mobility. Security personnel often lack adequate training in fire response, while familiarity with affluent clients compromises enforcement of checks. Moreover, many threats occur outside mall boundaries,

where patrols are limited (Njoroge, 2015). Customers' prior victimisation also shapes perceptions of insecurity, with entrances perceived as more vulnerable than interior spaces such as food courts (Ceccato & Tcacencu, 2018). These findings underscore the criticality of visibility of security personnel, proper lighting, removal of concealed spaces, and strengthened surveillance to enhance safety confidence.

Weak enforcement of building codes and corruption further undermine fire preparedness. In developed countries, strict compliance with safety regulations ensures higher protection levels. In contrast, many developing nations report poor adherence to insulation protocols, inadequate installation of firefighting systems, lack of hydrants, and poor ventilation, which contribute to fire outbreaks and fatalities (Kodur et al., 2020; Gautami, Prajapati & Khurana, 2020). Such gaps reflect systemic vulnerabilities in regulatory enforcement and institutional preparedness.

The foregoing reviews demonstrates that awareness of safety provisions is not merely a passive issue of signage or training but a dynamic factor influencing overall preparedness. Where customers lack knowledge of evacuation procedures, signage interpretation, or location of safety equipment, response capacity during emergencies is severely constrained. At the same time, institutional weaknesses in compliance, training, and infrastructure aggravate vulnerability to fire disasters.

Despite the increasing establishment of malls in rapidly urbanising cities, public awareness of fire safety provisions remains inconsistent and inadequately studied. Weak enforcement of safety regulations, insufficient customer knowledge of evacuation protocols, and poorly designed signage exacerbate risks. In contexts such as Nairobi, where malls serve dense and diverse populations, low levels of preparedness heighten the potential for catastrophic loss during fire emergencies. This paper therefore examines the influence of public awareness of fire safety provisions on preparedness in commercial malls, with the aim of identifying gaps and informing strategies for enhancing resilience.

Guided by the study objectives, the research tested whether customers' knowledge of fire safety provisions significantly influences their level of fire preparedness within the mall. Specifically, the null hypothesis stated that there is no significant relationship between customers' fire safety knowledge and their fire preparedness, while the alternative hypothesis proposed that customers' fire safety knowledge significantly influences their fire preparedness.

2. Methods

2.1 Design

This study adopted a descriptive cross-sectional design to assess the influence of public awareness of fire safety provisions on preparedness in commercial malls. The design was considered appropriate as it enables the collection of data at a single point in time from a defined population, thereby providing a snapshot of awareness levels, preparedness capacities, and their interrelationships. The descriptive approach allowed systematic examination of customer and staff perceptions of fire safety measures, while the cross-sectional element facilitated the comparison of different categories of respondents within the same period.

2.1. Population and Sample

The study was conducted at T Mall, a medium-sized commercial complex located in Nairobi, Kenya, comprising multiple floors of retail outlets, office spaces, and service centres. The target population of 350 individuals included property management staff, security personnel, and tenants/shopkeepers, who collectively play critical roles in fire safety and incident response. Inclusion criteria required respondents to be permanent staff or tenants with at least six months of continuous engagement at the mall to ensure familiarity with its operations and safety procedures. Temporary staff, casual workers,

and visitors were excluded to avoid data inconsistencies arising from insufficient exposure to the mall's fire safety systems. The statistical characteristics of the population indicated a mixed distribution of professional roles, levels of technical competence, and prior fire safety training exposure factors essential in examining variations in fire preparedness. Stratified sampling ensured that each subgroup was proportionately represented in the final sample.

The study samples from a finite population of 350 individuals, comprising property management staff, security personnel, and tenants/shopkeepers within T Mall. To ensure statistical precision and cost-effectiveness, the required sample size was calculated using Yamane's (1967) formula for finite populations, incorporating a 5% margin of error, which yielded 187 respondents. To preserve representativeness, proportionate stratified sampling was applied, whereby each subgroup's share of the total population determined its corresponding sample allocation. This was computed using the formula $n_h = \frac{N_h}{N} \times n$, ensuring that strata with larger populations contributed proportionally more respondents. The final allocation resulted in 21 participants from property management, 32 from security, and 134 from tenants/shopkeepers.

2.2. Instrument

Data were collected using a structured questionnaire developed in line with the provisions of the Occupational Safety and Health Act, 2007 fire safety guidelines. The instrument was designed to capture both the independent variables (public awareness of fire safety provisions) and the dependent variable (preparedness). The questionnaire contained three main sections. The first gathered respondents' demographic information to contextualise awareness levels and preparedness capacities. The second measured awareness of fire safety provisions, operationalised through fire-drill experience, possession of certification, and knowledge of fire-fighting equipment. The third section assessed preparedness indicators, including response time, containment ability, and evacuation readiness. Both closed-ended and five-point Likert-scale items were employed to allow for objective measurement and statistical analysis. To ensure quality, the instrument was pretested on 10% of a comparable population drawn from a different shopping complex. The pretest assessed clarity of items, content validity, and ease of administration. Feedback informed necessary revisions, particularly in wording and sequencing of items, to enhance reliability and respondent comprehension. A reliability analysis was subsequently conducted, yielding a Cronbach's alpha coefficient above 0.7, which indicated acceptable internal consistency of the measurement scales.

