



PERCEIVED ADVERSE HEALTH EFFECTS OF EXPOSURE TO PARTICULATE MATTER AMONG RESIDENTS OF PORT HARCOURT

Clement, Emmanuel Etim¹, Apugo, Uchechukwu. I.², Ukiwe, Okorafor Okorafor³
Okoro, Sylvia Ngozi⁴, Kenneth-Ohaeri, Christie Ugochi⁵, Nliam, Georgeline O.⁶
Etokwudo, Onyeka Stanley⁷

¹M.Sc Environmental Health, School of Public Health, University of Port Harcourt

²M.Sc Human Physiology, University of Port Harcourt

³MBBS, MPH, School of Public Health, University of Port Harcourt

⁴MPH, School of Public Health, University of Port Harcourt

⁵MPH, School of Public Health, University of Port Harcourt

⁶M.Sc Environmental Health, School of Public Health, University of Port Harcourt

⁷M.Sc Epidemiology, School of Public Health, University of Port Harcourt

ABSTRACT

Background: In recent years, there has been a public outcry in Port Harcourt over the presence of black particulate matter (PM) on surfaces, and in the nostrils, prompting health concerns. The study is to assess the knowledge, attitude, and perceptions of the adverse health effects of exposure to PM among residents in Port Harcourt metropolis.

Method: The study was carried out using a cross-sectional design technique, while data was collected using a structured, self-administered questionnaire, administered to respondents residing in Port Harcourt during the period of public outcry, 2016 to 2020.

Results: The questionnaire was administered to 400 respondents, 260 (65.0%) of whom are females. Most (96.0%) of the respondents were below the age of 50 years, of the Christian faith (96.0%), and had a tertiary education 270(67.5%). Finding from this study showed that the majority of the respondents (54.8%) have only fair knowledge of the adverse health effects of exposure to particulate matter, while 75.5% had poor attitude towards preventing the adverse health effects of exposure to PM. Most of the respondents (92.3%) in this study have poor perception towards the adverse effect of exposure to particulate matter.

Conclusion: The fair knowledge of the adverse health effects of PM among the respondent translated to poor attitude and perception towards its adverse health effects. Hence, an intense sensitization is required to boost the knowledge of the populace on the adverse health effect of exposure to soot so as to increase their attitude towards preventive measures and perception of the adverse effect of the menace.

KEYWORDS: Knowledge, attitude, perception, adverse effects, exposure, soot, particulate matter.

I. INTRODUCTION

Indoor and outdoor air pollution has been a major challenge worldwide and a serious public health issue particularly in the developing world due to the numerous risks and increasing concerns over its adverse health effects on human health. It is ranked the 4th health threat and the largest among all of the environmental risks to be associated with an annual

death rate of over 3 million globally.¹ Reports also shows that approximately 3.7 million and 4.3 million premature deaths in 2012 were attributed to outdoor and indoor air pollutions respectively.^{1,2}

Approximately 8 billion cubic meters of gas containing pollutants such as particulate matter (PM), ozone (O₃), nitrogen oxides (NO_x), volatile organic compounds (VOC), sulphur



dioxide (SO₂) and metals are flared every year at different oil production sites in Nigeria.³ Amongst the array of pollutants, the emphasis of this study is on PMs, which are particles of variable but very small diameter and are composed of black carbon, sulfate, nitrates, ammonia, sodium chloride, mineral dust and water.⁴ According to the United States Environmental Pollution Agency (USEPA), Particles of about 10µm (PM₁₀) or larger are typically trapped in the upper respiratory tract, preventing them from penetrating deeply into the respiratory tract, whereas particles of about 5µm or smaller can penetrate deeply into the lungs where the gas exchange occurs in the alveoli and impart a variety of severe health outcomes, including acute bronchitis and aggravated asthma in children, cardiac arrest, strokes, and early death.

The ultra-fine particulate matter (soot) measures about 2.5 microns (PM_{2.5}) and has been regarded as the leading cause of global pollution-related mortality.⁵ They can penetrate the respiratory system via inhalation, causing respiratory and cardiovascular diseases (lung inflammation, emphysema, pneumonia, bronchitis, asthma, respiratory tuberculosis, vascular dysfunction, and increased thrombosis), reproductive and central nervous system dysfunctions, and cancer,⁶⁻⁸ while Ohimain et al.⁶ reported that prolonged exposure to high concentration of particulates could damage eyes, teeth, and bones.

