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Prevalence, knowledge of hazards and practices regarding generator use among small-scale business operators in Sokoto, Nigeria

Edzu U. Yunusa*, Kehinde J. Awosan
Department of Community Health, Usmanu Danfodiyo University, Sokoto, Nigeria

ABSTRACT

Background: The perennial inadequate electricity supply in Nigeria has become a serious threat to the economic development of the country, and a major driving force behind the proliferation of fossil fuel generator as an alternative source of energy for both domestic and commercial purposes across the country. **Aim**: This study aimed to assess the prevalence, knowledge of hazards and practices regarding generator use among small-scale business operators in Sokoto, Nigeria. **Materials and Methods:** This was a cross-sectional study among 285 small-scale business operators selected by a multistage sampling technique. A structured self-administered questionnaire was used to collect data on the research variables. Data were analyzed using the IBM SPSS version 20 statistical computer software package. **Results**: The mean age of respondents was 28.59 ± 7.09 years; most of them were males (80.4%) and have worked for ≤ 10 years (91.9%). Majority, 212 (74.4%) of the 285 respondents use fossil fuel generator as an alternative source of energy to run their businesses. Despite high levels of good knowledge of the hazards of generator use (73.7%) and the methods of preventing exposure to them (94.7%), practices related to exposure to the hazards were very prevalent among the respondents. **Conclusion**: This study showed high prevalence of generator use and practices related to exposure to its hazards among small-scale business operators in Sokoto, Nigeria, despite good knowledge of the hazards and the methods of preventing exposure to them. The Nigerian government should provide adequate and regular electricity supply across the country.

Keywords: Prevalence, generator use, hazards, knowledge, practices, small-scale business operators

INTRODUCTION

The perennial inadequate electricity supply in Nigeria has become a serious threat to the economic development of the country, and a major driving force behind the proliferation of fossil fuel generator as an alternative source of energy for both domestic and commercial purposes across the country (Oyedepo, 2012; Iwayemi, 2008; Akande, 2008). Over the years, the proportion of households in Nigeria with access to electricity remains poor and only increased marginally from 56% in 2013 to 59% in 2018 (NPC and ICF International, 2014; NPC and ICF, 2019). It has been estimated that over 90% of businesses (particularly small-scale businesses) and over 30% of homes depend on generators for energy supply; and this constitutes a huge economic loss to the country because they are largely imported from other countries, and they are expensive to buy, maintain and fuel (Ikhuosho-Asikhia, 2014; Ibitoye and Adenikinju, 2007). In addition to its devastating effects on the economy, use of fossil fuel generators is known to be associated with serious environmental and health hazards including environmental pollution, noise, impaired hearing, sleeplessness, choking sensation, vibration, heat, and fire hazards; and all these in turn adversely affects the psychological and mental health of those concerned (Mbamali et al., 2012; Offiong, 2003).

While in operation, electric generators produce noise at high levels; a study conducted in Ibadan, Nigeria, reported high generator noise levels of between 91.2 and 100.5 dB(A) (Yesufu and Ana, 2012), and high noise levels (beyond the World Health Organization's limit of 70 to 75dB) have been found to be associated with adverse health and social effects including high blood pressure, abnormal fetal development, extreme emotions and behavior, hearing impairments, sleep disturbance, and friction among neighbors (Smith et al., 2004; Osuntogun and Koku, 2007; Minja et al., 2003). Electric generators also release toxic gases including carbon monoxide into the atmosphere which cause indoor air poisoning particularly when used in enclosed spaces

***Corresponding Author:** Dr. Edzu U. Yunusa, Department of Community Health, Usmanu Danfodiyo University, Sokoto, Nigeria.

E-mail: dryunusausmanedzu@gmail.com

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inside or close to business premises, thus increasing the risk of carbon monoxide poisoning (Dimari et al., 2007; Rao, 2007). Evidence from literature has confirmed that carbon monoxide poisoning is the most common type of fatal air poisoning in many countries (Omaye, 2002). It was also estimated that indoor air pollution from fossil fuel combustion claimed more than 1.6 million lives and left over 38.5 million disabled worldwide in the year 2000 (Smith et al., 2004).

Outdoor air pollution from incomplete combustion and other emissions from fuel use is also an important health risk globally. The Global Energy Assessment (GEA) estimates that it was responsible for some 2.7 million premature deaths in 2005, with the dominant sources of outdoor air pollution being combustion of fossil fuels in industry and transportation (Smith, 2020). In 2019, the World Health Organization (WHO) considered air pollution as the greatest environmental risk to health as it kills about 7 million people prematurely every year from diseases such as cancer, stroke, heart and lung diseases (WHO, 2020). In addition, the primary cause of air pollution (i.e., burning fossil fuels such as in generators) is also a major contributor to climate change, which impacts people's health in different ways. Between 2030 and 2050, climate change is expected to cause 250,000 additional deaths per year, from malnutrition, malaria, diarrhea and heat stress (WHO, 2020).

