Original Article

Awareness of Indoor Air Pollution and Prevalence of Respiratory Symptoms in an Urban Community in South West Nigeria

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ABSTRACT

Background: Air pollution is often perceived as an outdoor public health problem but the air in residential buildings, cars and offices can also be polluted. Indoor air pollution (IAP) is the presence of one or more contaminants in the indoor environment that has a degree of human health risk. IAP is a risk factor for respiratory tract infection and is associated with increased risk morbidity and mortality in developing countries.
Objective: The present study determined the relationship between awareness of IAP and prevalence of respiratory symptoms.
Methods: This was a descriptive cross-sectional study. Respondents were selected using a multistage sampling technique. Data were collected using structured questionnaires with the aid of interviewers.
Results: Two hundred and thirty-nine (95.6%) of 250 who were given questionnaires responded. One hundred and fifty (62.8%) of respondents were aware of IAP. The major source of their information was through the radio in 57 (23.8%). One hundred and four (43.5%) prepare food on the corridor with cooking with a kerosene stove, and 211 (88.3%) were using mosquito coil. Shortness of breath was reported by 49 (20.5%) while 25 (10.5%) expectorated phlegm. Respondents with exposure to tobacco smoke in the indoor environment had a 12-fold likelihood of having phlegm and an 8-fold likelihood of having shortness of breath.
Conclusion: The level of awareness of IAP by the respondents was low in this study. Indoor smoking was a major determinant of respiratory symptoms. There is thus, a need for widespread health promotion to raise awareness about IAP and its effects.

Key words: Air pollution, health promotion, indoor, respiratory symptoms

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INTRODUCTION

Air pollution is the presence of chemicals, particulate matter or biological materials more than ambient concentrations to the level that can cause harm or discomfort to the biotic components of the environment or cause damage to the natural or built environment. Air pollution can occur in the outdoor or the indoor environment. Indoor air pollution (IAP) has been described as the presence of one or more contaminants indoors that carry a certain degree of human health risk. IAP is listed as one of the world's worst pollution problems.[1] Sources of IAP can be biological, physical and chemical contaminants. Air pollution can arise from natural and anthropogenic sources such as forest fires, earthquakes, industrialisation, tobacco smoking, domestic cooking and vehicular or machinery fuel combustion.[2]

Approximately, half of the world's population and up to 90% of rural households in developing countries still rely on unprocessed biomass fuels in the form of wood, dung and crop residues.[2] These are typically burnt indoors in open fires or poorly functioning stoves. As a result, there are high levels of air pollution, to which women, especially those involved in cooking, and their young children are the most vulnerable.

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Despite the availability of clean fuels, households still continue to use simple biomass fuels in developing countries. In general, the types of fuel used become cleaner and more convenient, efficient and costly as people move up the energy ladder. People tend to move up the ladder as socioeconomic conditions improve.[3]

Poverty is one of the main barriers to the adoption of cleaner fuels. The slow pace of development in many countries suggests that biomass fuels will continue to be used by the poor for many decades.[4] In most homes in Africa, cooking with firewood, charcoal or kerosene is the rule rather than the exception.[2] They burn biomass fuels in open fireplaces, consisting of such simple arrangements as three rocks, a U-shaped hole in a block of clay, or a pit in the ground, or in poorly functioning earth or metal stoves. Combustion is usually incomplete in most of these cooking devices resulting in substantial emissions which, in the presence of poor ventilation, produce very high levels of indoor pollution.[3]

Indoor air pollutants are perhaps the most important for residents in the developing countries. Long-term effects include chronic obstructive airway disease, heart disease and lung cancer. Numerous studies have found associations between IAP and acute lower respiratory infection,[4,5] chronic obstructive pulmonary disease[6,7] and lung cancer in the case of coal smoke.[8,9] There is, however, emerging evidence that IAP increases the risk of other child and adult health problems, including low birthweight, perinatal mortality, asthma, otitis media, tuberculosis, nasopharyngeal cancer, cataracts, blindness and cardiovascular disease.[7]

