



UNIVERSITI PUTRA MALAYSIA

***OBSERVATION OF FIRE SAFETY PROVISION AND FACTORS
ASSOCIATED WITH KNOWLEDGE, ATTITUDE AND PRACTICES
AMONG HOSTEL OCCUPANTS IN A PUBLIC UNIVERSITY IN
MALAYSIA***

ALWAQFI AHMAD SAEED AHMAD

FPSK(m) 2022 37



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By

ALWAQFI AHMAD SAEED AHMAD

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of Master of
Science**

September 2021

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in
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Chair : Ng Yee Guan, PhD
Faculty : Medicine and Health Sciences

Man-made fire particularly in the multi-dwelling building such as hostel remains to be one of the top priorities in emergency preparedness. Failure to prepare adequately may result in extensive losses not limited to life and health but also in terms of physical and intellectual function as well as morale of those affected.

The objective of the study was to assess the fire safety provisions of hostels and factors associated with level of knowledge, attitude and practices (KAP) in fire safety and prevention among students (hostel's occupant) in Universiti Putra Malaysia's (UPM) residential colleges.

A cross-sectional study conducted at UPM's residential colleges from March 2020 to October 2020. An adapted checklist which was cross-referenced to Uniform Building By-Laws (UBBL) was used to determine the compliance of fire safety provision of the residential buildings. In terms of fire safety provision, all colleges were included, and a checklist was used in the research to collect data by observation which was done by researcher with help from the management staff. Convenient sampling was used to collect KAP on fire safety by online questionnaire from students. Face validity, content validity, and reliability value of KAP questionnaire were checked. Multiple logistic regression was used to investigate factors associated with KAP on fire safety among students.

A total of 283 students took part in the study, and 8 residential colleges were assessed in term of fire safety provision. Assessment using checklist revealed that despite available fire safety policy at all residential colleges, there were differences and inadequacy in terms of fire safety provision which may be attributable to the different management and operational team. Specifically, there were no uniformity in terms of investigated provisions (and aspects); prevention of fire occurrence (control of ignition sources, fuel/heat interaction and fuel characteristics), control spread of fire (fire detection and combustion control) as well as protection of building occupants (notification, egress and structural protection) across all residential colleges.

Prevalence of having acceptable knowledge, positive attitude and good practices was 62.0%, 87.9% and 49.3% respectively. Multiple logistic regression indicated that non-Malay students, experiences in fire drill training and hands-on experiences in fire drill training were significantly associated with knowledge. However, only hands-on in fire drill training was significantly associated with attitude (OR= 2.285, 95%CI: 1.048, 4.980, $p = 0.038$) while total household monthly income of RM4,850-RM10,959 was significantly associated with practices (OR= 3.000, 95%CI: 1.181, 7.620, $p = 0.021$).

Based on findings in this study, there are dire need to address not only the non-uniformity and inadequacy of fire safety provision across different residential colleges, but also take into consideration the level of fire safety KAP among students and its associated factors, to identify the potential risks and developing programs to enhance fire safety KAP.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**PENGAWASAN PERUNTUKAN KESELAMATAN KEBAKARAN DAN
FAKTOR YANG BERKAITAN DENGAN PENGETAHUAN, PERSEPSI DAN
AMALAN PENGHUNI HOSTEL DI SEBUAH UNIVERSITI AWAM DI
MALAYSIA**

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Kebakaran buatan manusia khususnya di bangunan kediaman bertingkat seperti asrama kekal menjadi salah satu keutamaan dalam persediaan kecemasan. Kegagalan untuk membuat persediaan yang secukupnya boleh mengakibatkan kerugian yang besar tidak terhad kepada nyawa dan kesihatan tetapi juga dari segi fungsi fizikal dan intelek serta semangat mereka yang terjejas.

Objektif kajian ini ialah untuk menilai peruntukan keselamatan kebakaran asrama dan faktor yang mempengaruhi tahap pengetahuan, sikap dan amalan (KAP) dalam keselamatan dan pencegahan kebakaran di kalangan pelajar (penghuni asrama) di kolej kediaman Universiti Putra Malaysia (UPM).

Ini merupakan kajian keratan rentas yang dijalankan di kolej kediaman UPM dari Mac 2020 hingga Oktober 2020. Senarai semak yang diadaptasi dirujuk daripada Undang-Undang Kecil Bangunan Seragam (UBBL) yang digunakan untuk menentukan pematuhan peruntukan keselamatan kebakaran bangunan kolej kediaman. Dari segi peruntukan keselamatan kebakaran, semua kolej telah dimasukkan, dan senarai semak digunakan dalam penyelidikan untuk mengumpul data secara pemerhatian yang dilakukan oleh penyelidik dengan bantuan daripada kakitangan pengurusan. Persampelan mudah digunakan untuk mengumpul KAP mengenai keselamatan kebakaran melalui soal selidik dalam talian daripada pelajar. Kesahan muka, kesahan kandungan dan nilai kebolehpercayaan KAP telah disemak. Regresi logistik berganda digunakan untuk menyiasat faktor berkaitan KAP terhadap keselamatan kebakaran dalam kalangan pelajar.

Sebanyak 283 pelajar mengambil bahagian dalam kajian ini, dan 8 kolej kediaman dinilai dari segi peruntukan keselamatan kebakaran. Penilaian menggunakan senarai semak mendedahkan bahawa walaupun terdapat dasar keselamatan kebakaran di semua kolej kediaman, terdapat perbezaan dan ketidakcukupan dari segi peruntukan keselamatan kebakaran yang mungkin berpunca daripada pasukan pengurusan dan operasi yang berbeza. Secara khusus, tiada keseragaman dari segi peruntukan (dan aspek) yang dinilai; pencegahan kejadian kebakaran (kawalan sumber pencucuhan, interaksi bahan api/haba dan ciri-ciri bahan api), kawalan penyebaran kebakaran (pengesanan kebakaran dan kawalan pembakaran) serta perlindungan penghuni bangunan (pemberitahuan, jalan keluar dan perlindungan struktur) di semua kolej kediaman.

