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Risk Perceptions Towards Fire Safety among Occupants of Residential College in a Higher Learning Institution

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ABSTRACT

Fire safety in residential colleges remains a critical concern due to high occupancy density, shared facilities, and limited emergency preparedness. Despite the implementation of various safety measures, there remains a scarcity of studies examining the relationship between knowledge, attitude, practice (KAP), and risk perception among occupants of Malaysian residential colleges. This study aims to fill a gap by evaluating fire safety knowledge, attitudes, and practices, as well as risk perception, among 363 students. It employs a cross-sectional survey method utilising a bilingual questionnaire. The analysis of data included descriptive statistics, chi-square tests, and Pearson's correlation analysis. The findings demonstrated a high level of knowledge, positive attitudes, and commendable safety practices. However, risk perception was only moderate, suggesting a disconnect between awareness and the readiness to act accordingly. Significant associations were found between age and KAP ($p < 0.05$) and between ethnicity and fire safety practices ($p = 0.030$). A weak but significant correlation exists between risk perception and safety practices ($r = 0.189$, $p = 0.000$), indicating that awareness alone does not ensure preparedness. The results highlight the necessity for institutional fire safety management to move beyond awareness campaigns by integrating practical drills, simulation-based training, and regular assessments to enhance a proactive safety culture within residential colleges.

INTRODUCTION

Residential colleges, commonly referred as hostels, play a vital role in higher education institutions. They function as more than mere living spaces (Rathnayake, et al, 2020). These facilities are centres for student growth and provide accommodation. They also offer spaces for scholarly activities, extracurricular

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involvement, and community participation (Buyung, et al, 2018). Many students prefer hostels because these are more economical and practical than off-campus options. Interest in residential colleges is therefore on the rise. However, the high resident density and shared facilities in these colleges make them vulnerable to incidents such as fires, which can cause injuries, fatalities and property damage (AlWaqfi, Guan, Ying, & Tamrin, 2022).

The potential for a fire incident is fundamentally associated with the 'fire triangle', which consists of oxygen, heat, and fuel. A fire requires the presence of three essential elements to ignite and sustain itself. However, elements such as architectural design, alterations to structures, human actions, disregard for fire regulations, insufficient fire safety protocols, and opposing priorities between architects and fire safety experts significantly heighten the risk (Rathnayake et al., 2020). Fires have significant environmental consequences, as they emit harmful greenhouse gases, that exacerbate air pollution and contribute to global warming (Tian et al., 2024). Fire incidents in residential colleges are attributed to insufficient fire safety protocols, structural weaknesses, and unsafe practices such as smoking in prohibited zones (Dzulkifli, Sarbini, Abidin, & Ibrahim, 2022; Onyekwere, Ajayi, & Owolabi, 2024; Tian et al., 2024). Smoking in dormitories poses an additional risk, as the improper disposal of cigarette butts or smoking in proximity to flammable materials heightens the risk of ignition (Li, Zhang, & Liu, 2024). Additionally, research demonstrated a notable percentage of students (65 %) and staff (86 %) are unaware of fire safety protocols, which increases their vulnerability in emergencies (Onyekwere et al., 2024). Structural deficiencies, especially in civil and electrical systems, significantly increase fire hazards. Research indicates that 62 % of safety-related complaints in residential colleges are linked to civil defects that compromise fire protection systems and evacuation routes (Dzulkifli et al., 2022).

Given these risks, a comprehensive fire prevention strategy is needed. This should include education, infrastructure upgrades, and the adoption of new technologies. Compulsory fire safety training, organised programmes, and drills can improve awareness and preparedness among students and staff. Routine maintenance of fire alarms, sprinkler systems, wiring, and emergency exits is vital. This helps follow regulations and reduces risk. Utilising advanced fire detection systems such as smoke sensors and AI-based monitoring, can significantly enhance safety by providing immediate alerts. However, the effectiveness of fire safety measures also depends on how the residents perceive and respond to these risks. Risk perception plays a crucial role in shaping individual behaviours and determining the extent to which students comply with fire safety protocols. When students fail to recognise the potential dangers associated with fire, they might adopt unsafe practices or overlook necessary safety precautions, which can heighten their vulnerabilities. To the authors' knowledge, there has been limited research examining risk perception among residential college occupants. Previous research on fire safety has primarily focused on general awareness or compliance levels among students and staff, without integrating how knowledge, attitude, and practice (KAP) interact with risk perception (Agyekum, Ayarkwa, & Opoku, 2016; AlWaqfi et al., 2022; Onyekwere et al., 2024). Therefore, this study aims to assess the knowledge, risk perception, attitudes, and practices regarding fire safety, while also examining the relationship between their risk perception and safety practices.