World Health Organization (WHO) estimates that IAP is responsible for 2.7% of the loss of disability-adjusted life years worldwide and 3.7% of high mortality in developing countries. According to a World Bank report, IAP in developing countries is one of the four most critical global environmental problems.[5] More recently, a meta-analysis of 200 publications on IAP in China showed a strong association between IAP and negative health outcomes such as reductions in lung function, immune system impairment and lung cancer.[10]

Studies have shown in different parts of the world and some parts of Nigeria that awareness of IAP is high, but this has not translated into positive action. In Ile-Ife however, the level of awareness is not known, and so it may be difficult to institute any evidence-based intervention. This study was designed to get baseline information that can help in programming and developing control strategies to minimize the effect of IAP. The aim of the study was to assess the level of awareness of residents of Ile-Ife on IAP and the association between the level of awareness IAP and occurrence of respiratory symptoms.

MATERIALS AND METHODS

The study was conducted in Ife Central Local Government Area (LGA), Ile-Ife, Osun State, Nigeria over a 4 weeks period. The study location was Ife Central LGA, a predominantly Urban LGA, carved out of the defunct Oranmiyan, LGA on May 1989. The LGA is made up of eleven wards.

The study was a descriptive cross-sectional study. The sample size was determined using the formula for estimating single proportions as described by Kish and Lesley with the prevalence of awareness of IAP of 82%,[1] level of significance of 95% and precision of 5%. This gave a minimum sample size of 227.

A multistage sampling technique was employed. In the first stage, four wards were randomly selected from 11 while at the second stage in each selected wards, listing of streets were made and a random sample of six streets was made per ward making a total of 24 streets. At the third stage, in each street, a bottle was spun at the centre of the street; the house the bottle faced was the starting point, and every other house in a clockwise direction was selected until 10 houses per street were selected. In each house, a listing of households was made, and one was selected randomly by balloting. If the household picked was not available for questioning or did not give consent, another household was picked.

Data were collected using pretested structured questionnaires with the aid of interviewers who administered the questionnaires. The questionnaires comprised the following sections: The socio-demographic data, housing characteristics, respondents' awareness of IAP, possible pollutants exposed to and 12 months reported symptoms of respiratory symptoms. The instrument used was translated and back translated into Yoruba and checked for content validity. A pre-test was conducted at the staff quarters of Obafemi Awolowo University. The observational checklist was also used to assess distance of cooking area from living area and presence of soot as markers of IAP. Soot was operationalised in the present study to mean blackish carbon deposits on the walls and ceilings.

Data were analysed using Statistical Package for Social Sciences for Windows, version 16.0 (Chicago, Illinois, USA). Data were presented at univariate level with frequency tables and charts while statistical analysis at bivariate level was with the Chi-square and binary logistic regression at multivariate level. The level of statistical significance was set at $P < 0.05$.

Ethical consideration

Ethical Approval was obtained from the Ethical Review Committee of the Institute of Public Health of the Obafemi Awolowo University, Ile-Ife. Informed consent was obtained from the respondents, during the data collection and they were assured that all information obtained will be kept private and confidential.

RESULTS

A total of 239 of the 250 eligible respondents completed the questionnaire. Data on socio-demographic characteristics of the respondents are presented in Table I. Eighty-three (34.7%) of the respondents were aged 50 years and above, 66 (27.6%) were between 20 and 29 years. There were 179 (74.9%)

Table I: Sociodemographic characteristics of the respondents *n*=239

Variables	*n* (%)
Age (years), *n*=239	
<20	17 (7.1)
20-29	66 (27.6)
30-39	42 (17.6)
40-49	31 (13.0)
≥50	83 (34.7)
Male	60 (25.1)
Female	179 (74.9)
Occupation	
Student/unemployed	36 (15.1)
Artisan	76 (31.8?)
Trader	102 (42.7)
Civil servant	20 (8.4)
Professional	5 (2.1)
Education	
No education	33 (13.8)
Primary	45 (18.8)
Secondary	79 (33.1)
Tertiary	37 (15.5)
Missing	45 (18.8)
Monthly income (Naira)	
<7500	69 (28.9)
7500-25,000	77 (32.2)
25,000-500,000	36 (15.1)
No response	57 (23.8)

*Source original

females and 60 (25.1%) males. There were 102 (42.7%) traders followed by 76 (31.8%) artisans. Seventy-nine (33.1%) of the respondents had secondary school education, and 146 (61.1%) were earning N25000 or less monthly.