Seeing the great negative potentials associated with exposure to PM, it is unfortunate to note that the emission of ultrafine particulate matter into the atmosphere have continued to rise globally, with this phenomenon palpably visible within the city of Port Harcourt which houses most of the oil exploration companies and illegal oil refining activities. This signifies a huge backward step from the progress made between 2005 and 2010 in the reduction of emissions due to various industrial and non-industrial operations and processes by 29%.⁹ This current poor air quality due to soot emission further aggravates the existing poor air quality situation of the region, suggesting a “double air pollution burden” as a result of the unresolved prevailing widespread air pollution due to stench smell from improper waste disposal management system and the emergence of particle pollution.¹⁰⁻¹¹

Though there has been a great level of awareness of this fact from different quarters, much attention is not being paid to the knowledge of its adverse effects on human health. Some existing studies have investigated knowledge and perception concerning air pollution and breathing experience among residents in Port Harcourt as well as the potential health impact of continuous exposure to soot,¹²⁻¹³ while some others have only emphasized the poor air quality in the metropolis.¹⁴⁻¹⁵ Hence, this study was hinged on investigating the knowledge level, attitude and perception of residents in Port Harcourt metropolis to the adverse human health effects of exposure to soot. Recommendations by Odonkor and Mahami,¹⁶ can play a significant role in the development and implementation of necessary intervention programmes to curb the menace.

II. METHODOLOGY

Study Design and setting

This survey adopted a descriptive cross-sectional study design and was set in the metropolitan city of Port Harcourt, Rivers State. The city occupies approximately 1811.6km² area, a multi-national, multi-cultural, and multi-religious community with a population of about 1.5 million.^{17,18} The city is situated in the southernmost part of the country, in the Delta of the Niger River, with a total size of 109 square kilometres. The city is located between the Dockyard Creek/Bonny River and the Amadi Creek, with an estimated mean elevation of 12 km above mean sea level.¹⁸ Since there are hardly any high lands in Port Harcourt, its topography, geographical location, land breezes, and occurrence of Harmattan make it possible for emissions to spread quickly throughout the city.¹⁹ Hence, periodic plumes of pollutants from industrial discharges (a principal source of air pollution) constitute a frequent occurrence in the city.²⁰ The activities of the multinational companies (especially oil and gas companies) and illegal refining of crude oil has significantly contributed to the poor ambient air quality of the city. For instance, soot results from gas flaring or pipeline explosion deposits on nearby surfaces including buildings and vegetation covers causing respiratory problem.

Study Population

The study consists of male and female genders from all age who are resident in Port Harcourt metropolis where the soot is also mostly observed.

Sample Size and Technique

The sample size for the study is 400 this was gotten using the Taro-Yamane formula,²¹ at 95% confidence level, population size of 538,558 according to 2006 National Population Commission census. The study adopted the use of the multi-stage sampling method in recruiting the respondents for the study

Study Instruments

The tool used for data collection was a pre-tested, structured questionnaire designed in line with the study objective, to elicit response from the respondents.

Statistical Analysis

Data analyses was done using SPSS version 22.0 (IBM, U.S.A) and Microsoft excel 2010. Descriptive statistics and t-test were used to analyse data obtained from the study. This was done using SPSS version 22.0 (IBM, U.S.A) and Microsoft excel 2010. The section on the knowledge, attitude and perception towards adverse health effects of the soot were scored using the correct answers to the questions as provided by the respondents. Each correct answer was scored 1 mark and cumulated to 100% and graded as follows: Poor knowledge (0 – 49%), Fair knowledge (50 – 74%) and Good knowledge (75 – 100%), while that of attitude towards preventive measures and



perception towards adverse health effects of soot was graded as negative practice (0 – 49%) and positive practice (50 – 100%).

Ethical Consideration

Ethical clearance was obtained from the University of Port Harcourt Research Ethics Committee and the Rivers State Ministry of Health before commencement of the study.

III. RESULTS

Socio-demographic Characteristics of Respondents

Table 1 show the analysis of the socio demographic characteristics of the respondents. According to the result, most respondents are female (65.0%), aged 31 – 40 years (42.5%), Married (54.5%), Christians (96.0%), educated up to the post graduate level (67.5%), employed as civil servants (34.3%) and had a monthly income level of > 90,000 (50.5%). Majority of the respondents (74.0%) indicated that they have lived in Port-Harcourt for 1 – 20 years, while 217(54.3%) spend most of their time outdoors.

