Assessment of Risk to Indoor Air Pollutants among Computer and Photocopier Business Operators in Tertiary Institutions in Zaria, Nigeria

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Abstract

Background
Exposure to indoor gaseous pollutants is an issue of serious public health importance in Nigeria.

Method
The study was a descriptive cross sectional survey carried out between February and March, 2012 to assess the awareness of risk to indoor air pollutants among computer and photocopier business operators in tertiary institutions in Zaria, Nigeria.Data was collected using semi-structured questionnaires and analyzed using SPSS version 16.0.

Results
Majority (56%) of the respondents were within the agerange of 21 -30 years, about half (51%) were male, 75% single, and 75% had tertiary education. About 93% o the business operators had generators with capacity of 2 - 9 KVA(34%) and majority (33%)of the generators run for 6 – 10 hrs per day. The distance between the generators and the shops was $\leq$ 5 metres in 47% of the cases, the ceiling height and area of the windows were below standard. A good percentage (99%)of the operators were aware of hazards associated with use of generators such as feeling of choking(37%) and dizziness (29%). Measures of controlling the hazards included changing the location of the generators (49%) and direction of the exhaust (40%).

Conclusion
The recommendations included the need for improvement in the national electric power supply by the federal government, connecting the shops to central power supply (generator) by the schools authorities, uniform construction of standard shops and continuous public enlightenment of the public on hazards associated with generator use and preventive measures, among others.

Key words: Indoor air pollutants, Generators, Business centres, Tertiary institutions, Nigeria

Introduction

People's health depends on the continuous balance of inspiration and expiration, the delicate exchange of gases between people and earth's atmosphere and study showed that every man, woman and child exchanges between 10,000 & 70,000 litres of air every 24 hours, just to sustain life (EPA, 2006). This shows how important the physical and chemical properties of indoor air quality.Indoor air quality (IAQ) refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants.IAQ can be affected by gases, particulates, microbial contaminants or any mass or energy stressor that can induce adverse health conditions. Exposure to indoor gaseous pollutants has been an issue of serious concern in most developing countries (Nigeria inclusive), attributing to man's docile

attitudes, poverty and insufficient energy supply.Despite the substantial quantities of pollutants emitted during generator operation into the indoor and outdoor environment, users are unconcerned about the effects (Dingle and Lalla, 2002; Stanley, 2011).The combustion of fossil fuel (diesel, petroleum, kerosene, coal and natural gas) especially petroleum in portable electric power generators for electric power supply in Nigeria has been influenced by the erratic nature of power supply from the national grid. The Power Holding Company of Nigeria (PHCN) is solely responsible for the generation and distribution of electricity which is usually inadequate and erratic (Akande and Owoyemi, 2008).This makes the use of power generators by households,computer and photocopier operators a very common phenomenon in Nigeria, including tertiary institutions.The country's peak electricity demand is 30,000MW, but at present the maximum generation is 3,000MW with losses of 30 – 35% during transmission (Hall, 2006; Stanley, 2008). This has influenced the use of over 60 million electric power generators in the country (Ideriah et al., 2007).The use of generators hasunwanted effects both on the environment and humans.

Indoor air quality affects the well being of building occupants who spent 80-90 % of their time indoor.9Exposure to indoor air pollutants above certain limits is associated with several health implications. Indoor air pollution is the 8th most important risk factor and responsible for 2.7% of the global burden of disease (WHO, 2005).Ventilation has various positive impacts on health and productivity of building occupants (Seppanen & Fish, 2004; Bell et al., 2009).

Study showed that indoor air pollution is one of the most serious environmental threats to human health, yet no agency can regulate it (Gavigan, 2009).Globally, more than 1 million people die yearly from chronic obstructive respiratory disease (COPD) that develop due to exposure to such indoor air pollution (WHO, 2005).

