The Effect of a Home Fire Safety Program on Fire Safety Knowledge and Behavior of Community-Dwelling Older Adults and their Family Caregivers

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Abstract

Background: Older adults are at higher risk for fire-related injuries and deaths than younger people due to their impaired physical and sensory functions. A fire safety programs should be developed for older adults and their family caregivers to prevent fire-related accidents. **Aim** of this study is to evaluate the effect of a home fire safety program on fire safety knowledge and behavior of community-dwelling older adults and their family caregivers. **Design:** A quasi-experimental research design was used (one-group pretest–posttest). **Setting**: The study was conducted in five community clubs for community-dwelling older adults in Alexandria namely; El-Saada, El-Hanan, El-Wafaa, El-Hayia Wl-Amal, and El-Wedad clubs. **Subjects** Purposive sample was composed of two subjects; older adults and their family caregivers were selected based on specific criteria. **Results:** There was a statistically significant effect of home fire safety program on the level of knowledge of both older adults and their family (P = 0.001). Also, there were a significant effect of the program on the reported home fire safety behavior for older adults and their family caregivers (P = 0.0001). **Conclusion:** There were improvements in home fire safety knowledge and behavior of the community-dwelling older adults and their family caregivers after the application of a home fire safety program. **Recommendations**: Home fire safety programs should be disseminated to the older adults and their family caregivers in various settings. Encouraging the involvement of home fire safety programs in the mandatory fire safety curriculum in the educational system.

Keywords: Home fire safety programs, fire safety knowledge and behavior, community-dwelling older adults, family caregivers.

Introduction

Changing demographics demonstrate the rising percentage of older persons in the general population as a result of rising life expectancies (Coty et al., 2015; Kholshevnikov et al., 2011). Not only is this population getting bigger, but it is also getting older. The survival gains for those ages 85 and older are remarkable (Lehna et al., 2015). The ability of this population to maintain a sense of independence and self-determination while residing in their own houses has made ageing in place a source of pride for them (Coty et al., 2015). Even while many elderly persons choose to age in place, research has shown that they are more likely to suffer fire burn-related injuries and even death (Federal Emergency Management Agency [FEMA], 2014). In the United Kingdom, falls are the leading cause of accidental death in elderly people's homes, followed by accidents involving "fire and flames" (Hodsoll & Nayak, 1999).

Elderly people are at risk for fire-related injuries and fatalities for a variety of reasons, including physical changes like declining physical health or injury susceptibility, mental aspects like diminished cognitive function or social isolation, and behavioral aspects like using sub-standard electrical appliances (Fernández-Vigil & Echeverría Trueba, 2019; Hodsoll & Nayak, 1999). Physiological changes like thinner skin and a decline in hearing and visual acuity are other variables that enhance the risk of fire-related accidents. These age-related changes lead to person's mobility and sensory functions being impaired (Hodsoll & Nayak, 1999). Decreased mobility, which increases the chance of accidents caused by falls and impairs a person's ability to escape a fire, is another factor that raises the risk of fire-related death in older persons (Coty et al., 2015; Michael et al., 2009). Additionally, as they suffer from more chronic conditions, older adults have a tendency to use more prescriptions. The adverse effects of medications, such as drowsiness, decreased judgment, and hypotension, enhance the danger of fire (Centers for Disease Control and Prevention [CDC], 2014).

According to Federal Emergency Management Agency (FEMA) 2010 assessment, older adults who live in poverty—often because of relatively low incomes—are more likely to die in a fire because of poor housing conditions such as weak building constructions and malfunctioning electrical systems. Furthermore, older adults frequently experience

cold, and they will rely on temporary heating sources (e.g. space heaters). Smoking in bed and dropping cigarette butts on the floor are risky behaviors common in older individuals that contribute to accidental home fires (Xiong et al., 2017). Numerous studies have shown a connection between building characteristics and fire-related injuries. The most significant of which were high-rise buildings and buildings with substandard construction materials (Glauberman, 2020; Shokouhi et al., 2019; Xing & Tang, 2012). High-rise buildings (HRs) greater than 75 feet (23 m) in height from the ground level to the highest floor (National Fire Protection Association [NFPA], 2016). Regarding occupant safety in HR buildings, there are numerous problems, including fire prevention and evacuation safety (Glauberman, 2020; Xing & Tang, 2012).

Fire poses a serious threat to people's lives, buildings, property, and the environment in both developing and developed countries (Kodur et al., 2019). Fire combustion produces various hazardous chemicals and lowers the amount of oxygen in the air, both of which are extremely dangerous to humans and can be inhaled fatally within minutes. When the oxygen level in a room drops to 17% from the normal 21%, humans experience decreased judgment and coordination, headaches, nausea, and exhaustion. When the oxygen level drops to 6%, they experience unconsciousness, respiratory and cardiac collapse, and even death. Additionally, breathing hot air can even be fatal because it can burn the respiratory tract. However, more fire fatalities result from smoke than from burning itself because the smoke causes irritation to the eyes and digestive system. Additionally, during a fire, smoke and hot gases obstruct and restrict escape routes from the building (National Fire Protection Association [NFPA], 2018).

Property safety is one of the main effects of fire risk, which costs billions of dollars worldwide in direct and indirect damages in both developed and developing countries (Brushlinsky et al., 2017). Also, fire has a negative consequence on the victim's psychological status. Most of the people after fire reported some type of post-traumatic stress disorder (PTSD). Despite the resilient overall trend, a significant portion of survey participants did report experiencing depression and post-traumatic stress disorder (Bryant et al., 2014).

Older adults who have been burned or scalded have worse outcomes and often need more medical attention than younger victims. Comorbid disorders make treatment and medical action more difficult. Physiological changes cause burns to recover more slowly and have a higher risk of infection, which increases the need for more extensive surgery or medical care as well as longer and more expensive hospital stays (National Fire Protection Agency [NFPA], 2010).Those 60 years of age or older have

a mortality rate of 55% related with post-burn complications, compared to a national mortality rate of only 4.5% for all ages. Among older adults, burns and other fire-related injuries are currently the second most common cause of fatal home accidents. (Kumar & Verma, 2016; Zanni, 2012). According to reports, the majority of older persons were hurt or killed while attempting to control or escape a fire (United States Fire Administration [USFA], 2006). In particular, for older adults with less body mobility and sensory ability, a lack of fire detection and suppression products would prolong reaction and preparation times for inhabitants to escape from residential fires and cause them to become trapped in the in-flash fires (Guan, 2016).

Accident prevention involves two steps: hazard detection through sensory processes and avoidance through appropriate psychomotor conduct. According to surveys, at least 75% of fires can be prevented (Istre et al., 2001). In an effort to decrease the frequency, morbidity, and mortality associated with fires, numerous fire prevention projects have been implemented in communities all over the world. These programs have included community-based education and training for young people, parents, and some high-risk groups including the elderly (Jonsson et al., 2016; Wuschke et al., 2013). One of the most overlooked causes of fire hazards worldwide is public awareness. According to research, younger and older people in particular lack the necessary fire safety knowledge and behave in ways that increase their risk of suffering burns and dying in a fire (Kodur et al., 2019).

Knowing how high-risk groups, such as young children and elderly people, are affected by fire risk variables might help program designers target interventions for them. The quantity of prior fire safety training is one of the key factors of how an individual would react to a fire, according to Proulx et al., 2003. Thus, an adequate level of fire safety knowledge and preparedness is crucial to reduce the time delay in immediately evacuating the building of fire origin (Proulx, 2000). To prevent fires and help individuals in their preparation for them, people's behavior must also be changed in addition to their knowledge. Fire crises are undoubtedly stressful situations since they start suddenly, are intense, and require a quick and immediate response (Huseyin & Satyen, 2006).

