SAFEGUARD PRACTICES AMONG HOUSEHOLDS ON HANDLING LIQUEFIED PETROLEUM GAS CYLINDERS FOR BETTER HEALTH AND SAFETY: A CASE OF URBAN MUNICIPALITY IN ZANZIBAR

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ENVIRONMENTAL STUDIES (HEALTH STREAM)

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CERTIFICATION

The undersigned certifies that he has read and here by recommends for acceptance by the Open University of Tanzania a dissertation entitled, "***Safeguard Practices among Households on Handling Liquefied Petroleum Gas Cylinders for Better Health and Safety in the Urban Municipality of Zanzibar***". In partial fulfilment of the requirements for the award of Degree of Master of Science in Environmental Health.

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Dr. Vedastus W. Makene

(Supervisor)

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Date

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DECLARATION

I, **Rehema Abdi Juma**, declare that, the work presented in this dissertation is original. It has never been presented to any other University or Institution. Where other people's works have been used, references have been provided. It is in this regard that I declare this work as originally mine. It is hereby presented in partial fulfilment of the requirement for the Degree of Master of Science in Environmental Health of the Open University of Tanzania.

……

Signature

……

Date

DEDICATION

This study work is dedicated to my lovely parents Ms. Zainab Ali Khamis and Mr Abdi Juma Moh'd and my husband Mr. Haji Khamis Mwadini for give much supports to complete my study. Also, I dedicate my children Halima Haji Khamis, Mukhliswin Haji Khamis and Hayyan Haji Khamis for their tolerance. I dedicate my beloved brothers and sisters in my family who laid the foundation of my education which made me what I am today.

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ABSTRACT

Safeguard practices on handling and uses of liquefied petroleum gas cylinders provide enormous health benefits for households. The aim of this study was to assess awareness on safeguard practices among households on handling LPG cylinders for better health and safety in the Urban Municipality of Zanzibar. The study adopted a descriptive cross-sectional research design involving a 142 respondents who were sampled purposively. Data was collected through a structured questionnaire with close ended questions, complemented with an observational checklist and interview guide. The quantative data was analysed descriptively using a Statistical Packages for Social Science version 20.0. Qualitative data was analysed through content analysis. Results were summarized using the frequencies, percentages and presented in tables, graphs, charts and rephrases. The findings generally show that majority of households (75.4%) were aware on safeguard practices on handling LPG cylinders. Moreover, the majority of households (92.3%) are aware of keeping all combustible materials away from the gas appliances. Further results of awareness on safeguard practices include: reading and following the manufacturer's instructions (88.5%), and closing properly the cylinder valve and securing after uses (81.5%). The results on proportion of health effects associated with uses of LPG cylinders show that more than half of households (56.2%) reported experiencing health injuries. Health effects reported by households include complains of respiratory system injuries (70.0%), eye injuries (23.1%), musculoskeletal injuries (5.4%) and nervous injuries (1.5%). Finally, low public awareness was found as the main challenge that hinder households to compliance with safeguard practices. These results imply that the households in the study area are at risk of succumbing to health injuries due to lack of training on how to handle and use of the LPG cylinders. In conclusion, the results of this study, reaffirm the importance of regular trainings on proper handling of LPG cylinders and its implication on effective emergency measures for prevention of accidents among households and the public at large.

Keywords: Awareness, households, handling, health injuries, safeguard practices, LPG cylinders

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ABBREVIATIONS AND ACRONYMS

CCOHS	Canadian Centre for Occupational Health and Safety
CNS	Central Nervous System
DWEA	Danish Working Environment Authority
FLS	Fire and Life-Safety Group
GLPGP	Global Liquefied Petroleum Gas Partnership
HSE	Health and Safety Executive
ICS	International Council for Science
IFC	International Finance Corporation
Kg	Kilogram
LPG	Liquefied Petroleum Gas
NBS	National Bureau of Statistics
NEI	Netherlands Energy Information
NORAD	Norwegian Agency for Development Cooperation
OCGS	Office of Chief Government Statistician
OLS	Office of Laboratory Safety
OSHA	Occupational Safety and Health Administration
OUT	The Open University of Tanzania
PPE	Personal Protection Equipment
SDS	Safety Data Sheet
SPSS:	Statistical Packages for Social Science
UNEP	United Nations Environment Programme

URT	The United Republic of Tanzania
USAID	United States Agency for International Development
WBG	World Bank Group
WLPGA	World Liquefied Petroleum Gas Association
WMSDs	Work-related Musculoskeletal Disorders
ZBS	Zanzibar Bureau of Standards
ZURA	Zanzibar Utilities Regulatory Authority

DEFINITION OF KEY TERMS

Accidents: Are unplanned occurrences that result in injuries, illness, death, and loss of property or production (EHS, 2018). Accidents can happen at any time, obviously not intentionally, and there are infinite possibilities for something to go wrong (Durisko and Writer, 2018). Most critical accidents require corrective actions for prevention in the manual delivery of heavy cylinders process (Kim et al., 2017).

Awareness: Is defined as the state of being conscious or the quality of being perceptually knowledgeable. It is also the ability to perceive, feel, know, or be cognizant of events. (Tagurum et al., 2018). The awareness it means that the understanding of the activities of others, which provides a context for your own activity.

Cylinders: Is a pressure vessel used to store gases at above atmospheric pressure (Chen et al., 2017). Due to safety reason now day's gas cylinder made up of composite materials (Bandpatte et al., 2017)

Data Collection: Is a methodical process of gathering and analysing specific information to proffer solutions to relevant questions and evaluate the results (Ajayi, 2017).

Handling: Is the action of touching with the hands (or the skilful use of the hands) or by the use of mechanical means (Chen et al., 2017).

Hazard: is any source of potential damage, harm or adverse health effect on something or someone (Dadvar, 2020). Basically, a hazard is something that can cause harm or

adverse effects such as to individuals as health effects, to the environment or to organizations as property or equipment damage (CCOHS, 2017).

Households: A household consists of one or several persons who live in the same dwelling and share meals. It is considered as being a set of (related or unrelated) people habitually sharing the same dwelling (whether it is their main residence or not) and who have a joint budget (Willekens, 2016).

Liquefied petroleum Gas (LPG): Is a fuel gas made of petrol which contains a flammable mixture of hydrocarbon gases, most commonly propane, butane, and propylene (Puzzolo *et al.,* 2020). LPG is a gas obtained during natural gas and oil extraction, or as a by-product of being manufactured during the refining of petroleum (Synák *et al.,* 2019). LPG is manufactured during the refining of crude oil (40%) or from natural gas during extraction (60%) (Larsen, 2021).

Risk: Is a chance or probability that a person will be harmed or experience an adverse health effect if exposed hazard turn into disaster (Outreville, 2018)

Safeguard Practices: Is a measure intended to prevent someone or something from being harmed (Grey, 2020). Improving safety practices in the workplace takes more than just telling people to wear personal protection equipment or finding ways to eliminate hazards (WHO, 2017). The main goal of safety and health practices is to prevent workplace injuries, illnesses, and deaths, as well as the suffering and financial hardship these events can cause for workers, their families, and their employers (OSHA, 2016).

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Pollutant fuels and unsustainable energy have been used for cooking since the beginning of human history. It is estimated that household air pollution from solid fuel use results in more than a million premature deaths each year in the developing countries and 2.8 million deaths worldwide (Farabi-Asl *et al.*, 2019). Significant efforts are ongoing to change energy systems in the globe, particularly for cooking, heating, and lighting (Isara and Aigbokhaode, 2014). One expected benefit of such endeavours is to reduce air pollutant emissions which affect the environment and human health (WHO, 2016).

The most consumption of LPG occurs at the household level (49%), followed by the use of LPG as feedstock in the petrochemical industry (21.6%), and other industrial uses (11.8%), direct consumption in refineries and finally the agricultural sector makes up 2% of global consumption (GLPGP, 2020). Achieving the Sustainable Development Goal of Universal Access to Energy implies that 3 billion people around the world must gain access to modern fuels and technologies for cooking by 2030 (NORAD, 2020). A switch to LPG can bring about a significant reduction in indoor air pollution since it reduces health-adverse exposures by more than 90% (Sepp, 2014).

Developed countries like France, from 2010 to 2018, had consumed around 2.5 million tons of liquefied petroleum gas for cooking (Baron, 2021). However, developing

countries in Africa during the year of 2014 a total consumption in that region was 13 million tons of LPG for cooking (NORAD, 2020). According to NORAD, (2020), only Ghana has established specific targets for LPG's of the household energy market (50%) and included LPG explicitly in their Intended Nationally Determined Contributions.

In Tanzania, LPG is the second most popular fuel, both as the main fuel (32%) and as part of the cooking fuel mix 58% (Doggart et al., 2020). Between 2012 and 2018, increasing use of LPG as the main household fuel matches a decline in kerosene and charcoal as the main fuel. According to NORAD, (2020), Tanzania targets 75% clean cooking access by 2030 but does not identify a specific proportion targeted for LPG cylinder users. In Zanzibar, many peoples use LPG cylinders for cooking to replace unsustainable energy sources and prevent environmental degradation (Nsehe, 2019). Only (5%) of the households in the urban areas reported to use LPG as a clean fuel for cooking (OCGS, 2014). Therefore, Zanzibar undertook a pilot study to build public awareness on how to handle LPG cylinders as a clean fuel for cooking (UNIDO, 2019).

However, improper storage and lack of awareness on handling LPG cylinders could be extremely hazardous and potential of injuries and calamities to the households (Qian et al., 2021). A survey done by Safety Institute of Japan (2016), shows that the number of accidents increased gradually and caused casualties to the households due to leaking equipment and improper handling of LPG cylinders. Nevertheless, very little, if any, has been documented about safeguard practices among households on handling LPG cylinders in Zanzibar and Tanzania in general.

This study aims to assess safeguard practices among households on handling LPG cylinders for better health in the urban municipality of Zanzibar. The findings of this study will be valuable to the Ministry of Energy and Housing, Ministry of Health, Policy makers and other responsible institutions such as Zanzibar Utilities Regulatory Authority (ZURA) and Zanzibar Bureau of Standards (ZBS) in their effort to ensure that health safety is maintained especially in handling LPG cylinders.

1.2 Statement of the Problem

The consumption of LPG cylinders for cooking has impacts on health and environment (Farabi-Asl *et al.*, 2019). A study done by Sirdah *et al.* (2013) in Palestine on possible health effects posed by handling LPG cylinders reported that about 63.4% of the handlers were developed respiratory problems. Chen et al., (2017) in Taiwan reported that overall prevalence of work-related musculoskeletal disorders (WMSDs) for gas cylinders handling tasks was reached to 91% within 1 year. A survey done in France by Normand et al., (2016), on LPG accidents during the period of 2010 to 2014 reported that, a total of 544 accidents was registered among the households when handling LPG cylinders. A potential of health effects among the households can arise from leaking equipment or the improper handling and poor storage of LPG cylinders (Sepp, 2014).

According to the Revolutionary Government of Zanzibar (2011), in the document of disaster management policy reported that the main factors that contributing to frequently occurrences of fire accidents in homes and hotels are included poor safeguard practices, poor enforcement of the standards and regulations that govern fire risk reduction. The

statistics indicate that during the period of 2006 to 2009 a total of 503 fire accidents occurred in Zanzibar, where 264 (52.4%) households were injured due to inappropriate operation of cooking stoves and other persons were lost their lives.

In order to recognize effects among the households who stand to gain from a transition of carbon fuels to gas fuel, several measures have been taken by the Government of Zanzibar to ensure that households conform to safeguards practices during handling and storing of LPG cylinders. The government introduced institutions such as Zanzibar Utilities Regulatory Authority (ZURA) and Zanzibar Bureau of Standards (ZBS) to educate people in building awareness on handling and uses of LPG cylinders safely. However, there is no clear documented evidence about safeguard practices among households on handling LPG cylinders for better health and safety in the Urban Municipality of Zanzibar. Policy and planning need to address the key challenges of supply, regulation, distribution, accessibility and affordability of LPG cylinders for better health and safety to the households.

1.3 Research Objectives

1.3.1 General research Objective

The main objective of this research is to assess awareness on safeguard practices among households on handling liquefied petroleum gas cylinders for better health and safety in the Urban Municipality of Zanzibar.

1.3.2 Specific research objectives

The study addressed the following specific research objectives

i) To evaluate households' awareness on safeguard practices on handling liquefied petroleum gas cylinders in the study area
ii) To determine proportion of health effects among households occupants due to improper handling of gas cylinders in the study area
iii) To assess emergence measures applied by households to prevent liquefied petroleum gas accidents in the study area
iv) To identify challenges that hinder safeguard practices on handling liquefied petroleum gas cylinders in the study area.

1.4 Research Questions

1.4.1. General Research Questions

1.4.2. Specific Research Questions

i) What are the households' awareness on safeguard practices on handling liquefied petroleum gas cylinders in the study area?
ii) What is the proportion of health effects among households' occupants due to improper handling of gas cylinders in the study area?
iii) What are the emergency measures applied by households to prevent liquefied petroleum gas accidents in the study area?
iv) What are the challenges that hinder safeguard practices on handling liquefied petroleum gas cylinders in the study area?

1.5 Significance of the study

Safeguard practices among households are of increasing importance in occupational health and safety. This study provides detailed information about the proper handling of LPG cylinders and how to prevent injuries and accidents in the community. The information gained will be a guide for proper handling and good storage of liquefied petroleum gas cylinders. The findings of this study will be useful to the community, policy makers, planners and occupational health and safety services in Zanzibar. Also, the study is a starting point for further studies on assessing the safeguard practices among the households on handling LPG cylinders in Zanzibar.

1.6 Limitations of the study

The limitations are the inherent design or methodology parameters that can restrict the findings and are outside the control of the researcher. The research was encountered by the following:-

i) **Time constraint**

The time scheduled to carry out the study was very tight for collecting adequate data and satisfy the motive behind it. The researcher worked hard and use overtime schedule for accomplishing the study findings.

ii) **Difficulty in Data Collection**

Some of the respondents were illiteracy to provide adequate information and others feared that the information may misused. The researcher provide consent to the respondents and assured them that the information asked for academic purpose and not for otherwise.

iii) **Budget Constraint**

Since the study was financed by own (researcher) for the Award of the Degree of Master of Science in Environmental Studies, the funds was inadequate as per study requirements. The researcher as the main sponsor, conduct the study in accordance to my personal fund.