The Sustainable Development Goals Report 2019 (United Nations, 2019) revealed that ambient air pollution from traffic, industry, power generation, waste burning and residential fuel combustion, combined with household air pollution, poses a major threat to both human health and efforts to curb climate change; and more than 90 percent of air pollution related deaths occur in low- and middle- income countries, mainly in Asia and Africa. Surprisingly, despite the myriads of health and environmental hazards that are associated with the use of generators, and the prevalent use of generators among small-scale business in Nigeria, there is a dearth of literature on their knowledge and practices regarding these hazards. This study was conducted to assess the prevalence, knowledge of hazards and practices regarding generator use among small-scale business operators in Sokoto, Nigeria.

MATERIALS AND METHODS

Study Design, Population and Area

This was a cross-sectional study among small-scale business operators in Sokoto metropolis, Sokoto State, Nigeria, in November and December 2014. Sokoto metropolis is both the capital and center of economic activities in the state. It comprises 4 Local Government Areas (of the 23 in the state) with a combined population of 809,387 based on the 2006 census, and covers an area of 60.33 square kilometers (NPC, 2006). The Hausas and Fulanis are the most predominant ethnic groups in the state, they are mainly farmers, while the non-natives belong to Igbo, Yoruba and Igala ethnic groups among others, and are mainly involved in small-scale businesses. Employees and operators of small-scale business establishments that were aged 18 years and above, and have worked for at least 6 months in the respective business establishments and consented to participate were considered eligible for this study.

Sample Size Estimation and Sampling Technique

The sample size was statistically estimated at 285, and the eligible participants were selected by a multistage sampling technique. At the first stage, Sokoto metropolis was divided into 12 business districts and 7 of them were selected by simple random sampling using the ballot option. At the second stage, the selection of business establishments in each of the selected districts was done by systematic sampling technique using the list of business establishments in the respective districts to constitute the sampling frame. One of every 3 business establishments was selected in the selected districts at the end of which 48 business establishments were selected. At the third stage, the selection of participants in the selected business establishments was done by systematic sampling technique using the staff list in the respective business establishments to constitute the sampling frame. One of every 5 eligible participants was selected in the selected business establishments at the end of which 285 participants were selected.

Data Collection and Analysis

A set of pretested, structured, interviewer-administered questionnaire was used to obtain information on the participants' socio-demographic characteristics; and the prevalence, knowledge of hazards and practices regarding generator use among them. The questionnaire was pretested on 20 employees and operators of small-scale business establishments in one of the business districts that were not selected for the study. Five resident doctors assisted in questionnaire administration after being trained on the conduct of survey research, the objectives of the study, and questionnaire administration. Data were analyzed using the IBM Statistical Package for the Social Sciences (SPSS) Version 20 statistical computer software package. Quantitative variables were summarized using mean and standard deviations, while qualitative variables were summarized

using frequencies and percentages. Respondents' knowledge of the hazards of generator use was scored and graded on a 7-point scale. One point was awarded for a correct response, while a wrong response or a non-response received no points. This gives a minimum score of '0' and a maximum score of '7' points. Those that scored ≥ 4 of 7 points were considered as having 'good' knowledge, while those that scored < 4 of 7 points were graded as having 'poor' knowledge. Knowledge of the methods of preventing exposure to the hazards of generator use was scored and graded on a 10-point scale. One point was awarded for a correct response, while a wrong response or a non-response received no points. This gives a minimum score of '0' and a maximum score of '10' points. Those that scored ≥ 6 of 10 points were considered as having 'good' knowledge, while those that scored < 6 of 10 points were graded as having 'poor' knowledge.

Ethical Consideration

Institutional ethical clearance was obtained from the Ethical Committee of Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria. Permission to administer the questionnaires was obtained from the management of the respective business establishments that were selected for the study. Informed consent was also obtained from the participants before questionnaire administration.

RESULTS

Distribution of respondents by age, sex and status in business

All the 285 questionnaires administered were adequately completed and found suitable for analysis giving a response rate of 100%. The ages of the respondents ranged from 18 to 65 years (mean = 28.59 ± 7.09), and majority 177 (62.1%) of the 285 respondents were aged < 30 years. Most of the respondents were males (80.4%) and have worked for ≤ 10 years (91.9%). A slight majority of respondents (50.2%) were employees (Table 1).