Choosing alarm systems with an alternate, audible way of smoke indication, arranging escape assistance with household members, and improving the safety of home electrical appliances are all examples of multiple prevention strategies for the elderly. Promotional and maintenance programs for smoke detectors are crucial components of preventative initiatives. To prevent fires caused by cigarettes dropped on furniture and mattresses, it's also crucial to smoke safely (Kodur et al., 2019).

The issue of ageing-related decline in cognitive, ambulatory, and sensory (such as hearing and visual) functioning should be acknowledged and addressed in fire prevention programs. For instance, some older adults might not be able to check and replace their own smoke alarm batteries. Alternatives need to be established and offered, like asking a caregiver or relative to keep their smoke alarms in working order or calling the local fire department (USFA, 2006). Most studies agreed that the participation of those around older people re key to the fire prevention process as they are in a better position to identify and reduce risks in the home (Coty et al., 2015; Diekman et al., 2010). For older adults, having access to social support and information (such as knowledge about how to lower risks) from family and friends has been recognized as a key protective factor. (Fuller-Iglesias, 2015; Merz & Huxhold, 2010). According to Shields et al. (2013), family and neighbours may be more involved in helping independent seniors with household tasks like maintaining smoke alarms and making sure they have knowledge about them.

In order to improve the health of older adults and their families and prevent injury and early death, community health and gerontological nurses focused their nursing interventions on primary prevention (American Nurses Association [ANA], 2013). In order to prevent fires, falls, and other accidents and to promote function, nurses aim to change the environment of the individuals. Another objective is to educate and encourage family caregivers as they supervise and take care of their loved ones. Educational interventions play a significant role in improving home fire safety knowledge and practices of the older adult's population and their families and decreasing their risks of experiencing fires and burn-related injuries and death. Home fire safety programs should be tailored to include special considerations for the vulnerable groups as elderly population and their family caregivers (Eliopolus, 2014).

Significance of the study:

Seniors have disproportionate risks for fire injuries, scalds, and carbon monoxide (CO) poisoning compared to a younger population, despite the fact that falls are the most common cause of injuries in this age group. Approximately 8 out of 10 U.S. fire deaths occur in rehomes. Older adults suffer twice as many fire deaths as the younger populations, and those aged 85 and older suffer almost 4 times as many deaths (Runyan & Casteel, 2004). The Federal Emergency Management Agency (FEMA) reported that older adults aged 65 years and older accounted for 35% of all fire death in 2010, and they have e relative risk of dying in a fire that is 2.7 times higher than that of the general (FEMA, 2010). Older adults appear to have difficulties with identifying or evacuating from a fire. In addition, the injuries older adults present with tend to be more severe and are often complicated by other medical conditions with worse prognoses and delayed recovery (Halvorsen et al., 2017).

Aim of the study:

To evaluate the effect of a home fire safety program on fire safety knowledge and behavior of community-dwelling older adults and their family caregivers.

Research Hypotheses:

- The community-dwelling older adults who received the home fire safety program will exhibit a higher score level of home fire safety knowledge after the program than before it.

- The family caregivers of older adults who received the home fire safety program will exhibit higher score level of home fire safety knowledge after the program than before it.

- The community-dwelling older adults who received the home fire safety program will report higher scores level of home fire safety behavior after the program than before it.

- The family caregivers of older adults who received the home fire safety program will report higher scores level of home fire safety behavior after the program than before it.

Operational Definition:

A home fire or a domestic fire includes any fire lit in a building or in a home properly contained as defined herein used for purpose of providing heat and/or light and/or being utilized for the purpose of cooking, it may be a small or large fire, caused injury or not.

MATERIALS AND METHODS

Materials

Research Design:

A quasi-experimental research design was used (one-group pretest–posttest).

Setting:

The study was conducted in five community clubs for community-dwelling older adults in Alexandria Governorate namely; El-Saada, El-Hanan, El-Wafaa, El-Hayia Wl-Amal, and El-Wedad clubs. These clubs were chosen because of the high attendance rate of community-dwelling older adults.

Subjects:

Purposive sampling was used to select community-dwelling older adults and their family caregivers.

These two subjects were selected based on the following inclusion criteria:

⇒ **Inclusion** criteria of older adults:
- Aged 60 years or more
- Attended the previously mentioned setting
- Live with their family
- Have no significant cognitive impairment (Pass in Tool (I) with a score 3 or more on the Mini cog. (Borson et al., 2003).
- Agree and available to participate in the study.
- Agree to involve one significant family caregiver in the study

⇒ **Inclusion** criteria of older adults' family caregivers:
- 18 years old or more
- Have an android mobile (personal or shared with a family member)
- Agree and available to participate in the study

Sample Size:

It was calculated based on a previous study and by using Med Calc statistical software. Assuming the area under ROC to be 0.80, an alpha of 0.05 and a power of study 90.0%, the beta error was 0.1. A typical advice is to reject the null hypothesis H0 if the corresponding p-value is smaller than 0.05. A minimum sample size was 112 subjects will be required for this study, 56 subjects in each group who will fulfil the previous inclusion criteria of the study (Table 1).

Table 1: Distribution of Sample Size according to Five Community-Dwelling Older Adults Clubs in Alexandria Governorate

Community clubs for community-dwelling older adults	No. of Older adults	No. of their Family caregivers
• El- Saada club	12	12
• El-Hanan club	10	10
• El-Wafaa club	14	14
• El- Hayia Wl-Amal club	10	10
• El- Wedad club	10	10
Total	56	56

Tools:

Six tools were used to collect the necessary data for the current study:

Tool (I): Mini- Cognitive (Mini-Cog):

It is a 3-minute instrument developed by Borson et al. (2003) used for the detection of cognitive impairment in older adults. It can be used in both healthcare and community settings. It consists of two components, (a 3-item recall test for memory and a simply scored clock drawing test). Item Recall Score: 1 point for each word recalled without cues, for a 3-item recall score of 1, 2, or 3. 2 points for a normal clock or 0 (zero) points for an abnormal clock drawing. A normal clock must include all numbers (1-12), each only once, in the correct order and direction (clockwise). There must also be two hands present, one pointing to the 11 and one pointing to 2. Hand length is not scored in the Mini-Cog© algorithm. The tool was translated into Arabic by Albanna et al., 2017 and proved to be valid and reliable in Arabic-speaking older adults. As the sensitivity and specificity of the Arabic version is 61.6%.

Scoring system:

- 3-5 score: No significant cognitive impairment indicated; further testing by a physician or other qualified healthcare professional not recommended; suggest repeating test in 1 year.
- 0-2 score: Possible cognitive impairment; further testing by a physician or other qualified healthcare professional is recommended.

Tool (II): Sociodemographic Characteristics, Health Profile and Smoking Behavior of Community-Dwelling Older Adults and their Family Caregivers Structured Interview Schedule:

This tool was developed by the researchers after reviewing recent literature (Huseyin & Satyen, 2006; Lehna et al., 2015; Lehna et al., 2017; Shields et al., 2013), to collect the quantitative data from the study subjects and consist of three parts as follows:

- **Part 1:** It includes 11 items to assess *sociodemographic characteristics of community-dwelling older adults and their family caregivers*. Some questions need to be answered from both study subjects such as age (years), sex, current work status, marital status, educational level and monthly income. In addition to, residential related characteristics such as living arrangement, age of family members, crowding index, type of buildings and home ownership status. These residential-related characteristics need one answer from family caregivers because the two subjects live in the same context.
- **Part 2:** It includes 4 items to assess the *health profile of community-dwelling older adults*

and their family caregivers such as current health problems, current medication used (prescribed /over the counter), use of assistive devise and history of falls within the previous 6 months.