LITERATURE REVIEW

Research on how risk perceptions influence fire safety in residential colleges has become increasingly important, as residential fires pose a significant threat to both people and property. Fire safety in university hostels and residential buildings has gained attention over recent years, particularly in developing countries where preparedness is often inadequate (Daramola, Bakare, & Owabumowa, 2024; Shokouhi et al., 2019). Studies have documented that despite the presence of fire safety equipment such as smoke detectors and extinguishers, awareness and participation in fire drills remain low among students and staff (Onyekwere et al., 2024). Globally, residential fires cause a large number of fire deaths and injuries, with over 300,000 deaths each year, mostly in low and middle-income countries (Istre et al., 2014; Shokouhi et al., 2019).

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Fire safety research increasingly emphasises behavioural aspects such as risk perception and preparedness, as they are crucial for effective outcomes (Kinateder, Kuligowski, Reneke, & Peacock, 2015). Understanding risk perception and safety behaviour can be explained through two behavioural models: the Protection Motivation Theory (PMT) and the Health Belief Model (HBM). PMT suggests that individuals adopt protective actions when they perceive a threat as severe and believe they can effectively respond (Rogers, 1975), whereas HBM emphasises perceived susceptibility, severity, and self-efficacy as drivers of preventive behaviour (Becker, 1974). Recent studies have successfully applied these theories to contexts of fire safety and disaster preparedness (Jansen, Snijders, & Willemsen, 2020; Kurata et al., 2023). University hostels face specific challenges in implementing fire safety measures, including limited resources, low occupant awareness, and insufficient training (Daramola et al., 2024; Onyekwere et al., 2024). Despite the critical importance of these measures, a knowledge gap persists regarding how risk perceptions shape the fire safety behaviours, such as smoke detector installation and fire drill participation among residential college occupants (AlWaqfi et al., 2022; Jansen, Snijders, & Willemsen, 2024; Mankell & Nilson, 2023). Studies suggest that higher risk perception correlates with increased safety behaviours (Olsen, Kline, Ager, Olsen, & Short, 2017; Wolters, Steel, Weston, & Brunson, 2017), while others indicate that risk perception alone may not be sufficient to motivate action, highlighting the role of efficacy beliefs and social norms (Jansen et al., 2024). This issue highlights the importance of a comprehensive understanding of the interplay between risk perception, behavioural intentions, and safety practices (Jansen et al., 2020). Failure to address this gap may result in insufficient fire preparedness, thereby increasing vulnerability to fire-related injuries and fatalities (Shokouhi et al., 2019).

In terms of sociodemographic variables, studies have demonstrated that education, gender, and prior fire drill participation influence fire safety knowledge and attitudes (Mankell & Nilson, 2023; Vu & Lin, 2024). Contrasting perspectives exist regarding whether high-risk groups underestimate their fire risk or possess accurate risk perceptions but face other challenges in implementing safety measures (Mankell & Nilson, 2023). Moreover, limited research specifically focuses on residential college populations, whose unique living arrangements and social dynamics may influence risk perception differently from the general population (Adisa & Simpeh, 2019). Therefore, further investigation is necessary to explore how these sociodemographic factors of residential college occupants influence their fire safety behaviours and perceptions.

METHODOLOGY

Study design, study location, and respondents' selection

Residential fires cause a large number of fire deaths and injuries, with over 300,000 deaths each year, mostly in low and middle-income countries during that period. The sample size was 357, based on Krejcie and Morgan's Table. The research was conducted from May to December 2024 at Universiti Malaysia Pahang Al-Sultan Abdullah, Gambang campus. A convenience sampling method was used, whereby participants were selected based on their availability and willingness to participate in the online survey distributed through residential college WhatsApp groups. Before completing the questionnaire, respondents were informed about the study's objectives, and informed consent was obtained to ensure voluntary participation. All responses were kept confidential, and the collected data were used solely for academic and research purposes. While this approach enabled efficient data collection from a large number of respondents within a limited timeframe, it may introduce sampling bias as participants who were more aware of or interested in fire safety might have been more likely to respond. Consequently, the results should be interpreted with caution, and the generalisability of the findings may be limited to similar higher-learning institution settings rather than all residential college populations in Malaysia.

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Instrumentations

A bilingual questionnaire (Malay and English) was used in this study to assess respondents' sociodemographic characteristics, knowledge, attitudes, practices, and risk perception regarding fire safety. The questionnaire comprised five sections, each adapted from validated research instruments. The first section focused on sociodemographic details, collecting data on age, gender, ethnicity, residential college, and academic background. These questions were customised to ensure relevance to the target population.