Prevalence of generator use among respondents

Majority, 212 (74.4%) of the 285 respondents use fossil fuel electricity generator as an alternative source of energy to run their businesses (Figure 1).

Respondents' knowledge of the hazards of generator use

Majority, 210 (73.7%) of the 285 respondents had good knowledge of the hazards of generator use with the hazards most commonly known to them being fire accident (87.4%), social problems like annoyance and communication problems (80.7%), and exposure to poisonous gases (77.2%). About a third and less of respondents knew the other hazards of generator use (Table 2).

Table 1: Socio-demographic characteristics of respondents

Variables	Frequency (%) n = 285
Age group (years)	
<30	177 (62.1)
30-49	103 (36.1)
≥50	5 (1.8)
Sex	
Male	229 (80.4)
Female	56 (19.6)
Length of stay in business (years)	
≤10	262 (91.9)
>10	23 (8.1)
Status in the business	
Owns the shop/factory	142 (49.8)
Employed to work in the shop or factory	143 (50.2)

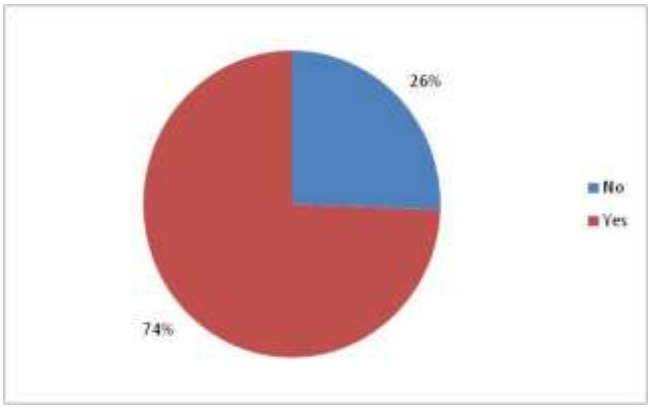

Figure 1: Prevalence of generator among respondents

Respondents' knowledge of the methods of preventing exposure to the hazards of generator use

Most, 270 (94.7%) of the 285 respondents had good knowledge of the methods of preventing exposure to the hazards of generator use with the methods most commonly known to them being avoiding storing fuel inside the shop or near flames (95.4%), operating generator outdoor and far from windows and vents (95.1%), and turning off the generator and allowing it to cool before refueling (92.6%). Most of the respondents also knew the other methods of preventing exposures to the hazards of generator use (Table 3).

Respondents' practices regarding exposure to the hazards of generator use

Majority of respondents had engaged in practices related to exposure to the hazards of generator use such as operating a generator inside or in front of the shop near windows or doors (76.1%), using an old and noisy generator close to the shop or factory (67.0%), and storing fuel inside the shop or near flames (56.1%). The other practices related to exposure to the hazards of generator use ever committed by the respondents are shown in Table 4.

Table 2: Respondents' knowledge of the hazards of generator use

Variables	Frequency (%) n = 285
Knew the following as hazards of generator use:	
Exposure to poisonous gases	220 (77.2)
Social problems like annoyance and communication problems	230 (80.7)
Adverse health effects such as noise induced hearing loss and sleep disturbance	194 (68.1)
Electric shock and electrocution	191 (67.0)
Fire accident	249 (87.4)
Back-feeding into the national grid	140 (49.1)
Damage to equipment and machines	193 (67.7)
Knowledge grading	
Good	210 (73.7)
Poor	75 (26.3)

Table 3: Respondents' knowledge of the methods of preventing exposure to the hazards of generator use

Variables	Frequency (%) n = 285
Knew the following as methods of preventing exposure to the hazards of generator use:	
Operate generator outdoor and far from windows and vents	271 (95.1)
Use sound muffler and enclose generator to reduce noise	257 (90.2)
Operate generator under an open canopy-like structure and dry surface to prevent contact with water	254 (89.1)
Dry hands before touching the generator while in operation	256 (89.8)
Connect appliances correctly using appropriate extension cords	253 (88.8)
Protect electric cord from getting crushed or pinched if it passes through a window or doorway	261 (91.6)
Avoid running electric cords under rug or carpet	262 (91.9)
Avoid storing fuel inside the shop or near flames	272 (95.4)
Turn off the generator and let it cool before refueling	264 (92.6)
Use an appropriate device to prevent back-feeding into the national grid	256 (89.8)
Knowledge grading	
Good	270 (94.7)
Poor	15 (5.3)

Table 4: Respondents' practices regarding exposure to the hazards of generator use