- **Part 3:** It includes 3 items to assess the *smoking behavior of community-dwelling older adults and their family caregivers* such as a current smoker, place of smoking and bedtime smoking.

Tool (III): Previous Home Fire- Related Circumstances of Community-Dwelling Older Adults and their Family Caregivers Structured interview schedule:

This tool was developed by the researchers after reviewing recent literatures (Cassidy et al., 2019; Lehna et al., 2017; Shields et al., 2013) to assess previous home fire- related circumstances from study subjects. It includes 8 items answered by family caregivers. In case of a response by yes to the question of availability of past experience of a home fire, they should answer the following questions: frequency of a home fire occurrence, causes of fire, place of fire, time of fire, effect of a home fire , immediate response to home fire , and finally ask two subjects about if they have previous fire safety training program.

Tool (IV): Home Fire Safety Preparedness of Community-Dwelling Older Adults and their Family Caregivers Structured interview schedule:

This tool was developed by the researchers after reviewing recent literature (Cassidy et al., 2019; Lehna et al., 2015; Shields et al., 2013). It includes 7 items to assess the home fire safety preparedness of community-dwelling older adults and their family caregivers. These items need to be answered by family caregivers such as having a home fire smoke alarm, carbon monoxide (CO) alarms, home fire blankets, home fire extinguishers, home fire sprinklers, home fire escape plan and finally having an emergency information sheet.

Tool V: Home Fire Safety Knowledge of Community-Dwelling Older Adults and their Family Caregivers Structured interview schedule:

This tool was developed by the researchers after reviewing recent literature (Huseyin & Satyen, 2006; Lehna et al., 2017; Shields et al., 2013). It includes 40 questions representing three parts to assess home fire safety knowledge among the study subjects.

- **Part I** include two sections used to assess knowledge **before** the occurrence of a home fire. First section is called "*prevention of home fires*", this section includes 7 subtitles. each

subtitle includes several questions. Total number of questions for this section were 12. Second section was the use of *fire safety equipment*, this section includes 5 subtitles. Total questions for this section were 10 .

- **Part II** represents knowledge needed to follow *home fire escape plan during the fire*. Total questions for this part were 8.
- **Part III** includes knowledge related to *recovering after a home fire* through *Checking the Home.* Total question for this part were 10.

The knowledge score:

Regarding to each subtitle's questions, it represented in the study result as a mean of right answer of each subject in this point

Regarding to total knowledge score, there were 40 questions to measure the knowledge of the two subjects, for each question if correct it equals 1 and for wrong answer 0, then collect the total number for each subject, then the total summation was divided by 40 to get the percent of knowledge level, if >65% it means that the knowledge was good, from 50-65% the knowledge was fair; less than 50.0% the knowledge was poor.

Tool VI: Reported Home Fire Safety Behaviors of Community-Dwelling Older Adults and their Family Caregivers Structured Interview Schedule:

This tool was developed by the researchers after reviewing recent literatures (Huseyin & Satyen, 2006; Lehna et al., 2017; Shields et al., 2013; Shokouhi et al., 2019). It includes 13 parts of 106 questions to assess home fire safety behaviors as reported by the study subjects as follows: smoke alarms, carbon monoxide (co) alarms, home fire blankets, home fire extinguishers, home fire sprinklers, cooking safety, kitchen safety, electrical and appliance safety, home heating safety, smoking safety, candle safety, home fire escape plan, bedtime safety check.

The behaviors score:

*Regarding to each part's questions, it represented in the stud*y result as a mean of safe behaviors of each subject that is point

Regarding to total safety behaviors score, there was 106 questions to measure the reported behaviors of the two subjects, for each question if safe behavior it equals ..1 and for unsafe answer 0, then collect the total number for each subject, then the total summation was divided by 106 to get the percent of safety behaviors levels, if >65% it means that the behaviors were completely safe, from 50-65% the behaviors were partial safe; less than 50.0% the behaviors were unsafe behavior.

Method:

The study was carried out in three phases: (Diagram 1)

I. Preparation phase:

- An official letter was obtained from the Faculty of Nursing, Alexandria University directed to the Undersecretary of the Ministry of Social Solidarity and the **directors of five community Clubs for community-dwelling older adults in the Alexandria Governorate** after explaining the purpose of the study, date, and time of the data collection to obtain their approval to conduct this study.
- **Tools II, III, IV, V and tool VI** were developed by the researchers after reviewing the related literature and translated into Arabic.
- **Content validity** of tools **III, IV, V and tool VI** to be used were developed carefully to ensure the data generated addressed the objectives of the study. In addition, the validity of the research instruments was improved by seeking the opinions of Jury committee of 5 experts in the related fields as Community Health Nursing and Gerontological Nursing to promote the accuracy and meaningfulness of inferences.
- **Stability, reliability of the tools V and VI:** internal consistency was measured by use of Cronbach's Alpha. The alpha value ranges between 0 and 1 with reliability increasing consistently with increase in value. This study used coefficient values> 0.7 which is the normally accepted rule of thumb that designates acceptable reliability. The

Cronbach's alpha for the two tools was more than 0.7, this means that the results of the tools were stable, also the interclass correlation coefficient for the two tools was more than 0.7 which means that the results of the tools were highly reliable (Table 2).

- **Pilot study** was carried out on both subjects; 6 community-dwelling older adults and 6 of their family caregivers within the same clubs to pre-test the study tools to test the feasibility, applicability and changing any unclear and ambiguous questions. They were chosen based on the inclusion criteria of the study and were not included in the study subjects. Accordingly, the necessary modifications were made.
- **Designing the Home Fire Safety Program:** setting the program objectives, content, activities to meet those objectives, and educational materials used in the program within a timeline schedule were developed by the researchers for each session. The study settings were prepared to simulate home fire safety scenarios.
- **Selection of Study Subjects:** The researchers start to clarify the purpose of the study with attendees of five clubs of community-dwelling older adults in Alexandria governorate. The study subjects were selected by using **Tool I** and fulfilled the inclusion criteria.
- **Assessment (Pre-Test)** was performed by interviewing community-dwelling older adults and their family caregivers individually in the study setting by using Tools **II, III, IV, V, and VI.** They lasted about 30–45 minutes.

Table (2): Stability, Reliability of the Tools V and VI

	Number of items	Cronbach's alpha coefficient	Interclass correlation coefficient
Knowledge	40	0.753	0.80
Behavior	106	0.761	0.82
Total tools	146	0.756	0.81

II. Implementation Phase:

- The researchers divided the study subjects into 5-6 groups, each group must include community-dwelling older adults and their family caregivers.
- Each group received six sessions (three sessions per week) to complete the program. The session started from 11 AM to 11:45 AM. Each session last 45 minutes.
- The researchers have specific objectives for each session and start with 10 minutes revision of the previous session, then clarify the sessions' outline, brief introduction, active discussion of content, summarization, and feedback of the main points in the session.
- Different teaching methods were used during the simulation of home fire safety scenarios such as

role play, brainstorming, peer feedback, and competition between participants.