Prevalens mempunyai pengetahuan yang diterima, sikap positif dan amalan baik masing-masing adalah 62.0%, 87.9% dan 49.3%. Regresi logistik berganda menunjukkan bahawa pelajar bukan Melayu, pengalaman dalam latihan kebakaran dan pengalaman langsung dalam latihan kebakaran mempunyai kaitan secara signifikan dengan pengetahuan. Walau bagaimanapun, hanya latihan kebakaran secara langsung dikaitkan secara signifikan dengan sikap (OR = 2.285, 95% CI: 1.048, 4.980, $p < 0.038$) sementara jumlah pendapatan bulanan isi rumah sebanyak RM4,850-RM10,959 secara signifikan dikaitkan dengan amalan (OR = 3.000, 95% CI: 1.181, 7.620, $p < 0.021$).

Berdasarkan penemuan dalam kajian ini, terdapat keperluan untuk menangani bukan sahaja ketidakseragaman dan ketidakcukupan peruntukan keselamatan kebakaran di kolej kediaman yang berbeza, tetapi juga mengambil kira tahap KAP dalam keselamatan kebakaran di kalangan pelajar dan faktor yang berkaitan, untuk mengenal pasti potensi risiko dan membangunkan program untuk meningkatkan KAP keselamatan kebakaran.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

ADF	Accidental Dwelling Fire
ALFs	Assisted Living Facilities
AS	Australian Standard
AFAC	Australasian and Emergency Services Authorities Council
B	Beta
BOMBA	Fire and Rescue Department of Malaysia
CI	Confidence Interval
Cm	Centimeter
CO ₂	Carbon Dioxide
DCLG	Department for Communities and Local Government
DFES	Department of Fire and Emergency Service
DCP	Dry Chemical Powder
DOSH	Department of Occupational Safety and Health, Malaysia
Df	Degrees of Freedom
FOC	Fire Officers' Committee
FRA	Fire Risk Assessment
FRS	Fire and Rescue Services
HFS	Home Fire Safety
HSE	Health and Safety Executive
IAAI	International Association of Arson Investigators
IAFC	International Association of Fire Chiefs
IBC	International Building Code
ICC	International Code Council
IFC	International Fire Code

IFSTA	International Fire Safety Training Association
interns	Internship
IQR	Interquartile Range
IRC	International Residential Code
JBDP	Jabatan Bomba dan Penyelamat Malaysia
KAP	Knowledge, Attitude and Practices
KNUST	Kwame Nkrumah University of Science and Technology
LPG	Liquefied Petroleum Gas
MPC	Malaysia Productivity Corporation
MCO	Movement Control Order
N	Sample size / number
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
OR	Odds Ratio
OSHA	Organization Safety and Health Administration
P	Significance value
PG	Postgraduate
Ph.D.	Doctor of Philosophy
POE	Post Occupancy Evaluation
QR code	Quick Response code
R-2	Occupancies containing sleeping units or more than two dwelling units.
RM	Ringgit Malaysia
SE	Standard Error
SO ₂	Sulphur Dioxide
SPSS	Statistical Package for Social Sciences

ST	Suruhanjaya Tenaga
TV	Televisions
UBBL	Uniform Building By-Laws
UG	Undergraduate
UK	United Kingdom
UPM	Universiti Putra Malaysia
UPNM	Universiti Pertahanan Nasional Malaysia
USA	United State of America
USFA	United State of Fire Administration
WHO	World Health Organization
WMFS	West Midlands Fire Service
χ^2	Chi-square statistic

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Prior to the COVID-19 pandemic, the past decades have indicated increasing demand for hostels as tertiary education becomes a foremost priority in development of highly skilled and knowledgeable workers towards knowledge-based economy. Hostels are among the foremost necessary investment for any academic establishment which serves as short to mid-term accommodation facilities for the students (Nadzim & Taib, 2014). Therefore, it is very important to prepare residential building adequately to protect occupants as well as residential building from fire, which can be done by implementing a fire safety management. Fire safety management is a combination or co-ordination of some activities or programs to prevent damage from fires (Ebenehi et al., 2017). Knowledge, maintenance and equipment are considered the elements to use firefighting equipment's according to Kulkarni et al. (2016), he added, delay in firefighting is related to lack of knowledge and inadequate training in emergency drill.

As the students comes from a diverse socio-economic background as well as knowledge, attitude and practices (KAP), the fire safety in the hostels rest upon various individual factors they carry over from their life experiences in relation to fire safety and experience with fire incidents. In that regards, Muhammad (2013) described that safety culture is developed based on how the organization take responsibility on safety like how they act to enhance safety concerns and learning from mistakes. Gehandler (2017) mentioned that, a good safety culture can be supported by factors which relevant for fire safety design such as, shared concern and care for hazard, realistic and flexible norms and rules about hazard, and training and seminars.

1.2 Problem Statement

As Malaysia targets to become the sixth largest education exporting country by 2020, it is therefore, anticipated that the Higher Education Institution establishment to be able to accommodate 200,000 students which lead to increase in hostels demands (Ebenehi et al., 2017). The increase in hostel occupancy potentially increases the risks of fire regardless of the buildings design of escape route, door opening, corridor way and stairways (Stollard, 2014) due to the inherent risk attributed by the individual occupying the building. A simple lack in awareness has been considered as an epistemic risk that can put them at risk (Buratti & Allwood, 2018).

A study by (Abdul Rahim, Taib, & Othuman Mydin, 2014) found that the fire safety awareness was low among the Malaysian public which was reflected by their actions when facing a fire incidents. In a media interview in Malaysia, a fire expert, Mohd Isa said that many people, referring to the Malaysians do not know how to stop or contain a fire while firefighters are being deployed to the scene of fire (BERNAMA, 2016). Based on Fire and Rescue Department of Malaysia (BOMBA) (n.d.) annual report for the year 2018, 158 people had died of fire nationwide in 2015. Although the statistics showed a reduction to 107 deaths in 2016, it increased to 145 in 2017 before declined in 2018 to become 97 (Figure 1.1) which appear to be at random.

