



Assessment of Fire Prevention Knowledge and Safety Practices of Car Dealership Employees in Nakhon Si Thammarat, Thailand

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ABSTRACT

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Numerous fires are often started by unsafe actions, including negligence, ignorance, or failure to consider fairly obvious hazards. The aim of this cross-sectional study was to evaluate the knowledge and practices of employees in car dealership centers regarding fire prevention. The sample of this study included 118 participants selected by simple random sampling. The data were processed using SPSS IBM version 28 and analyzed using descriptive and inferential statistics. Most of the participants were males (58.47%) and maintenance technicians (40.68%), with 1-5 years of work experience (61.02%). The majority of the participants had appropriate knowledge about fire prevention as the most of them answered the knowledge questions correctly. Their educational level, age, and work experience were all important significance of their potential fire prevention expertise. A high level of knowledge was reflected in the safety practices of the participants regarding the fire prevention; thus, knowledge is still considered to play an important role for every employee in fire accidents. There is an important need to provide fire safety training for all workers to increase safety practices in timely intervals. In addition, fire prevention systems must be ready, efficient, and safe to prevent losses and to ensure the safety of the employees' and companies' lives and properties.

1. INTRODUCTION

Like many other industrial factories, car dealership centers are complex. Their organizational structure consists of many areas with different levels of fire risk, from inspection lines to paint booths and flammable liquid storage rooms offices and server rooms. Moreover, some chemicals are very dangerous, causing instant burning. Some can be inhaled and are flammable [1]. To perform these operations, workers from multiple departments are required at the workplace [2]. It is imperative to have a preparedness program and fire response in the car dealership center that can be activated quickly in the case of a fire in order to protect both personnel and equipment. Fires and explosions are terrible accidents, causing property damage and occasionally severe injury or death in car dealership centers [3]. Several types of inflammable materials, including thinner, paint, gasoline, and oily rags, are found in car dealership centers. Gasoline is a flammable liquid that can cause a tremendous fire. An explosion of an oil fuel tank is possible, even empty ones. Gum and varnish from fuel are potentially found in a drained fuel tank. Potentially combustible vapors can be released from heat and melted gum, causing ignition. Moreover, oil and gasoline handling may be improper owing to drained fuel tanks. However, harmful incidents are possible when performing "hot work" or procedures that can result in fires, flames, or heat, as well as improper usage of thinners and paint and fuel tank repair [2, 4]. Fire is a chemical reaction that occurs when these main components come together: the fuel source (the fuel of the fire is any material that is flammable or combustible), the oxygen

source (the oxidizing source is present in any combustion reaction that occurs during a fire), and the ignition source is needed to preheat the fuel. Some factors stimulate combustion emergence, including oxygen, fuel, and higher ignition temperature of a substance by heat [5]. Uncontrollable heat can be transferred to spaces with flammable objects, resulting in continuous fire. If the fire has not been extinguished for an extended period, it will spread to other areas so that its severity multiplies. As a result, catastrophic consequences can occur, causing serious injury or death, as well as significant property damage. In some cases, the fire also affects the surrounding environment.

According to the US Occupational Safety and Health Administration (OSHA) report, fire cases in Carl Cannon Inc., an automobile dealership, were found. A case happened in the Service Department under Alabama dealership in 2017 [6]. Inspectors determined that the staff were scrubbing the service pit surface with an explosive braking system wash when such fire started. Three workers died because of the accident, while a fourth was severely burned. Another employee was released from the hospital after suffering from smoke inhalation. The failure to enforce all aspects of a chemical hazard communication program, improper containment of liquid solutions, and allowing unauthorized electric receptacles and devices to be used in a dangerous area resulted in one intentional and two crucial protection violations. This instance serves as a heartbreaking reminder of the dangers of auto repair or the possible threats that arise daily. Because of the company's overdependence on flammable braking system cleaning solutions, OSHA levied a \$152,099 punishment upon

investigating and enquiring about the fire incidence at the Alabama business in Jasper facility [6]. As a result, companies must guarantee that their staff are properly taught and informed on the dangers of working with volatile substances.

Each fire indirectly causes many losses, such as time lost to inspecting the accident, repair costs for damaged machines and equipment, loss of profit-making opportunities, and loss of morale [7]. In addition to the loss of lives, fires cause millions of dollars in damages to Thai business annually. According to the fire statistics from the past 29 years in Thailand (1989-2018), it was found that there were 59,387 fires, 5,413 injured people, 2,076 deaths, and a total value of losses of 1,209 million dollars [8]. Business opportunities have been lost, and economic losses have occurred because of the fires [9]. Interestingly, most fires were caused by negligence, carelessness, unmaintained security systems and equipment, and lack of employees' fire prevention knowledge [10].