⇒ *The first session* aims to establish the relationship by breaking the ice with the participants and asking them about their program expectations. They then start with an overview of home fire safety.

⇒ *The second and third sessions* for the theoretical part aimed to provide the participants with knowledge about **before, during, and after home fire occurrences.** Home fire prevention are measures needed **before a home fire** to decrease the likelihood of fire incidence. These measures include preparing fire safety equipment such as smoke alarms, home fire sprinkler systems, fire extinguishers, carbon monoxide alarms, and

checking their homes' appliances, electronics, and outlets. Moreover, they should clarify that kitchen fires are the most common type of fire in a home with a focus on the causes of kitchen fires, frequently inspect storage areas, and discuss how to keep their home safe during the use of heating sources for warmth in the winter. In addition to preparing a home fire escape plan, they should initiate to develop fire safety habits that can prevent a fire from starting. On the other hand, the researchers explained the measures needed **after a home fire** occurrence such as recovering after a home fire, cleaning up after a fire, caring for self and family members and returning immediately to the home after fire to check it.

⇒ The materials used were PowerPoint presentations, flipchart paper, markers, pictures, posters, brochures, and booklet.

⇒ ***The fourth, fifth and sixth sessions*** for the practical part aimed to discuss participants' responses **during a home fire** in the form of a practice home fire escape plan. The materials used were mapping out a home fire escape plan by using different home fire safety scenarios, watching videos, and role-playing home fire risk factors.

Evaluation phase:

⇒ ***Finally, the seventh session*** for closing the program aimed to share closing thoughts and impressions.

⇒ It was done immediately after the implementation of the home fire safety program in the ***sixth session***, through performing a **post-test** using the same tools of pre-test (Tool IV, V and VI) to identify the effect of the home fire safety program on preparedness, knowledge and reported home fire safety behavior.

Ethical Consideration:

Ethical considerations were considered across the study. Written consent was obtained from the community- dwelling older adults and their family caregivers after a complete explanation of the study's purpose. The privacy and anonymity of the study subjects and the confidentiality of the collected data were assured throughout the study.

Statistical analysis:

Data was fed to the computer using the IBM SPSS software package version 24.0. Quantitative data were described using numbers and percentages. Comparison between different groups regarding categorical variables was tested using Chi-square test, for small numbers in the cells (less than 5) used Fisher exact test. Significance test results are quoted as two-tailed probabilities. Significance of the obtained results was judged at the 5% level. Multivariable linear regression was used to determine which demographic characteristics, clinical data, influence knowledge scores, and the effects of safe behaviors on the incidence of fire.

Preparation phase lasted 1 month (January 2019)

Preparation Phase:

- Official letter was obtained
- **Tools II, III, IV, V and tool VI** were developed by the researchers
- **Content validity** of tools **III, IV, V and tool VI**
- **Stability, reliability of the tools V and VI**
- **Pilot study** was carried out on 6 both subjects (6 and 6).
- **Designing the Home Fire Safety Program:** program objectives, content, activities, and educational materials used
- **Selection of Study Subjects** by using **Tool I** and inclusion criteria
- **Assessment (Pre-Test)** was performed by interviewing community-dwelling older adults and their family caregivers individually by using **Tools II, III, IV, V, and VI.** Each interview lasted about 30–45 minutes.

Implementation and Evaluation Phase lasted 2 months (February to April 2019)

Implementation Phase:

- **Each Researcher (3 study researchers):**
  o Assigned to implement the program for 1-2 groups (total study subjects (n=112) divided into 5-6 groups)
- **Each Group:**
  o Include 20-22 person/group
  o Must include community-dwelling older adults and their family caregivers in same group
  o Received six sessions (three sessions per week) to complete the program.
- **Each Session**
  o started from 11 AM to 11:45 AM
  o Last 45 minutes.
  o Have specific objectives
  o Different teaching methods were used

Evaluation Phase:

- Done immediately after the implementation of the home fire safety program (***seventh session)***,
- Performing a **post-test** using the same tools of pre-test (Tool IV, V and VI)

Diagram 1: Home Fire Safety Program Phases

Results:

Part I: Description of the study subjects:

Table **(3)** shows that the distribution of the community-dwelling older adults and their family caregivers according to their sociodemographic characteristics. The table reveals that the age of the studied participants ranged from 62 to 84 for community-dwelling older adults and from 18 to 82 for their family caregivers with a mean age 66.9±12.3 and 41.2±29.2, respectively and the highest percent of both subjects were female 64.29%, 82.14%, respectively. Regarding the current work status, all studied older adults were retired (62.5%) or housewives (37.5%). The highest percent of family caregivers were unskilled workers (28.6%) followed by professional workers (26.8%) while only 8.9% of them were retired. 51.79% of older adults were divorced or widowed and 67.86% of their family caregivers were married. Nearly one-third (32.14%) of older adults have completed basic education (primary and preparatory) and nearly two-thirds (62.50%) of their family caregivers studied at the university or higher education level and the highest percent of both subjects didn't have enough monthly income 71.43% and 64.29% respectively.

Table **(4)** clarifies the residential characteristics of community- dwelling older adults and their family caregivers. Regarding the living arrangement of older adults, 44.64% of them living with their children followed by 35.71% of them live with their spouse. 62.50% of the family members were adults and aged from 18 to 60 years old. As for the crowding index, 46.4% of them have a high crowding index with a mean of 2.31± 1.03. All the study subjects live in a high-rise building, 89.29% live in buildings without fire detectors and fire extinguishing systems, and 53.57% of them live in building with unsafe electrical systems. 44.64% of older adults and their families were homeowner.

Table **(5)** shows the health profile and smoking behaviors of community- dwelling older adults and their family caregivers. Regarding the current health problems of older adults, it was reported that

46.43%, 44.64%, and 37.50% of older adults suffered from vision impairment, hypertension, and cardiovascular diseases respectively. 35.71% of them suffered from diabetes and mobility impairment with the same percent. Regarding the current health problems of the family caregivers, 48.21% of them reported having no health problems followed by 21.43% of them suffering from visual impairment. The same percent 17.86% of them reported having hypertension and diabetes. Regarding the current medication used, 53.57%, 37.50%, and 35.7% of older adults reported taking analgesics, cardiovascular medications, and anti-diabetics respectively. 48.21% of the family caregivers reported that they did not take any medication, followed by the same percent of 17.86% .who reported taking anti-diabetics and analgesics medications. As for using an assistive device 46.43% of older adults reported using eyeglasses and 26.79% of them and their family caregivers did not use any assistive device. Regarding the history of falls within the previous 6 months, 73.2% of older adults and 96.4% of their family have no previous history of falls. Regarding the smoking behaviors of the older adults, 44.6% are current smokers, 84% of them smoke inside the home, and all of them smoke at bedtime. As for the smoking behaviors of their family caregivers, 35.7% of them are current smoker, 65.0% of them smoke inside the home, and 80% smoke at bedtime.

Table **(6)** reveals the previous and the current home fire-related circumstances of community-dwelling older adults and their family caregivers. It was reported that 46.43% of older adults and their family caregivers have past experience with home fire occurring for once. As regard the causes of home fires, 76.9% of them reported that the fire occurs related to cooking activities, followed by 26.9% reported that the fire occurs due to electrical and appliance and 19.2% of them reported that smoking is the cause of the fire. Regarding the place of fire, 76.9% reported that the fire occurs in the kitchen and 30.8% reported that fire occurs in the living room. As for the time of fire, 50%, 34.6% and 26.9% of them reported that the fire occurs in the winter, at bedtime and in the fall respectively. As regard the

effect of a home fire on them, 69.2%, 34.6%, and 26.9% reported that they had burns, suffocation/respiratory irritation, and eye irritation as a result of home fire respectively. 26.9% of them reported that they extinguish the fire with water as an immediate response to the fire followed by 15.4% who reported that they get out, stay out, remain out and hide with the same percent. No one of the study subjects Received any previous fire safety training program before.