It is important to carry out this study in order to assess the socio-demographic characteristics and risk awareness,among others of persons operating computer and photocopier businesses in tertiary institutions in Zaria, Nigeria. The information generated will help in the mounting of an appropriate health education programmes in the institutions for the business operators, management of the schools, staff and students who patronage such businesses.

The effects of indoor air pollutants range from short-term effects such as eye and throat irritation to long term effects as respiratory disease and cancer. Exposure to high levels of some pollutants, such as carbon monoxide, can even result in immediate death. Also, some indoor pollutants can magnify the effects of other indoor pollutants.

Poor air quality has been limited to be both short and long term health problems and the following conditions can be caused or exacerbated by poor indoor air quality- asthma, allergies and other respiratory problems, headaches, eyes and skin irritation, sore throat, colds, memory loss, dizziness, fatigue and depression among others (Brundaje et al., 1988;USEPA, 2009).

Majority of the students in Nigerian tertiary institutions are poor. Their programmes and accommodations are either financed by families or the students work for money during short breaks and holidays for the fees. There are no opportunities to access scholarship as obtainable in most developed countries. These coupled with the economic situation in the country have made it difficult for the students to afford the necessary educational aids (computer inclusive) for their use. This problem has encouraged the patronage of computer and photocopying business operators around the campuses. The students are charged for the services of typesetting, printing, photocopying, internet access, among others.

Because of unreliable power supply in the country, the use of electric generators by computer and photocopier operators for business is very common especially in the tertiary institutions in Nigeria in order to meet the needs of the staff and students in particular. Very few studies have assessed the risk to indoor air pollutants among computer and photocopier business operators in tertiary institutions in Nigeria.

This study was carried out to assess the risk to indoor air pollutants among computer and photocopier business operators in tertiary

institutions in Zaria, Nigeria, with a view to enlightening the public on the hazards and possible control measures.

MATERIALS AND METHODS

Study Area

Zariais situated in the centre of Northern Nigeria; located on plateau at a height of 2,200 feet (652.5 metres) above sea level. It is positioned between Latitude 110 3'N and 7042'E (Mortimore, 1970).

Zaria metropolis comprises of two local government areas (LGAs); Zaria City and Sabon Gari. These local government areas consist of six districts each. Zaria city consists of Zaria, Tudun Wada, Gyelesu, Tukur Tukur, Wuciciri and Dutsen Abba; while Sabon Gari consists of Sabon Gari, Hanwa, Muciya, Samaru, Basawa and Bomo.

Zaria is a very large heterogeneous city with a population of about 1,490, 000people and located in Kaduna State. It is second in size to Kaduna, the state capital. It possesses a tropical continental climate with a pronounced dry season, lasting up to seven months (October to May). The dry season which is usually cold is experienced between November and February.

Study Design

A descriptive cross sectional type studywas carried out in 3 tertiary institutions located in Zaria, Nigeria between February and March, 2012. The selected schools were Ahmadu Bello University, Zaria (main and Kongo campuses), Federal College of Education, Zaria and Nuhu Bamali Polytechnic, Zaria. The list of all approved computer and photocopier business premises where obtained from the schools market management committees. A list of the attendants in each of the premises was obtained to form the sampling frame and two were randomly selected using simple balloting from each premise where there were more than two attendants, thus giving 100 respondents.The sampling frame was made up of 120 attendants.

Permission was obtained from the owners of the business premises and informed consent obtained from the operators before the data collection instruments were applied.

Data collection Tools

Data was collected with the use of an interviewer –administered questionnaire which had 4 sections. Section A contained socio-demographic characteristics and section B contained questions on generator possession and operational characteristics. Section C had building related issues and section D contained questions on awareness of hazards as well as safety and preventive measures.The investigators were trained to reduce inter-observer errors and the data collection tool was pretested at Kaduna State University, Kaduna, Nigeria and necessary adjustment made.