The second section assessed respondents' knowledge of fire safety, consisting of 20 items. Participants responded using a 5-point Likert scale: strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1). The third section examined attitudes toward fire safety using 10 items. The fourth section assessed fire safety practices, comprising 10 items. The final section assessed risk perception of fire hazards, consisting of 6 items, rated on a 5-point Likert scale. The questionnaire underwent content validation to confirm its relevance to the study's objectives. It was pretested on a small sample of students to identify any ambiguities before full-scale data collection. To evaluate reliability, Cronbach's Alpha analysis was performed to determine the internal consistency of the instrument. The overall reliability coefficient for all 46 items was $\alpha = 0.950$, indicating excellent internal consistency. At the subscale level, the Knowledge domain (20 items) recorded $\alpha = 0.881$, the Attitude domain (10 items) $\alpha = 0.944$, and the Practice domain (10 items) $\alpha = 0.887$, all of which demonstrate high reliability. The Risk Perception domain (6 items) yielded $\alpha = 0.758$. These results confirm that the instrument reliably measured the constructs of interest and is suitable for inferential analysis.

Data Analysis

The collected data were analysed using IBM SPSS Statistics version 22.0, employing both descriptive and inferential statistical methods to assess the study variables. For normally distributed data, parametric tests were performed, and continuous variables such as knowledge, attitude, practice, and risk perception were summarised using the mean ± standard deviation (SD). Additionally, Pearson's correlation analysis was conducted to investigate the relationship between risk perception and fire safety practices, identifying the strength and significance of associations between these variables. The levels of knowledge, attitude, practice, and risk perception toward fire safety were interpreted based on the mean score ranges presented in Table 1 (Wiersma, 2000), where mean values between 3.50–5.00 indicate a high level, 2.50–3.49 denote a moderate level, and values below 2.49 represent a low level of fire safety awareness and engagement.

Table 1. Mean score and percentage interpretation

Mean Score	Percentage	Interpretation
3.50 – 5.00	80-100%	High
2.5 – 3.49	50-79%	Moderate
1.00 – 2.49	<50%	Low

RESULTS

Socio-demographic Characteristics of the Respondents

Table 2 illustrates the results obtained from the sociodemographic background. The demographic characteristics of the 363 respondents provide valuable insights into the distribution of individual and institutional factors among residential college occupants. In terms of gender, the majority of respondents were female (66.9%), while male respondents accounted for 33.1%. This gender distribution aligns with general enrollment trends in many higher education institutions, where female students often outnumber males in certain academic programmes. The age distribution shows that most respondents were within the 21–25 age group (61.4%), followed by those aged 20 years and below (36.1%), while only a small

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percentage were aged 26 years and above (2.5%). This distribution is expected, as residential colleges primarily accommodate undergraduate students, with fewer postgraduate students opting for on-campus housing. In terms of ethnicity, Malay students comprised the majority (57.6%), followed by Chinese (28.7%), and Indian (8.0%). Regarding the level of study, the vast majority of respondents were undergraduate students pursuing a degree (81.5%), followed by diploma students (16.8%), while postgraduate students, including Master's (1.1%) and PhD candidates (0.6%), represented a smaller fraction of the residential college population.

Table 2. Sociodemographic background of the respondents

Variables	Frequency (N=363)	Percentage (%)
Gender		
Male	120	33.1
Female	243	66.9
Age (years)		
<20	131	36.1
21-25	223	61.4
26-30	5	1.4
>30	4	1.1
Ethnic		
Malay	209	57.6
Chinese	104	28.7
Indian	29	8.0
Other	21	5.8
Level of study		
Diploma	61	16.8
Degree	296	81.5
Master	4	1.1
PhD	2	0.6
Faculty		
Faculty of Chemical and Process Engineering Technology (FTKKP)	69	19.0
Faculty of Civil Engineering Technology (FTKA)	53	14.6
Faculty of Industrial Sciences and Technology (FSTI)	131	36.1
Faculty of Industrial Management (FIM)	58	16.0
Faculty of Electrical and Electronics Engineering Technology (FTKEE)	14	3.9
Faculty of Mechanical and Automotive Engineering Technology (FTKMA)	10	2.8
Centre for Human Sciences (PSK)	1	0.3
Centre for Mathematical Sciences (PSM)	27	7.4
Residential College		24.0
Residential College 1	87	

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Residential College 2	62	17.1
Residential College 3	152	41.9
Residential College 4	62	17.1

Knowledge towards Fire Safety

As demonstrated in Table 3, a majority of respondents (74.1%) expressed strong agreement that although fires are unavoidable, it is possible to implement preventive strategies to reduce risks, demonstrating a general understanding of fire prevention practices. Furthermore, 69.1% of participants expressed strong agreement regarding their awareness of fire hazards and the influences, while 58.1% strongly agreed that they are always concerned about fire safety precautions. The responses reflect a commendable awareness of fire risk among students. Nonetheless, there seems to be a lack of awareness concerning essential fire safety regulations, as 28.1% of participants strongly disagreed with knowing the Uniform Building By-Laws 1984, while 25.3% remained neutral about the Fire Services Act 1988. The observed lack of understanding of national fire safety policies indicates a necessity for focused educational programmes.