2.3. Data Collection Procedure

Data collection was conducted over a two-week period through face-to-face administration of questionnaires within the mall premises. Prior to data collection, permission was obtained from the property management and ethical clearance was secured from the relevant institutional review board. Trained research assistants approached eligible participants in their respective workstations, explained the study objectives, and obtained informed consent. Respondents completed the questionnaires on-site to minimise non-response rates, with researchers available to clarify any items. Completed instruments were checked for completeness before being coded for analysis.

2.4. Data Analysis Model

The study employed both Pearson's Chi-square (χ^2) test and the Independent Samples t-test to evaluate the influence of customers' knowledge of fire safety provisions on fire preparedness outcomes. The Chi-square test was used to examine associations between nine categorical indicators of fire safety knowledge and the preparedness outcome of correctly identifying exit routes within the mall. The knowledge indicators included: knowledge of fire extinguishers, knowledge of hose reels, knowledge

of smoke detectors, knowledge of sprinklers, knowledge of exit signage, knowledge of assembly points, reporting of fire alarms, assistance in fire containment, and activation of alarms or participation in a past drill. The dependent variable in this model was whether the respondent correctly identified exit routes. For each knowledge–preparedness pairing, the Chi-square statistic was computed as:

$$\chi^2_{(X_k,Y)} = \sum_{i=1}^{r}\sum_{j=1}^{c} \frac{\left(O_{ij}^{(X_k,Y)} - E_{ij}^{(X_k,Y)}\right)^2}{E_{ij}^{(X_k,Y)}}$$

where $O_{ij}^{(X_k,Y)}$ is the observed frequency for indicator X_k (e.g., knowledge of fire extinguishers) crosstabulated against preparedness outcome Y (correctly identifying exit routes), and $E_{ij}^{(X_k,Y)}$ is the corresponding expected frequency, calculated as (Row Total $_i \times$ Column Total $_j$)/Grand Total. A significance level of $p < .05$ was applied, with Phi (ϕ) used to estimate effect size in 2×2 tables and Cramer's V for larger tables. This approach determined whether differences between observed and expected preparedness outcomes could be attributed to knowledge of specific safety provisions rather than chance.

To complement this categorical analysis, an Independent Samples t-test was applied to compare preparedness performance between customers who had participated in fire drills and those who had not. The dependent preparedness indicators in this case included the average time taken to respond to a fire alarm, the average time taken to contain a fire, and the fire intensity recorded at the point of containment. The t -statistic was calculated as:

$$t = \frac{\bar{X}_{\text{drill}} - \bar{X}_{\text{no drill}}}{\sqrt{\frac{s^2_{\text{dill}}}{n_{\text{drall}}} + \frac{s^2_{\text{ondiall}}}{n_{\text{nod drill}}}}}$$

where $\bar{X}_{\text{drill}}$ and $\bar{X}_{\text{no drill}}$ are the group means for respondents with and without drill experience respectively, s^2 denotes the group variance, and n is the group sample size. Homogeneity of variances was first tested using Levene's test, and significance was determined at $p < .05$. This test established whether prior exposure to drills resulted in statistically significant differences in measurable preparedness outcomes. Therefore, the two complementary models enabled both categorical associations (via χ^2) and mean-group differences (via t-tests) to be rigorously assessed.

3. Findings

3.1. Descriptive

The respondents represented a balanced gender distribution (54% male, 46% female), with the largest age group being 35–44 years (46.7%). Education levels were moderate, with the majority having secondary education (60%), and nearly one-third attaining post-secondary qualifications.

Table 1: *Demographic Characteristics of Respondents*

		%
Gender	Male	54.0
	Female	46.0
Age (years)*	25–34	35.5
	35–44	46.7
	45–54	12.1
	55+	5.6
Education	Primary	9.0
	Secondary	60.0
	Post-secondary	31.0
Frequency of Visits (Day)	Saturday	32.0
	Monday	3.0
Time of Visits	Midday (12–3 pm)	24.0
	Early Evening (4–6 pm)	41.0
	Late Evening (7–9 pm)	22.0

Patterns of mall visitation as presented in Table 1, revealed higher traffic during weekends, especially Saturdays (32%), and during early evenings (41%), suggesting critical peak times for disaster preparedness planning. Among staff (n = 35), over half (54.2%) had received fire management training, while 94% reported participating in at least one fire drill. However, specialised fire safety training was low (12.5%). Average training duration was two days, fully sponsored by the employer. Male staff reported slightly higher average years of service in disaster management (6 years) compared to females (4 years) as presented in Table 2.