Table II shows the distribution of the types of houses and the prevalence of various risks factors for IAP). One hundred and forty (58.6%) of the houses were bungalows with carpets as floor covering. For the 77 (32.2%) of the respondents who were cooking in the kitchen, the distance from the kitchen to the living area was 10 m or less in 45 (58.4%) of respondents with 31 (40.3%) of them having soot on the kitchen walls or ceiling. A total of 60 (77.9%) of the kitchens did not have cross ventilation. For the 104 (43.5%) respondents who were cooking on the corridor, the distance from the corridor to the living area was <5 m in all of them; with 55 (52.9%) having soot on the corridor walls or ceiling. For the 32 (13.4%) who were cooking in the backyard, 12 (37.5%) were cooking at a distance of 10 m or less from the living area.

Analysis of the level of awareness of IAP and the source of information showed that 136 (56.9%) of the respondents were aware of IAP. The sources of information were a mostly radio in 55 (23.0%), television in 28 (11.7%) and newspapers in five (2.1%). The other sources of information included personal experiences, hospital, seminars, peers and schools in 76 (31.8%).

Table II: The distribution of types of houses and the prevalence of risks factors for indoor air pollution

Variables	*n* (%)
Type of building; *n*=239	
Bungalow	140 (58.6)
Storey building	99 (41.4)
Floor type; *n*=239	
Mud	10 (4.2)
Concrete	88 (37.0)
Tile	8 (3.4)
Carpet	140 (58.8)
Rug	41 (17.2)
Others	3 (1.3)
Cooking area; *n*=239	
Kitchen	77 (32.2)
Corridor	104 (43.5)
Backyard	32 (13.4)
Living room	26 (10.9)
Distance of kitchen to living area (m); *n*=77	
<5	24 (31.2)
5-10	21 (27.3)
>10	32 (41.5)
Soot in kitchen; *n*=77	
Yes	31 (40.3)
No	46 (59.7)
Cross ventilation; *n*=77	
Yes	17 (22.1)
No	60 (79.9)
The distance from corridor to living room; *n*=104	
<5 m	104 (100.0)
Soot in the corridor; *n*=104	
Yes	55 (46.6)
No	63 (53.4)
Distance of backyard to living area (m); *n*=32	
<5	6 (18.8)
5-10	6 (18.8)
>10	20 (62.4)

*Source original

Table III shows distribution of the responses of the respondents on possible causes of IAP. The commonly reported causes by the respondents were dust in 223 (93.3%), improvised kerosene lamp 220 (92.1%) and firewood in 215 (90.0%) while over 80% each reported that kerosene stove, generator, cigarette smoking and use of mosquito coil were sources of IAP, and about 50% reported that the use of perfume, electric cooker and gas cooker were the sources of IAP.

Table IV shows the sources exposure to smoke as a cause of IAP. Household cooking methods were the major source of smoke. Kerosene stove was the mode of cooking by 214 (89.9%) of the respondents, followed by firewood in 41 (17.2%) and coal pot in only 4 (1.7%). Other major sources of smoke were mosquito coil in 105 (43.9%) and smoking within the house in 25 (10.4%).