CHAPTER TWO

LITERATURE REVIEW

2.1 Awareness on Safeguard Practices on Handling LPG Cylinders

Due to the dangers associated with the use of the LPG, there are recommended standards or protocols that one must follow to ensure the safe use of the gas cylinders (Amorin and Dabo, 2022). Safety awareness, maintenance procedure and risk analysing capacity of the LPG users help to decrease accidents possibility due to LPG cylinders(Chowdhury *et al.,* 2020). According to SDS, (2017), following safety guidelines are to be considered and be aware for households who use LPG cylinders:- A major part of any prevention program is good housekeeping practices and to arrange the kitchen room properly; Keep all combustible materials away from the flame of your gas appliances; Follow manufacturer's instructions in the care and operation of gas-fired appliances; Don't block furnace room air vents, because gas appliances require air to burn fuel completely and operate efficiently, the yellowish flame can signal improper operation; If the pilot flame on a gas appliance goes out, shut off the gas supply at the appliance's valve and allow time for accumulated gas to escape before attempting to re-light pilot flame; Have qualified personnel handle gas-related uses and emergence cares and If gas leak or smell inside buildings contact the utility notification centre of fire department prior to any digging.

LPG in the cylinders remains constant at a given temperature as long as liquid remains in the cylinders. For domestic purposes, LPG is recommended to be stored in high

pressured bottles or cylinders to accommodate the stored pressure in the gas (Amorin and Dabo, 2022).The only way for gas suppliers and the households to know how much remains in a cylinder is to weigh the cylinder and not shake the gas cylinders (Liang et al., 2012). Because of the high internal pressure in compressed LPG cylinders, they can become projectiles to the households if they shake in a manner that could damage the valve (SDS, 2017). In home or at any place, make sure that you keep the compressed LPG cylinders in an upright position and secured individually to a wall or an immovable object. Because movable LPG cylinders could cause injuries to the households through hitting the objects or themselves (SDS, 2017). Make sure that you have basic knowledge and responses to accidental gases include detecting the leakage in cylinders, securing the origin and taking measures to prevent it from worsening. It is very important to secure the leaking gas and the area, move the people away from the leakage gas cylinders, prevent ignition sources and monitoring should be performed carefully until no vapour remains in the flammable limits (Arefin et al., 2020).

2.1.1 Handling of Compressed LPG Cylinders

The majority of LPG-related incidents occur at, or close to, the point of use. Safety discipline must include the consumer who, having been made aware of certain hazards, should respond by exercising every reasonable care (UNEP, 2018). According to HSE, (2013), remind us to take the following precautions for prevent injuries when handling compressed LPG cylinders:- Always use gas cylinders in a vertical position, unless stated otherwise by the manufacturer; Restrain cylinders securely to prevent them from

falling over; Wear suitable footwear and other PPEs; When the LPG cylinder is not in use, close all valves; Ensure that the valve is protected by a valve cap or collar to prevent any damage if the cylinder is dropped.

Safety Data Sheet, (2017), also emphasize that, never drag or slide cylinders, even for short distances; Never drop cylinders or permit them to strike each other violently; Never subject cylinders to mechanical shocks that may cause damage to their valves; Never use cylinders as rollers for moving material or other equipment; Never tamper with pressure-relief devices; Never permit oil, grease, or other readily combustible substances to come in contact with cylinders, valves, or other equipment in oxidizer service. Never remove any product labels or shipping hazard labels or refill compressed gas cylinders; Never lift a cylinder by its cap using a sling or a magnet and Never attempt to catch a falling cylinder.

2.1.2 Transporting of Compressed LPG Cylinders

The transportation of LPG cylinders is incredibly important. The vehicle must be suitable for the purpose and be marked to warn other drivers and pedestrians that it is carrying dangerous and possibly flammable goods (HSE, 2013). The driver must be suitably trained on how to drive the vehicle as well as handling the cylinders themselves and must carry the appropriate documentation. According to HSE, (2013), loading and unloading LPG cylinders should be a safe and secure operation; Cages, trolleys and containers are a great way of keeping the cylinders in an upright position; The cylinders should be marked with signs associated with their contents and their hazards. It may be

necessary to take extra measures and precautions with certain types and volumes of gases and fluids to make sure they are safely transported.

2.1.3 Storing of Compressed LPG Cylinders

Compressed LPG cylinder always stored in heavy-walled metal designed, produced and tested for use with compressed gases (ASI, 2020). According to HSE, (2013), store LPG cylinders in dry, safe places; LPG cylinders should be placed on a flat surface and not in a tightly confined space e.g. open air or ventilated; Always ensure they do not lie or stand in water, you can stand them on a pallet to avoid any damage to them; Protect LPG cylinders from any external heat sources that may affect their mechanical integrity and they should be stored away from sources of ignition and other flammable materials. Also, Safety Data Sheet, (2018), remind us to take the following precautions for prevent injuries caused by asphyxiation, fire, explosion, high pressure, and improper handling of compressed LPG cylinders:- Never allow storage temperature to exceed 125°F (52°C); Never permit smoking or open flames in oxidizer or flammable gas storage areas; Never expose cylinders to corrosive materials such as ice melting compounds; Always store LPG cylinders in accordance with ISO Standard 14245:2019; Store LPG cylinders upright with valve outlet seals and valve protection caps in place. Don’t turn a cylinder into a rocket.

Safety Data Sheet (2017), also emphasize that, to secure cylinders when in storage, transit, or use; Store LPG cylinders in areas designated for that purpose; Segregate full and empty cylinders; Store LPG cylinders in a dry, cool, well- ventilated, secure area

protected from the weather and away from combustible materials; Ensure that there is adequate separation from combustibles as specified by national regulations; Monitor the atmosphere in areas where gases may vent and collect; Use a first-in, first-out (FIFO) inventory system to prevent full containers from being stored for long period of time.

2.1.4 Handling of Empty LPG Cylinders

When a compressed gas cylinder is "empty," handle it as though it is full since it does contain gas (ASI, 2020). Empty cylinders with open valves can "breathe". This could result in hazardous conditions depending on how much the gas is forced out. According to (SDS, 2017), always take these precautions for handling empty LPG cylinders:- Close the LPG cylinder valve before removing the gas discharge equipment; Clearly mark or label the LPG cylinder "empty" or "MT"; Place the cylinder in a storage area separate from that used for full cylinders; Keep incompatible materials away from the cylinder; Notify the gas supplier if the cylinder or any part of it is damaged or defective, or may have been exposed to a possibly hazardous condition such as a fire or electric arc; Contact the gas supplier for advice on disposing of unserviceable cylinders.

2.1.5 Use of Compressed LPG Cylinders

According to SDS, (2017), the following precautions to prevent injuries caused by the improper use of compressed gases:- Always use gas cylinders in well ventilated areas; Seek expert assistance in designing and installing mechanical ventilation systems; Ensure the correct regulator is used for the purpose; Ensure there is a suitable emergency

response procedure in place; Wear appropriate PPE for the gas been used; Also, SDS (2017), emphasis to ensure connections, fittings and lines are leak tight and suitable for use; Ensure that flammable and oxidizing gases are not used near ignition sources; Disconnect empty cylinders from equipment to avoid backflow issues; Always close the cylinder valve when not in use; DO NOT use an empty cylinder as a waste receptacle; Fit non-return valves in line if required; DO NOT use a gas cylinder that shows evidence of damage or corrosion. The gas cylinder is a rented item, its integrity is the responsibility of the gas supplier and if the cylinder contents cannot be clearly identified and do not use it, you are supposed to return it to the supplier.

2.2 Health Effects Posed by Compressed Liquefied Petroleum Gas Cylinders

Due to physical and chemical characteristics of filled LPG in the cylinders, it can be extremely hazardous when improperly handled (OLS, 2021). Many of the incidents involving LPG (including those resulting in fatalities) occur at, or close to, the point of use (Beheshti *et al.,* 2018). They may result from defects in the LPG supply, in the appliance, the equipment or the manner of installation (UNEP, 2018). Some incidents are the result of misuse by the consumer (Nyabuto, 2021). This type of misuse may be accidental or due to the consumer being inadequately informed in the extreme, it may not be accidental but deliberate (Chowdhury *et al.,* 2020). Compressed and empty liquefied petroleum gas cylinders cause health injuries among households who use LPGs and suppliers, if not handled properly (Paliwal *et al.,* 2014). The increasing of usage of

LPG cylinders to the households as a cooking or heating fuel has resulted in many burn injuries from LPG mishaps (Tarim, 2014).

Suppliers must handle LPG cylinders by almost entirely manual means every day. Handling involves clutching the top handles of the cylinders and rapidly rolling the cylinders by twisting the wrists. Furthermore, lifting a cylinder onto the shoulders requires supporting the cylinder by hand, which may cause severe musculoskeletal injuries to the hands, back and shoulders (Chen et al., 2017). The handlers of LPG cylinders from a large technology company found that their tasks may potentially cause injured to the upper limbs (particularly the wrists) and fatigue (Sirdah et al., 2013). The main symptom of musculoskeletal injuries is aching pain that slightly influenced operation abilities and reported that it occurred almost daily (Chen et al., 2017).

The health effects such as deaths and fire burns also happened to the households when handling LPG cylinders. LPG explosion happens when a substance rapidly changes its chemical state i.e., is ignited or is uncontrollably released from a pressurized state of gas in the cylinders (SDS, 2017). According to Sirdah et al., (2013), inhalation of liquefied petroleum gas from filled cylinders can cause dizziness, nausea, vomiting, confusion, hallucinations and a feeling of euphoria, and to suppression of central nervous system (CNS) function. Other effects include breathing difficulties, loss of consciousness and eventual death caused by an inadequate supply of oxygen to the body (SDS, 2018). Some of them suffered inhalation injury that increases the risk of mortality (Putri et al., 2021). Also, households who have long-term exposure to liquefied

petroleum gas may lead to CNS damage, nosebleeds, rhinitis, halitosis, oral and nasal ulcerations, conjunctivitis, bloodshot eyes and thirst (Sirdah et al., 2013).

2.3 Emergence Measures Applied to Prevent LPG Accidents

Emergence measures are very much essential before and during any job which has risk of injury (Chowdhury *et al.,* 2020). Applicable internationally recognized standards may include provisions for commissioning, overfill protection, secondary containment, metering and flow control, fire protection (flame-arresting devices), and grounding (to prevent electrostatic charge) (SDS, 2017). Whenever gas cylinders are present at home or a storage site, all regulations involved in storing and handling the gas cylinders must be adopted with appropriate personal protective equipment (Ingles, 2018).

Since LPG is combustible, it is imperative for households to ensure that certain safety measures, precautions and procedures are maintained so that there are no casualties and issues (DFS, 2021). While industry works to provide a sustainable modern energy supply, government should be aware of, and work to rectify, some of the more egregious practices of unscrupulous operators (Abebe, 2019). Management level of accidents for prioritizing preventive safety measures is induced for the combination of accident agencies, types, and gas cylinder handling work processes (Kim et al., 2017). Release of flammable gases, vapours, or liquids into the atmosphere in the presence of sources of ignition (e.g., hot surfaces, motors, electrical switches) can lead to fire. The emergency procedures for LPG cylinders are similar to that for fire emergencies. All fire incidents will use the incident command system. According to SDS, (2017), report the problem

as soon as possible to your supervisor, who will initiate the appropriate response from the supplier, Safety Resources, Waste Management, Protective Services or fire department.

2.3.1 Safety Emergency Programs for Preventing LPG Accident

Safety emergency programs are recommended to create awareness about LPG using and safe handling (Chowdhury *et al.,* 2020). Given the fact that most kitchens house a number of appliances, it is important to keep a few simple points in mind to avoid any LPG related accidents (DFS, 2021). When making emergency programs, the various possible scenarios should be fully considered to enhance predictability. According to DFS, (2021) in case of an emergency, customers can dial 100 for the police, 101 for the fire brigade or contact their closest LPG gas service station. The programs also need the content of vehicles, communications, commands, operational coordination, traffic control, dangerous reconnaissance, accident disposal, ambulance personnel, evacuation, security alert, fire administration, fire-fighting operations and other aspects and the content of traffic management, urban water supply, security forces, use of large-scale lifting devices, medical care, environmental testing and so on. DFS, (2021) also emphasizes to carry out coordination and joint exercises or seminars, listen to opinions of units and experts to improve and revise the programs to make it more suitable to actual needs.

2.4 Challenges That Hinder Safeguard Practices on Handling LPG Cylinders

The burden of occupational injuries is high in developing countries due to several challenges including poor regulatory frameworks (Atusingwize et al., 2019). According to (DWEA, 2009), the current and future challenges in the working environment are closely linked to the changes taking place in society and can be clustered in five main areas as follow: Social changes such as demographics (including ageing, gender, migration) and lifestyles; New technologies; Economic changes and the effect of globalization on our economic system; Environmental issues and sustainable development and "Classical" OSH risks such as biological, chemical, psychosocial stress, violence and intimidation.

Atusingwize et al. (2019) found that the existing OSH laws were largely outdated compared to the current needs of workplaces. The safety barriers, i.e., PPE, may have been used for preventing, controlling or mitigating undesired LPG accidents or events (Arefin et al., 2020). Challenges affecting implementation are related to: gaps in the legal framework, low public awareness about OSH, poor planning, and limited human capacity, transparency, and accountability. Measures to address these gaps including training, upgrading OSHA laws and policies, and prioritization are warranted to improve the status of OSHA in Zanzibar.

2.5 Research gap

There are few literature reviews which discuss about safeguard practices among households on handling liquefied petroleum gas cylinders, also no data from many areas

of Tanzania, most notably Zanzibar. There is a large knowledge gap around occupational hazards especially health effects associated by LPG fuel. For example, Ozoh et al's dissertation data reveals that most households (77.3%) rated highly the health benefits associated with LPG fuel in cooking. There is a lack of longitudinal research studies examining the health effects of switching from biomass fuel to LPG for cooking (Fandiño-Del-Rio *et al.,* 2017). Specific deficiencies in understanding existed in health related injuries posed by LPG cylinders. The present study provides impetus for tailored awareness among households to reduce the injuries and make the fuel more effective and environmentally friendly when using it for cooking. An important qualitative and quantitative gap surrounds the specifics of the LPG cylinders that lead to health injuries. There is a complete lack of experimental studies including any sort of intervention.