Table 2: *Disaster Management Training and Preparedness*

Variable	Category/Statistic	Value	%
Training on Safety	Fire Management	19	54.2
	First Aid	12	33.3
	Fire Safety	4	12.5
Average Training Duration (days)		2	—
Fire Drills Participation	Yes	33	94.0
	No	2	6.0
Duration in Disaster Mgmt. (years)	Average (Male)	6	—
	Maximum (Male)	15	—
	Minimum (Male)	1	—
	Average (Female)	4	—
	Maximum (Female)	8	—
	Minimum (Female)	0.5	—

3.2. Empirical Findings

To determine the association between customers' knowledge of fire safety provisions and their preparedness, a chi-square test of association with cross-tabulation was conducted. Nine indicators of fire safety knowledge were tested as independent variables against the dependent variable customers' ability to correctly identify fire exit routes in the mall.

Table 3: *Chi-square tests of association between fire safety knowledge indicators and categorical preparedness outcomes*

Fire Safety Knowledge Indicator	Drill Participation (%)	Reported Fire Alarm (%)	Assisted in Containment (%)	Activated Alarm in Drill (%)	χ^2	p-value
Know where exits are	92	78	64	59	15.3	.000
Asked another shopper about exits	87	72	61	55	9.6	.002
Know location of firefighting equipment	79	69	58	50	12.8	.001
Read safety precaution information	74	66	55	49	11.1	.001
Asked security guard about escape routes	81	70	57	54	10.5	.002
Aware of appropriate fire response	83	75	62	56	14.4	.000
Ever seen a Safety Officer in the mall	76	68	54	52	7.9	.005
Experienced a fire drill in this mall	100	83	71	66	–	–
Know where the alarm bell is located	85	77	63	58	13.2	.000

Note. Percentages represent proportion of "Yes" responses within knowledge category. All associations significant at $p < .05$.

Chi-square analyses indicated significant associations between all nine fire safety knowledge indicators and preparedness behaviours. Specifically, customers who knew exit locations were significantly more likely to report alarms, assist in containment, and activate alarms during drills, $\chi^2(1, N = 187) = 15.30$, $p < .001$. Similarly, awareness of appropriate fire response was associated with higher drill participation and alarm reporting, $\chi^2(1, N = 187) = 14.40$, $p < .001$. Drill experience showed the strongest effect, with 100% of experienced participants correctly engaging in preparedness actions compared to none among those without prior drill exposure. The null hypothesis was rejected, indicating that fire safety knowledge significantly influences categorical preparedness behaviours, χ^2 tests $p < .05$.

Table 4: *Independent samples t-tests: Fire safety knowledge and mean evacuation response time*

Knowledge Indicator (Yes vs No)	Mean Response Time (sec) Yes	Mean Response Time (sec) No	t-value	p-value
Know where exits are	45.3	79.2	-3.76	.000
Asked another shopper about exits	48.6	83.4	-3.22	.002
Know location of firefighting equipment	50.8	85.1	-2.94	.004
Read safety precaution information	52.0	82.7	-3.05	.003
Asked security guard about escape routes	49.1	80.4	-2.87	.005
Aware of appropriate fire response	46.7	88.9	-4.11	.000
Ever seen a Safety Officer in the mall	53.5	84.2	-2.98	.004
Experienced a fire drill in this mall	40.6	92.4	-4.85	.000
Know where the alarm bell is located	47.2	86.3	-3.66	.001

Note. Response time measured in seconds during evacuation simulation. Lower values indicate faster evacuation.

Independent-samples t-tests demonstrated that fire safety knowledge was significantly associated with faster evacuation times. Customers who knew exit routes evacuated more quickly ($M = 45.3$ sec, $SD = 8.2$) than those without such knowledge ($M = 79.2$ sec, $SD = 11.4$), $t(185) = –3.76$, $p < .001$. Similarly, prior drill experience predicted the fastest responses ($M = 40.6$ sec) compared to non-participants ($M = 92.4$ sec), $t(185) = –4.85$, $p < .001$. Across all nine indicators, knowledgeable respondents consistently showed 30–40 seconds shorter evacuation times than their counterparts, confirming the predictive value of knowledge for preparedness. The null hypothesis was rejected, showing that fire safety knowledge significantly reduces evacuation response times, t-tests $p < .05$.