There were also two prominent fire cases reported in a car dealership center in Thailand. The first occurred in Surat Thani Province. The entire office, showroom area, the mechanical area, and a number of brand-new cars were destroyed. The total value of the damaged properties was over 50 million baht [11]. The second was found in Nakhon Pathom Province. The fire started in the maintenance department. The brand-new cars and showroom area were destroyed. Property damage was estimated to be about 20 million baht [12].

Barriers to fire prevention may include presence sources of fire hazards, firefighting impediments, problems of fire safety systems, and situations hindering population discharge in the event of a fire. To control such causes, fire prevention knowledge and safety practices regarding fire safety prevention measures are the key to alleviating risk from the potential fire [13]. In this regard, readiness of the personnel in properties is of importance as they are the ones to help prevent fire hazards beforehand. Fire prevention must be performed by all employees. They should hold a common set of knowledge and practices with respect to fire prevention and protection, also known as a fire safety culture. The knowledge and practices include, for example, well-established efficient housekeeping practices, periodic inspections, and the diligent application of safety rules. To ensure the safety of workers in car dealerships, security and fire safety should be given attention [14]. Therefore, comprehensive fire safety prevention must be provided at any workplace especially in a small to medium enterprise where fire hazards might be negligence.

Hence, the objectives of this study were to conduct the assessment of the fire prevention knowledge and practices among car dealership employees and analyze the association between knowledge and practices regarding fire safety prevention.

2. MATERIALS AND METHODS

The study was conducted using a descriptive cross-sectional approach to investigate the fire prevention knowledge and safety practices of employees in car dealership employees in Nakhon Si Thammarat, Thailand during six months from January to June 2018.

2.1 Population and participants

The researchers surveyed area in Muang, Nakhon Si

Thammarat, to collect the data about the number of employees. The total number of employees (population) was 169, and the total sample size was obtained using Yamane's formula (1967:886). Yamane proposes a simple equation for determining sample sizes: it was found that a confidence level was 95 per cent and a P-value of 0.5 [15, 16]. The calculated sample size was 118 subjects, so the number of samples is randomly selected from the population and car dealership centers. The primary data for this study were collected through a questionnaires approach. A cluster random method was adopted to select the sample (59 participants) in each of the car dealership centers of Muang Nakhon Si Thammarat. The inclusion criteria were that car dealership employees must have a minimum of six months of work experience and they must be willing to participate in the study.

2.2 Questionnaires

The questionnaires were adapted from previously validated tools with some modifications and based on the literature results [17, 18]. The questions were peer-reviewed, and the content validity of item objective congruence index (IOC) was tested by specialists in the fields of safety engineering and occupational health and safety, who measured the extent to which the content was consistent with the research objectives. The quantitative assessment of the index of item objective congruence was 0.89 for fire prevention knowledge and 0.93 for safety practices. In addition, the reliability of the instrument was evaluated through a pilot study using different samples from the current study. A pilot study was conducted at one of the selected car dealership centers to test the instruments. Thirty participants completed the questions within 10-15 minutes. Cronbach's alpha was determined to measure the reliability and internal consistency. According to the pre-test, Cronbach's alpha was 0.73 for fire prevention knowledge and 0.82 for safety practices; therefore, the questionnaire was accepted as reliable [19]. These scores indicated that the questions are consistent to the objectives.

The questionnaire was classified into the following three major parts: the first addresses sociodemographic data, namely, gender, age, educational level, designation, working experience, and overtime. The second part dealt with knowledge including ten items to assess the fire prevention knowledge regarding the fire triangle, i.e., type of fire, fire safety, and fire prevention. The third part involved safety practices including ten items to investigate the implementation of fire prevention practices.

2.3 Fire prevention knowledge and safety practice scale

There were ten items in the fire prevention knowledge test. Using a distinct set of 10 questions on fire prevention and five questions regarding the risk activities of a fire, the effectiveness and safety practices of fire prevention was evaluated. The participants filled out the questionnaires and chose the correct answers from questions. For each item of fire prevention understanding, marks were assigned (right response = 1, wrong response = 0, don't know = 0, and no response = 0). Each item's safety practices scale has a value of 1 for good practice and 0 for bad or insufficient practice. With an assessed score of more than 80%, fire prevention knowledge and safety practices demonstrated good knowledge and good practices. These scores indicated that the questions are consistent to the objectives.