2.6 Conceptual Framework

The conceptual framework of this study will be made by focusing on the research objectives of this study as constructed by the researcher and shown in **figure 2.1**

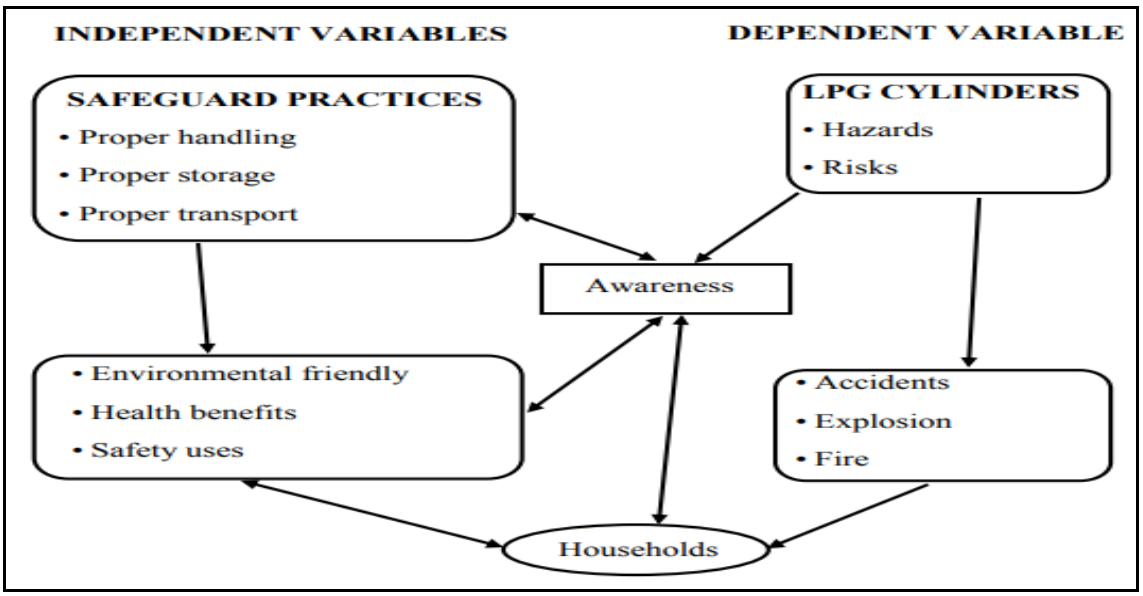

Figure 2.1: Conceptual Framework Illustrating Safeguard Practices on Handling LPG Cylinders

Source: Researcher, 2022

The description of conceptual framework (**Figure 2.1**) shows how the factors influence safeguard practices for each other.

OBJECTIVES	VARIABLES
i) To evaluate households' awareness on safeguard practices on handling liquefied petroleum gas cylinders in the study area	**Awareness** • Safety uses • Safe handling
ii) To determine proportion of health effects among households occupants due to improper handling of gas cylinders in the study area	**Health Effects** • Accidents • Injuries • Burns
iii) To assess emergence measures applied by households to prevent liquefied petroleum gas accidents in the study area	**Safety Measures** • Proper handling • Proper storage • Proper transport • Training
iv) To identify challenges that hinder safeguard practices on handling liquefied petroleum gas cylinders in the study area	**Challenges** • Low public awareness • Poor policies • Ignorance

CHAPTER THREE

MATERIALS AND METHODS

3.1 Research Design

A descriptive cross-sectional study design was conducted from September to October 2021 among the households in the Urban Municipality of Zanzibar. Qualitative research method was deployed to LPG stakeholders and quantitative research method were employed to households and LPG suppliers for data collection.

3.2 Description of the Study area

The study was carried out in the Urban Municipality of Zanzibar. The municipality is located in the Urban District in the Urban West Region of Zanzibar.

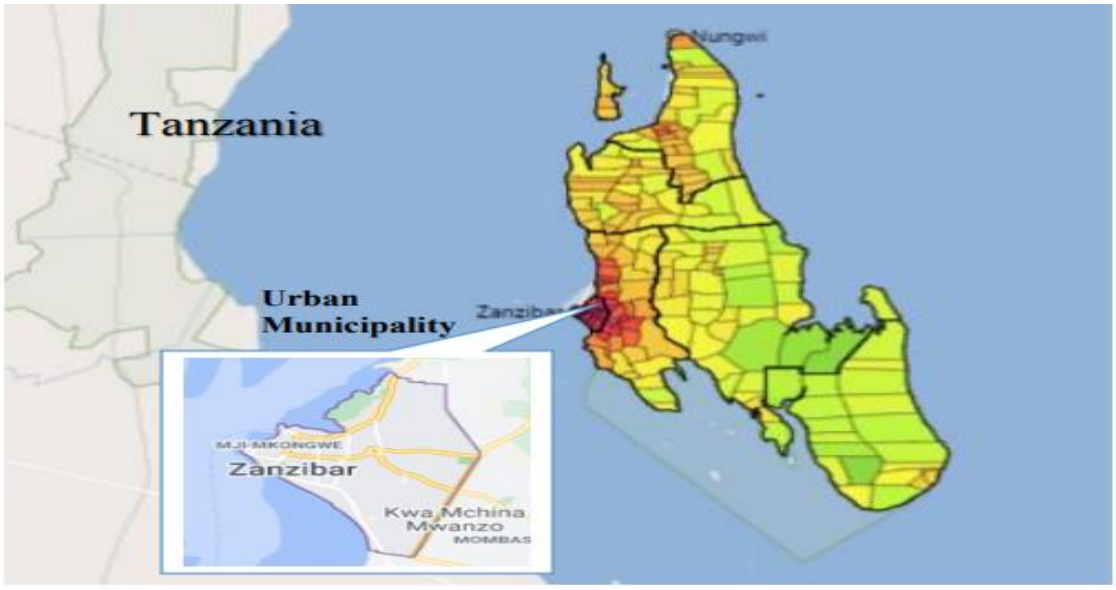

Figure 3.1: The Map of Urban Municipality of Zanzibar

Source: Adapted from Brinkhoff, (2017)

Zanzibar is a part of the United Republic of Tanzania, off the coast of Mainland Tanzania East Africa (Unguja about 40 km and Pemba about 60 km), extending between latitudes 4 degrees and 6.5 degrees south of the equator. The Urban Municipality of Zanzibar is divided in 45 wards with 56 Shehia (Brinkhoff, 2017). Shehia is the lowest official administration unit in Zanzibar islands and each Shehia consists of a number of villages and households (TWG, 2017). The Urban Municipality of Zanzibar covers an area of 1,600 m^2 with a population of 219,007 (URT, 2022).

3.3 The Study Population

The study population included occupational health officers, fire extinguisher and rescue officers, energy utilization regulatory agencies (ZBS and ZURA), LPG cylinders suppliers and households that use LPG gas for cooking in the Urban Municipality of Zanzibar. A survey done by the Office of Chief Government Statistician (2014), about the main source of energy in Zanzibar found that, 250,212 of the total households use different sources of energies for cooking. According to OCGS (2014), only 112,550 of the households in Urban Municipality use industrial gas and biogas energy for cooking. A survey done by Moh'd, (2013), about the efficiency of different energy sources used by households in Urban Municipality of Zanzibar, found that 5.8% of the households use liquefied petroleum gas (LPG) for cooking. The simple random sampling used to select households who use liquefied petroleum gas to be constituted the study unit of this study.

3.4 Sample Size

The sample for the present study was calculated by using Dillman, (2007); Needham and Vaske, (2008), a simplified formula. This is only applicable when the numerical strength of the population is known (Oribhabor and Ayanwu, 2019). OCGS (2014), given the population of 112,550 in Urban Municipality of Zanzibar, the sample size computed as:

$$n = \frac{[(N)\,(p)\,(1-p)]}{[(N-1)\left(\frac{B}{C}\right)^2 + (p)\,(1-p)]}$$

Where; N = the population size (112,550 households)

n = the computed sample size needed for the desired level of precision

p = the proportion of population (90% = 0.9) as noted from Mugahed, (2022).

B = acceptable amount of sampling error, or precision (0.05)

C = Z statistic associated with the confidence level which (1.96)

1 = unit or a constant

Substitution; N = 112,550, p = 0.9, B = 0.05, C = 1.96

n = [(N) (p) (1 − p)] / [(N − 1) (B/C) ^{2} + (p) (1 − p)]

n = [(112,550) (0.9) (1-0.9)] / [(112,550-1) (0.05/1.96)^2 + (0.9) (1-0.9)]

n= [(10129.5] / [(112549) (0.00065) + (0.09)]

n= 10129.5 / 73.2

n= 138

Based on the results of sample size computation with an addition of 5% (7 respondents), 4 to stakeholders (occupational health, fire extinguisher, ZBS and ZURA) and 3 to take care of the non-responses, this study involved 145 respondents.

3.4.1 Criteria for Inclusion

Households that was included in the present study were only those who used compressed LPG cylinders, suppliers who either handled or stored LPG cylinders and stakeholders who deals with LPG namely; occupational health officers, fire extinguisher officers and energy utilization regulatory agencies (ZBS and ZURA).

3.4.2 Sampling Methods

Probability sampling method was employed to select 10 wards out of 18 wards and non-probability sampling method was employed to select 130 households, 8 LPG cylinder suppliers and 4 stakeholders.

3.4.3 Sampling Techniques

Simple random and purposive sampling techniques was deployed in this study. The 18 wards were labelled on separate small pieces of paper, then mixed together in a container. The lottery method was applied to simple randomly for picking the 10 wards namely; Malindi, Kiwajuni, Magomeni, Miembeni, Mwembemakumbi, Mpendae, Kilimahewa, Kwahani, Chumbuni and Shaurimoyo. After identified those ten wards, purposive sampling were deployed for selecting 13 households from each selected ward and 8 LPG cylinder suppliers was selected from unpicked eight wards. Also purposive sampling techniques was deployed to select four stakeholders namely occupational health officer, fire extinguisher officer, energy utilization regulatory agencies (ZBS and

ZURA). The stakeholders were included intentionally in order to provide important information that cannot be obtained from the households and LPG cylinder suppliers.

3.5 Data Collection Techniques

Both quantitative and qualitative approaches in this study were deployed primary data collection methods including; observation for LPG suppliers, interview for Health officers', energy utilization officers and Fire Department officers and questionnaires for households who use compressed LPG cylinders.

3.5.1 Questionnaires

Data collection was done using structured questionnaires with closed ended questions (Appendix). Each individual was asked to answer the same set of questions in a predetermined order for households who use LPG cylinders. The questionnaire was arranged into five parts with twenty five questions covering socio-demographic characteristics information; awareness on safeguard practices on handling liquefied petroleum gas cylinders; incidences of health injuries among households' occupants due to improper handling of gas cylinders; emergence measures applied by households to prevent liquefied petroleum gas accident and challenges that hinder safeguard practices on handling liquefied petroleum gas cylinders in Zanzibar.

Part I had question to assess socio- demographic characteristics of the households and suppliers which including age, sex and educational requirements; **Part II** had question to

evaluate households' awareness on safeguard practices on handling liquefied petroleum gas cylinders; **Part III** had question which aim to determine the number of health injuries among households occupants due to improper handling of gas cylinders which included 6 questions with options; Part IV would assess emergence measures applied by households to prevent liquefied petroleum gas accident and Part V: of the questionnaire would identify challenges that hinder safeguard practices on handling liquefied petroleum gas cylinders in the urban municipality of Zanzibar. The households who use and handling the LPG's cylinders were interviewed.

3.5.2 Interview Guideline

Data collection was also collected using structured guidelines with open ended questions (Appendix) answer. The same set of questions were answered in a predetermined order for Fire Extinguisher and Rescue Force Officer, Occupation Health Officer and energy utilization regulatory agencies (ZURA and ZBS). The interview guideline was arranged into four questions covering on awareness on safeguard practices on handling LPG, health injuries among households' occupants, emergence measures applied to prevent LPG accident and challenges that hinder safeguard practices on handling LPG cylinders in the urban municipality of Zanzibar. The structured interview was used in the collection of data for this study.

3.5.3 Observation Checklist

Data collection was conducted using structured items to observe LPG suppliers and storage areas. This intended to verify the verbal responses by providing an in depth and rich understanding of the real situation and the actual safeguard practices of LPG cylinder suppliers and in storage areas. The observation checklist was included to two parts with 12 items to assess safeguard practice of the LPG suppliers and storage areas.

3.5.4 Pre Testing the Questionnaire

Data collection tool was pre- tested to see the applicability and the methodology of the study. Pretesting was done to check whether the tool could collect the information needed and whether tools are reliable and valid. The pre testing was conducted on 10 recruited respondents with similar characteristics to the study population.

3.6 Data Analysis

Data was analysed by using descriptive for stakeholders and inferential statistical households and LPG suppliers, so as to explain the main statistical features of the data collected. IBM Statistical Packages for Social Science (SPSS) version 20.0 was used to analyse the data. Results are summarized using mean, frequency, percentages and standard deviations. The results are presented via pie charts, tables and graphs.

3.7 Ethical Considerations

A letter of introduction from Open University of Tanzania was obtained so as it used to introduce the researcher to the government authorities so as was permitted to conduct the study in Urban Municipality of Zanzibar. Also consider seeking clearance from Zanzibar Research Committee or any other relevant authority in Zanzibar, so as was permitted to conduct the study in the Urban Municipality of Zanzibar. Consent for participation was obtained from the respondent and confidentiality of the information were ensured. The research assistant was full trained on data collection tools to ensure the errors are minimized.

CHAPTER FOUR

RESULTS

4.1 Response rate

This chapter presents the results of the present study, which focuses on the assessment of safeguard practices among households on handling LPG cylinders for better health and safety in the Urban Municipality of Zanzibar. A total of 142 respondents were involved; of which 130 respondents were households, eight (8) observed LPG suppliers and four (4) interviewed stakeholders to giving a total of (98%) response rate.

4.2 Socio-Demographic Information of the Households

The results of socio-demographic characteristics of the households are given in Table 4.1. The results indicated that the majority of the respondents (89.2%) were female. The results also indicate that 4.6% of the households were below 20 years old, 24.6% were between 20 to 29 years old, and 27.7% were between 30 to 39 years old. Similarly, 21.5% were between 40 to 49 years old, 13.1% were between 50 to 59 years old and 8.5% were above 60 years old. The age distribution of the respondents shows that in general, most of the LPG cylinder users in Urban Municipality fall within the range of 20 to 49 years of age, with the dominating age group being from 30 to 39 years old.

In terms of marital status, the results indicate that majority of the households 59.2% were married. Similarly, the findings show that 17.7% of the respondents had attained primary education and the majority of them, 52.3%, had attained up to secondary education. While 26.9% had attained up to tertiary education and few of them 3.1% had

non-formal education. However, an interaction with the respondents revealed that reading, writing and understanding English were not a problem in the study area.