When assessing students' understanding of fire safety protocols and emergency resources, findings suggest a moderate to high level of awareness. For instance, 46.6% of participants expressed strong agreement regarding their awareness of the emergency contact number for fire-related situations. In comparison, 47.7% indicated strong agreement about their knowledge of the nearest assembly area in their residential college. Similarly, 46.6% expressed strong agreement regarding their familiarity with the locations of fire extinguishers or hose reels within their residential college, while 42.1% strongly agreed that they were knowledgeable about the building's layout. However, only 34.4% expressed strong agreement regarding their ability to recall the fire action plan of their residential college, indicating a possible gap in procedural understanding. It is noteworthy that 49.6% expressed strong agreement regarding their knowledge of appropriate actions during a fire, while 49.0% indicated a strong willingness to assist their roommates in an emergency. The findings highlight the necessity of strengthening structured fire safety training to improve students' procedural knowledge and emergency response skills.

Table 3. Response to knowledge

Item	Frequency (%)				
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Fire is unavoidable, but we must be able to do something to prevent the occurrence of fires	6 (1.7)	3 (0.8)	8 (2.2)	77 (21.2)	269 (74.1)
I've heard about the Uniform Building By-Laws 1984	102 (28.1)	70 (19.3)	94 (25.9)	48 (13.2)	49 (13.5)
I'm conscious of the Fire Service Act 1988	65 (17.9)	63 (17.4)	92 (25.3)	83 (22.9)	60 (16.5)
I know about the fire hazards and their consequences	9 (2.5)	3 (0.8)	19 (5.2)	81 (22.3)	251 (69.1)
I'm always concerned about the precautions for fire safety	6 (1.7)	10 (2.8)	30 (8.3)	106 (29.2)	211 (58.1)
I won't let my roommates cook in the hostel	40 (11.0)	59 (16.3)	123 (33.9)	59 (16.3)	82 (22.6)
I won't let my roommates throw cigarette buds in the hostel	15 (4.1)	8 (2.2)	18 (5.0)	42 (11.6)	280 (77.1)
I've experienced fire incidents before	173 (47.7)	66 (18.2)	36 (9.9)	43 (11.8)	45 (12.4)
Fire extinguishers are the best tools to extinguish fires at the early stage of fire events	10 (2.8)	8 (2.2)	31 (8.5)	105 (28.9)	209 (57.6)

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I know the source of ignition in my residential college can be	10 (2.8)	21 (5.8)	69 (19.0)	116 (32.0)	147 (40.5)
I'm conscious of the emergency contact number provided for an emergency of fire	19 (5.2)	22 (6.1)	63 (17.4)	90 (24.8)	169 (46.6)
I can remember the fire action plan for my residential college	21 (5.8)	32 (8.8)	97 (26.7)	88 (24.2)	125 (34.4)
I know where the nearest assembly area in my residential college is	19 (5.2)	11 (3.0)	48 (13.2)	112 (30.9)	173 (47.7)
I'm familiar with where the nearest fire extinguisher or hose reel in my residential college is	24 (6.6)	19 (5.2)	61 (16.8)	90 (24.8)	169 (46.6)
I'm conscious of the layout plan of the buildings in my residential college	23 (6.3)	15 (4.1)	65 (17.9)	107 (29.5)	153 (42.1)
I know what I supposed to do during a fire outbreak in my residential college	7 (1.9)	10 (2.8)	51 (14.0)	115 (31.7)	180 (49.6)
I'm willingly to help my neighbouring mates to escape if fire occurs	10 (2.8)	9 (2.5)	42 (11.6)	124 (34.2)	178 (49.0)
I'll check any occupants left in the rooms or toilets during an occurrence of fire	18 (5.0)	28 (7.7)	87 (24.0)	108 (29.8)	122 (33.6)
Before leaving my hostel room, I'll turn off all electrical appliances	18 (5.0)	12 (3.3)	54 (14.9)	92 (25.3)	187 (51.5)
I'll evacuate immediately even leave my personal belongings behind during a fire	8 (2.2)	24 (6.6)	65 (17.9)	105 (28.9)	161 (44.4)

Attitude towards Fire Safety

Table 4 demonstrated a generally positive attitude toward fire safety, recognising the seriousness of fire risks in residential settings. 72.5% of respondents strongly agreed that a fire incident could occur in a residential building, while 71.9% strongly agreed that all occupants must be aware of fire emergency protocols. The majority of respondents also acknowledged the importance of fire safety training, with 66.7% strongly agreeing that fire prevention and control training should be mandatory for all occupants. Additionally, 67.8% strongly agreed that investments in fire safety equipment are not a waste of financial resources, further reinforcing that students acknowledge the value of fire preparedness measures.