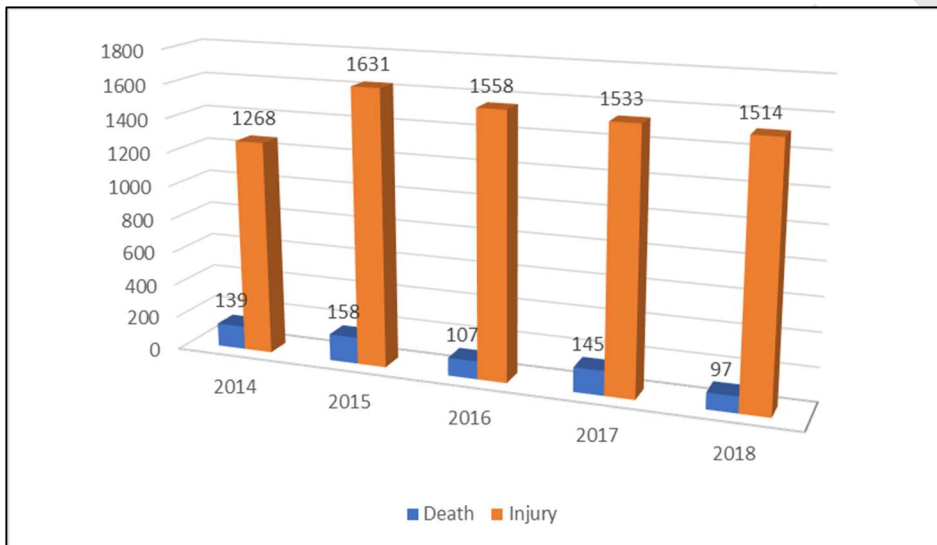


Figure 1.1: Statistics of Fire Victims in Malaysia

(Source of data: Fire and Rescue Department of Malaysia [BOMBA], 2018 & 2016)

Fire outbreaks can start without warnings and cause massive damage in properties and lead to lose lives. Various studies in the past has been conducted in different establishment including malls, hospitals and other dwelling with multi-residential occupancy such as nursing homes for elderly or orphanage especially in other countries (Kulkarni, Giri, & Gangwal, 2016; Abdul Rahim, Taib, & Mydin, 2014; Nimlyat, Audu, Ola-Adisa, & Gwatau, 2017; Mkharem, Adam, & Supeni, 2018; Agyekum, Ayarkwa, & AMOAH, 2016; Harpur, Boyce, & McConnel, 2014).

Comparing between dwelling types, multi-units housing has the highest number of fire occurrences around 40.0% of total fire between 2012-2014 (Tan et al., 2012). The lack in fire safety management lead to increase in casualties, such as, in the year 2017, the fire rapped in the residential tower “Grenfell Tower” in London caused 72 deaths (Potton, 2019). The fridge-freezer and cladding (made from polyethylene) which was the fuel of fire in Grenfell Tower, and the building was equipped by only one staircase which increased the tragedy of this accident,

that this only route was used by occupants and firefighters in both directions up and down (Mansor, Hamid, Suliman, Ahmad, & Hamzah, 2019). Locally in Malaysia, an arson fire at Tahfiz Darul Quran Ittifaqiyah school, in Malaysia 2017, killed 23 students and the main cause of death was suffocation (Bernama, 2019). Two gas cylinders cause to spread the fire fast, according to director-general, Datuk Wan Mohd Nor Ibrahim, also he added, the department investigation team found two empty gas cylinders at the front door of the hostel (Bernama, 2017). Keeping or using flammable material in the residential buildings without preparing adequately whether the fire is incident or arson will help to spread the fire then increase the casualties.

According to the International Labor Organization (2012), the lack of emergency procedure and failure in the warning system are among the several reasons on the failure of timely evacuation from the building. In 2017, the World Health Organization (WHO) further stressed that emergencies must be dealt and supported by the emergency preparedness which ultimate aims was to build the capacity of an organization and communities to stand in front of the emergency. The time factor is important during an evacuation as delayed evacuation will undoubtedly increase the risk to evacuees leading to casualties among the building's occupants (Yatim, 2009).

The statistical analysis in United States of America (USA) in a study of campus's fires between the years 2000-2015 which claimed 118 fatalities, showed that the main cause of fires was smoking which was responsible about (29.0%) of fire cases, followed with intentional fires with 16% and electrical fires with 11% (USFA, n.d.). In Malaysia, the leading cause of fires was electrical failure which was responsible about 54.8% of total fires in the year 2016, followed with gas appliances failures (22.5%) (BOMBA, n.d.). Once started, fires will continue grows and how quickly it grows, depend to a large extent on the basic flammability of building materials and contents, as well as on the building design (Nimlyat et al., 2017).

The apparent risk of fire especially in the hostel which houses a large number of students is prominent, present a considerable gap not only on the fire preparedness in the university's hostels but also amongst the hostels occupants in Malaysia. Failure to prepare the students adequately may results in various losses not limited to life and health but also in terms of properties, intellectual properties and morale, but also the post-disaster consequences such as post-traumatic stress disorders, productivities, time and resources required to return to daily livelihood in the recovery phase.

1.3 Study Justification

As this study seeks to assess fire safety knowledge, attitude and practices (KAP) among UPM hostel occupants and to provide fire safety assessment checklist throughout defining and adapting a checklist items according to the various local

and international requirements, it is expected that the findings could provide an insight and benchmark to existing KAP of the hostel occupants on the fire safety and the existing fire risk management in UPM.

Furthermore, the results of this study could be used by the university's management to develop programs in enhancing fire safety awareness to the hostels' occupant indirectly creating a safe residential environment while increasing the vigilant and attention to the hostels' fire safety provisions (facilities) in identifying the potential risk of domestic residential fires.

1.4 Objectives

1.4.1 General Objective

The general objective of the study is to assess KAP among students at UPM residential college and the fire safety provisions of UPM residential colleges.