Table 4.1: Socio-Demographic Characteristics of the Households in Urban Municipality of Zanzibar (n = 130)

Variables	Category	Frequency (n)	Percent (%)
Sex	Male	14	10.8
	Female	116	89.2
Age group	<20 years	6	4.6
	20-29 years	32	24.6
	30-39 years	36	27.7
	40-49 years	28	21.5
	50-59 years	17	13.1
	>60 years	11	8.5
Marital status	Single	34	26.2
	Married	77	59.2
	Divorced	8	5.1
	Widowed	11	8.5
Level of Education	Primary education	23	17,7
	Secondary education	68	52.3
	Tertiary education	35	26.9
	Non-formal education	4	3.1

Source: Field Data (2022)

4.3 Usage of LPG Cylinders among Households

The results of usages of liquefied petroleum cylinders (LPG) cylinders among the households are given in Table 4.2. With regard to the experience of using LPG cylinders

for domestically purpose in homes, the study shows that few among the households (9.2%) had experience using LPG cylinders in less than 1 year, while the majority of the households (70.0%), had experience in using LPG cylinders between 1year and 5 years. A low number (19.3%) of the households had experience of using LPG cylinders between 6 years to 10 years. Only the fewest (1.5%) of respondents had over ten years' experience in using the LPG cylinders.

Furthermore, the results in Table 4.2 indicates that Oryx Gas (61.5%) was the most LPG cylinders company which were ordered by the majority of the households in the study area. This is followed by other LPG companies which were non-specified gases cylinders (18.5%), Mihan/Taifa gas (11.5%), Virgo gas (7.7%) and Lake Gas was 0.8%. Oryx gas cylinder company is well known and preferred as the first choice by the households. The preference of Oryx gas cylinder for domestic uses may be due to the increased advertisement in media.

Similarly, the results in Table 4.2 showed that most of the favourable LPG cylinders weight for domestic uses ordered by households in the study area are 6 kilograms (61.5%) followed by order of 2.7 kilograms which is (16.2%), non-specified kilograms (kg) weights were only (11.5%), whereas 12.5kg (5.9%), 18kg (2.3%) and 47.3kg were 1.5% respectively. The 6 kilograms LPG cylinders are also the most common found in stores (Figure 4.1)

Table 4.2: Usage of LPG Cylinders among Households (n = 130)

Question Items	Response Options	Frequency (n)	Percent (%)
Experience of using LPG cylinders (in years)	< 1	12	9.2
	1 – 5	91	70
	6 – 10	25	19.3
	> 10	2	1.5
Most LPG cylinders company which are ordered for uses	Virgo gas	10	7.7
	Oryx gas	80	61.5
	Lake gas	1	0.8
	Mihan/Taifa gas	15	11.5
	Not specified gas	24	18.5
Most LPG cylinders weight for domestic uses (in kg)	2.7	21	16.2
	6	80	61.5
	12.5	9	6.9
	18	3	2.3
	47.2	2	1.5
	Not specified weight	15	11.5

Source: Field Data (2022)

Figure 4.1: Show the most common LPG Cylinders used

4.4 Awareness on Safeguard Practices on Handling LPG Cylinders

In order to assess the awareness of safeguard practices on handling LPG cylinders, households were asked various questions about safeguard practices. Awareness measured for households in five safeguard practices on handling LPG cylinders is presented in Table 4.3. The majority of the household's responses were “Yes” which means they are aware and a few of them response “No” which mean they were not aware. Responses for “Yes” ranged from 92.3 to 36.9% and for “No” ranged from 63.1 to 7.7%. Overall responses for five questions concerned with households’ awareness of handling LPG cylinders showed that; “Aware” was 75.4% and “Not aware” were 34.6 percent. The results imply that the awareness of safeguard practices among households on handling liquefied petroleum gas cylinders are moderate.

The awareness of households on safeguard practices on keeping all combustible materials away from the gas appliances were (92.3%), reading and following the manufacturer's instructions when operating LPG cylinders (88.5%), closing properly the cylinder valve and securing after uses or when LPG cylinders are empty were (81.5%) and knowing that LPG cylinders are a hazardous material when improper handled were (79.2%). These results showed the high level of awareness on handling liquefied petroleum gas cylinders by the most of the households (Table 4.3). The results also show that (63.1%) of households have never received any training on how to handle and how use LPG cylinders (Table 4.3). This implies that the majority of the households were at risk of injuries due to a lack of knowledge on how to handle and how use the LPG cylinders.

Table 4.3: Households' Awareness on Handling LPG Cylinders n=130

Safeguard Practices	Awareness Indices	
	Yes n(%)	No n(%)
Do you agree that LPG cylinders are a hazardous material when improper handled?	103(79.2)	27(20.7)
Have you received any training on how to handle, and use LPG cylinders?	48 (36.9)	82(63.1)
Is it important to read and follow the manufacturer's instructions when operating LPG cylinders?	115(88.5)	15(11.5)
It is necessary to close properly the cylinder valve and secure it after use or when LPG cylinders are empty?	106(81.5)	24(18.5)
Keep all combustible materials away from your gas appliances is a safeguard practices on handling LPG cylinders?	120(92.3)	10(7.7)

Source: Field Data, (2022)

Moreover, on awareness of checking empty cylinders (Figure 4.2), the very few households (10.8 %) were aware on how check empty LPG cylinders as they said they weigh the cylinders, 15.4% said they were shaking, 13% they were lifting, and 60.8% said they wait until the cylinder seizing off. This implies that the majority of the households were not aware on how to identify empty LPG cylinders. Knowledge on how to identifying empty LPG cylinders is needed for the households.

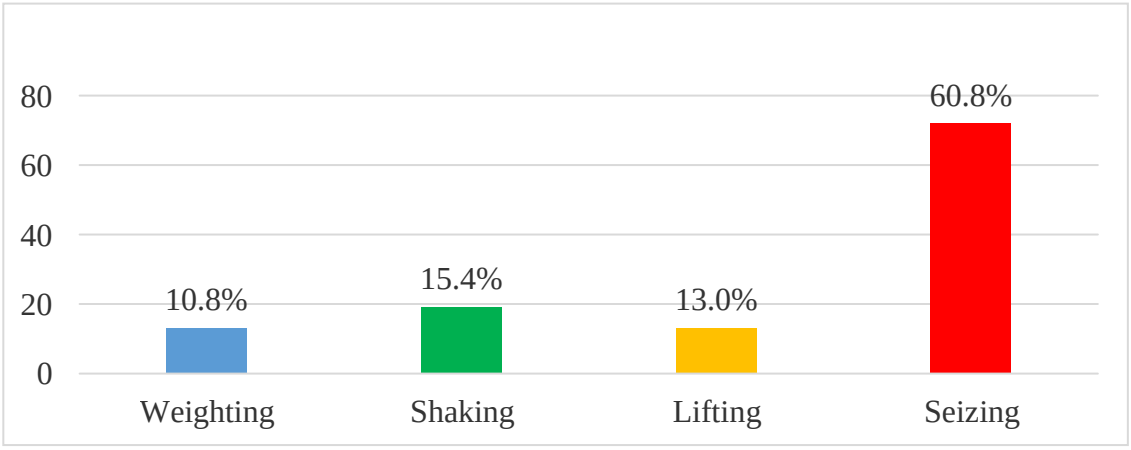

Figure 4.2: Ways of Identification of Empty LPG Cylinders
Source: Field Data (2022)

In Figure 4.3, the results reveal that 48.5% of the households were aware on inappropriate operation of LPG cylinder stoves as they said yellowish colour is a sign of effective operation of LPG stoves whereas the majority (51.5%) were not aware about inappropriate operation of LPG cylinder stoves. This implies that awareness on sign of inappropriate operation of LPG cylinder stoves is needed by the households.

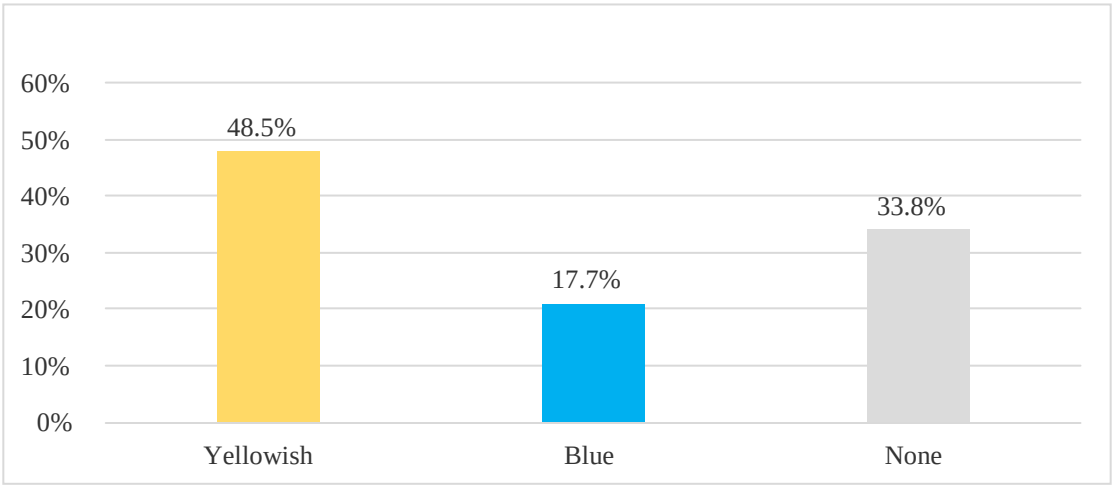

Figure 4.3: Signal of Inappropriate Operation of LPG Cylinder Stoves
Source: Field Data (2022)

Awareness among LPG suppliers: The supplier's awareness on safeguard practices on handling LPG cylinders for better health and safety is very crucial. This study observed awareness for LPG suppliers for five safeguard practices on handling LPG cylinders. These including checking cylinders' valve before starting dispensing the gas cylinders, using of secured transport for dispensing the gas cylinders, using of marked signs to warn other drivers and pedestrians that it is carrying hazardous materials, transporting the gas cylinders in upright position and attaching catalogues to the newly customers that show how to handle and how to use the gas cylinders as presented (Table 4.4). Overall responses for five questions concerned with suppliers' awareness of handling LPG cylinders that for "Aware" were 42.5% and for "Not aware" were 57.5%. The results imply that the level of awareness of safeguard practices among LPG suppliers on handling liquefied petroleum gas cylinders is low.

Among them, the awareness of LPG suppliers on safeguard practices in handling liquefied petroleum gas cylinders, and transporting the gas cylinders in an upright position were 87.5% and checking the cylinders' valve before starting dispensing the gas cylinders were 75%. This showed the large extent of awareness by the most of the LPG suppliers. Similarly, the data indicate that all LPG suppliers were not aware of attaching catalogues for new customers that show how to handle and how to use the gas cylinders. Similarly, majority of the LPG suppliers (87.5%) were not aware of using marked signs for warning other drivers and pedestrians that it is carrying some hazardous materials. Furthermore, results show that 62.5% of the LPG suppliers were not aware of using secured transport for dispensing the gas cylinders. The results imply that; the majority of

the LPG suppliers cause injuries to the households who use LPG cylinders due to the lack of knowledge on how to handle properly the LPG cylinders.

Table 4.4: Suppliers' Awareness on Handling LPG Cylinders

Safeguard Practices	Awareness Indices	
	Yes n(%)	**No n(%)**
Does the LPG suppliers checked cylinders' valve before starting dispensing the gas cylinders?	6(75)	2(25)
Does the LPG supplier use secured transport for dispensing the gas cylinders?	3(37.5)	5(62.5)
Does the LPG suppliers use marked signs to warn other drivers and pedestrians that it is carrying a hazardous materials?	1(12.5)	7(87.5)
Does the LPG suppliers transport the gas cylinders in upright position?	7(87.5)	1(12.5)
Does the LPG suppliers attached catalogues to the newly customers that show how to handle and how to use the gas cylinders?	0(0)	8(100)

Source: Field Data, (2022)

Awareness of stakeholders on safeguard practices on handling LPG cylinders: The discussions with stakeholders about the awareness on safeguard practices on handling LPG cylinders for better health and safety was very important in this study. The data was obtained directly in verbal from Fire Extinguisher and Rescue Force Officer, Health Officer and energy utilization regulatory agencies (ZURA and ZBS). The data included a current situation of awareness of safety practices on handling LPG cylinders among

households in the urban municipality of Zanzibar. In general, the current situation of awareness on safeguard practices on handling LPG cylinders among households was not certified. Here below are some of the responses from the interviewees.

> *"We provide training programs on awareness of safeguard practices on handling LPG cylinders for better health and safety to the LPG suppliers and households, but not in routine training programs" (*ZURA*).*
>
> *"Majority of the LPG suppliers were not aware because they transport filled gas cylinders by using motorbikes in horizontal position without covering the cylinders valves and most of them ignore to use PPEs"* (Occupation Health Officer*).*
>
> *"Some of the households are not aware because they handle gas stoves carelessly and ignore to close properly the cylinder valves after using it which caused the accidents and explosion of fire in the habitants"* (Fire Extinguisher and Rescue Force Officer*)*

4.5 Health Effects among Households Occupants due to Improper Handling of Gas Cylinders

Health effects associated with handling LPG due to improper handling are showed in Figure 4.4. The results indicate that majority of the households (56.2%) were experienced injuries followed by 31.5% who experienced fire burns and 12.3% died. This implies that the households were suffering from many health effects associated with LPG and most of them were injured frequently when handling LPG cylinders.

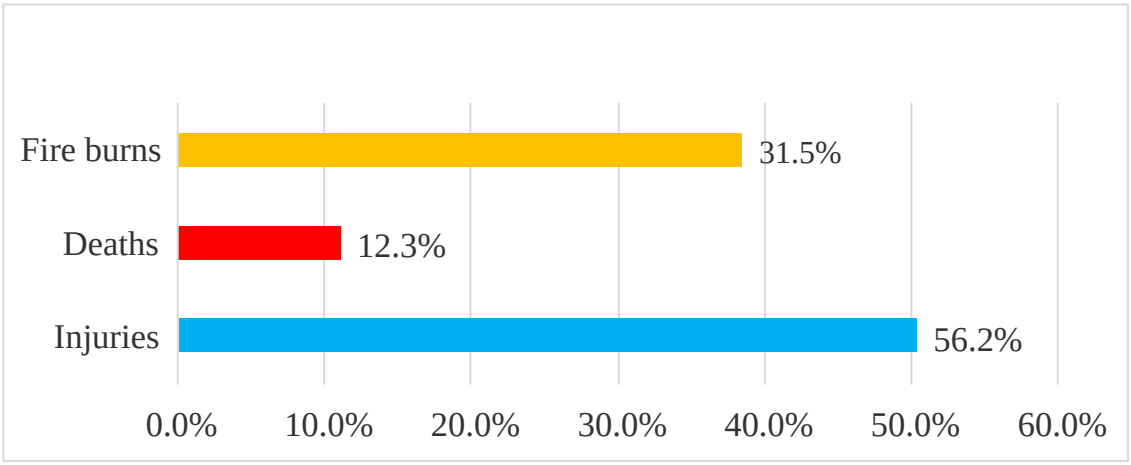

Figure 4.4: Health effects of LPG Cylinders which are Frequently Occurring
Source: Field Data (2022)

Number of health effects among households' occupants due to improper handling of LPG cylinders are showed in Figure 4.5. The study established a total of 55 households (42.3%) occupants were suffered health injuries due to improper handling of LPG cylinders whereas the, remaining 75 households occupants (57.7%) did not experience any health injuries related to handling and usage of LPG cylinder stoves.