Part II: Effect of Home Fire Safety Program:

Table (7) illustrates the home fire safety preparedness of community-dwelling older adults and their family caregivers pre and post intervention. It was found that there is a statistically significant difference (P = 0.002, P = 0.001, P = 0.0001, and P = 0,001) between having a home fire blankets, home fire extinguishers, home fire escape plan and emergency information sheet before and after the intervention respectively.

Table (8) demonstrates the home fire safety knowledge of community-dwelling older adults and their family caregivers. It was observed that only 1.79% of the older adults had a good level of knowledge before the program and it increased to 42.86% after the program. 87.50% of them had a poor level of knowledge before the program and it decreased to 17.86% after the program with a statistically significant difference (P = 0.001). Regarding the level of knowledge of the family

caregivers, it was observed that 71.43% of them have a poor level of knowledge before the program and their knowledge improved to 60.71% after the program, with a statistically significant difference (P = 0.001).

Table (9) explains the reported home fire safety behaviors of community dwelling older adults and their family caregivers. It was observed that there is a decrease in the reported unsafe behavior from 67.9% to 10.7% before and after the program among older adults and an increase of the complete safe behavior from 3.6% before the program to 3.6% after the program, and the difference is a statistically significant (P = 0.0001). Regarding the reported fire safety behavior among family caregivers, also there is a decrease in the reported unsafe behavior from 53.6% before the program to 7.1% after the program and increase of the complete safe behavior from 14.3% before the program to 64.3% after it, and the difference is a statistically significant (P = 0.0001).

Figure (1) This figure shows the level of different risk factors that lead to a fire in the home of community-dwelling older adults and their family caregivers. The results show clearly that smoking inside home, low level of education (basic education), age >65 years, unsafe home fire related behavior, poor home fire related knowledge, low monthly income, high crowding index, and living in the old type of buildings were significantly associated with an increased risk of home fires.

Table 3: Sociodemographic Characteristics of Community-Dwelling Older Adults and their Family Caregivers

Sociodemographic Characteristics	Community-Dwelling Older Adults (n=56)		Family Caregivers (n=56)	
	N	%	N	%
Age (years)				
• <20	0	0.00	5	8.9
• 20 -	0	0.00	24	42.9
• 40 -	0	0.00	17	30.4
• 60-	33	58.93	7	12.5
• 70-	19	33.93	3	5.4
• ≥ 80	4	7.14	-	
Min – Max	62-84		18-82	
Mean ± SD	66.9±12.3		41.2±29.2	
Sex				
• Male	20	35.71	10	17.86
• Female	36	64.29	46	82.14
Current work status				
• Retired	35	62.5	5	8.9
• Housewife	21	37.5	11	19.6
• Unskilled	0	0	16	28.6
• Skilled worker	0	0	9	16.1
• Professional	0	0	15	26.8
Marital status				
• Single	2	3.57	7	12.50
• Married	25	44.64	38	67.86
• Divorced/ Widowed	29	51.79	11	19.64
Educational Level				
• Illiterate/read &write	16	28.57	5	8.93
• Basic Education (Primary& preparatory)	18	32.14	7	12.50
• Secondary Education	12	21.43	9	16.07
• University or higher	10	17.86	35	62.50
Monthly Income				
• Not enough	40	71.43	36	64.29
• Enough	16	28.57	20	35.71

Table 4: Residential Related Characteristics

Items	Family Caregivers (n=56)	
	No	%
Living arrangement of older adults #		
• With Spouse	20	35.71
• With children (Son/daughter)	25	44.64
• With grand children	13	23.21
• With Brother/sister	7	12.50
• With Relatives	5	8.93
Age of family members #		
≤5 (Under Five)	15	26.79
6-11 (Middle Childhood)	13	23.21
12-17 (Adolescent)	9	16.07
18<60 (Adult)	35	62.50
≥ 60(Older Adult)	10	17.86
Crowding index		
1	10	17.9
2	20	35.7
≥3	26	46.4
Min – Max	1-4	
Mean ± SD	2.31±1.03	
Type of Buildings #		
• Older buildings	23	41.07
• Cluttered buildings and buildings in a state of disrepair	7	12.50
• High-rise building	56	100.00
• Building without fire detection & fire extinguishing systems	50	89.29
• Building with unsafe electrical system	30	53.57
Home ownership status		
• Rental	18	32.14
• Homeowner	25	44.64
• Owned by family member	13	23.21

 # Multiple responses were allowed

Table 5: Health Profile and Smoking Behavior of Community-Dwelling Older Adults and their Family Caregivers

Items	Community-Dwelling Older Adults (n=56)		Family Caregivers (n=56)	
	No	%	No	%
Health Profile				
Current health problems#	**n= 56**		**n= 56**	
• No	6	10.71	27	48.21
• Cancer	2	3.57	0	0.00
• Cardiovascular Disease	21	37.50	7	12.50
• Hypertension	25	44.64	10	17.86
• Kidney Disease	6	10.71	2	3.57
• Lunge Disease	5	8.93	3	5.36
• Diabetes	20	35.71	10	17.86
• Parkinson's Disease	3	5.36	0	0.00
• Arthritis	19	33.93	2	3.57
• Mobility impairment	20	35.71	2	3.57
• Vision impairment	26	46.43	12	21.43
• Hearing impairment	10	17.86	0	0.00
• Smell alteration	3	5.36	0	0.00
Current Medication used (prescribed /over the counter) #				
• No	6	10.71	27	48.21
• Chemotherapy	2	3.57	0	0.00
• Cardiovascular medication	21	37.50	7	12.50
• Kidney Disease Medication	6	10.71	2	3.57
• Respiratory medication	5	8.93	3	5.36
• Antidiabetics	20	35.71	10	17.86
• Hypnotic medication	18	32.14	9	16.07
• Sedatives	8	14.29	5	8.93
• Analgesics	30	53.57	10	17.86
• Tranquilizers	5	8.93	2	3.57
Use of Assistive Devise #				
• No	15	26.79	42	75.00
• Cane	10	17.86	2	3.57
• Walker	0	0.00	0	0.00
• Eye glasses	26	46.43	12	21.43
• Hearing aid	5	8.93	0	0.00
History of Falls within previous 6 Months				
• Yes	15	26.8	2	3.6
• No	41	73.2	54	96.4
Smoking Behavior				
Current Smoker	**n= 56**		**n= 56**	
• No	**31**	55.4	**36**	64.3
• Yes	25	44.6	20	35.7
Common Place of Smoking	**n= 25**		**n= 20**	
• Inside Home	21	84.00	13	65.0
• Outside Home	4	16.00	7	35.0
Bedtime Smoking	**n= 25**		**n= 20**	
• No	0	0.0	4	20.0
• Yes	25	100.0	16	80.0