1.4.2 Specific Objective

- i) To observe the fire safety provisions (in preventing occurrence of fire, controlling the spread of fire and protecting exposed building occupants) in UPM residential colleges.
- ii) To determine sociodemographic characteristics (age, gender, ethnicity, education level, marital status, occupation, duration of stay in the hostel and name of the hostel) and experiences with fire (incidents, training, and practices) among students at residential college in UPM.
- iii) To determine the level of KAP on the fire safety among students at UPM residential college.
- iv) To determine the associate between fire safety KAP among students at UPM residential college with demographic characteristics (age, gender, ethnicity, education level, marital status, occupation, duration of stay in the hostel and name of the hostel) and experiences with fire (incidents, training, and practices).
- v) To determine the factors of the fire safety KAP among students at UPM residential college.

1.5 Hypothesis

- i) There are significant differences in the fire safety KAP among students at different residential college in UPM.
- ii) There is a significant association between fire safety KAP among students at the residential college in UPM with sociodemographic characteristics (age, gender, ethnicity, education level, marital status, occupation, duration of stay in the hostel and name of the hostel) and experiences with fire (incidents, training, and practices).

1.6 Research Questions

- i) Are the current fire safety provisions among UPM residential colleges in compliance to the legislative requirements?
- ii) What is the relationship between sociodemographic on fire safety KAP among students at the residential college in the UPM?
- iii) What is the relationship between previous experiences on fire with KAP on fire safety among students at residential college in the UPM?

1.7 Conceptual Framework

The conceptual framework is divided into two parts buildings (physical) and the hostel's occupants (students), as seen in Figure 1.2. Although Rasbash, Ramachandran, Kandola, Watts, and Law (2004) sub-categorized fire safety into fire prevention, fire protection, fire safety design and fire safety management, on a broader outlook, fire protection can contain all these terms and can be defined as design options, systems, equipment, buildings or alternative structures to scale back dangers to persons and property by sleuthing, quenching or containing fires (Rasbash et al., 2004).

The aim of fire safety to save lives and prevent property loss. Within the scope of this study, fire safety provisions were divided into three scopes: preventing occurrence of fire, controlling the spread of fire and protecting exposed building occupants according to a study by Sanni-Anibire & Hassanain (2015). Socio-demographic characteristics (age, gender, ethnics, education level, marital status, occupation, experience with fire) has been mentioned in several previous study as factors which potentially affect human lifestyle (Nimlyat et al., 2017; Agyekum et al., 2016; Fasoro, Rampal, Sherina, & Salmiah, 2013; Yatim, 2009). The fire safety among occupants is divided into three categories (knowledge, attitude, and practices). Both occupants' characteristics and fire safety regulation are steps in fire risk assessment which aim to identify hazard and prevent or reduce, and identify physical fire safety management to insure safety of

occupants in the premises Department for Communities and Local Government
[DCLG] (2006)



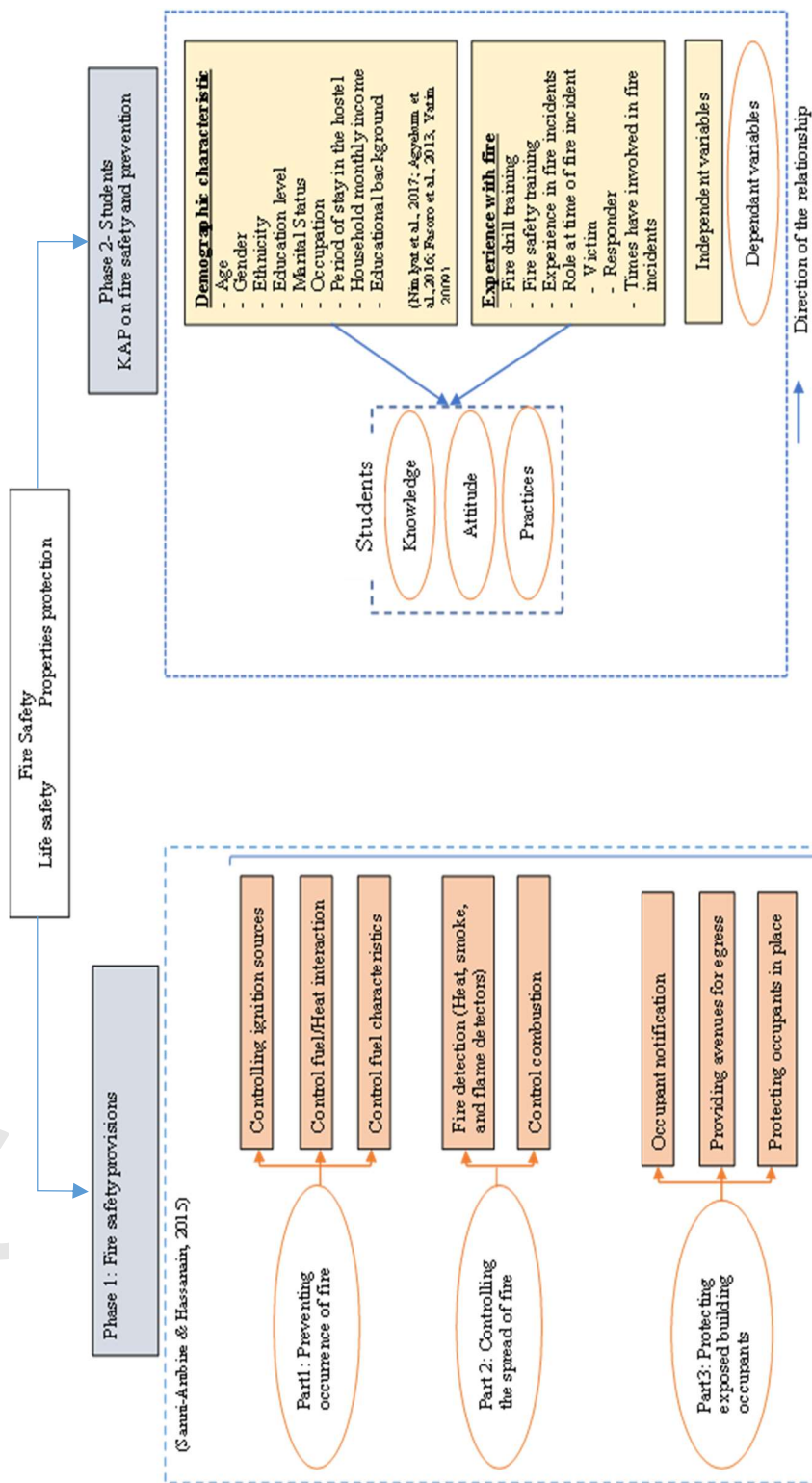


Figure 1.2: Conceptual Framework



1.8 Scope of the study

- i) This study focused on residential colleges inside UPM campus based on the list which was provided by UPM students' affair division.
- ii) Only corridors components (e.g., staircase, corridor, fire door, fire extinguisher) and building surrounding area were included in the study due to restricted access into the room.
- iii) Only students who live in the UPM residential colleges were included in the questionnaire.