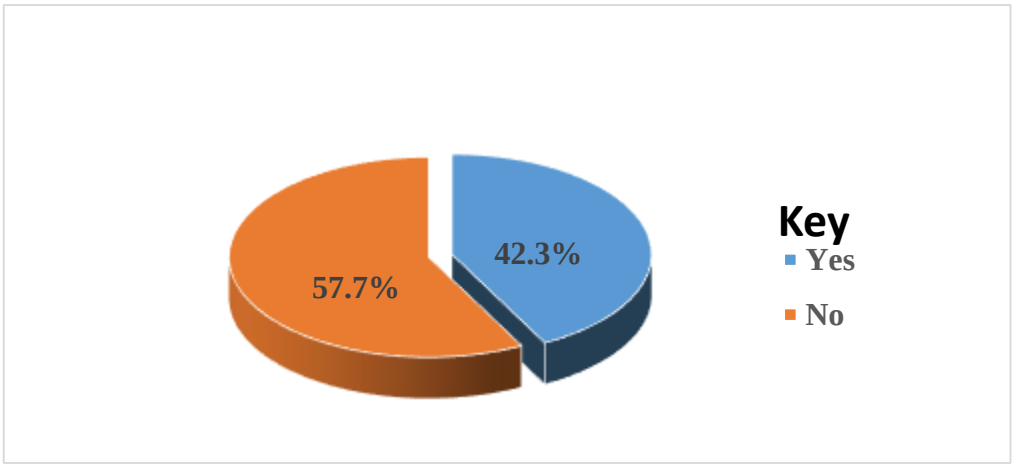

Figure 4.5: Injuries due to Improper Handling of LPG Cylinders
Source: Field Data (2022)

According to interviewed stakeholders, between 2020 and 2021 a total of 202 accidents was registered among the households' occupants in Zanzibar. The data indicated that approximately 76 cases (38%) were reported to be injured due to improper handling of LPG cylinders, 116 cases (57%) were injured due to electrical shocks and 10 cases (5%) were injured due to other sources of fire.

> *"The root causes of the accidents are: leakages of LPG cylinders leading to fire, poor end uses due to inadequate knowledge, poor technician training leading to poor installation hence an explosion, external heat application, manufacturer's default-defective bung weld, and negligence in fixing the LPG burners while in proximity to a burning stove*" (ZURA and ZBS).

In addition, Figure 4.6 represents the types of health injuries which frequently occurred when improper handling or inappropriate storage of LPG cylinders. The results indicated that the majority of the households (70.0%) were suffering from respiratory system injuries, followed by eye injuries 23.1%, then the musculoskeletal injuries (5.4%) and nervous system injuries (1.5%). This implies that the possible health effects of liquefied petroleum gas cylinders are due to improper handling by households and LPG suppliers are respiratory system injuries.

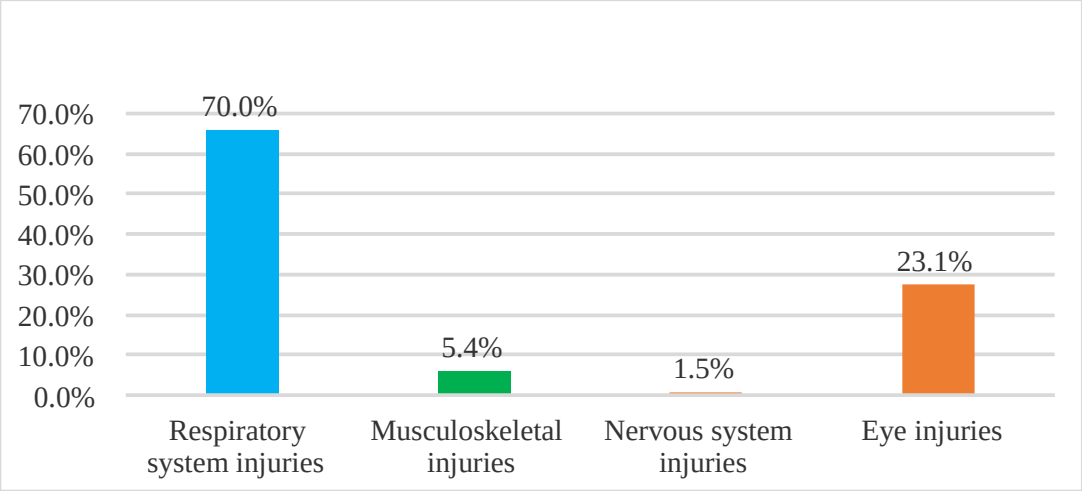

Figure 4.6: Health Injuries Which Occurred Frequently due to Improper Handling of LPG Cylinders
Source: Field Data (2022)

4.6 Emergency Measures Applied Households to Prevent Gas Cylinders Accidents

The safety emergency measures applied by households in handling LPG cylinders help to prevent accidents and minimize the number of injuries and their consequences among households. Table 4.5 depicts the emergency measures applied by households to prevent the incidence of gas cylinder accidents. The majority of the households were responses "Yes" means applicable and a few of them reported "No" means inapplicable. Responses for "Yes" ranged from 99.2 to 18.5% and for "No" ranged from 81.5 to 0.8%. Overall responses for six questions concerned with the applicability of emergence measures applied by households to prevent gas cylinder accidents were; "Yes" 61.5% and "No" 38.5%. The results imply that the applicability of emergency measures among households to prevent gas cylinders accident is positive practices which needed to be improve.

Among the applicability of emergency measures applied by households are; the use of gas detection devices (99.2%), training and education on handling LPG cylinders (93.8%) and maintaining good housekeeping practices and proper arrangement of the kitchen rooms (90.8%) were agreed in large extent to prevent gas cylinders accidents (Table 4.5). Similarly, making timely services for LPG cookers (46.2%), keeping the fire extinguisher nearby the operating or handling LPG cylinder (20.8%) and uses of personal protective equipment (PPE) such as protective clothing (18.5%) were not applicable to a large extent by the households. This implies that awareness is needed in households to prevent LPG cylinder accidents.

Table 4.5: Emergence Measures Applied By Households (n=130)

Emergence Measures	Applicability Indices (%)	
	Yes n(%)	No n(%)
Do you agree training and education on handling LPG cylinders, can help to prevent LPG accidents?	122(93.8)	8(6.2)
Do you use personal protective equipment (PPE) such as protective clothing, gloves, and face protection for prevention of LPG accident?	24(18.5)	106(81.5)
Do you make timely services for LPG cookers?	60(46.2)	70(53.8)
Do you have fire extinguisher nearby when operating or handling LPG cylinder?	27(20.8)	103(79.2)
Good housekeeping practices and proper arrangement of the kitchen rooms help to prevent LPG cylinders accidents?	118(90.8)	12(9.2)
Do you agree to use gas detection devices by households help to prevent LPG accidents?	129(99.2)	1(0.8)

Source: Field Data (2022)

Figure 4.7: Safety Measures to Prevent Accidents Associated with LPG

Regarding to the interviewed stakeholders on emergency measures applied to prevent liquefied petroleum gas accidents. The authorities (ZURA and ZBS) had managed to register LPG suppliers and storage areas in the whole country; with the urban municipality of Zanzibar having the highest number of registered suppliers, introducing of timely operations and inspections of LPG cylinders and approving of licences. The Fire Extinguisher and Rescue Force Officer introduced a fire safety management plan at the workplaces and facilitating training for handling LPG cylinders and gas-related uses and emergency cares. Also the Fire Extinguisher and Rescue Force Officer introduced a special phone number which is 118 to call and report any accidents for rescue.

4.7 Challenges That Hinder Safeguard Practices on Handling LPG Cylinders

The researcher wanted to know the challenges that hinder safeguard practices in LPG cylinders. Almost all accidents involving LPG cylinders initially result from not

following established methods for the safe handling and transportation of gas cylinders. The results in Table 4.6 represents the challenges that hinder safeguard practices in handling LPG cylinders.

The results indicated that the majority of the respondents (86.9%) reported low public awareness on safeguard practices on handling LPG cylinders as a great challenge to fulfil better health and safety in the study area. Similarly, the results indicated that some respondents (7.7%) reported poor planning, limited human capacity, and accountability among households, as a challenge that hinder on safeguard practices in handling LPG cylinders. Moreover, the results indicated that few respondents (5.4%) said that poor enforcement of the standards and regulations that govern risk reduction are also the challenges that hinder safeguard practices in handling LPG cylinders.

Table 4.6: Challenges that Hinder Safeguard Practices on Handling LPG (n = 130)

Variables	**Frequency n(%)**
Low public awareness about safeguard practices on handling LPG cylinders	113(86.9)
Poor enforcement of the standards and regulations that govern risk reduction on handling LPG cylinders	7(5.4)
Poor planning, limited human capacity, and accountability of safeguard practices on handling LPG cylinders	10(7.7)

Source: Field Data (2022)

There are some challenges that hinder compliance with safeguard practices on handling LPG cylinders in the urban municipality of Zanzibar. According to the interviewed stakeholders, the challenges that hinder to compliance with safeguard practices on handling liquefied petroleum gas cylinders in the urban municipality of Zanzibar are;

> *"Financial support associated with LPG cylinder safety plan and enhancement* (ZURA and ZBS).
>
> *"Resistance to implementation of good safety practices at the workplace, ignorance by suppliers and households on LPG safety issues* (Fire Extinguisher and Rescue Force Officer)
>
> *"Shortage of training and sensitization on LPG safety and low awareness on the importance of safety and health issues*" (Occupation Health Officer).

CHAPTER FIVE

DISCUSSION

5.1 Socio-Demographic Characteristics of the Households

The study revealed that approximately 89.2% of the household respondents were females while only 10.8% were males. This implies that the majority of households who adopted and uses LPG cylinder stoves are women. This is in agreement with other studies conducted in other developing countries including Ozoh *et al.,* (2018) in Nigeria and Hsu *et al.,* (2019) in Kenya but differed by those reported by Joshua *et al.,* (2020) in Nigeria and Pope *et al.,* (2018) in Cameroon. Generally, the higher proportion of female households who adopted on LPG cylinder stoves can explain by the fact that women are traditionally responsible for cooking. The mother or female prepared family meals and spent much time in using LPG stoves for cooking at least 1 to 2 hours per day (Ozoh *et al.,* 2018). This cooking responsibility leads to disproportionately high risk of injuries exposure for women and, in turn, a high burden of diseases (Gould and Urpelainen, 2020), ssuggesting that gender inequality is also an obstacle to LPG adoption because men may fail to appreciate the full benefits of clean cooking fuels. Therefore, it could be also attributed to limited progression of women in spreading of awareness on safeguard practices on handling LPG cylinders for better health and safety.

The present study shows that the dominant households in adoption of LPG cylinder stoves are those aged 20-49 years (73.8%) which suggest the more involvement of active age groups. This further supported by the decline in the number of households when in

aging age (Table 4.2). The recorded active age group in the present study slightly varies with Hammeed *et al.,* (2016) findings for the study conducted in Lagos, Nigeria where the dominant households was aged 21-50 years (81.5%). The study revealed that approximately 59% of the respondents were married while only 26.2% were single and the remaining percentages were divorce or widows. This implies that the dominant majority of households are married. This is in agreement with other studies conducted in other developing countries including Joshua *et al.*, (2020) in Nigeria who reported that, most of those households who refill gas cylinders in LPG stations were married. Previous study by Kumar *et.al.* (2020) revealed a significant association between adoption of LPG cylinder stoves and marital status. However, unmarried households also adopt on LPG cylinder stoves for cooking their meals at home.

Households with secondary school educational attainments were dominant (52.3%), while 26.9% had attained up to tertiary education but those with non-formal attainment were at minimal. Studies in other developing countries such as Ghana have also consistently shown that tertiary education are the most significant aspect in LPG industry (Salifu and Al-hassan, 2018). Nearly similar results were also reported by earlier researchers Nyabuto, (2021) but differed slightly by those reported by Pye *et al.*, (2020) in which secondary and primary school leavers were the dominant groups but minimal involvement were experienced among tertiary and non-formal schools leavers.

According to the study done in Nigeria (Joshua *et al.*, 2020) only 32.2% of the LPG refill attendants have tertiary education, which is far from the present (26.9%). This

could be associated with their high engagement in formal employment. This is further justified by the fact that the some of the households (3.1%) in present study had no any formal education on occupational health and safeguard practices, which is an important requirement for prevent the risk of injury. Nyabuto, (2021) in Kenya stated that, safe handling of LPG cylinders is associated with training and not their educational levels. Arguably, Salifu and Al-hassan, (2018) revealed that there was a great effects on education levels of the households. He argued that having high levels of education is an essential component on the probability of using LPG stoves and to compliance on safety practices on handling LPG cylinder.

In response, the World Health Organisation (WHO) has recommended the urgent need to scale the adoption of LPG, in low and middle-income countries (Pye *et al.*, 2020). The results indicated that, LPG industry seems to be continuously absorbing new customers as the majority of households (79.2%) have been using LPG cylinder stoves for less than 5 years and only 19.3% of them have been using LPG cylinders for 6 to 10 years and only 1.5% have been using LPG cylinders over 10 years. This imply that LPG fuel for domestic purposes is a new technology in developing countries, and that is why there's plenty of entrants in the past five years. More and more people are increasingly going for greener and cleaner energy. Similar results were also reported by earlier researchers (Nyabuto et al., 2020) but differed slightly by those reported by Amorin and Dabo (Jnr), (2022) in which the majority of them (52.7%), have been using LPG cylinders for 6 to 10 years while only 17.5% are between the ages of 0 and 5 years.