Table V shows the knowledge of the respondents on possible remedies to reduce IAP. Only 93 (38.9%) of respondents

Table III: Respondents' knowledge on possible causes of indoor air pollution

Possible causes of indoor air pollution (*n*=239)	*n* (%)		
	Yes	No	Don't know
Electric cooker	123 (51.5)	62 (25.9)	54 (22.6)
Gas cooker	128 (53.6)	46 (19.3)	65 (27.2)
Kerosene stove	185 (77.4)	34 (14.2)	20 (8.4)
Coal pot	170 (71.1)	30 (12.5)	39 (16.3)
Cigarette	211 (88.3)	7 (2.9)	21 (8.8)
Firewood	215 (90)	11 (4.6)	13 (5.4)
Mosquito coil	211 (88.3)	10 (4.2)	18 (7.7)
Generator	201 (84.1)	13 (5.4)	25 (10.5)
Improvised kerosene lamp	220 (92.1)	5 (2.1)	14 (5.9)
Overcrowding	213 (89.1)	14 (5.9)	12 (5.0)
Leftover food	209 (87.6)	15 (6.3)	15 (6.3)
Dust	223 (93.3)	9 (3.8)	7 (2.9)
Perfume	122 (51.1)	53 (22.1)	64 (26.8)
Insecticide	185 (77.4)	22 (9.2)	32 (13.4)
Pets	145 (60.6)	40 (16.8)	54 (22.6)

*Source original

Table IV: Sources of exposure to smoke as a cause of indoor air pollution

Variable (*n*=239)	*n* (%)
Mode of cooking*	
Kerosene stove	214 (89.9)
Firewood	41 (17.2)
Coal pot	4 (1.7)
Others	4 (1.7)
Other sources of exposure to indoor air pollution	
Smoking in household	25 (10.4)
Mosquito coil	105 (43.9)

*Source original

reported having knowledge on remedies to reduce exposure to IAP. Of the 93 respondents, operating generators far from room, cooking far from room and cleaning of dust were the most reported remedies in 13 (14.0%), 12 (12.9%) and 12 (12.9%), respectively.

Table VI shows the frequency of the reported respiratory symptoms in the preceding 12 months. Shortness of breath was the most common respiratory symptom reported by 49 (20.5%) while 34 (14.2%) reported cough without a cold and 24 (10.0%) were expectorating phlegm.

Multiple regression analysis showed that exposure to passive smoking was the risk factor associated with expectoration of phlegm (odds ratio [OR] = 12.2, 95% confidence interval [CI] = 2.25–65.9, P = 0.004), indicating that a history of exposure to smoking in the household had a 12-fold likelihood of producing phlegm. Regression of shortness of breath against selected covariates showed respondents that had a history of exposure to smoking in the household had an 8-fold likelihood of having shortness of breath (OR = 8.36, 95% CI = 1.54–45.44, P = 0.01).

Table V: Knowledge on possible remedies to reduce indoor air pollution

Variables	*n* (%)
Knowledge on remedy to reduce exposure to indoor air pollution; *n*=239	
Yes	93 (38.9)
No	146 (61.1)
Possible remedies; *n*=93	
Alternates firewood with kerosene stove	3 (3.2)
Cooks outside the room	12 (12.9)
Avoids leftover food	1 (1.1)
Avoids overcrowding	3 (3.2)
Changed from mosquito coil to net	1 (1.1)
Cleans stove regularly	1 (1.1)
Cleaning of dust	13 (14.0)
Cooks in the kitchen	1 (1.1)
Does not keep pets	1 (1.1)
Leaves room when using mosquito coil	11 (11.8)
Uses generator far from room	13 (14.0)
Ensures good ventilation	9 (9.7)
Isolation	1 (1.1)
Leaves stove area after putting out fire	6 (6.5)
Reduces the frequency of use of mosquito coil	3 (3.2)
Maintenance of lantern/stove	4 (4.3)
Stopped using improvised kerosene lamp	2 (2.2)
Wets floor before sweeping	1 (1.1)
Uses netted windows	1 (1.1)
Avoids dust/smoke	3 (3.2)
Regulates stove	2 (2.2)
Smokes outside	1 (1.1)

*Source original

Table VI: Reported respiratory symptoms in the preceding 12 months

Variables*	*n* (%)
Cough when there is no cold	34 (14.2)
Cough on most days of the month	10 (4.2)
Cough on most days for as much as 3 months in a year	4 (1.7)
Produce phlegm	24 (10.0)
Phlegm on most days of the month	8 (3.3)
Shortness of breath	49 (20.5)