Generator use practices	Frequency (%) n = 285
Operate generator inside or in front of the shop near windows or doors	217 (76.1)
Use an old and noisy generator close to the shop/factory	191 (67.0)
Operate the generator on a wet surface or where water can reach it	146 (51.2)
Touch the generator while in operation with wet hands	152 (53.3)
Use any available electric extension cord irrespective of the load capacity or length	153 (53.7)
Use an electric cord to connect appliances without checking to ensure absence of cuts or tears	160 (56.1)
Run electric cords under rug or carpet	105 (36.8)
Store fuel inside shop or near flames	160 (56.1)
Refuel the generator while it is in operation	121 (42.5)

DISCUSSION

This study assessed the prevalence, knowledge of hazards and practices regarding generator use among small-scale business operators in Sokoto, Nigeria. The high prevalence of use of fossil fuel electricity generators (74.4%) among the respondents in this study is in consonance with findings in studies conducted in other cities in Nigeria including Kaduna (89.9%) (Mbamali et al., 2012), Anyigba (73.2%) (Akande and Owoyemi, 2008), and some cities in South-Southern Nigeria (80.1%) (Ibhadode et al., 2016); and these essentially reflect the grossly inadequate electricity supply across the country.

Although, the high proportion of respondents with good knowledge of the hazards of generators use in this study (73.7%) is in contrast to the low proportion of respondents with good knowledge of generator use hazards in a study conducted in selected areas of Ibadan, Nigeria (44.5% and 53.3%) (Yesufu et al., 2013), awareness of the respective hazards of generator use was similarly high in the studies conducted in other cities across Nigeria (Akande and Owoyemi, 2008; Mbamali et al., 2012; Ibhadode et al., 2016). These findings are reassuring in view of the fact that those concerned are more likely to prevent exposing themselves to these hazards since they are aware of them.

A very disturbing finding in this study is the prevalent engagement in practices related to exposure to the hazards of generator use among the respondents despite the fact that most of them (94.7%) had good knowledge of the methods of preventing exposing themselves to the hazards. Worse of all, the most common hazardous practices among the respondents such as operating generators inside or in front of their shop near windows or doors (76.1%) and using old and noisy generators close to their shops or factories (67.0%) appear to be inevitable in view of the prevalent poverty and unhealthy housing conditions across Nigeria. These findings bring to the fore the enormities of the harsh and dangerous conditions in which small-business operators are inextricably entangled in Nigeria, by having to operate in a country with inadequate and irregular power supply, as only 59% of the population have access to electricity (NPC and ICF, 2019); and having to provide alternative sources of energy supply to run their businesses where they could neither afford new generators that produce less noise and smoke, nor rent conducive premises with sufficient space to operate their generators safely, as about 40% of the population live below the country's poverty line (National Bureau of Statistics, 2020).

It is therefore not surprising that studies conducted across Nigeria reported high prevalence of adverse health and social hazards of use of fossil fuel generators among small-scale business operators. A study among traders by Ighoroje et al. (2004) reported high ambient noise levels (>90dB) in their workplaces, and noise-induced hearing impairment was present in 100% of the workers exposed for a period of 14 years, and by 4-8years, 100% of sawmill workers had developed hearing impairment. An institutional based study among staff, students and business operators by Olamijulo et al. (2016) reported that the mean indoor and outdoor noise levels in all the sampling locations exceeded the World Health Organization (WHO) guideline limits of 35dB and 55dB respectively. Also, about 24.0% of respondents reported experiencing difficulty in hearing clearly when at work, while the major complaints reported by them were tinnitus (34.0%), sleeplessness (68.0%), tiredness (60.0%), ear pains (68.0%), headache (40.0%) and annoyance (28.0%).

A study among commercial workers in Agbowo and Ajibode areas of Ibadan, Nigeria by Yesufu and Ana (2012) reported high prevalence of indoor generator placement (Agbowo, 60.0%; Ajibode, 19.0%), high mean generator sound levels [Agbowo, 100.5 ± 7.5dB(A); Ajibode, 91.2 ± 4.86dB(A)], and high prevalence of non-audictory health effects including headache, tiredness, sleeplessness, irritability, lack of concentration, annoyance and poor social interaction. The high prevalence of generator use and exposure to its hazards despite good knowledge of the hazards and the methods of preventing exposure to them among the respondents in this study underscore the need for the Nigerian government to provide adequate and regular electricity supply across the country.

CONCLUSION

This study showed high prevalence of generator use and practices related to exposure to its hazards among small-scale business operators in Sokoto, Nigeria, despite good knowledge of the hazards and the methods of preventing exposure to them. The Nigerian government should provide adequate and regular electricity supply across the country.

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Conflict of interest
None declared.

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