It is noteworthy that 76.3% of respondents expressed strong agreement on the necessity for all occupants to respond promptly to a fire alarm, while 68.9% strongly agreed that they should participate in the fire drills. However, only 47.4% strongly agreed that residents should volunteer in fire rescue operations until professional firefighters arrive. This may indicate a hesitation to engage in direct fire response activities, possibly due to limited training, perceived risk, or unconfident handling of fire-related situations. Additionally, 67.8% strongly agreed that smoking indoors presents a significant fire hazard and that maintaining good housekeeping practices could facilitate evacuation during emergencies. These findings suggest a strong awareness of individual accountability in fire prevention while also emphasising the necessity to enhance confidence in engaging in active fire response participation.

Table 4. Attitude of respondents

Item	Frequency (%)				
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
A fire incident can happen in a residential building	7 (1.9)	2 (0.6)	20 (5.5)	71 (19.6)	263 (72.5)
Every occupant in a residential college must be aware of the do's and don'ts in a fire emergency	9 (2.5)	5 (1.4)	22 (6.1)	66 (18.2)	261 (71.9)
Every occupant should undergo fire prevention and fire control training.	6 (1.7)	5 (1.4)	31 (8.5)	79 (21.8)	242 (66.7)

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Spending funds on fire safety equipment is NOT a waste of money	6 (1.7)	9 (2.5)	22 (6.1)	80 (22.0)	246 (67.8)
Every occupant should react to a fire alarm	5 (1.4)	4 (1.1)	18 (5.0)	59 (16.3)	277 (76.3)
Every occupant should know emergency contact numbers	7 (1.9)	5 (1.4)	22 (6.1)	62 (17.1)	267 (73.6)
Every occupant should take part in mock fire drills	6 (1.7)	3 (0.8)	28 (7.7)	76 (20.9)	250 (68.9)
During an occurrence of fire, residents should be able to volunteer in fire rescue operations until fire professionals reach	20 (5.5)	18 (5.0)	62 (17.1)	91 (25.1)	172 (47.4)
Smoking indoors can pose a significant risk of accidental fire	8 (2.2)	4 (1.1)	18 (5.0)	87 (24.0)	246 (67.8)
Good housekeeping could assist in evacuation during a fire emergency	8 (2.2)	2 (0.6)	25 (6.9)	82 (22.6)	246 (67.8)

Practice towards Fire Safety

The data in Table 5 demonstrates that respondents have differing degrees of involvement in fire safety practices, with some measures being commonly followed, whereas others require additional emphasis for improvement. 49.0% of respondents strongly agreed that an evacuation map was available in their residential college, and 52.9% strongly agreed that they had participated in fire safety training at least once. Additionally, 46.6% expressed strong agreement regarding their practical training in using fire extinguishers, while 40.5% strongly agreed that they knew how to use one correctly. The results reveal deficiencies in practical skills, with a notable percentage of students lacking hands-on experience, highlighting the necessity for more organised fire safety education, regular drills, and engaging training sessions to improve preparedness.

Regarding fire safety infrastructure, 55.6% strongly agreed that their residential college had at least one type of firefighting equipment, 62.0% strongly agreed that a fire alarm was available, and 58.4% strongly agreed that their college had a fire hose reel. However, a slightly lower percentage (46.0% strongly agreed) indicated the existence of smoke or heat detectors. The accessibility of emergency contacts was well recognised, with 48.8% strongly agreeing that a fire emergency number was provided for immediate contact. The findings indicate that basic fire safety measures are in place; however, they also underscore the urgency of enhanced awareness, accessibility, and training initiatives, to ensure that students are competent in utilising them effectively during fire emergencies. Institutions should emphasise the importance of conducting regular fire drills, providing clear signage for safety equipment, and implementing enhanced awareness campaigns to cultivate a proactive safety culture among the residents.