*Multiple answers allowed, *Source original

DISCUSSION

People generally associate air pollution with exposure of the public urban outdoor settings. On the other hand, indoor environments have air pollutants from both outdoor and indoor sources which are poorly understood by the communities. Most exposures to health-damaging indoor air pollutants occur in the developing world. As a result, much of the ill health impacts from indoor pollutants occur among the poorest and most vulnerable populations; largely women and their young children.[11]

This study showed that 56.9% of the respondents were aware of IAP. This was lower than 83.9% reported by Oke-Oyi in

Kwara State[1] and 73% reported in Beijing, China.[12] This was surprising considering that the present study was conducted in a University town where the awareness of IAP was expected to be high. The most common source of information was radio which was similar to report by Osagbemi *et al.*[1] This underscores the popularity of radio as a medium of infotainment for many households in Nigeria.

Kerosene stoves were being used by 90% of the respondents, though this was not the cleanest available source of energy. The proportion of respondents using stoves in the present study was much higher than was reported in a previous study.[1] It is known that the position on the energy ladder correlates with socio-economic status. Thus, the preponderant use of Kerosene stoves in the present study suggests that majority of respondents were below middle class. The was corroborated by the fact that over 35 (61%) of the respondents were earning below N25,000.00 monthly which was about $5 per day. Even if some of the respondents wished to use a cleaner source of energy they might be unable to escape the poverty trap because cleaner energy sources were more expensive. The frequent power outages experienced in the country would make it difficult for the populace to use electric cookers as an alternative regular source of energy.

Use of mosquito coil was also common among the respondents in this study. Use of mosquito coil had been associated with ill-health in some Asian studies.[12] Nigeria lies within mosquitoes are very common. Further study is needed on alternative methods for preventing mosquito bites.

Thirty-nine per cent of the respondents had knowledge of the remedies that could reduce or prevent exposure to IAP. The knowledge base was much lower than the proportion of 64% in the Beijing study where of the residents demanded strict control of indoor air quality.[13] The difference could, therefore, be attributed to the higher literacy level in the China and therefore higher awareness of the problems that are associated with IAP.

About 43.5% of respondents were having their cooking points on the corridor at a distance <5 m from the living room area; while a third were cooking in the kitchens; of which 58.5% were located at a distance <10 m from the living room area. This would provide ample opportunities for the diffusion of smoke into the living area thereby reducing the indoor air quality. These findings were similar to that reported by Oyebanji *et al*.[7] in Odeda LGA of Ogun State.

Coughing and shortness of breath were the most common respiratory symptoms reported in this study; similar to the reports in previous studies.[1,7] Both symptoms together with expectoration of phlegm were strongly associated with exposure to passive smoking confirming seriousness of the health hazards of exposure to passive smoking. Respondents who were passive smokers in the present study had a 12.2-fold increase of expectorating phlegm. This odd found in the present study was much higher than the value of 1.41 reported a study in Los Angeles.[14] This could be attributed to the fact that the respondents in the study conducted in Los Angeles were all student nurses, who likely knew the health implications of exposure to tobacco smoking in the environment and IAP; therefore, reduced their exposure to the health hazards. This was in contrast to the present study in which most of the respondents were not health workers. It was also possible that there was an interaction between smoke from cigarettes and other sources of IAP which might have increased their risk of producing phlegm. The evidence in this regard was inconclusive and therefore requires further investigations.

CONCLUSION

The level of awareness of respondents on IAP was low in the present study. Most of them who had the awareness also had good knowledge of the causes of IAP. Despite the knowledge of causes of IAP, many of them were still involved in the health hazardous activities in their daily living probably due to their low socio-economic status. Respiratory symptoms were not very common in the respondents in the present study, though indoor air exposure to passive smoking was likely to produce symptoms, including phlegm expectoration. There is a need for massive and widespread health promotion campaigns to raise awareness among the people on the acute and chronic health risks of IAP, in particular, the indoor environmental exposure to passive tobacco smoking.

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Conflicts of interest

There are no conflicts of interest.

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