 # Multiple responses were allowed

Table 6: Previous Home Fire- Related Circumstances

Items	Family Caregivers (n=56)	
	No	%
Past experience of home fire	n= 56	
• No	30	53.57
• Yes	26	46.43
Frequency of home fire occurrence	n= 26	
• Once	17	65.4
• Two times	6	23.1
• Three times	3	11.5
Causes of fire #	n= 26	
• Cooking- Related Fire	20	76.9
• Heating Appliance	3	11.5
• Electrical and appliance	7	26.9
• Smoking	5	19.2
• Candles	0	0.0
• Flammable material	0	0.0
• Behavioral Related cause (Hoarding)	0	0.0
Place of fire #	n= 26	
• Kitchen	20	76.9
• Bedroom	5	19.2
• Bathroom	2	7.7
• Living room	8	30.8
Time of fire #	n= 26	
• Winter	13	50.0
• Fall	7	26.9
• Summer	4	15.4
• Bedtime	9	34.6
• Holidays /Feast	2	7.7
Effect of Home Fire #	n= 26	
• No effect	6	23.1
• Loss of property	3	11.5
• Burn	18	69.2
• Suffocation / respiratory irritation	9	34.6
• Eye irritation	7	26.9
• Death	0	0.0
Immediate Response to home fire	n= 26	
• Get out, stay out, remain out	4	15.4
• Call 180 or local firefighters	2	7.7
• Get others out	3	11.5
• Breaking windows	2	7.7
• Opening hot doors	1	3.8
• Returning for your belongings	0	0.0
• Hiding	4	15.4
• Do not use lifts	0	0.0
• Use of fire extinguishers	0	0.0
• Cover fire with blanket	0	0.0
• Extinguish the fire with water	7	26.9
• Turn off source of fire	3	11.5
Previous Fire Safety Training Program "for all studied subjects in the two groups"	n= 112	
• No	112	100.0
• Yes	0	0.0

 # Multiple responses were allowed

Table 7: Home Fire Safety Preparedness

Items	Family Caregivers (n=56)				Test of Significance
	Pre intervention		Post intervention		
	No	%	No	%	
Have Home Fire Smoke alarm #	0	0.0	4	7.14	0.118
Have Carbon Monoxide (CO) Alarms #	0	0.0	2	3.57	0.322
Have Home Fire blankets #	0	0.0	15	26.79	0.002*
Have Home Fire extinguishers #	0	0.0	21	37.50	0.001*
Have Home Fire Sprinklers #	0	0.0	2	3.57	0.322
Have Home Fire Escape Plan #	0	0.0	40	71.43	0.0001*
Have Emergency Information Sheet #	0	0.0	30	53.57	0.001*

 # Mean of right answer
P was calculated by using Fisher exact test
* Statistically significant at P ≤ 0.05

Table (8) Home Fire Safety Knowledge of Community-Dwelling Older Adults and their Family Caregivers Pre and post intervention

Items	Community-Dwelling Older Adults (n=56)					Family Caregivers (n=56)				
	Pre intervention		Post intervention		Test of Significance	Pre intervention		Post intervention		Test of Significance
	No	%	No	%		No	%	No	%	
Before Home Fire#										
Prevention of Home Fires										
− Cooking and Kitchen Safety	9	16.07	40	71.43	0.001*	12	21.43	44	7.91	0.001*
− Home Heating Safety	4	7.14	45	80.36	0.006*	6	10.71	50	8.99	0.001*
− Electrical and Appliance Safety	13	23.21	50	89.29	0.004*	10	17.86	54	9.71	0.001*
− Principles of home fire escape plan	0	0.00	45	80.36	0.001*	0	0.00	48	8.63	0.001*
− Emergency Information Sheet	0	0.00	40	71.43	0.001*	5	8.93	45	8.09	0.003*
− Smoking Safety	5	8.93	50	89.29	0.001*	17	30.36	56	10.07	0.001*
− Bedtime safety check	6	10.71	46	82.14	0.001*	11	19.64	56	10.07	0.001*
Fire Safety Equipment										
− Smoke Alarm installed and Maintenance	0	0.00	35	62.50	0.001*	0	0.00	46	82.14	0.001*
− Carbon Monoxide (CO) Alarm	0	0.00	17	30.36	0.001*	0	0.00	40	71.43	0.016*
− Fire blankets	0	0.00	50	89.29	0.003*	3	5.36	50	89.29	0.008*
− Fire extinguishers	17	30.36	56	100.00	0.001*	15	26.79	56	100.00	0.001*
− Fire Sprinklers	0	0.00	29	51.79	0.001*	0	0.00	38	67.86	0.001*
During Home Fire#										
Steps of Home Fire Escape Plan	0	0.0	45	80.36	0.006*	0	0.0	56	**100.0**	0.001*
Recovering After a Home Fire#										
Checking the Home										
− Checking for Structural Damage	0	0.00	30	53.57	0.003*	5	8.93	42	75.00	0.001*
− Checking Utilities and Major Systems such as Telephones, Electrical, Plumbing and Heating Systems	3	5.36	35	62.50	0.014*	6	10.71	44	78.57	0.001*
− Checking Household Items such as Throw away food, beverages and medicine exposed to heat, smoke or soot and cleaning products, can cause toxic fumes.	2	3.57	39	69.64	0.005*	7	12.50	45	80.36	0.001*
− Cleaning Up and Removing Smoke Odor	3	5.36	42	75.00	0.002*	6	10.71	46	82.14	0.001*
Total knowledge Score										
− Good	1	1.79	24	42.86	0.001*	6	10.71	34	60.71	0.001*
− Fair	6	10.71	22	39.29		10	17.86	17	30.36	
− Poor	49	87.50	10	17.86		40	71.43	5	8.93	

Mean of right answer   *P was calculated by using Fisher exact test if the number in one cell less than 5*
* *Statistically significant at P ≤ 0.05*   *P was calculated by using Chi square test for cell contain number more than 5.*

Table (9) The Reported Home Fire Safety Behavior of Community-Dwelling Older Adults and their Family Caregivers Pre and post intervention

Items	Community-Dwelling Older Adults (n=56)				Test of Significance	Family Caregivers (n=56)				Test of Significance
	Pre intervention		Post intervention			Pre intervention		Post intervention		
	No	%	No	%		No	%	No	%	
Smoke Alarms (SA) #										
• Installation and maintenance	0	0.0	19	33.9	0.001*	2	3.6	25	44.6	0.001*
Carbon Monoxide (CO) Alarms #										
• Installation and maintenance.	0	0.0	22	39.3	0.001*	1	1.8	30	53.6	0.001*
• Management of suspected Carbon Monoxide Poisoning	0	0.0	18	32.1	0.001*	1	1.8	29	51.8	0.001*
Home Fire blankets #										
• Use of safe technique	4	7.1	30	53.6	0.001*	6	10.7	42	75.0	0.001*
• Use correct Stop, Drop, and Roll" technique	3	5.4	32	57.1	0.001*	5	8.9	48	85.7	0.001*
Home Fire extinguishers #										
• Use PASS technique (Pull, Aim, Squeeze and Sweep)	3	5.4	28	50.0	0.001*	4	7.1	50	89.3	0.001*
• Predictive maintenance.	2	3.6	30	53.6	0.001*	4	7.1	52	92.9	0.001*
Home Fire Sprinklers #										
• License, Installation and maintenance	4	7.1	22	39.3	0.001*	6	10.7	32	57.1	0.001*
• Use of safe technique	5	8.9	24	42.9	0.001*	5	8.9	42	75.0	0.001*
Cooking Safety activities #	15	26.8	29	51.8	0.001*	16	28.6	44	78.6	0.001*
Kitchen Safety Rules #	14	25.0	32	57.1	0.001*	18	32.1	52	92.9	0.001*
Electrical and appliance safety #										
• Switches and Outlets safety	10	17.9	32	57.1	0.001*	12	21.4	51	91.1	0.001*
• Electrical Cords safety	2	3.6	40	71.4	0.001*	4	7.1	50	89.3	0.001*
• Electrical Panel safety	4	7.1	36	64.3	0.001*	8	14.3	49	87.5	0.001*
• Appliances safety	3	5.4	34	60.7	0.001*	11	19.6	47	83.9	0.001*
Home Heating Equipment safety #	10	17.9	41	73.2	0.001*	20	35.7	53	94.6	0.001*
Smoking Fire Safety #	12	21.4	44	78.6	0.001*	16	28.6	53	94.6	0.001*
Candle safety #	9	16.1	40	71.4	0.001*	12	21.4	50	89.3	0.001*
Home Fire Escape Plan #										
• Design a Home Fire escape Plan	1	1.8	38	67.9	0.001*	5	8.9	46	82.1	0.001*
• Practice Home Fire escape plan for clear escape route	2	3.6	39	69.6	0.001*	6	10.7	48	85.7	0.001*
• Practice Home Fire escape plan for Blocked escape route	0	0.0	32	57.1	0.001*	4	7.1	44	78.6	0.001*
Bedtime fire safety #										
Total Behavior score										
• Complete Safe Behavior	2	3.6	30	53.6	0.0001*	8	14.3	36	64.3	0.0001*
• Partial Safe Behavior	16	28.6	20	35.7		18	32.1	16	28.6	
• Unsafe Behavior	38	67.9	6	10.7		30	53.6	4	7.1	