Table 5. Responses to practices

Item	Frequency (%)				
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
The evacuation map is available in your residential college	9 (2.5)	11 (3.0)	67 (18.5)	98 (27.0)	178 (49.0)
You have participated in fire safety training(s)	22 (6.1)	12 (3.3)	48 (13.2)	89 (24.5)	192 (52.9)
You have taken part in practical training on the correct use of a fire extinguisher	21 (5.8)	23 (6.3)	57 (15.7)	93 (25.6)	169 (46.6)
If a fire occurs, you know how to use fire extinguishers correctly	19 (5.2)	29 (8.0)	66 (18.2)	102 (28.1)	147 (40.5)
You know your residential college has a procedure for a fire emergency	14 (3.9)	12 (3.3)	45 (12.4)	114 (31.4)	178 (49.0)
Your residential college has at least one type of firefighting equipment	8 (2.2)	11 (3.0)	41 (11.3)	101 (27.8)	202 (55.6)

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Your residential college has a fire alarm	10 (2.8)	4 (1.1)	45 (12.4)	79 (21.8)	225 (62.0)
Your residential college has a fire hose reel	7 (1.9)	11 (3.0)	58 (16.0)	75 (20.7)	212 (58.4)
Your residential college has a smoke or heat detector(s)	14 (3.9)	16 (4.4)	92 (25.3)	74 (20.4)	167 (46.0)
A fire emergency number is provided to contact during a fire accident	9 (2.5)	11 (3.0)	72 (19.8)	94 (25.9)	77 (48.8)

Risk perception towards fire safety

As shown in Table 6, 61.4% strongly agreed that they would stop working and evacuate upon hearing a fire alarm, indicating a notable level of awareness and urgency in addressing potential fire situations. Notably, 22.6% of respondents expressed disagreement or neutrality regarding their likelihood of panicking or struggling to escape from an unfamiliar environment, suggesting varied levels of confidence and preparedness in navigating emergencies. Additionally, 26.2% of respondents were neutral regarding the decision to wait for family or friends before evacuating, suggesting a possible reluctance to take independent action, which may hinder the timely evacuation procedure. A concerning 36.4% strongly disagreed with leaving the building immediately without first activating the fire alarm upon noticing a fire, suggesting that some students may not fully understand their responsibility in initiating emergency procedures. Similarly, 35.0% strongly disagreed with assuming that a triggered alarm was simply a false alarm, indicating a commendable level of scepticism that promotes adherence to fire safety protocols.

Additionally, 30.6% strongly disagreed with not taking fire drills seriously when informed in advance, highlighting the significance students attribute to fire safety practices. These findings emphasise the importance of continuous reinforcement of emergency preparedness strategies, ensuring that all students are aware of their roles and responsibilities during fire incidents. Increasing the frequency of fire drills, utilising scenario-based simulations, and strengthening fire safety education through targeted awareness campaigns could enhance students' confidence, decision-making abilities, and overall response effectiveness during actual fire emergencies.

Table 6. Risk perceptions towards fire safety

Item	Frequency (%)				
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
When I hear a fire alarm ringing, I will stop working and evacuate immediately	9 (2.5)	3 (0.8)	38 (10.5)	90 (24.8)	223 (61.4)
If a fire alarm is triggered, I will panic and have difficulty escaping from an unfamiliar building or environment	61 (16.8)	82 (22.6)	82 (22.6)	69 (19.0)	69 (19.0)
During an event of fire, I will wait for my family, friends or colleagues before running away from the building	42 (11.6)	44 (12.1)	95 (26.2)	93 (25.6)	89 (24.5)
When I first discover a happening of fire, I will not trigger the fire alarm but leave the building immediately	132 (36.4)	77 (21.2)	53 (14.6)	44 (12.1)	57 (15.7)
I will assume a triggered fire alarm as a false alarm, simply	127 (35.0)	72 (19.8)	71 (19.6)	42 (11.6)	51 (14.0)
I will not treat a fire drill seriously if I have known about it earlier	111 (30.6)	76 (20.9)	64 (17.6)	51 (14.0)	61 (16.8)

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Level of knowledge, attitude, and practices towards fire safety

As shown in Table 7, the respondents demonstrated a high level of knowledge, achieving an average mean score of 3.90 (SD = 1.089). This indicates that students generally understand the principles of fire safety, recognise hazards, and emergency protocols. The high level of knowledge can be linked to institutional fire safety initiatives, prior experiences with fire drills, and educational initiatives that have enhanced awareness. However, despite achieving a high score, there are still specific areas that require improvement, including knowledge of fire safety regulations and the practical implementation of safety measures. This finding is consistent with the previous work, which indicated that most respondents exhibited a strong understanding of fire safety (Nasruddin et al., 2023). This may result from improvements in the educational framework and initiatives focused on fire safety awareness that highlight the significance of preventive strategies. Furthermore, it is essential to consistently assess the effectiveness of evacuation procedures during fire emergencies to ensure that students can effectively apply their knowledge in real-life scenarios.