According to the study done in Kenya by Hsu *et al.,* (2019) the households who had less time of using LPG may affect knowledge and perceptions about the health benefits. The results revealed that Oryx gas cylinders is highly preferred by majority (61.5%) of the households probably due to the fact that their distribution networks are well organized and available almost all areas in Zanzibar. The results in present study is justified to those reported by NORAD, (2020) on the potential of increased use of LPG for cooking in developing countries who reported that in 2018, Oryx gas in Tanzania had highly market share of 49%, followed by Mihan gas (named Taifa gas) with a market share of 18% and other companies showed minimal market shares like Lake gas had (12%), Manjis gas (11%), Oilcom gas (6%), Orange gas (2%) and Mount Meru gas only (1%).

LPG cylinders are typically available in different sizes to meet local market needs, with smaller sizes being more affordable for low-income households. LPG for household fuel use is sold in cylinders ranging in size from 3-15 kg. The results of present study revealed that majority of the households (61.5%) purchased 6 kilograms weight LPG cylinders while, those who purchased 12.5kg, 18kg and 47.3kg weight were minimal. This is in agreement with other studies conducted in other developing countries including Puzzolo *et al.,* (2019) and Hsu *et al.,* (2019) in Kenya who reported that, most of the households who offered LPG cylinder stoves through the loan were 6kg weight with ring top.

In addition, during the study concerning of conformity based on leak test and weight measurement done by Nyabuto, (2021) in Kenya, also found that 6 kilograms weight

LPG cylinders was dominate. Arguably, Chen *et al.*, (2017) document in Taiwan who reported that, handling of gas cylinders of their weights are heavier than over 40kg may induces the risks of health injuries. He argued that handling the small size of gas cylinders weights are among the safety measures for prevention or minimize the risk of injury to handlers. LPG cylinders for domestic purpose typically containing a small weight because these cylinders can easily be handled and it reduces health related injuries compared with heavier gas cylinders (WLPGA, 2019).

5.2 Awareness on Safeguard Practices on Handling LPG Cylinders

Awareness on safeguard practices on handling LPG cylinders and risk analysing capacity of the households help to decrease accidents possibility due to improper handling of LPG fuel and storage cylinders. The present study assessed the households' awareness on safeguard practices on handling LPG cylinders for better health and safety. This study indicate that households were awareness on safeguard practices on handling LPG cylinders with average score of 75.4%.

However, this awareness in present study is higher than those reported by Nyabuto *et al.*, (2020a) in Kenya, who established only (23.0%) of the respondents were aware whereas the majority (77.0%) of the respondents were not aware on safety practices on handling LPG cylinders. High level of awareness in present study could influenced by previous training on safety practices with procedures for connecting and disconnecting of LPG cylinder stoves (Broni-Bediako *et al.*, 2017) or even experience gained from informal training or experience since the LPG is an environmentally friendly cooking energy

(Hammeed *et al.*, 2016). It is possible that the lack of awareness and knowledge of safety practices on handling of LPG cylinders and risk analyzing capacity of the LPG users contribute the accidents to the households (Chowdhury *et al.,* 2020). Safety trainings and campaigns are recommended to create awareness about using and safe handling of LPG cylinders.

According to the results, majority 79.2% of the households were aware that LPG cylinders are hazardous material when handling or operating inappropriately, merely 56.2% of them reported to experience health injuries and 31.5% were injured due to fire burns. This simply indicates that the majority of the households are handling or operating LPG cylinder stoves through personal experience. The results is contrary to those reported by Chowdhury *et al.*, (2020) who established almost 93% of the respondents in residential area were aware and agreed that LPG cylinders are dangerous materials and fire hazard could occur if handled inappropriately. Furthermore, it suggests that safety programmes should be organised by the government and non-governmental institutions to educate households on the safe handling of LPG cylinders.

Personnel who engaged in LPG operations should receive formal training by competent persons for their normal activities and for emergencies responses (WLPGA, 2018). The results revealed that formal training on safeguard practices on handling and operating of LPG cylinders was possessed by only 36.9% of the households. This simply indicates that the majority of households were handling and operating LPG cylinder stoves through their own personal experiences. Furthermore, this could suggest poor

enforcement of health safety laws and absence of regular organization of health education by the respective authorities. The results of present study compares well with those reported by Joshua *et al.,* (2020) in Nigeria who revealed that only 34.7% of the respondents had acquired formal training on safety practices on handling LPG cylinders as they work in the LPG refill stations or retail shops. Safety practices for handling and operating LPG cylinder stoves, detecting leaks, lighting LPG appliances and other important safety related issues are the basic knowledge to be training the LPG users (Broni-Bediako *et al.,* 2017).

The findings of this study indicated that majority of households were aware on the importance of reading and to follow the manufacturer's instructions when operating LPG cylinders, closing properly the cylinder valve and securing it in safe after use or when LPG cylinders is empty and keeping all combustible materials away from gas appliances. This implies that the households are only partially and not completely ignorant of the basic knowledge of safeguard practices on handling LPG cylinders for better life and safety. However, the results of present study contradict to those reported by Chowdhury *et al.,* (2020) in Bangladesh who revealed that more than 80% of LPG users were not aware to check up the tube or regulator before connecting LPG cylinders and also about 60% were not aware on checkup the cylinder valve after connecting a full LPG cylinder.

The results also indicated that only a few of respondents (10.8 %) were aware on checking of empty LPG cylinders and give correct answer by weighting, while about

89.2% of them were not aware and they give incorrect answers by seizing, shaking and lifting of empty cylinders. Regarding to the signs of inappropriate operation of LPG stoves, only 48.5% of the respondents were aware and give the correct answer that is yellowish colour is a sign of ineffective operation of the LPG stove. This could suggest public awareness and knowledge of handling LPG cylinders are needed to the households for reducing the accidents. The results compares well with those reported by Chowdhury *et al.*, (2020) in Bangladesh who indicated that 55% of the respondents were not aware on knowledge of lighting LPG stove for home and 52 % of them also were not aware on idea of gas leakage detection technique.

On physical observation, the results in Table 4.4 revealed that only 75% of LPG suppliers were aware to checking cylinders' valve before starting dispensing the gas cylinders. The results is correlated with those reported by Joshua *et al.*, (2020) in Kaduna State, Nigeria who observed only 66.1% of the cooking gas refill attendants were aware to checking cylinders' valve when handling gas cylinders. LPG cylinder connection and disconnection properly is very much important as several accidents can occur from the lack of this knowledge (Chowdhury *et al.*, 2020).

Moreover, the researcher observed only 37.5% of suppliers were aware to use secured transport for dispensing the gas cylinders, 12.5% of them were aware to use marked signs for warning other drivers and pedestrians that they carry an hazardous materials, 87.5% of the suppliers were aware to transporting gas cylinders in upright position and no one of the suppliers were aware to attaching catalogues for the newly customers for

educating them on handling and usage of the LPG cylinder stoves. There has been series of accidents due to lack of effective system to ensure the continuity of educating new users on the proper ways for handling LPG cylinders (Broni-Bediako and Amorin, 2018). Interviews with stakeholders who deals with usages of LPG cylinders from various departments (Fire Extinguisher and Rescue Force Officer, Occupation Health Officer, energy utilization regulatory agencies ZURA and ZBS) they were reported that;

> *"We provide training programs to the LPG suppliers on proper handling of gas cylinders, but still the majority of them transporting filled cylinders by using motorbikes in horizontal position without covering the cylinders valves and most of them ignore to use PPEs* (ZURA and ZBS).
>
> *Some of the households handle LPG cylinder stoves carelessly and they ignore to close properly the cylinder valves after using it which caused the accidents and explosion of fire in the habitants"* (Fire Extinguisher and Rescue Force and Occupation Health Officers)

From the case studies on fire and explosion of LPG cylinders at the hotels in Zanzibar, the accident was brought about by human error whereby the operators did not close the LPG cylinders valves properly. Cylinder valve is used both for re-filling of cylinder and use of gas cooker in home, therefore, its condition and performance are crucial for safety (WLPGA, 2018). The uses of PPE protect professionals from risk and harm in the workplace and is the main equipment which protecting the most vulnerable routes of exposure against chemical products (Rocha *et al.*, 2014). Training of households and LPG suppliers are very important in order to prevent or minimize the risk of injury to them and also damage of cylinders.

5.3 Proportion of Health Effects among Households Occupants due to Improper Handling of LPG Cylinders

Proper handling of LPG has a critical role to the occupational safety as inappropriate handling can predispose the health effects. The findings of this study found 55 cases of health effects with proportion of 42.3% among households' occupants due to improper handling of gas cylinders. However, during the interview in government institutions, it found 76 cases of health effects with proportion of 38% among households' occupants in a year of 2020-2021. This simply indicated that majority of households were at risk of serious health injuries or deaths because of low knowledge of safeguard practices on handling LPG cylinders. The results compares well with Putri *et al.,* (2021) observation carried out in Bandung, Indonesia in 2017 who observed that a total of 54 cases of burns injuries with prevalence of 46% among patients was associated by poor handling of LPG cylinders. An effective training programme can reduce the number of injuries and deaths, property damage, legal liability, illnesses, and compensation claims (Broni-Bediako and Amorin, 2018).

Moreover, the results revealed the health effects that majority (70.0%) of the households were complained to have respiratory system injuries, 23.1% of eye injuries, 5.4% musculoskeletal injuries and 1.5% nervous system injuries (Figure 4.4). This is in agreement with other studies conducted in other developing countries including in Palestine (Sirdah *et al.,* 2013); Indonesia (Putri *et al.,* 2021) and those reported in China (Jin et al., 2018) revealed that the most common accompanying health injuries associated to the LPG is inhalation injuries. This could be a potential effects of LPG

exposure on the health of households. There is a need to improve public awareness and the safety standards in the LPG cylinders system (Paliwal *et al.,* 2014).

5.4 Emergency Measures Applied By Households to Prevent LPG Accidents

An emergency measures at LPG operations should be applied by the local level for prevention of accidents (WLPGA, 2018). 'Prevention is better than cure' and effective emergency measures starts by getting things right in every stage. This study indicate that households demonstrate positive practices on applying the emergency measures for prevention of LPG accidents with average score of 61.5%. This findings of present study is correlated to those documented by Zeb *et al.*, (2017) in Pakistan who reported that 59.7% of the respondents demonstrate the safety measures which instructed by their supervisors for prevention of occupational hazards which reflecting positive practices. The reasons to adherence emergency measures was because of the existence of safety laws and health programs from the authorities (Mukhtar *et al.,* 2020). The results also revealed that majority (99.2%) of households recognise to use gas detection devices as an emergency measures applied for prevention of LPG accidents. This results of present study is supported by Joshua *et al.*, (2020) in Nigeria who stated that uses of new technologies such as LPG leak detection devices helps to improve safeguard practices and may reduce accidents associated with poor handling of LPG cylinders.

This results imply that households were ignore safety training as an effective approach to reduce the accidents and also increase the knowledge of emergency measures for operating the LPG stoves in safety. The studies that support training as an effective

emergency measures approach to be applied by households include Raynes-greenow *et al.,* (2020); in Bangladesh Kumar *et al.,* (2020) in India and Broni-Bediako *et al.,* (2017) in Ghana who recommended that LPG safety programmes should be organised by the government and non-governmental organisations (NGOs) to educate domestic LPG users on the safe handling of LPG cylinders. Joshua *et al.,* (2020) revealed that training of cooking gas refill attendants' is very important in order to prevent or minimize the risk of injury and damage of cylinders. Training programs provide motivations to complying with safety practices which could minimize the occupational hazards and improve the health of the households (Zeb *et al.,* 2017).

The results also show that only 18.5% of the households accept to use personal protective equipment (PPE) as an emergency measures for prevention of LPG accident, whereas 46.2% of them ignore to make timely services of LPG stoves and only 20.8% having fire extinguisher nearby when operating LPG stoves as an emergency measures to prevent LPG accidents. This suggests that the majority of households are operating LPG stoves in risk conditions thus increasing the possibility of accidents and injuries. The use of PPEs as emergency measures in this study observed to be ignored compared with a study done in Nigeria with a figure of 76% (Joshua *et al.,* 2020) and slightly higher in relation to a study done in Pakistan where 76.8% of the respondents used PPE as the emergency measures (Zeb *et al.,* 2017). This could be due to occupational safety training received and educational status of the respondents in their studies. There is a need for health promoters to implement protective and preventive measures to assure

households are not exposed to risks and hazards, while also encouraging health surveillance (Rocha *et al.,* 2014).

About the obligation of households to maintained good housekeeping practices and proper arrangement of the kitchen rooms as an emergency measures, the results indicate majority of the respondents (90.8%) were adhered to preventing LPG accidents. Keeping the workplace clean and tidy encourages a tidier work ethic and helps to eliminate unwanted items that could fuel a fire, create an obstruction, or cause potential injury. The results also indicate almost all the households used gas detection devices as an effective emergence measures to preventing LPG accidents. This results in the present study is higher than the recorded by Chowdhury *et al.,* (2020) in Bangladesh who shows that only negligible percentage of both domestic and restaurant use gas detector in their kitchen. This is supported by Joshua *et al.,* (2020) in Nigeria who stated that uses of new technologies such as composite cylinders, advanced cooking equipment (infra-red burners, double spindle valve system, reinforced hose), cylinder tracking system, cylinder sensors, smart metering (pay-as-you-cook model) and LPG leak detection system may improve safety and reduce accidents associated with the sale and use of LPG cylinders. This will reduce the preventable injuries, deaths and loss of properties from LPG accidents.

5.5 Challenges That Hinder Safeguard Practices on Handling LPG Cylinders

While investigating challenges that hinder to compliance with safeguard practices on handling LPG cylinders among households for better health and safety through surveys,

it was established that LPG suppliers were not aware of the role they play in handling LPG cylinders. The study revealed that majority of the households (86.9%) identified low public awareness on handling LPG cylinders is a great challenge that hinder to compliance with safeguard practices. Poor planning, limited human capacity and accountability, poor enforcement of the standards and regulations that govern risk reduction are considered as non-seriously challenges in study area. This result is supported by earlier researchers including Chowdhury *et al.,* (2020); Bangladesh, Kumar et al., (2020); India, Kyalo, (2020) and Nyabuto et al., (2020) in Kenya who revealed that low public awareness is a serious challenge that hinder to compliance with safety practices on handling LPG cylinders.