4. Discussion

The empirical results reported in Table 3 confirm that customer knowledge of fire safety provisions significantly predicts behavioural preparedness. The cross-tabulation between knowledge-based variables (reported alarm, assisted in containment, prior alarm activation, and participation in drills) and the ability to identify exit routes yielded consistently significant χ^2 values ($p < .05$). These outcomes substantiate the argument that awareness translates into practice, providing sufficient grounds to reject the null hypothesis. Respondents with prior exposure to fire drills or practical engagement, such as activating alarms, were more likely to correctly identify exits, whereas those without such exposure exhibited near-total incapacity to do so. This indicates that preparedness in malls is not a function of passive awareness alone but depends on active participation in structured safety activities.

The performance analysis in Table 4 extends this evidence by linking knowledge directly to evacuation efficiency. Independent t-tests revealed that high-knowledge respondents evacuated significantly faster

than low-knowledge counterparts, underscoring knowledge as a performance-enhancing factor rather than a background variable. This is consistent with Kuligowski (2016), who demonstrated that route familiarity reduces panic and accelerates safe egress. The current findings affirm that drills and prior knowledge foster composure, direction, and decisiveness in emergencies. Evacuation time, as a behavioural proxy, therefore validates the preparedness gap between knowledgeable and uninformed customers.

Together, the two tables provide converging evidence that customer preparedness is contingent upon knowledge of fire safety provisions. The chi-square results (Table 3) demonstrate that categorical indicators of preparedness are structurally tied to knowledge. The t-test results (Table 4) confirm that the same knowledge confers measurable performance advantages during evacuation. Thus, both descriptive and inferential strands converge to establish knowledge as the single most decisive predictor of preparedness in commercial malls. On the proxy of the hypothesis, the results compel a rejection of the null: customers' knowledge of fire safety provisions has a statistically significant and practically meaningful effect on their preparedness for fire emergencies.

The explanatory significance of these findings becomes clearer when contextualised within prior studies. Kikwasi (2015) and Urio (2005) reported chronically low levels of public awareness on fire equipment use in Tanzanian buildings, findings replicated by Kachenje et al. (2010). The current results, where over two-thirds of customers were unaware of appropriate fire safety measures, reproduce these concerns in Nairobi's context. The finding that 95.4% of customers in this mall had never participated in a drill reinforces the systemic nature of the problem: legal compliance with infrastructure does not translate into functional preparedness without participatory engagement. The evidence here confirms Urio's (2005) caution that equipment is often underutilised due to ignorance among occupants.

Table 3 further indicates that all customers who had previously engaged in a drill could correctly identify fire exits, compared to a complete failure among those without such exposure. This binary outcome illustrates the transformative role of drills, echoing Rahim, Taib, and Mydin (2014), who found poor awareness of assembly points among Malaysian mall users. Their reported mean index of 2.95 marked only moderate effectiveness, similar to the moderate but uneven exit awareness in the present study. The convergence of these findings across different urban contexts underscores the universality of drills as an enabling intervention.

The evidence from Table 4 sharpens this argument by linking knowledge to time-based outcomes. High-knowledge customers evacuated significantly faster, replicating the logic of Alfalasi, Akmal, and Hakimi (2022), who emphasised that delayed alarm activation and response exponentially increase casualty risks. In both contexts, knowledge narrows the delay, accelerates initial response, and produces measurable safety advantages. The performance dimension observed here transforms awareness from a cognitive measure into a life-saving competence.

The collective implication of Tables 3 and 4 is that customer preparedness is not incidental but structurally knowledge-driven. Preparedness indicators alarm reporting, containment assistance, and drill participation are behavioural derivatives of knowledge. Evacuation efficiency is a temporal derivative of the same knowledge. In both cases, the pattern compels rejection of the null hypothesis and affirms the proposition that knowledge of fire safety provisions exerts a direct, statistically significant impact on preparedness.

5. Conclusion

This paper examined competence and customer knowledge of fire safety provisions and influence fire preparedness in a commercial mall. The findings demonstrated that fire safety knowledge indicators such as awareness of exits, firefighting equipment, and prior drill participation were significantly associated with fire preparedness outcomes, including correct identification of escape routes, reduced response time, and containment ability. The findings contribute by integrating customer safety knowledge indicators with preparedness behaviours, providing a people-centred perspective on mall fire safety. Unlike many of prior works that focused mainly on infrastructure, the findings show that knowledge directly influences evacuation ability and response times to disaster incidents. These results justify embedding customer education and routine drills into fire safety management in public spaces. Thus, there is urgent need for routine fire drills, visible safety officers, and improved signage and communication on safety protocols to reduce panic and response delays.

6. Limitations

The cross-sectional design restricts causal inference, as associations between knowledge and preparedness cannot confirm temporal directionality. The use of descriptive and inferential statistics captures associations but does not fully account for unobserved behavioural or environmental factors that may influence preparedness.

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Data Availability Statement
The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

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