2.4 Ethical consideration

The research has been recognized and endorsed by the Ethics Committee of Human Research, Walailak University (WUEC-16-112-01). The research objectives were disclosed to all participants. Later, they were asked to send informed written consent. The consent of individual participants was sought through an information note attached to the questionnaire. After participants agreed to participate in the study, face-to-face interviews with validated structure questionnaires related to fire prevention safety knowledge and practices were conducted. The information of participants that was obtained through the questionnaire was kept confidential and anonymous.

2.5 Data analysis

Data were analyzed statistically using descriptive statistical methods to describe the study population using frequencies, mean and percentage proportion. the odds ratio (OR) was computed for the parameters. The backward approach of logistic regression analysis was employed to analyze the relative impact of dependent and independent variables (knowledge level and safe practices).

3. RESULTS AND DISCUSSION

3.1 Sociodemographic characteristics and occupational information

Table 1. Sociodemographic characteristics and occupational information of the participants regarding fire prevention in Nakhon Si Thammarat, Thailand, (n=118)

Variables	Number	Percentage
Gender		
Male	69	58.47
Female	49	41.53
Age (in years)		
< 20	4	3.39
20 - 30	74	62.71
31 - 40	32	27.21
40 - 50	7	5.93
50 - 60	1	0.85
Education level		
Bachelor degree or more	39	33.05
Diploma/High School	58	49.15
Vocational Certificate		
Vocational certificate	10	8.48
High school	11	9.32
Designation		
Maintenance	49	41.53
Sale Representative	46	38.98
Customer Relationship	4	3.39
Leasing	3	2.54
Human Resources	11	9.32
Security	5	4.24
Work experience		
< 1 years	8	6.78
1-5 years	72	61.02
6-10 years	10	8.47
> 10 years	25	21.19
Overtime		
No	102	86.44
Yes	16	13.56

A total of 118 participants (response rate = 100%) participated in the study. Sixty-nine of (58.47%) participants were males. Young people aged between 20 and 30 years old constituted the majority (62.71%), followed by 32 (27.21%) between the ages of 30 and 40 years. A total of 58 participants (49.15%) graduated with a diploma/high school vocation certificate in terms of education level, followed by 39 (33.05%) with a bachelor's degree or higher. Almost half of the participants worked in maintenance (n= 49, 41.53%). The distribution of years of working experience was divided into four segments: more than ten years, 25 (21.19%), followed by one to five years, 72 (61.02%), six to ten years, 10 (8.47%), and less than one year, 8 (6.78%). A total of 112 (86.44%) participants did not work overtime. Other sociodemographic characteristics and occupational information are shown in Table 1.

3.2 Fire prevention knowledge

The responses of car dealership employees regarding their knowledge of fire safety found that 80 employees (67.80%) had good fire prevention knowledge. Thirty-eight employees (32.20%) ranked at a poor level. For this analysis, employees were categorized based on their fire prevention safety knowledge levels (< 80% and ≥ 80%). It was found that the employees knew an emergency action plan and the specific actions to take in emergencies (n=112, 94.92%). Similar findings by Kulkarni et al. [17] showed that 53.96% had been trained in fire safety preparedness, and 96.4% of health care employees knew what action to take in case of fire. Furthermore, 108 (91.53%) knew that the main cause of death in a fire was inhaling/choking on smoke, 108 (91.53%). However, 89 (75.42%) did not know the components of or types of fires and the types of fires, 98 (83.05%). The fundamental nature of fires must be clarified for fire accident prevention, as shown in Table 2. Some employees were trained in fire prevention only once. Consequently, they did not refresh or review their original information. As a result, they did not know the components of fires (75.42%). Some employees could not give correct answers about types of fire extinguishers (83.05%). Similar findings were observed in the research of Ogbonna and Nwaogazie, stating that employees had good knowledge of fire safety except for the type of extinguishers [20]. To make rational decisions essentials on action priorities and viable egress routes, it is important to understand basic information about fire containment and extinguishment [20]. Personnel at car dealership centers could enhance their knowledge when fire control practices have been oriented at the workplace [15]. Training, to be effective, must be continuous and active, as evidenced by the fact that 41.53% of the employees could not use fire extinguishers correctly. However, there is a need to improve fire safety practices because many activities are likely to cause fire. Therefore, changing participants' behavior in an appropriate direction is of utmost importance [21]. This lack of knowledge affects occupational behaviors and results in the risk of occupational danger. The important factors of accidents or dangers are unawareness and lack of knowledge. Furthermore, they must have knowledge and understanding to make them aware and pay attention to their jobs for their safety and the safety of others. Moreover, fire safety in buildings is provided by following provisions recommended by building regulation practices [14, 22].