Mean of safe behavior
* *Statistically significant at P ≤ 0.05*

P was calculated by using Fisher exact test if the number in one cell less than 5
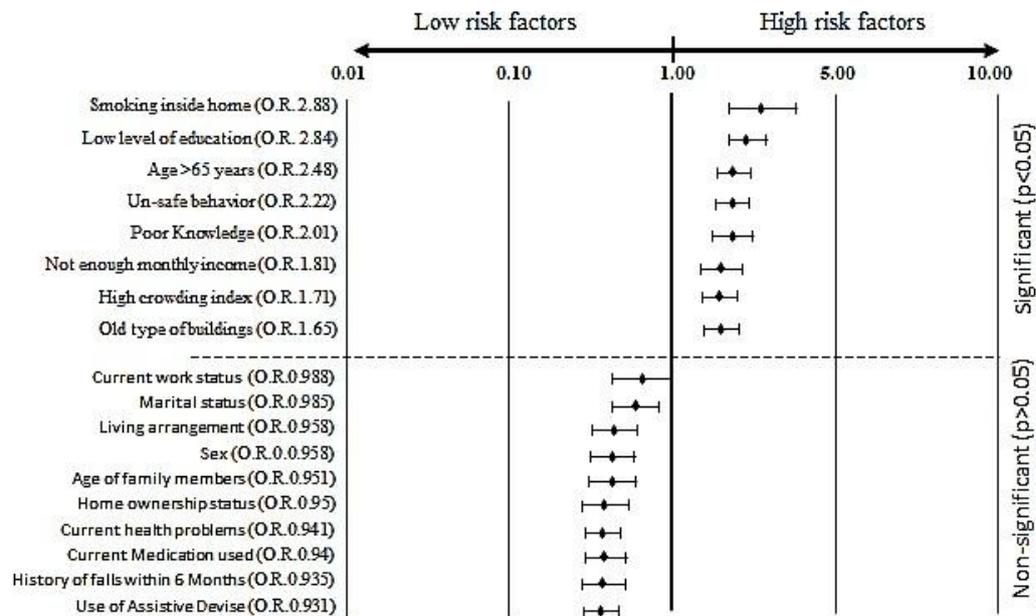*P was calculated by using Chi square test for cell contain number more than 5.*

Figure 1. Odds Ratio of Different Home Fire Risk Factors

Discussion:

Older adults appear to have factors that put them at a greater chance of experiencing a fire or burns such as more chronic illnesses, greater difficulty in performing ADLs (Lehna et al., 2015; Shields et al., 2013). The majority of older adults often lacked crucial knowledge about home fire safety and fire prevention, which may prove to be essential in protecting them from injuries caused by fires (Shield et al., 2013, Lehna et al., 2015). There is a need for home fire safety education and awareness campaigns aimed towards older adults and their families. Findings of Huseyin and Satyen (2006)showed that fire safety training is necessary for improved fire safety knowledge and accuracy of response in a fire. Little research has been done to try and improve fire safety behaviors among older adults and their family caregivers (Coty et al., 2015).

Burn-related morbidity and death are significantly higher in older adults above the age of 60 and they are at high risk for thermal damage (Kumar & Verma, 2016). It is widely known that residential fires where all occupants have survived with no serious injury are the most dominant fires and constitute an important public safety issue (Xiong et al., 2015). The findings of the present study revealed that nearly half of the study subjects experienced a home fire before, and nearly one-third of them reported the frequency of home fires. Xiong et al. (2017) came in the same line with the present findings and concluded that the majority of the participants reported that, it is not their first time to experience fire incidents. Also, DiGuiseppi et al. (2000) supported the present findings and observed that the most leading causes of injury were unintentional house fire. The higher percent of the

home fires among the study subjects of the present study can be attributed to their lack of knowledge regarding fire safety, living in older buildings, and having no fire safety preparedness in their homes. Although they live with their families, they experience a higher rate of home fires. Xiong et al. (2015) revealed that living alone was associated with an increasing rate of fire risk which contradicted with the present findings. This finding can be interpreted in the light that the variable of living arrangement by itself might not provide adequate information about social context at the time of a residential fire. Older adults living with their families do not necessarily mean they were not alone at the time of a fire. The present finding revealed that all older adults were retired or housewives, while more than two-thirds of their family caregivers were still working and leaving them alone. The increasing time the older adults likely to spend at their home alone, thereby increasing their chance of being involved in any residential fire (Xiong et al., 2015).

The present study found that the most common causes of home fires as reported by older adults and their families are cooking activities, electrical and appliance, and smoking. Cassidy et al. (2019) agreed with the present study and revealed that the main causes of fire among older adults were established as smoking materials, cooking and electrical faults. Also, DiGuiseppi et al. (2000) confirmed the present study and concluded that cooking, and smokers' materials were leading fire sources. United States Fire Administration [USFA] (2001) reported that cooking fires are the leading cause of fire- related injury to older adults. In contrast to the present study, Xiong et al. (2017) reported that electrical

failure was the leading ignition factor of non-fatal / injury house fires, followed by cooking- related activities. The present study revealed that the kitchen is the most common place of fire as the study subjects reported followed by the living room and the bedroom. Xiong et al. (2015) came in the same vein and reported that the leading rooms of fire origin for non-fatal fires were the kitchen and the bedroom. Also, Xiong et al. (2017) is in accordance with the present finding and revealed that kitchen was the main room of fire origin followed by bedroom. Cassidy et al. (2019) contradicted the present finding and found that most fires ignited in the living room or the bedroom.