The present observation is also correlated to the study done by Broni-Bediako and Amorin, (2018) in Ghana who also identified that, lack of safety education on LPG usage and poor transporting network of LPG cylinders were serious challenges to compliance with safety practices. Other challenges that hinder to compliance with safety practices on handling LPG cylinders among households are such as socio-economic and cultural barriers, institutional factors affecting access to maintenance or upgrades as needed, and policy issues such as subsidies and affordability might continue to present themselves (Rao *et al.,* 2020).

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The results of the present study have indicated moderate awareness of households on safeguard practices on handling LPG cylinders. Most of the households cared to kept combustible materials away from gas appliances, implying the exposure of gas appliances with combustion materials has potential of fire accidents. Very few households were aware on checking of empty LPG cylinders. Observed suppliers' awareness on dispensing LPG cylinders by using secured transport was also similarly low which could also be evidenced by moderate awareness of checking cylinders' valves and uses of warning signs in transporting vehicles suggesting improper handling of LPG cylinders.

The number of health injuries among households' occupants in study area. It was found that 55 cases of health injuries with incidence of 42.3%. Among households' occupants include complains of respiratory system injuries (70.0%), eye injuries (23.1%), musculoskeletal injuries (5.4%) and nervous system injuries (1.5%). In terms of emergency measures to prevent liquefied petroleum gas accidents, almost all the respondents demonstrated to use gas detection devices as an effective emergence measures applied by households to preventing LPG accidents, which is contrary to the actual emergence measures as demonstrated from other researchers that, training and monitoring through inspection was an integral part and necessary to those who handle LPG in order to complying with safety practices when handling gas cylinders in home.

Despite the households showed positive practices on handling LPG cylinders for better health and safety, it was observed that more than two thirds of the respondents had low public awareness on the importance of safe handling of LPG cylinders a great challenge that hinder to compliance with safeguard practices. Poor enforcement of the standards and regulations that govern risk reduction was observed. Poor planning, limited human capacity, and the high costs associated with LPG safety enhancement were also observed.

6.2 Recommendation

It is recommended that the relevant authorities at local and national levels should apply routine inspections in LPG retail shops to ensure appropriate handling of LPG cylinders. This could well be complemented with regular trainings on proper handling of LPG cylinders and its implication of effective emergency measures on prevention of accidents, which could also acts as a pre-qualification for engagement into LPG business. Monitoring and evaluation of LPG handlers' compliance with safeguard practices when handling LPG cylinders and should be implemented at a regular interval. The Ministry of Water, Energy and Minerals, Ministry of Health with ZURA and ZBS and others stakeholders should raise public awareness on safety practices through training, prepare guideline and policy on standard regarding to the risk pose on poor safe handling practices, poor emergency measures and the importance of good safeguard practices to the suppliers and users.

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APPENDICES

I: Questionnaires for Households – (English Version)

INTRODUCTION

Dear respondent. I am ***Rehema Abdi Juma***, a student in Master of Environmental Studies (Health) Of the Open University of Tanzania 2023 conducting a study on, "***Assessment of safeguard practices among households on handling liquefied petroleum Gas cylinders for better health and safety in Urban Municipality of Zanzibar***"**.** I am grateful for accepting to participate in completing this questionnaire that seeks to collect information for this study. I assure you that the information you give will remain confidential.

I. Socio-demographic information of the households				
NO.	QUESTIONS AND FILTERS	CATEGORIES Put [V] for appropriate answer)		SKIP
1	Age group (in years)	Bellow 20	1	
		20-29	2	
		30-39	3	
		40-49	4	
		50-59	5	
		Above 60	6	
2	Sex	Male	1	
		Female	2	

3	Marital status	Single	1		
		Married	2		
		Divorced	3		
		Widowed	4		
4	Level of Education	Primary education	1		
		Secondary education	2		
		Tertiary education	3		
		Non formal education	4		
5	Experience of using LPG cylinder stoves (in years)	< 1	1		
		1 – 5	2		
		6 – 10	3		
		>10	4		
6	Most LPG cylinders company which are purchased for uses	Virgo gas	1		
		Oryx gas	2		
		Lake gas	3		
		Mihan/Taifa gas	4		
		All of the above	5		
7	Most LPG cylinders weight for domestic uses (in kg)	2.7	1		
		6	2		
		12.5	3		
		18	4		
		47.2	5		
		All of the above	6		
II. Awareness on safeguard practices on handling LPG cylinders					
8	Do you agree that LPG cylinders is a hazardous material when improper handling?		Yes	No	
			1	2	

9	Which hazardous of LPG cylinders are frequently occur when improper handling?	Injuries		1	
		Deaths		2	
		Fire burns		3	
10	Have you received any training on how to handle, uses LPG cylinders?		Yes	No	
			1	2	
11	Is it important to read and follow manufacturer's instructions when operating of LPG cylinders?		Yes	No	
			1	2	
12	How do you known if LPG cylinder is empty?	Weighting		1	
		Shaking		2	
		Lifting		3	
		Seizing		4	
13	It is necessary to close properly the cylinder valve and secure after uses or when LPG cylinders is empty?		Yes	No	
			1	2	
14	Keep all combustible materials away from your gas appliances is a safeguard practices on handling LPG cylinders?		Yes	No	
			1	2	
15	Which flame is a signal inappropriate operation of LPG cylinders stove?	Yellowish		1	
		Blue		2	
		None		3	

III. Health injuries among households occupants due to improper handling of liquefied petroleum gas cylinders					
16	Have you experience any health injuries that are resulted from improper handling of LPG cylinders?		Yes	1	
			No	2	
17	Which of the health injuries are most frequently occur when inappropriate handling of LPG cylinders?	Respiratory system injuries		1	
		Musculoskeletal injuries		2	
		Nervous system injuries		3	
		Eye injuries		4	
IV. Emergence measures applied by households to prevent cylinders accident					
18	Training and education on handling LPG cylinder stoves, can help to prevent LPG accidents?		Yes	No	
			1	2	
19	Personal protective equipment (PPE) such as protective clothing, gloves, and face protection helps for prevention of LPG accident?		Yes	No	
			1	2	
20	Timely services of LPG cylinder stoves can help to prevent accidents?		Yes	No	
			1	2	
21	Fire extinguisher near the operating LPG cylinder can help to prevent accidents?		Yes	No	
			1	2	

22	Good housekeeping practices and proper arrangement of the kitchen help to prevent LPG cylinders accidents?		Yes	No	
			1	2	
23	The uses of gas detection devices by household help to prevent LPG accidents?		Yes	No	
			1	2	
V. Challenges that hinder safeguard practices on handling LPG cylinders					
24	What are the challenges that hinder safeguard practices on handling liquefied petroleum gas cylinders in the urban municipality of Zanzibar?	Low public awareness about safeguard practices on handling LPG cylinders	1		
		Poor enforcement of the standards and regulations that govern risk reduction on handling LPG cylinders	2		
		Poor planning, limited human capacity, and accountability of safeguard practices on handling LPG cylinders	3		
Adopted from Nyabuto *et al.*, (2020a)					

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

I1: Dodoso la Wanakaya (Swahili Version)

UTANGULIZI

Mpendwa mshiriki. Mimi ni ***Rehema Abdi Juma***, ni mwanafunzi wa ngazi ya Uzamili katika Afya ya Mazingira kutoka Chuo Kikuu Huria cha Tanzania mwaka 2023 ambaye ninafanya utafiti kuhusiana na "***Tathmini ya matumizi salama ya mitungi ya gesi za kupikia miongoni mwa wanakaya katika kudhibiti ajali za mitungi gesi na kwa afya bora katika Manispaa ya Mjini Zanzibar***"**.** Nina matumaini makubwa ya kuwa utashiriki katika kujibu dodoso hili kwa dhumuni la kupata taarifa za utafiti huu. Nakuhakikishia kuwa taarifa zitakazokusanywa zitakuwa siri na kwa matumizi ya utafiti huu tu.

I. Taarifa za kijamii kwa Wanakaya na Wasmbazaji wa mitungi ya gesi			
NO.	MASWALI YALIYOPENDEKEZWA	ALAMA weka vyema [V] kwa jibu sahihi)	ACHA
1	Umri wa mshiriki	Umri chiniya miaka 20 — 1 Kati ya miaka 20-29 — 2 Kati ya miaka 30-39 — 3 Kati ya miaka 40-49 — 4 Katiki ya miaka 50-59 — 5 Zaidi ya miaka 60 — 6	
2	Jinsi	Mme — 1 Mke — 2	
3	Hali ya ndoa	Sijaoa / Sijaolewa — 1 Nimeoa / Nimeolewa — 2 Mtalaka — 3 Nimefiwa — 4	
4	Kiwango cha elimu	Elimu ya msingi — 1 Elimu ya sekondari — 2 Elimu ya juu — 3 Sijasoma — 4	
5	Uzoefu katika kutumia mitungi ya gesi	Chini ya miezi 12 — 1 Kati ya mwaka 1 hadi 5 — 2 Kati ya miaka 6 hadi 10 — 3 Zaidi ya miaka 10 — 4	

6	Kampuni ya gesi unayopendelea kutumia	Gesi ya Virgo	1
		Gesi ya Oryx	2
		Gesi ya Lake	3
		Gesi ya Mihan/Taifa	4
		Gesi ya aina yoyote	5
7	Kiwango cha uzito wa migungi wa gesi ninaopendelea kutumia	Kilo 2.7	1
		Kilo 6	2
		Kilo 12.5	3
		Kilo 18	4
		Kilo 47.2	5
		Ujazo wa aina yoyote	6
II. Uelewa wa mambo ya tahadhari wakati wa udhibiti mitungi ya gesi			
8	Unakubaliana kuwa mitungi ya gesi ni hatari kama hujaibeba kwa tahadhari?	Ndio	Hapana
		1	2
9	Ni aina gani ya hatari hutokezea kama hujabeba mitungi ya gesi kwa tahadhari?	Kuumia	1
		Kufa	2
		Kuungua moto	3
10	Je, umeshawahi kupata mafunzo yoyote juu ya matumizi au usambazaji wa mitungi ya gesi?	Ndio	Hapana
		1	2
11	Je, ni muhimu kusoma alama na kufuata maelekezo yanayohusiana na utumiaji wa mitungi ya gesi?	Ndio	Hapana
		1	2
12	Utajuaje kama mtungi wa gesi umemalizika?	Kuupima	1
		Kuutikisha	2
		Kuuinua	3
		Kuzima ghafla	4
13	Ni lazima kuufunga mfereji wa gesi baada ya kutumia au baada ya gesi kumaliza?	Ndio	hapana
		1	2

14	Kuweka mbali nyanzo vya moto ni miongoni mwa tahadhari za udhibiti wa ajali za mitungi ya gesi?		Ndio	Hapana	
			1	2	
15	Rangi gani ya moto inaonyesha uwakaji usio sahihi wa mtungi wa gesi?	Manjano	1		
		Buluu	2		
		Siijui	3		
III. Idadi ya majanga ya kiafya miongoni mwa wanakaya yatokanayo uthibiti holela wa mitungi ya mitungi ya gesi za kupikia					
16	Je, umeshawahi kutokezewa na ajali zozote zinazotokana na ubebaji holela wa mitungi ya gesi?		Ndio	Hapana	
			1	2	
17	Je, ni ajali ipi ya kiafya ambayo hutokezea mara kwa mara kutokana na kutozingatia utumiaji sahihi wa mitungi ya gesi?	Ajali za mfumo wa upumuaji	1		
		Ajali za mfumo wa mifupa na misuli	2		
		Ajali za mfumo wa ufahamu	3		
		Ajali za kuumia macho	4		
IV. Hatua za haraka zinazochuliwa na wanakaya na wasambazaji wa gesi ili kukinga ajali zinazotokana na mitungi ya gesi					
18	Je, unakubaliana kuwa mafunzo na elimu inayo husiana na utumiaji au usambazaji wa mitungi ya gesi, inasaidia kuepusha ajali za gesi?		Ndio	Hapana	
			1	2	
19	Je, unatumia zana za kujikinga na ajali za mitungi ya gesi kama nguo zito, viziba uso na vikinga mikono ili kujikinga na athari za mitungi ya gesi?		Ndio	Hapana	
			1	2	

20	Je, unafanya ukarabati wa miundombinu ya jiko la gesi au sehemu za kuhifadhia mitungi kila baada ya muda?		Ndio	Hapana	
			1	2	
21	Je, unacho kifaa cha kuzimia moto karibu na jiko la gesi au sehemu zinazohifadhia mitungi ya gesi?		Ndio	Hapana	
			1	2	
22	Je, mpangilio mzuri wa sehemu ya jiko au sehemu za kuhifadhia mitungi ya gesi inasaidia kuepusha ajali zinazotokana na mitungi ya gesi?		Ndio	Hapana	
			1	2	
23	Je, unakubaliana kuwepo vifaa maalum vya kugundua tatizo la uvujaji wa gesi ili kukinga ajali za mitungi ya gesi?		Ndio	Hapana	
			1	2	
V. Vikwazo vinavyopelekea watu kutokufuata njia salama za utumiaji na ubebaji wa mitungi ya gesi					
24	Ni vikwazo gani vinavyopelekea watu kutokufuata njia salama za utumiaji na ubebaji wa mitungi ya gesi katika manispaa ya mji wa Zanzibar?	Uelewa mdogo juu ya njia salama za kubeba mitungi ya gesi	1		
		Kutokufuata njia za kisheria zinazozuia ajali zinazotokana na mitungi ya gesi	2		
		Mipango duni na mabadiliko ya jamii katika kufuata njia salama za utumiaji na ubebaji sahihi wa mitungi ya gesi	3		
Maboresho kutoka kwa Nyabuto *et al.*, (2020a)					

AHSANTE SANA KWA USHIRIKI WAKO

III: Observation Checklist for Suppliers during Handling of LPG Cylinders.