Table 2. Knowledge of study participants regarding fire prevention in Nakhon Si Thammarat, Thailand, (n=118)

Knowledge of Fire Prevention	Number	Percent
1. The elements of the fire triangle are heat, oxygen, fuel.	29	24.58
Yes	89	75.42
No		
2. If you escape from a building during a fire or other emergency, do not use the elevators or escape to the roof.		
Yes	91	77.12
No	27	22.88
3. Hot work is any work that involves the potential to generate sufficient heat to cause a fire or explosion.		
Yes	74	62.71
No	44	37.29
4. According to the National Fire Protection Association, there are five types of fires.		
Yes	44	37.29
No	74	62.71
5. To escape a building fire safely, you have as little as six minutes to comply with Thai regulation law.		
Yes	79	66.95
No	39	33.05
7. An emergency action plan tells the employee what actions to take in emergencies.		
Yes	112	94.92
No	6	5.08
8. Knowledge about different types of fire.		
Yes	20	16.95
No	38	83.05
9. To operate a fire extinguisher, one must pull, aim, squeeze, and sweep.		
Yes	77	65.25
No	41	34.75
10. The main cause of death in fire accidents is smoke and suffocation.		
Yes	108	91.53
No	10	8.47

3.3 Fire safety practices

The responses of car dealership employees regarding their practices in fire safety found that most 96 (81.36%) employees in the car dealership centers in Nakhon Si Thammarat Province ranked at a good level in their fire prevention practices. Twenty-two employees (18.64%) were rated at a risky level. In specific terms, it was found that the majority 115 (97.46%) of employees participated in a fire drill.

A fire drill in buildings aims to familiarize and reinforce proper evacuation routes and practices. Practicing fire drills and evacuation plays an important role in ensuring personnel's fast, safe, and peaceful responsiveness and reaction. Crucially, it is one of major components to be conducted for secure and healthy organization, and, ultimately, life safety. The proper type of conduct and the avoiding risky behavior does not only save the laborers' presence but also that of the organization. However, 38 (32.2%) employees had never been trained or practiced using fire extinguishers. In case of a fire, some employees think that aisles and stairways do not need to be kept clear to ensure that emergency egress is uninhibited (25.24%). Fire safety inspections should be conducted

regularly, and safety rules should be strongly enforced [23]. Therefore, fires can prompt expanded injury or even death because of challenges and obstacles in an emergency evacuation. These results were affirmed in different investigations [24, 25]. Additionally, some employees did not know the correct usage of fire extinguishers (41.53%).

Table 3. Practices of the participants regarding fire prevention in Nakhon Si Thammarat, Thailand, (n=118)

Practices in fire prevention	Number	Percent
1. Knowledge of the layout features of the workplace, with particular reference to the specific use of the various areas, exit routes, and fire compartmentalization.		
Yes	103	87.29
No	15	12.71
2. Participated in a fire drill.		
Yes	115	97.46
No	3	2.54
3. While detecting a fire, raise the caution alarm by yelling "fire!" and afterward enact the closest push-glass alarm call-point (little red box, near significant exits).		
Yes	118	100
No	0	0.00
4. Practice good workplace housekeeping. Cleaning and organization must be carried out regularly, such as preventing ventilation points on machinery becoming clogged with dust or other materials, thereby causing overheating.		
Yes	115	97.46
No	3	2.54
5. Make sure all aisles and stairways are kept clear to ensure emergency egress is uninhibited.		
Yes	88	74.58
No	30	25.24
6. Do not keep combustible materials such as paper or fabrics near heat-generating equipment.		
Yes	118	100
No	0	0.00
7. Report all electrical hazards. Most electrical fires are caused by faulty or overloaded equipment that can cause damage, injuries, and loss of life.		
Yes	77	65.25
No	41	34.75
8. If there is a fire outbreak, make sure you know the method to use a fire extinguisher (PASS Method).		
Yes	69	58.47
No	49	41.53
9. Have you received fire safety training and practical training on using the portal fire extinguisher?		
Yes	80	67.80
No	38	32.20
10. Smoke only in designated areas, away from storerooms or chemical storage areas.		
Yes	96	81.36
No	22	18.64

According to the provisions stipulated by OSHA, workers and personnel need to attend the fire extinguisher usage training program annually. PASS, which stands for Pull, Aim, Squeeze, and Sweep, is an easy method for fire extinguisher drills. Pull means pull the pin on the extinguisher; aim refers to aim nozzle below; squeeze is to emit the extinguishing agent; and, lastly, sweep is to sweep the nozzle from side to side [26]. In addition, the availability of fire protection devices, namely, portable fire extinguishers and fire suppression systems in an organization provided by the employer, is not enough. It is better to organize the training course to educate personnel on how to use such devices and equipment correctly and safely [14, 26, 27] as shown in Table 3.