1.9 Thesis Organization Structure

There are six chapters in this thesis with references and appendices list.

Chapter 1: Introduction

Chapter one is a brief introduction to the overall thesis; introduces the study background, problems, hypothesis, research questions, objectives of the study, study justification and conceptual framework.

Chapter 2: Literature review

A review of literature that involves reviews on the previous findings or related literature that influences the understanding of the study. Understanding general fire terminology, fire safety management (physical parts) that related to preventing occurrence of fire, control spread of fire and protect exposed building occupants, and KAP about fire safety among buildings occupants.

Chapter 3: Methodology

This chapter presents the methodology used for this thesis, and explain sampling strategies, sample size, data collecting procedures, data analysis, and ethical issues.

Chapter 4: Results

The result outlines by descriptive statistics (frequency, percentage) among the hostels. The data collected by the questionnaire analyzed and tabulated using descriptive analysis and logistic regression.

Chapter 5: Discussion and Conclusion

Contains discussion and conclusion, recommendations for further research, and limitation of the study.

Chapter 6: Conclusion, Limitation and Recommendation

Contains three parts which are: conclusion, study limitation and recommendation of the study.



REFERENCES

- Abdul Rahim, N., Taib, M., & Othuman Mydin, M. A. (2014). Investigation of Fire Safety Awareness and Management in Mall. *MATEC Web of Conferences*, 10, 06004. <https://doi.org/10.1051/matecconf/20141006004>
- Aigbodion, D. O., Orukpe, P. E., & Igbinovia, S. O. (2014). An Assessment of the Electrical Safety Awareness of Senior Secondary School Students. *International Journal of Engineering Research and Technology*, 7(2), 117-130.
- Agyekum, K., Ayarkwa, J., & Opoku, D.-G. J. (n.d.). Fire Safety Awareness and Management in Multi-Storey Students' Hostels. *Asian Journal of Applied Sciences*, 04(02), 10.
- Akashah, F. W., Baaki, T. K., & Lee, S. P. (2017). Fire Risk Assessment of Low Cost High Rise Residential Buildings in Kuala Lumpur: A Case Study. *Journal of Design and Built Environment*, 124-139.
- Alarifi, A. A. S., Phylaktou, H. N., & Andrews, G. E. (2016, January). What kills people in a fire? heat or smoke?. *In 9th SSC Proceedings*. Leeds.
- Allareddy, V., Peek-Asa, C., Yang, J., & Zwerling, C. (2007). Risk factors for rural residential fires. *The Journal of Rural Health*, 23(3), 264-269.
- Almquist, Y. B., Ashir, S., & Brännström, L. (2014). *A guide to quantitative methods*. Stockholm: CHESS.
- Azmi, H., Shuaib, N.A., Ghazali, M.F. and Zain, M.Z.M. (2009), Fire alarm system, portable fire extinguisher and hose reel system maintenance for safety purpose and requirements. *National Symposium on Advancements in Ergonomics and Safety (ERGOSYM2009)*, Perlis.
- Baharudin, M. R., Nasruddin, H. N., Rahman, A. A., Mahadi, M. R., & Noor, S. B. M. (2018). Numerical model for individual time calculation for evacuation among secondary students. *International Journal of Building Pathology and Adaptation*, 36(5), 450-470. <https://doi.org/10.1108/IJBPA-11-2017-0059>
- Bernama. (2017, September 21). Tahfiz school fire arson, says Fire and Rescue Dept. *Malaymail*. Retrieved from <https://www.malaymail.com/news/malaysia/2017/09/21/tahfiz-school-fire-arson-says-fire-and-rescue-dept/1469933>
- Bernama. (2016, March 15). Raising fire safety awareness in Malaysia. *The sun daily*, pp. 1-3. Retrieved from <https://www.thesundaily.my/archive/1728009-ASARCH355002>

- Bernama. (2019, February 22). Raising fire safety awareness in Malaysia. *The Star Online*, pp. 1–3. Retrieved from <https://www.bernama.com/en/news.php?id=1697614>
- Boubaker, S., Mekni, S., & Jerbi, H. (2017). Assessment of Electrical Safety Beliefs and Practices: A Case Study. *Engineering, Technology & Applied Science Research*, 7(6), 2231-2235.
- British Standard Institution (BSI). (2002). *Fire detection and fire alarm systems for buildings- Part 1: Code of practice for system design, installation, commissioning and maintenance*. BSI.
- British Standard. (2003).
- British Standard Institution (BSI). (2006). *Code of practice for fire extinguishing installations and equipment on premises – Part 1: Hose reels and foam inlets*. BSI
- British Standard Institution (BSI). (2008). *Code of practice for fire safety in the design, management and use of buildings*. BSI.
- British Standard Institution (BSI). (2011). *Fire protection installations and equipment on premises- Part 0: Guide for selection of installed systems and other fire equipment*. BSI
- British Standard. (2012). *Fire extinguishing installations and equipment on premises- Part 8: Selection and positioning of portable fire extinguishers – Code of practice*. BSI.
- Buratti, S., & Allwood, C. M. (2018). The effect of knowledge and ignorance assessments on perceived risk. *Journal of Risk Research*. <https://doi.org/10.1080/13669877.2018.1459795>
- Burgiel, S. W. (2020). The incident command system: a framework for rapid response to biological invasion. *Biological Invasions*, 22(1), 155-165. <https://doi.org/10.1007/s10530-019-02150-2>
- Chandler, R. K. (2009). *Fire investigation*. Delmar Cengage Learning.
- Chen, X., Dai, G. L., & Liu, P. (2013). Study on human evacuation behavior in a university fire. *Journal of Safety and Environment*, (4), 60.
- Colonna, G. R. (2001). *Introduction to Employee Fire and Life Safety*. National Fire Protection Association.
- Department for Communities and Local Government (DCLG). (2006). *Fire safety Risk assessment: Sleeping accommodation*. London: The Stationery Office. Retrieve from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/422192/9281_Sleeping_Accommodation_v2.pdf