Data Analysis

The data collected were entered into the computer and analysed using Statistical Package for Social Sciences using version16.0 (Chicago Illinois) software. Discrete variables were presented with the use of tables.

RESULTS

Majority (56%) of the respondents were within the age bracket of 21 -30 years, about half (51%) were male, 75% single and 75% had tertiary education (Table 1).

About 93% of the business operators had generators,96% of the total generator uses petrol as fuel. 34% of the generators have capacity of 2-9 KVA and majority (33%) run for 6 – 10 hrs per day and daily quantity of fuel use was 2.1 – 4.0 litres (36%). The distance between the generators and the shops was $\leq$5 metres in 47% of the cases (Table 2).

About 79% of the shops were built with mud. The ceiling height and area of the windows were below standardand 95% of the shops had fans (Table 3).

A good percentage (99%) of the operators were aware of hazards associated with the use of generators such as feeling of choking (38%) and dizziness (28%). 43% of the respondents complained of smoke in their shops and measures of controlling the hazards included changing the location of the generators (49%) and exhaust of the generator (40%) (Table 4).

Table 1.Socio-Demographic characteristics of the respondents(N= 75)

Variables	Frequency	Percentage
Age in years		
≤20	18	24.0
21-30	42	56.0
≥30	15	20.0
Sex		
Male	38	50.7
Female	37	49.3
Marital status		
Married	19	25.3
Single	56	74.7
Educational level attained		
Primary	1	1.3
Secondary	18	24.0
Tertiary	56	74.7

Table 2.Generator possession and characteristics

Variable	Frequency	Percentage
Generator possession & use(N=75)		
Yes	70	93.3
No	5	6.7
Type of generator		
Petrol	67	95.7
Diesel	3	4.3
Capacity of generator (KVA)		
≤0.9	5	7.1
1.0-1.9	6	8.6
2.0-2.9	12	17.1
5.0-9.0	12	17.1
10.0-19.0	7	10.0
≥20.0	1	1.4
No idea	27	38.6
Generator daily hours in operation		
≤5	42	60.0
6-10	23	32.8
11-15	2	2.8
≥16	3	4.3

Daily quantity of fuel used(litres)		
0-2	5	7.1
2.1-4.0	25	35.7
4.1-6.0	21	30.0
6.1-8.0	7	10.0
>8.0	10	14.3
No idea	2	2.9
Daily amount spent on fuel (N)		
0-150	1	1.4
151-300	6	8.6
301-450	21	30.0
451-600	25	35.7
>600	15	21.4
No idea	2	2.9
Distance away from shop (metre)		
≤5.0	33	47.1
5.2-10.0	19	27.1
10.1-15.0	10	14.3
>15.0	5	7.1
No idea	3	4.3

Table 3.General characteristics of the shops

Variable	Frequency	Percentage
Material used for shop construction (N=70)		
Timber	9	12.9
Metal	5	7.1
Cement Block	56	80.0
Height of shop ceiling from the floor in metre (N=70		
≤2)	8	11.4
2.1-2.9	39	55.7
≥3	14	20.0
No idea	9	12.9
Provision of window (s) in the shop (N=70)		
Yes	35	50.0
No	35	50.0
Surface area of the window for ventilation (m^2) (N=70)		
≤1	22	31.4
1.1-1.44	32	45.7
≥1.45	8	11.4
No idea	8	11.4

Possessing ventilating system in the shop (N-=70)		
Yes	62	88.6
No	8	11.4
Type of ventilating systems in use (N=62)		
Fan	59	95.2
Air conditioner	3	4.8

Table 4. Awareness of Hazards associated with generator use and related issues (N=70)

Variable	Frequency	Percentage
Awareness of hazards		
Yes	69	98.6
No	1	1.4
Types of hazards aware of		
Dizziness	20	28.6
Feeling of Choking	26	37.1
Impaired vision	12	17.1
Death	8	11.4
Others	4	5.7
Complaint of smoke in the shop		
Yes	30	42.9
No	40	57.1
Action taken		
Change generator exhaust direction	28	40.0
Stop generator use	3	4.3
Change generator location	34	48.6
Did nothing	4	5.7
Others	1	1.4