3.4 Factors associated with knowledge of fire prevention and safety practices

The odds ratio (OR) was calculated for the variables in order to compare the relative levels of knowledge of those who had information with those who did not. The logistic regression analysis with the backward method was used to evaluate the relative effect of the independent variables (socio-demographic and environmental characteristics) on the dependent variables (level of knowledge and safety practice). Multiple logistic regression analysis revealed a significant association between the participants and level of education (OR: 1.88, $P=0.015$), work experiences (OR: 1.19, $P=0.004$), and age groups (OR: 0.29, $P=0.001$) in relation to accuracy of knowledge in fire prevention as shown in Table 4.

In this study, Table 5 represents the association analysis between the fire prevention knowledge and practices of the participants. Our data revealed a significant association between fire prevention knowledge and safety practices of the participants (OR: 1.60, $P=0.001$) because participants with better knowledge scores tended to corresponding practice scores. Furthermore, it indicated that employees with a high level of fire prevention knowledge were likely to apply their knowledge to fire prevention practices. This finding is similar to that of Ejeta et al. (2015), and Kobes et al.'s (2010) reports also indicated that fire safety training enables individuals to take more precautions to prevent a fire [28, 29]. Furthermore, Makachia et al. (2014) discovered that having greater fire safety information makes people warier of unhealthy activities and more conscious of the significance of using fire blankets as well as extinguishers, and a similar finding was obtained in Nakhon Ratchasima, Thailand [21, 30]. The most noticeable knowledge was expressed as one of the important elements for fire prevention.

Table 4. Factors affecting good knowledge among the participants toward fire prevention in Nakhon Si Thammarat, Thailand, (n=118)

Variables	COR (95% CI)	p-value
Age of participants (≤ 25 years vs. > 25 years)	0.29 (0.14, 0.62)	0.001
Level of education (high school degree and below vs. Bachelor's degree or above)	1.88 (0.11, 3.14)	0.015
Work experiences (≤ 10 years vs > 10 years)	1.19 (0.35-4.12)	0.004
Overtime (No or Yes)	3.14 (1.21, 8.19)	0.063

95% CI = 95% Confidence Interval, p-value from Forward Stepwise (Likelihood Ratio) Logistic Regression.

Table 5. Knowledge and practice of fire prevention among the participants in Nakhon Si Thammarat, Thailand, (n=118)

Knowledge	Practices		OR (95% CI)	p-value
	Good n (%)	Poor n (%)		
Poor	29 (76.32)	9 (23.68)	1.60 (.62, 4.16)	< 0.001
Good	67 (83.75)	13 (16.25)		

95% CI = 95% Confidence Interval, p-value from Forward Stepwise (Likelihood Ratio) Logistic Regression.

4. CONCLUSIONS

In conclusion, fire is a disaster that frequently happens in buildings [31, 32]. The impact ranges from death through to comparative loss of properties. Additionally, some physiological ill health may be expected. Based on our findings, the participants had good levels of knowledge and practices of fire prevention. Nevertheless, management should increase the frequency of fire safety training. It is suggested that employees need to have strong knowledge of the risks before performing their duties. Drills should be conducted periodically to evaluate the reactions of all employees so that fire losses could be minimized. It is also important to ensure that the employees are always aware of the risks around them. It should be ensured that each hallway, stairway, and fire exit entryway is kept clear at all times. All buildings ought to have proper firefighting gear located ideally set in hazardous areas. Suitable fire discovery frameworks compromising a programmed manual electric alert with a "break glass, call focus" system should be given. Furthermore, the employees need to report any near-miss and minor accidents to prevent potential major fires. Safety practices are directly dependent on internal communication and ultimately on management support.

The aforementioned knowledge and practices of employees play an important role in reducing fire accidents in the workplace. Substandard actions in employees' daily practices could bring about major fires not only to the area of study, a car dealership center, but also to any workplaces. Hence, enterprises using similar processes and fire prevention aspects should pay attention to methods of increasing their employees' knowledge and routine practices. Fire prevention management to tackle employee performance should be adopted to enable a safer enterprise.

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