- Department of Fire and Services. (2015). *Maintaining Your Smoke Alarms*.
- Department of Standard Malaysia. (1999). *Fire Extinguishing Installations and Equipments: Part 1: Hydrant System, Hose Reel and Foam Inlets*.
- Department of Occupational Safety and Health (DOSH). (2011). *Guidelines on Occupational Safety and Health Management Systems*. Retrieve from <https://www.dosh.gov.my/index.php/legislation/guidelines/general/597-04-guidelines-on-occupational-safety-and-health-management-systems-oshms/file>
- Department of Occupational Safety and Health (DOSH). (2018). *Guidelines on Occupational Safety and Health for Lighting at Workplace*. Retrieve from <https://www.dosh.gov.my/index.php/legislation/guidelines/industrial-hygiene-1/2912-guidelines-on-osh-for-lighting-at-workplace/file>
- Department of Occupational Health (DOSH). (2008). *Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC)*. Retrieve from <https://www.dosh.gov.my/index.php/competent-person-form/occupational-health/regulation/guidelines/hirarc-2/1846-01-guidelines-for-hazard-identification-risk-assessment-and-risk-control-hirarc-2008/file>
- Dorn, T., Yzermans, J. C., Spreeuwenberg, P. M., Schilder, A., & Zee, J. V. D. (2008). A cohort study of the long-term impact of a fire disaster on the physical and mental health of adolescents. *Journal of Traumatic Stress, 21*(2), 239-242. <https://doi.org/10.1002/jts.20328>
- Duncanson, M., Ormsby, C., Reid, P., Langley, J., & Woodward, A. (2001). *Fire Incidents Resulting in Deaths of New Zealanders Aged 15-64 Years: 1991-1997*. University of Otago.
- Ebenehi, I. Y., Mohamed, S., Sarpin, N., Masrom, M. A. N., Zainal, R., & Azmi, M. M. (2017). The management of building fire safety towards the sustainability of Malaysian public universities. *IOP Conference Series: Materials Science and Engineering (Vol. 271, No. 1)*, p. 012034. IOP Publishing. Retrieve from <https://iopscience.iop.org/article/10.1088/1757-899X/271/1/012034/pdf>
- Evans, D. D., Peacock, R. D., Kuligowski, E., Dols, W. S., & Grosshandler, W. L. (2005). Active fire protection systems (NIST NCSTAR 1-4; p. NIST NCSTAR 1-4). *National Institute of Standards and Technology*. <https://doi.org/10.6028/NIST.NCSTAR.1-4>
- Ezeani, E. U., & Musa, O. I. (2019). Knowledge of Risk Factors and Preventive Practices towards Domestic Fire Accidents among Residents of Tanke Community in Ilorin, Nigeria. *International Journal of Innovative Science and Research Technology, 4*(8), 328–338.

- Fasoro, A. A., Rampal, G., Rampal, L., Mohd Sidik, S., & Md Said, S. (2013). Prevalence of smoking and its associated factors among university staff. *Malaysian J Med Health Sci*, 9(2), 45-51.
- Fernandez, G., Tun, A. M., Okazaki, K., Zaw, S. H., & Kyaw, K. (2018). Factors influencing fire, earthquake, and cyclone risk perception in Yangon, Myanmar. *International journal of disaster risk reduction*, 28, 140-149.
- Fire Safety Advice Centre. (2017). *Fire Extinguishers – Classes, Colour Coding, Rating, Location and Maintenance-Firesafe*. Retrieved from <https://www.firesafe.org.uk/portable-fire-extinguisher-general/>
- Ferguson, L. H., & Janicak, C. A. (2005). *Fundamentals of fire protection for the safety professional*. United States of America: Government Institutes
- Francisco, J., & Imperiali, M. (2012). *Factors influencing fire safety in Brazil*. Worcester: Worcester Polytechnic Institute.
- Gehandler, J. (2017). The theoretical framework of fire safety design: Reflections and alternatives. *Fire safety journal*, 91, 973-981.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed). England: Pearson.
- Hairul nizam. (2019, April 22). *Facts & Figures*. Retrieved from https://www.upm.edu.my/about_us/facts_figures/facts_figures-8289?L=en
- Hanapi, N. A., Shazali, M. A. I., Abd Wahab, I., & Mahmud, N. A. A. (2020). The Study of Fire Safety for Multi-Storey Container Hotel: A Case Study in Muar PPT Hotel. In *IOP Conference Series: Earth and Environmental Science*, 498 (1), p. 012082. IOP Publishing.
- Harpur, A. P., Boyce, K. E., & McConnell, N. C. (2013). An investigation into the circumstances surrounding fatal dwelling fires involving very young children. *Fire safety journal*, 61, 72-82.
- Hastie, C., & Searle, R. (2016). Socio-economic and demographic predictors of accidental dwelling fire rates. *Fire Safety Journal*, 84, 50-56.
- Hirschberger, P. (2016). *Forests ablaze: Causes and effects of global forest fires*. Retrieved from <https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF-Study-Forests-Ablaze.pdf>
- Home Office. (2018). *Fire and rescue incident statistics: England, year ending June 2018*
- Home Office. (2019). *Detailed analysis of fires attended by fire and rescue services*