Table 7. Level of knowledge, attitude, practice and risk perception of respondents toward fire safety

Element	Average mean score (SD)	Interpretation (level)
Knowledge	3.90 (1.089)	High
Attitude	4.51 (0.853)	High
Practice	4.16(1.051)	High
Risk perception	3.08(1.318)	Moderate

Similarly, respondents exhibited a strong fire safety attitude, achieving an average mean score of 4.51 (SD = 0.853), reflecting a proactive approach to fire prevention, adherence to safety standards, and readiness for emergencies. The high attitude score indicates that students understand the significance of fire safety, support fire drills, and acknowledge the need for emergency response training. The findings align with those of AlWaqfi et al. (2022), who highlighted that previous experiences with fire drills significantly shape positive attitudes toward fire safety. Practical training is essential as it offers students direct experience with emergency scenarios, thereby enhancing their chances of responding effectively during actual fire incidents.

In terms of fire safety practices, respondents exhibited a high score, with an average mean score of 4.16 (SD = 1.051). This indicates that a majority of students engage with fire safety protocols, participate in fire drills, and comply with emergency preparedness measures. The findings align with previous work indicating that a majority of participants demonstrated effective fire safety practices, attributed to high awareness, access to firefighting resources, and compliance with established safety protocols (Zul et al., 2024). Despitee extensive practice, continuous education and focused interventions are essential to maintain compliance and enhance fire safety behaviours. Academic institutions should prioritise practical, hands-on fire safety training to enhance students' confidence in utilising fire extinguishers and responding promptly in case of emergencies.

Despite high scores in knowledge, attitude, and practice, the perception of risk regarding fire safety remained at a moderate level, reflected by an average mean score of 3.08 (SD = 1.318). This indicates that although students recognise fire safety measures, their understanding of fire risks may not be entirely comprehensive. A moderate risk perception score suggests that certain students may not perceive fire incidents as an immediate threat or may underestimate the severity of fire hazards. This corresponds with findings indicating that a significant number of participants expressed reluctance during emergency evacuations, often delaying their departure until others had left or mistakenly believing there were false alarms. Previous research has demonstrated that risk perception is influenced by various sociodemographic

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factors including age, gender, educational level, type of residence, income, occupation, and socio-geographic influences (Mankell & Nilson, 2023). To enhance risk perception, institutions could conduct realistic fire drills, emergency simulation exercises, and awareness campaigns that highlight the severity of fire hazards.

Association between demographic profile and knowledge, attitude and practice towards fire safety

The analysis of the association between respondents' demographic profiles and their fire safety knowledge, attitude, and practice, shown in Table 8, reveals age as the most significant influencing factor. A strong statistical significance ($p < 0.05$) was identified between age and the three elements—knowledge ($p = 0.001$), attitude ($p = 0.000$), and practice ($p = 0.000$). The result contradicts the findings reported by (Ishak, Samad, Hamzah, Nawi, & Shaari, 2023; Zul et al., 2024). This may be linked to greater exposure to fire drills, past experiences, and enhanced awareness over time. Meanwhile, gender showed no significant association with knowledge, attitude, or practice ($p = 0.963$, $p = 0.235$, and $p = 0.085$, respectively), indicating that fire safety awareness and involvement are relatively equal between male and female students. Additionally, the analysis demonstrated no significant association between ethnicity and fire safety knowledge ($p = 0.065$) or attitude ($p = 0.778$), suggesting that awareness and perceptions of fire safety are similar across various ethnic groups. However, a notable association was identified between ethnicity and fire safety practices ($p = 0.030$), indicating that certain ethnic groups may participate in fire safety practices more actively than others. Finally, the level of study showed no significant association with fire safety knowledge ($p = 0.592$), attitude ($p = 0.065$), or practice ($p = 0.147$), suggesting that students at diploma, undergraduate, and postgraduate levels exhibit comparable engagement in fire safety. This may result from consistent fire safety policies and training initiatives implemented throughout all academic levels.

Table 8. Association between respondents' demographic profile and knowledge, attitude, practice towards fire safety

Variables	Knowledge		Attitude		Practice	
	χ^2	*p*-value	χ^2	*p*-value	χ^2	*p*-value
Gender	35.343	.963	30.810	.235	39.936	.085
Age	219.977	.001	156.845	.000	159.257	.000
Ethnic	183.499	0.065	68.203	.778	113.401	.030
Level of study	151.286	0.592	97.721	.065	100.834	.147

Association between risk perception and practice towards fire safety

The analysis of the association between risk perception and fire safety practices, as shown in Table 9, demonstrated a statistically significant yet weak positive correlation ($r = 0.189$, $p = 0.000$), suggesting that an increase in risk perception is linked to slightly improved fire safety practices among respondents. Although the correlation is significant, the low *r*-value indicates that risk perception only has a limited influence on actual fire safety practices. This finding implies that respondents who perceive fire as a significant threat might engage in fire safety practices. However, other factors such as fire safety training, institutional policies, past experiences with fire incidents, and accessibility to firefighting equipment could have a greater influence on actual safety practices. The weak correlation indicates that some respondents, while aware of fire hazards, might not translate it into proactive fire safety measures, potentially due to complacency, a lack of urgency, or inadequate practical training.