DISCUSSION

The age distribution of the respondents showed that majority are within the productive age range of 21-30 years and 2/3 had tertiary education. This could be as a result of high level of unemployment in the country. Also because male and female equally engaged in the business of computing and photocopying in the studied institutions, that buttressed the fact that, both sexes are affected by the high unemployment issue in the country. Majority being single may not be too far from the aforementioned factor of unemployment. Lack of jobs could discourage most young people marrying.Majority of the operators of these businesses had tertiary education showed that underemployment is also a problem in Nigeria.

Over 90% of the business operators have generators which uses petrol. This is necessary due to the erratic power supply in Zaria and the country at large. The immediate reason why most operators preferred generators that use petrol could be due to the high cost of diesel in the country.Also in 93% of cases, the generators are usually in use for 5- 10hrs daily which in most cases coincides with the hours of lack of electricity from the national grid and hours of

business. Daily quantities of petrol used by the majority of the respondents (66%) were 2.1 – 6.0 litres per day which amounts to N300 – N600 daily($2- 4) spent daily by 74% of the respondents.Thesefinding also showed that the use of solar energy for power generation is not common despite the abundance of sun in Zaria.

Another important variable measured was distance of the generator from the shop. This is important in relation to gaseous emission from the generator that may have a harmful effect on the health of the operators and their customers. Close to half (47%) had the distance $\leq$ 5 metres which is far below standard. A distance of 17.7 metres for small generator is what is required for safety purposes (Stanley, 2011). Closely related to this, are materials used for the construction of the shops, height of the ceiling from the floor, provision of windows in the shop and its size, provision of ventilating system in the shop and the type (Table 3).

In almost 4/5 of the shops cement blocks were used to construct the shops, and height of the ceiling was 2.1 – 2.9 metres in slightly more in 50% of cases, and 50% of the shops have windows but what matters were the sizes of the windows and their positions. The area of the window for ventilation was 1.1- 1.44 m2 in close to half of the shop (46%) which is adequate. About 89% have ventilating system of which 95% were fans. This is understandable in view of the hot weather usually in Zaria except during harmattan, November to January). The use of ventilation among others to dilute contaminants is the primary methods for improving indoor air quality in most buildings (Bako-Biro et al., 2004).Also, ventilation reduces the prevalence of air borne infectious diseases and thus the number of sick leave days.11Almost 99% of the operators were aware of hazards associated with generator use, the highest being choking sensation (37%),followed by feeling of dizziness (28.6%)(Table 4). None of them mentioned noise pollution and other environmental degradation as issues.Almost 4/5 of the respondents said they were aware of ways of reducing generator indoor pollution by changing the location of the generator and the position of the generator exhaust. These are usually difficult to carry out because of the constant change in the direction of flow of wing and usually when there are many customers waiting these may be difficult to carry out.The information on awareness on hazards associated with the use of generators will serves as a baseline and will be used in the mounting of an appropriate health education for the respondents and the general public.

CONCLUSION

The study showed that most of the operators are highly educated in the studied institutions and generator use is very common because of epileptic power supply. Most of the shops are deficient in terms of the building standards.

In view of that, the following recommendations are made:

1. Shops to be given out for business to operators should be constructed for uniformity and to meet standards by estate department of the respective schools.
2. Encouragement of the provision of central electric power generating plant by the schools authorities for use by business centres.
3. Continuous public enlightenment and education of the general public and operators of computers and photocopying machines on hazards associated with the use of generators and how to reduce that by the relevant stakeholders.
4. There is a need to improve the national electric power supply.
5. This is a need to explore the use of solar energy which is environmentally friendly to power the machines buy the business operators among others.

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