- HOU, L. 2018. Fire safety in high-rise residential building. Unpublished Bachelor of Science). Universiti Teknologi Malaysia, Malaysia
- Hulse, L. M., Galea, E. R., Thompson, O. F., & Wales, D. (2020). Perception and recollection of fire hazards in dwelling fires. *Safety science*, 122, 104518. <https://doi.org/10.1016/j.ssci.2019.104518>
- Huseyin, I., & Satyen, L. (2006). Fire safety training: Its importance in enhancing fire safety knowledge and response to fire. *Australian Journal of Emergency Management*, 21(4), 48.
- Ice, G. G., Neary, D. G., & Adams, P. W. (2004). Effects of wildfire on soils and watershed processes. *Journal of Forestry*, 102(6), 16-20. <https://doi.org/10.1093>
- International Association of Fire Chiefs, & International Association of Arson Investigators. (2017). *Fire Investigator: Principles and Practice to NFPA 921 and 1033*. Jones & Bartlett Learning.
- International Code Council. (2017a). *2018 International Building Code*. Retrieved from <https://www.ci.independence.mo.us/userdocs/ComDev/2018%20INTL%20BUILDING%20CODE.pdf>
- International Code Council. (2017b). *2018 International Fire Code*. Retrieved from <https://www.ci.independence.mo.us/userdocs/ComDev/2018%20INTL%20FIRE%20CODE.pdf>
- International Code Council. (2017c). *2018 International Residential Code*. Retrieved from <https://www.ci.independence.mo.us/userdocs/ComDev/2018%20INTL%20RESIDENTIAL%20CODE.pdf>
- International labour office.2012. *Fire risk management / Programme on Safety and Health at Work and the Environment (SafeWork)*. Geneva. Author
- Ismail, I., & Taib, M. (2013). Assessment of Fire Protection System in Student Accommodation at Universiti Sains Malaysia (USM) Main Campus. *In building surveying and technology undergraduate conference 2013*, 98.
- Fire and Rescue Department of Malaysia (BOMBA). (n.d. a). *Laboran Tahunan 2016. Malaysia*
- Fire and Rescue Department of Malaysia (BOMBA). (n.d. b). *Laboran Tahunan 2018. Malaysia*
- Jaslow, D., Ufberg, J., Yoon, R., McQueen, C., Zecher, D., & Jakubowski, G. (2005). Fire safety knowledge and practices among residents of an assisted living facility. *Prehospital and disaster medicine*, 20(2), 134-138. [https:// DOI: 10.1017/S1049023X00002314](https://doi.org/10.1017/S1049023X00002314)

- Kelechava, B. (2018). NFPA 10-2018: *Standard for Portable Fire Extinguishers*. Retrieved February 4, 2020, retrieve from <https://blog.ansi.org/2017/12/nfpa-10-2018-standard-portable-fire-extinguisher/>
- Kegler, S. R., Dellinger, A. M., Ballesteros, M. F., & Tsai, J. (2018). Decreasing residential fire death rates and the association with the prevalence of adult cigarette smoking - United States, 1999-2015. *Journal of safety research*, 67, 197–201. doi:10.1016/j.jsr.2018.06.001
- Khan, M. (2013). Developing a safety culture in developing countries. *In International Conference, "Safety, Construction Engineering & Project Management (ICSCEPM)"* Islamabad (Vol. 2013).
- Kulkarni, R., Giri, P., & Gangwal, P. (2016). Knowledge and practices regarding fire safety amongst health care workers in tertiary care teaching hospital in Marathwada region of Maharashtra, India. *International Journal of Community Medicine and Public Health*, 1900–1904. <https://doi.org/10.18203/2394-6040.ijcmph20162062>
- Laugharne, J., Van de Watt, G., & Janca, A. (2011). After the fire: The mental health consequences of fire disasters. *Current Opinion in Psychiatry*, 24(1), 72–77. <https://doi.org/10.1097/YCO.0b013e32833f5e4e>
- Lee, I. H., Kang, H. Y., Suh, H. S., Lee, S., Oh, E. S., & Jeong, H. (2018). Awareness and attitude of the public toward personalized medicine in Korea. *PloS one*, 13(2), e0192856.
- Lehna, C., Fahey, E., Janes, E. G., Rengers, S., Williams, J., Scrivener, D., & Myers, J. (2015). Home fire safety education for parents of newborns. *Burns*, 41(6), 1199-1204. <https://doi.org/10.1016/j.burns.2015.02.009>
- Malaysia Standard. (2007). *Electrical installations of Buildings - Code of Practice*
- Uniform Building By Law (UBBL). (2012). *Laws of Malaysia (Act 133): Uniform Building By-Laws 1984 (UBBL 1948)*
- Mansor, H., Hamid, Y. S., Suliman, N. H., Ahmad, N., & Hamzah, N. (2019). Evacuation egress in high rise building: Review of the current design evacuation solution. *In MATEC Web of Conferences*, 258, 03012. EDP Sciences.
- Ministry of Education Malaysia. 2014b. *Quick Facts 2018: Malaysia Educational Statistics*. Educational Planning and Research Division, Ministry of Education: Putrajaya Retrieved from <https://www.moe.gov.my/penerbitan/1587-quick-facts-2018-malaysia-educational-statistics-1/file>
- Miorazham. (2019, September 13). *UPM SERDANG CAMPUS MAPS*. [Updated by miorazham]. Retrieved from