Although fires were relatively even across the different seasons, the present study found that the most common time of the fire was winter and fires occur during bedtime as reported by the study subjects. These findings are consistent with Xiong et al. (2015) who reported that winter had a moderately stronger association with home fires. Also, Skokouhi et al., 2019 supported the present findings and concluded that most fires ignited at night and during winter months. Fire-related injuries are more common in those aged 65 years and older (Halvorsen et al., 2017). The finding of the present study revealed that burn injury is the most common effect of home fire among older adults and their families followed by suffocation and respiratory irritation. This finding is in the same context with Kumar et al., 2016 who reported that burn injuries are considered the most common manner among elderly related to home fires. In contrast to the present results DiGuiseppi et al. (2000) found that the principal diagnosis after exposure to home fires are smoke inhalation while the second diagnosis is usually burn.

In order to limit the number of fire fatalities and injuries, it is crucial to understand how people might behave in such situations (Xiong et al., 2017). The immediate responses to home fires as reported by the present study subjects were extinguish fire with water, getting out, staying out the building, hiding, and getting others out. Purser and Kuipers (2004) came in line with the present study and observed that once the occupants of the buildings had received an initial cue regarding a fire, they tend to engage in a variety of activities before evacuation including trying to extinguish the fire and helping others. Also, Xiong et al. (2017) agreed with the present study when investigating the human response to fires and found that the initial two activities in which the participants engaged were attempting to extinguish the fire with water and trying to alert others. A decision not to fight a fire such as hiding and staying out as reported by the study subjects may have been the safest and most sensible option or may have arisen from difficulties using the fire equipment if present, absence of

firefighting equipment such as fire extinguisher, lack of knowledge on what would be safe to do and/or psychological stress such as anxiety and disorientation when facing the fire. No one of the study subjects reported receiving any previous fire safety training program. Cassidy et al. (2019) confirmed the present finding and reported that neither older adults nor their families, friends, or neighbours had a fire safety background, with the possibility of being unaware of what might be considered fire safety basics. Also, Xiong et al. (2017) supported the present finding and reported that no one had pre-existing fire safety-related knowledge, training or practice prior to the fire incident.

By understanding the risk associated with older people, it is possible to highlight and address issues that may lead to a home fire. Mayhorn (2012) stressed the value of providing older people with access to information about the risk of fire and recommended an educational program to alert them to the risk factors. The present study found that there are multiple risk factors that may lead to home fires among older adults and their families. They include age 65 years and more, smoking inside the home, low educational level, unsafe home fire related behavior, poor level of knowledge, low income, high crowding index, and living in an old type of building. Cassidy et al. (2019) were in accordance with the present finding and observed that smoking materials posed many risks associated with unsafe cooking-related behavior. United States Fire Administration [USFA] (2001) agreed with the present finding and explained that poverty is associated with increased fire risk among the older adults' population. Lambie et al. (2015) supported the present finding and revealed that areas with more significant socioeconomic disadvantages e.g. older houses, lower income, and low literacy are at a higher risk of fire. Harpur (2014) and United States Fire Administration [USFA] (2001) disagreed with the current finding, concluding that a decline in physical health and the presence of more chronic conditions, such as cardiovascular disease, stroke, and diabetes, is a major risk factor for older people.

The present finding did not find a significant relation between having health problems and the risk of fire. It can be attributed to the fact that older adults with chronic diseases, who did not report experience of a previous home fire, may have controlled medical health problems with no cognitive impairment. The present study did not find a relation between the sex of the study subjects and the increasing risk of home fires. DiGuiseppi et al. (2000) agreed with the present finding and reported that rates of home fire exposure did not vary by sex. Xiong et al. (2015) contradicted the present finding and found that males had a higher chance of experience increasing accidental residential fires

than females. This result can be justified as both males and females reported past experiences of home fires at the same level. Males and females performed unsafe behaviors either during cigarette smoking for males or during unsafe cooking activities for females.

One of the key signs of a community's readiness to respond to a fire is the presence of firefighting equipment in the home. Even if an attempt to extinguish a fire is unsuccessful, quick identification of smoke can still save lives. Smoke detectors which have been installed in Germany can reduce the annual fatalities due to fire by half (Stumpf et al., 2017). The present finding of this study revealed that none of the study subjects had any form of home fire safety preparedness equipment before the program, while after the implementation of the study program, the situation improved. Almost half of the study subjects have home fire blankets, home fire extinguishers, and emergency information sheets, and more than two thirds of them have a home fire escape plan. There is no significant difference regarding having a fire smoke alarm, a carbon monoxide alarm, and home fire sprinklers. These findings can be attributed to the lower income of the study subjects and the older type of building where they live which can make alarms and sprinklers difficult to install. Satyen et al. (2003) confirmed the present study and found that an increased level of fire safety knowledge enables individuals to be more aware of the importance of the use of fire blankets and fire extinguishers. Lehna et al. (2017) disagreed with the present study and concluded that a majority of the participants reported that they had a working smoke alarm in their homes, most of them had a home exit plan but they never practice it. Also, Huseyin and Satyen (2006) contradicted the present findings and showed that most people own a smoke alarm while only small proportions of them own a fire blanket or fire extinguisher.

It is now more crucial than ever to educate people about disaster risks, mitigation techniques, and preparedness strategies in order to reduce the negative effects of disasters (Johnson et al., 2014). According to research reported by Shields et al. (2013), the majority of older individuals are unaware of the causes of home fires and ways to protect themselves adequately. Chan et al. (2018) showed that knowledge about using a fire blanket, dialling the correct emergency number, unplugging unneeded electrical appliances, and not using water to extinguish electrical fires improved immediately following the intervention. The findings of the present study showed that there was a significant relationship between the home fire safety knowledge and home fire safety behavior of older adults and their family caregivers before and after the program, which indicates a positive effect

of the program. Lehna et al. (2015) came in the same line with the present findings and reported that their findings highlight the importance of fire prevention programs targeted toward older adults. Increasing home fire safety knowledge among older adults can lead to improved home fire safety practices which in turn may eventually bring about a reduction in home fires in this population. Also, Huseyin and Satyen (2006) supported the present findings and showed a statistically significant main effect of fire safety training on the level of fire safety knowledge and fire safety behavior. In addition to the study of Lehna et al. (2017) who agreed with the present findings and found that the home fire safety scores for both knowledge and behavior significantly increased after home fire safety education program. Ibrahim and Hassan (2019) confirmed the present finding and showed the positive effects of An instructional program on caregivers' knowledge of older adults on their responses related to emergency care of care receivers. Also, Cassidy et al. (2019) agreed with the present finding and concluded that there is a noticeable improvement in the level of knowledge around electrical safety among family and friends of older adults after receiving fire safety intervention strategies. A study by Coty et al. (2015) contradicted the present finding and found that many of the participants were unable to identify preventive fire safety measures or articulate a fire escape plan.

The findings of the present study supported the hypothesis and revealed that community-dwelling older adults and their family caregivers exhibited higher scores of their total level of home fire safety knowledge and behavior after receiving a home fire safety program.

Conclusion:

It can be concluded from the present study that there are many risk factors for home fire among community-dwelling older adults and their family caregivers. They include smoking inside the home; low level of education; older age; unsafe home fire-related behavior; poor home fire-related knowledge; low income; and living in old types of buildings. Also, there are significant effects of the application of a home fire safety program on the community-dwelling older adults and their family caregivers' home fire safety knowledge and behavior.

Recommendations:

Based on the results of the present study, it can be recommended that;

- A Home fire safety program should be disseminated to older adults and their families in all settings such as elderly clubs, out-patients clinics, primary care units, and social media, and encouraging involving it in the mandatory fire safety curriculum in the educational system.

- An in-service training program should be done by gerontological and community health nurses for all health care personnel who work directly with older adults and their families in different settings.

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