Table 9. Association between risk perception and practice towards fire safety

Variable	Risk perception		
Practice	Correlation (r-value)	Sig. (2-tailed) (p-value)	Interpretation
	0.189**	0.000	Low

**Correlation is significant at the 0.01 level (2-tailed)

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DISCUSSIONS

The findings of this study provide important insights into the fire safety awareness and behaviour of college residents. The students demonstrated high levels of knowledge, positive attitudes, and strong fire safety practices, aligning with earlier findings that indicate educational initiatives and institutional drills enhance students' awareness and preparedness (AlWaqfi et al., 2022). However, the moderate level of risk perception indicates a persistent gap between students' knowledge and their actions in emergencies. This result agrees with the literature (Mankell & Nilson, 2023) demonstrated that individuals possessing good knowledge frequently underestimate their personal risk, leading to complacency in preventive behaviour. In the context of the Protection Motivation Theory (PMT) and the Health Belief Model (HBM), this indicates that although there is a cognitive understanding of threat awareness (knowledge of hazards), the perceived vulnerability and response efficacy might not be adequately stimulated. Students understand fire hazards on a conceptual level but they may not perceive themselves as being at risk.

The weak positive correlation ($r = 0.189$) between risk perception and fire safety practices reinforces this interpretation that mere knowledge and attitude do not ensure safe behaviour. Brown et al. (2022) reported comparable findings in their study, indicating that heightened awareness did not consistently lead to preparedness. This study suggests that complacency may arise from the belief that residential colleges are secure and adequately equipped, which could reduce students' sense of personal accountability (Brown, et al, 2022).

While the findings provide valuable insights, several limitations should be acknowledged. The application of a convenience sampling method could have introduced sampling bias, thereby limiting the external validity of the findings. Furthermore, the cross-sectional design limits the ability to draw causal conclusions regarding the relationship between risk perception and behaviour, and the study lacked comprehensive psychometric validation beyond measures of internal consistency. Future studies should utilise probability sampling across various institutions, implement longitudinal or mixed-method approaches, and incorporate behavioural observations to capture actual safety practices over time more effectively.

Furthermore, it is important to acknowledge potential response biases that may have influenced the findings. This study utilised self-administered questionnaires, which may have led participants to report socially desirable behaviours, such as indicating a higher compliance with fire safety procedures or greater involvement in training activities than they genuinely practised. The presence of social desirability bias may result in an overestimation of positive safety behaviours, particularly regarding reported attendance in fire drills and use of firefighting equipment. Therefore, the high levels of reported practice and awareness should be interpreted cautiously, as they might indicate perceived expectations rather than genuine behaviours.

CONCLUSION

This study reveals that residential college occupants demonstrate high levels of fire safety knowledge, positive attitudes, and strong fire safety practices, but only moderate risk perception. Although students understand the concept of fire hazards and engage in safety measures, their perception of fire risks does not always translate into proactive emergency responses. Age significantly influences knowledge, attitude, and practice, whereas gender and level of study do not exhibit a significant effect. The low correlation observed between risk perception and fire safety practices suggests that awareness alone is insufficient in ensuring preparedness. From a practical perspective, this study highlights the need for higher-education institutions to enhance their fire safety management by implementing regular practical drills, simulation-based learning, and subsequent evaluations to track changes in safety behaviour. Integrating fire safety and risk management components into student orientation programmes has the potential to cultivate a more

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proactive and sustainable safety culture in residential colleges. The findings enhance our understanding of the relationship between risk perception and safety practices, providing empirical evidence to inform the development of targeted fire safety education and preparedness programmes in higher education environments.

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CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial, or financial conflicts and declare the absence of conflicting interests with the funders.

AUTHORS' CONTRIBUTIONS

Chen Pei Wen carried out the research and wrote the article. Khairiah Mohd Mokhtar conceptualised the central research idea and supervised the research progress. Wan Zaiton Wan Sulaiman and Noor Diana Abdul Majid reviewed the manuscript. Ratih Damayanti performed the proofreading. All authors read and approved the final manuscript.

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