Suppliers' Awareness on safeguard practices on handling LPG cylinders				
CRITERIA	SAFEGUARD PRACTICE CHECKS	Yes	No	Comment
1. Proper handling and care of LPG cylinders	Does the LPG suppliers checked cylinders' valve before starting dispensing the gas cylinders?			
	Does the LPG suppliers use secured transport for dispensing the gas cylinders?			
	Does the LPG suppliers use marked signs to warn other drivers and pedestrians that it is carrying a hazardous materials?			
	Does the LPG suppliers transport the gas cylinders in upright position?			
	Does the LPG suppliers attached catalogues to the newly customers that show how to handle and how to use the gas cylinders?			
2. Safety Working Environment on Handling LPG cylinders	Does the LPG suppliers spend time to train the newly customers on how to handle and how to use gas cylinders?			
	Does the LPG suppliers use personal protective equipment (PPE) during the work for prevention of LPG cylinders accident?			
	Does the LPG suppliers design and build the storage areas for the purpose of storing gas cylinders?			
	Does the LPG suppliers had a fire extinguishers in there dispensing vehicles and storage areas?			
	Does the LPG suppliers segregate the empty gas cylinders from full cylinders in storage areas?			
	Does the LPG suppliers strictly the customers to smoke at the storage areas?			
	Does the LPG suppliers use gas detection devices to prevent gas cylinders accidents?			
Adopled from Nyabuto *et al.,* (2020a)				

IV: Observation Checklist for Suppliers during Handling of LPG Cylinders. – (Swahili Version)

Muamko wa Wasambazaji wa ubebaji salama wa mitungi ya gesi				
VIGEZO	HATUA SALAMA	NDIO	HAPANA	MAELEZO
1. Ubebaji sahihi wa mitungi ya gesi.	Je wasambazaji wa mitungi ya gesi huikagua vifuniko (valve) kabla ya kuanza kuisambaza?			
	Je wasambazaji hutumia usafiri ulio salama wakati wa kusafirisha mitungi ya gesi?			
	Je wasambazaji wa mitungi ya gesi hutumia alama zenye kutoa tahadhari kwa madereva wengine na watembea kwa miguu kwamba wamebeba nyenzo hatari?			
	Je wasambazaji wa mitungi ya gesi husafirisha mitungi ya gesi ikiwa imesimama wima?			
	Je wasambazaji wa mitungi ya gesi huambatanisha katalogi kwa wateja wapya zinazoonyesha jinsi ya matumizi sahihi ya mitungi ya gesi?			
2. Mazingira ya kazi salama juu ya kushughulikia mitungi ya gesi.	Je, wsambazaji wa mitungi ya gesi huwafundisha wateja jinsi ya kushughulikia na jinsi ya kutumia mitungi ya gesi?			
	Je, wasambazaji wa mitungi ya gesi hutumia vifaa vya kinga ya kibinafsi (PPE) kwa ajili ya kuzuia ajali zitokanazo na mitungi gesi?			
	Je, wasambazaji wa mitungi ya gesi wanasanifu na kujenga maeneo ya kuhifadhia kwa madhumuni ya kuhifadhi mitungi ya gesi?			
	Je, wasambazaji wa mitungi ya gesi hubeba vizima moto (fire extinguishers) ndani ya magari ya kusambazia gesi na sehemu za kuhifadhia?			
	Je, wasambazaji wa mitungi ya gesi hutenganisha mitungi ya gesi mitupu mbali na mitungi ya gesi iliyojaa katika maeneo ya kuhifadhi?			
	Je, wasambazaji wa mitungi ya gesi huwapa tahadhari wateja juu ya uvutaji wa sigara karibu na mitungi ya gesi?			
	Je, wasambazaji wa mitungi ya gesi hutoa vifaa kwa wateja vya kuweza kugundua gesi ili kuzuia ajali zitokanazo na mitungi ya gesi?			
Maboresho kutoka kwa Nyabuto *et al.*, 2020a)				

V: In-Depth Interview Guide for Occupational Health officer, Fire and Rescue Department and regulatory agencies (ZURA and ZBS) – (English Version)

Data from this study will only be used for educational purposes; all data will be kept confidential and anonymous. Participation is completely voluntary and you may stop at any point. The aim of the current study is to assess safeguard practices among households on handling LPG Cylinders in Urban Municipality of Zanzibar

Date……

Time starts: ……. Time end…….

1. Could you describe the current situation of awareness on safeguard practices on handling LPG cylinders in the Urban Municipality of Zanzibar? Probe on
    - Publication of knowledge, information and awareness about proper handling of LPG cylinders. Example, in case of a gas leak, switching on lights or smoking cigarettes can cause an explosion/fire, uses of PPE in handling of LPG cylinders
    - Publication of safety data sheets and document on safeguard practices
2. What are the number of health injuries among households' occupants due to improper handling of gas cylinders in the urban municipality of Zanzibar?

    Probe on

    - Number of injuries and accidents however minor which associated with LPG cylinders are reported and recorded to authorised institutions.

3. What are the emergence measures applied by government to prevent liquefied petroleum gas accident in the urban municipality of Zanzibar? Probe on

    - Approval of licences and training for handling LPG cylinders and gas-related uses and emergence cares.
    - Contracting the LPG dispensing facilities and storage areas properly
    - Hazards and risk assessments has been undertaken in the workplace
    - Fire safety management Plan at my workplace.
    - Health and safety practices are inspect and undertaken regularly.
    - Operational and inspections of LPG cylinders

4. What are the challenges that hinder safeguard practices on handling liquefied petroleum gas cylinders in the urban municipality of Zanzibar? Probe on

    - Financial support associated with LPG cylinder safety plan and enhancement
    - Resistance to implementation of good safeguard practices at the workplace
    - Ignorance by suppliers and households on LPG safety issues
    - Lack of trainings and sensitization on LPG safety.
    - Lack of awareness on the importance of safety

THANK YOU FOR YOUR COOPERATION

VI: Muongozo wa Mahojiano ya kina kwa Afisa wa Afya, Idara ya Zimamoto na Uokoaji na Wakala wa Udhibiti (ZURA na ZBS) – (Swahili Version)

Taarifa zote za utafiti huu zitatumika kwa madhumuni ya kielimu pekee. Taarifa zote zitawekwa kwa siri na bila ya kutajwa majina ya mtoa taarifa. Kushiriki ni kwa hiari kabisa na unaweza kuacha wakati wowote. Madhumuni ya utafiti kwa sasa kutathmini mbinu za ulinzi miongoni mwa kaya zinazotumia mitungi ya gesi katika Manispaa ya Mjini Zanzibar.

Tarehe…… Muda wa kuanza ……..…… Muda wa kumaliza ……..

1. Je, unaweza kueleza hali ya sasa ya uelewa juu ya mbinu za ulinzi juu ya utunzaji wa mitungi ya gesi katika Manispaa ya Mjini Zanzibar? Chunguza kuhusu:

- Taarifa na ufahamu kuhusu utunzaji sahihi wa mitungi ya gesi. Mfano; iwapo gesi inavuja, kuwasha taa au kuvuta sigara karibu na sehemu ya kuhifadhia mitungi ya gesi na namna ya kushughulika na ajali zitokanazo na gesi.
- Uchapishaji wa vipeperushi vinavyoonyesha njia salama za utunzaji wa mitungi ya gesi.

2. Je, ni idadi gani ya mejeruhi wa kiafya miongoni mwa wakaazi wa kaya kutokana na utunzaji usiofaa wa mitungi ya gesi katika Manispaa ya mji wa Zanzibar? Chunguza kuhusu:

    - Idadi ya majeruhi na ajali hata kama ni ndogo zinazohusishwa na mitungi ya gesi ambazo zimeripotiwa na kuridiwa kwa taasisi zilizoidhinishwa.

3. Je, ni hatua gani zinazochukuliwa na Serikali kuzuia ajali ya gesi katika Manispaa na Mjini Zanzibar? Chunguza:

   - Uidhinisahji wa leseni na mafunzo ya kushughulikia mitungi ya gesi na matumizi yanayohusiana na gesi na utunzaji wa dharura.
   - Sehemu sahihi za kuhifadhia vifaa vya kusambazia mitungi ya gesi.
   - Tathmini juu ya hatari za mitungi ya gesi imefanywa katika vituo kazi?
   - Mpango wa usimamizi wa usalama wa moto mahali pa kazi.
   - Uendeshaji na ukaguzi wa mitungi ya gesi.

4. Je, ni changamoto zipi zinazozuia uhifadhi ya mitungi ya gesi katika Manispaa ya Mjini Zanzibar? Chunguza kuhusu:

   - Msaada wa kifedha unaohusishwa na mpango salama na uboreshaji wa mitungi ya gesi.
   - Vikwazo katika utekelezaji wa kanuni za uhifadhi wa mitungi ya gesi vituoni na sehemu za kazi.
   - Uelewa mdogo wa wasambazaji na kaya kuhusu masuala ya usalama wa mitungi ya gesi.
   - Ukosefu wa mafunzo na uhamasishaji juu ya usalama wa mitungi ya gesi.

ASANTE KWA USHIRIKI WAKO.

VII: Appendix Showing the Pictures of LPG Cylinders Handling in the Study Area

Picture 1: Show the LPG supplier transporting filled cylinder by using motorbike in horizontal position without covering the cylinder valves and he ignore to use PPEs.
Picture 2: Show availability of gas stations in the Urban Municipality of Zanzibar

Picture 3: Show a poor housekeeping of LPG cylinders in a storage areas
Picture 4 and **5:** Show LPG suppliers not use secure transport for dispensing cylinders.

VIII: A Letter from the Directorate of Postgraduate Studies at the OUT

THE OPEN UNIVERSITY OF TANZANIA
DIRECTORATE OF POSTGRADUATE STUDIES

P.O. Box 23409
Dar es Salaam, Tanzania
http://www.out.ac.tz

Tel: 255-22-2668992/2668445
ext.2101
Fax: 255-22-2668759
E-mail: dpgs@out.ac.tz

Our Ref: PG201902352

10th September, 2021

The Principal Secretary,
Office of the Second Vice President,
P. O. Box 239,
ZANZIBAR.

RE: RESEARCH CLEARANCE

The Open University of Tanzania was established by an Act of Parliament No. 17 of 1992, which became operational on the 1st March 1993 by public notice No.55 in the official Gazette. The Act was however replaced by the Open University of Tanzania Charter of 2005, which became operational on 1st January 2007. In line with the Charter, the Open University mission is to generate and apply knowledge through research.

To facilitate and to simplify research process therefore, the act empowers the Vice Chancellor of the Open University of Tanzania to issue research clearance, on behalf of the Government of Tanzania and Tanzania Commission for Science and Technology, to both its staff and students who are doing research in Tanzania. With this brief background, the purpose of this letter is to introduce to you **Ms. JUMA, Rehema Abdi, Reg No: PG201902352** pursuing **Master of Science in Environmental Studies MES (Sc.).** We here by grant this clearance to conduct a research titled **"Safeguard Practices among Households on Handling Liquefied Natural Gas Cylinders for Better Health and Safety: A Case of Urban Municipality in Zanzibar".** She will collect her data at your area from 13th September 2021 to 15th October 2021.

In case you need any further information, kindly do not hesitate to contact the Deputy Vice Chancellor (Academic) of the Open University of Tanzania, P.O. Box 23409, Dar es Salaam. Tel: 022-2-2668820.We lastly, thank you in advance for your assumed cooperation and facilitation of this research academic activity.

Yours Sincerely,

Prof. Magreth S. Bushesha
For: VICE CHANCELLOR
DIRECTOR OF POSTGRADUATE STUDIES.

IX: Research Permit from the Office of the Second Vice President - Zanzibar

SERIKALI YA MAPINDUZI YA ZANZIBAR
AFISI YA MAKAMU WA PILI WA RAIS,
SERA, URATIBU NA BARAZA LA WAWAKILISHI

P. O. Box 239
Vuga Street
Zanzibar-Tanzania

Tel. 024 22 30808
Fax. 024 22 30808
E-mail :

OMPR/M.95/C.6/2/VOL. XVII/ 21/09/2021.

KATIBU MKUU,
WIZARA YA AFYA USTAWI WA JAMII, JINSIA NA WATOTO,
ZANZIBAR.

KAMISHNA,
KIKOSI CHA ZIMAMOTO NA UOKOZI (KZU),
ZANZIBAR.

MKURUGENZI,
TAASISI YA VIWANGO (ZBS),
ZANZIBAR.

MKURUGENZI MKUU,
MAMLAKA YA UDHIBITI WA HUDUMA ZA MAJI NA NISHATI (ZURA),
ZANZIBAR.

MHESHIMIWA,
MKUU WA WILAYA,
WILAYA YA MJINI,
UNGUJA.

KUH: RUHUSA YA KUFANYA UTAFITI

Kwa heshima, naomba uhusike na mada ya hapo juu.

Serikali ya Mapinduzi ya Zanzibar imemruhusu **Ndg. Rehema Abdi Juma** mtafiti mwanafunzi kutoka **Chuo Kikuu Huria cha Tanzania** anaesomea **Shahada ya Uzamili** katika fani ya **Mazingira** kufanya utafiti katika mada inayohusiana na **"Safeguard Practices Among Households on Handling Liquefied Petroleum Gas Cylinders for Better Health and Safety: A Case of Urban Municipality in Zanzibar"** Utafiti huo utafanyika Wizara ya AFya, Zanzibar, Kikosi cha Zimamoto na Uokozi (KZU), ZBS, ZURA pamoja na kwenye maeneo ya Wilaya ya Mjini Unguja kuanzia tarehe **21/09/2021** mpaka **21/12/2021** Tunaomba asaidiwe ili aweze kukamilisha utafiti huo.

Kwa nakala ya barua hii mara baada ya kumaliza utafiti, mtafiti anatakiwa kuwasilisha nakala (copy) 3 za ripoti ya utafiti huo Ofisi ya Makamu wa Pili wa Rais- Zanzibar.

Naambatanisha na kivuli cha kibali cha kufanyia utafiti.

Wako mtiifu,

Siajabu S. Pandu

SIAJABU S. PANDU,
/KATIBU MKUU,
AFISI YA MAKAMU WA PILI WA RAIS,
SERA, URATIBU NA BARAZA LA WAWAKILISHI,
ZANZIBAR.

NAKALA: Ndg. Rehema Abdi Juma.

X: A Research Permit from Office of Chief Government Statistician

REVOLUTIONARY GOVERNMENT OF ZANZIBAR

SECRETARY
ZANZIBAR RESEARCH COMMITEE
P.O Box 2321, Mazizini, Zanzibar
Tel: 024 2231869
Fax: 024 2231742

RESEARCH/FILMING PERMIT
(This Permit is only Applicable in Zanzibar for duration specified)

SECTION **Reference No#: 6149AB5C50428**

Name	REHEMA ABDI JUMA
Gender	F
Date and Place of Birth	1987-09-16, MAISARA
Nationality	Tanzanian
Duration of study	3 Month(s)
Research Tittle	Safeguard Practices Among Households on Handling Liquefied Petroleum Gas Cylinders for Better Health and Safety. A Case of Urban Municipality.
Date of Issue	21-09-2021
Valid until	21-12-2021

Full Address of Sponsor

Name of the authorizing officer	Abdalla M. Denge
Signature and seal	.....
Institution	Office of the Chief Goverment Statistician
Address	P.O Box 2321, ZANZIBAR