https://bku.upm.edu.my/perkhidmatan/peta_kampus_upm_serdang-11053?L=en

- Mkharem, M., Adam, N. M., & Supeni, E. E. (2018). Awareness, Knowledge, Attitude and Practice of Safety Occupants at Residential Houses in Libya. [https:// doi:10.20944/preprints201811.0379.v1](https://doi.org/10.20944/preprints201811.0379.v1)
- Myone, G. I., & Mdoe, M. C. N. W. (2016). Knowledge, Attitude and Practice (KAP) of Property Owners and Users towards Conflagration. *Imperial Journal of Interdisciplinary Research*, 2: 617-625
- Musigapong, P., & Phanpravit, W. (2013). Knowledge, attitudes and practices relating to fire prevention among students in the elementary schools of Muang Nakhon Ratchasima, Thailand. *Journal of Educational and Social Research*, 3(7), 288-288.
- Mydin, M. A. (2014). *Human Factors in Fire Safety Management and Prevention*. *Analele Universitatii'Eftimie Murgu'*, 21(1).
- Mydin, M. A. O., Arminda, W., & Sani, N. M. (2014). Fire Risk Assessment of Adaptive Re-Use of Historic Shop Houses for Sleeping Accommodations in Malaysia. In *MATEC Web of Conferences*, 17, 01011. EDP Sciences. [https://doi: 10.1051/mateconf/201174_01011](https://doi.org/10.1051/mateconf/201174_01011)
- Nadzim, N., & Taib, M. (2014). Appraisal of fire safety management systems at educational buildings. In *SHS Web of Conferences*, 11, 01005. EDP Sciences.
- National Fire Protection Association. (2015). *NFPA 101 Fire Safety Code*.
- National Fire Protection Association. (2019). *NFPA glossary of terms*.
- Nimlyat, P. S., Audu, A. U., Ola-Adisa, E. O., & Gwatau, D. (2017). An evaluation of fire safety measures in high-rise buildings in Nigeria. *Sustainable Cities and Society*, 35(August), 774–785. <https://doi.org/10.1016/j.scs.2017.08.035>
- Nilson, F., Bonander, C., & Jonsson, A. (2015). Differences in determinants amongst individuals reporting residential fires in Sweden: results from a cross-sectional study. *Fire Technology*, 51(3), 615-626. <https://doi.org/10.1007/s10694-015-0459-0>
- Oladiran, O. J. (2013). A post occupancy evaluation of students' hostels accommodation. *Journal of building performance*, 4(1).
- Pacheco-Torgal, F. (2015). *Introduction to handbook of alkali-activated cements, mortars and concretes*. *Handbook of alkali-activated cements, mortars and concretes* (pp. 1-16) doi:10.1533/9781782422884.1 Retrieved from www.scopus.com

- Perneger, T. V., Courvoisier, D. S., Hudelson, P. M., & Gayet-Ageron, A. (2015). Sample size for pre-tests of questionnaires. *Quality of Life Research*, 24(1), 147-151. <https://doi.org/10.1007/s11136-014-0752-2>
- Potton, E. (2020). *Grenfell Tower Fire: Background. Commons Library Briefing*. Retrieved from <https://researchbriefings.files.parliament.uk/documents/CBP-8305/CBP-8305.pdf>
- Proulx, G. (2001, May). Occupant behavior and evacuation. In *Proceedings of the 9th International Fire Protection Symposium* (pp. 219-232).
- QBE insurance (Malaysia) Berhad. (n.d.). *QBE Fire Insurance Policy*. Retrieved from <https://www.qbe.com/my/-/media/malaysia/Files/Business-Insurance-v2/Policy%20wordings/Commercial%20property/Fire%20Policy%20Wording%20Non%20Consumer.pdf>
- Queensland Fire and Emergency Services. (2016). *Information Sheet Fire Extinguishers – QFES*
- Rasbash, D., Ramachandran, G., Kandola, B., Watts, J., & Law, M. (2004). Evaluation of fire safety. *John Wiley & Sons*.
- Sanni-Anibire, M. O., & Hassanain, M. A. (2015). An integrated fire safety assessment of a student housing facility. *Structural Survey*, 33(4/5), 354-371. doi:10.1108/ss-03-2015-0017.
- Senate Legal and Constitutional Affairs Committee secretariat. (2016). *Use of smoke alarms to prevent smoke and fire related deaths*.
- Stollard P. (2014). *Fire from First Principles* (4th Edition). Milton Park, Abingdon: Routledge.
- Suruhanjaya Tenaga (ST). (2008). *Guidelines for Electrical Wiring in Residential Buildings*. *Suruhanjaya Tenaga*, Putrajaya, 1-50. retrieved from http://ocw.ump.edu.my/pluginfile.php/11228/mod_resource/content/1/ST%20Guidelines%20For%20Electrical%20Wiring.pdf
- Tannous, W. K., & Agho, K. (2017). Socio-demographic predictors of residential fire and unwillingness to call the fire service in New South Wales. *Preventive medicine reports*, 7, 50-57.
- Tan, Y. R., Akashah, F. W., & Mahyuddin, N. (2016). The analysis of fire losses and characteristics of residential fires based on investigation data in

Selangor, 2012-2014. In *MATEC Web of Conferences*, 66, 00109. <https://doi.org/10.1051/mateconf/20166600109>

The National Institute of Standards and Technology. (2018). *Fire Dynamics*. Retrieved from <https://www.nist.gov/el/fire-research-division-73300/firegov-fire-service/fire-dynamics>

The star online. (2016). *Fire drills 'must be held at least once a year'*. Retrieved from <https://www.thestar.com.my/news/nation/2016/11/16/fire-drills-must-be-held-at-least-once-a-year>

United States Fire Administration. (2016). *Campus Fire Fatalities in Residential Buildings (2000-2015)*. United States. Federal Emergency Management Agency: Author

van Kamp, I., van der Velden, P. G., Stellato, R. K., Roorda, J., van Loon, J., Kleber, R. J., Gersons, B. B., & Lebet, E. (2006). Physical and mental health shortly after a disaster: first results from the Enschede firework disaster study. *European journal of public health*, 16(3), 253–259. <https://doi.org/10.1093/eurpub/cki188>

World Health Organization. (n.d.). *Environmental health in emergencies*. https://www.who.int/environmental_health_emergencies/preparedness/en/

Xin, J., & Huang, C. (2013). Fire risk analysis of residential buildings based on scenario clusters and its application in fire risk management. *Fire Safety Journal*, 62, 72-78. <https://doi.org/10.1016/j.firesaf.2013.09.022>

Yatim, Y. M. (2009). *Fire Safety Models for High-Rise Residential Building in Malaysia*. (Unpublished doctoral dissertation, Heriot-Watt University). The ROS Theses Repository

Yeturu, S. K., Annapurani, R., Janakiram, C., Joseph, J., & Pentapati, K. C. (2016). Assessment of Knowledge and Attitudes of Fire Safety-An Institution Based Study. *Journal of Pharmaceutical Sciences and Research*, 8(11), 1281.