Table 1: Socio-economic characteristics of respondents

Variable	Frequencies (n=400)	Percentage (%)
Sex		
Male	140	35.0
Female	260	65.0
Age		
21-30	149	37.3
31-40	170	42.5
40-50	65	16.3
≥51	16	4.0
Marital Status		
Single	177	44.3
Married	218	54.5
Divorced/separated	3	0.8
Widowed	2	0.5
Religion		
Christianity	384	96.0
Islam	11	2.8
Traditional	1	.3
Others	4	1.0
Highest level of education completed		
Primary	1	0.3
Secondary	8	2.0
Tertiary	121	30.3
Post-graduate	270	67.5
Employment status		
Civil servant	137	34.3
Self-employed	88	22.0
Employed in private sector	106	26.5
Others	69	17.3
Income		
None	59	14.8
<30,000	33	8.3
30,000-60,000	48	12.0
60,001-90,000	58	14.5
> 90,000	202	50.5
How long have you lived where you live now (386)		
1-20	296	74.0
21-40	103	25.8
≥41	1	0.3



Do you spend more time outdoor		
Yes	217	54.3
No	183	45.8
Do you spend more time indoor		
Yes	198	49.5
No	202	50.5

Knowledge of adverse effect of Soot

Table 2: Knowledge of human adverse health effects of particulate matter

Variable (n=400)	Frequencies	Percentage (%)
Knew that exposure to soot can lead to COPD	366	91.5
Knew that exposure to soot can cause skin irritation	306	76.5
Knew that exposure to soot can cause loss of vision	189	47.3
Knew that exposure to soot can cause underweight among under-five children	145	36.3
Can the following respiratory systems be affected by soot		
Nose	350	18.5
Mouth	150	7.9
Throat	306	16.1
Voice box	171	9.0
Windpipe	234	12.3
Airways	330	17.4
Lungs	356	18.8
Soot cause more adverse effects on children compared to adults	281	70.3

The analysis of the knowledge of the adverse health effect of soot as presented in table 4.3 indicates that majority of participants, knew that exposure to soot can lead to chronic obstructive pulmonary disease (91.5%), skin irritation (76.5%), loss of vision (47.3%) and underweight of under-five children (51.5%). Also, majority of the respondents are aware that exposure to soot can affect the different organs of the respiratory system such as; lungs (18.8%), nose (18.5%), airways (17.4%), throat (16.1%), windpipe (12.3%), voice box, (9.0%) and mouth (7.9%), while 281 (70.3%) of the respondents agreed that exposure to soot causes more adverse effects on children compared to adults. Further analysis of this result showed that 219 (54.8%) of the respondents has fair knowledge of the adverse health effects of particulate matter on their health, while 161 (40.3%) had a good knowledge of the same and the remaining 20 (5%) had poor knowledge.

Attitude towards adverse health effects of exposure to particulate matter

The result of the attitude of the respondents towards preventing exposure to soot and curtailing its adverse effect on

their health is presented in Table 3 above. According to the findings, majority of the respondents, stated that they try to close their doors (82.5%) and windows (78.3%) at night to reduce the amount of soot entering their rooms, while more than half, 233(58.3%), of the participants do not remember or try to wear protective clothes to reduce the amount of the soot falling on your body. The table also show that most respondents, 209(52.3%) and 243(60.8%) do not remember or try or like the use of nose mask and glasses respectively, when at a place of high level of soot, while 355(88.8%) and 339(84.8%) stated that they remember or try to wash their hands regularly after touching soot surfaces and bath regularly after being exposed to soot or spending time outside their rooms respectively. Furthermore, 313(78.3%) stated that covering food is a very effective way of preventing the adverse effects of the black. Further analysis revealed that majority of the respondents, 302 (75.5%), have poor attitude while 98 (24.5%) had good attitude towards the human adverse health effects of particulate matters.



Table 3: Attitude towards adverse health effects of particulate matter

Variable (n=400)	Frequencies	Percentage (%)
Closing doors at night to reduce entry of soot into the room	330	82.5
Closing windows at night to reduce entry of soot into the room	313	78.3
Wear protective clothing to reduce exposure of the skin to soot	167	41.8
Use of nose mask to prevent breathing in soot	191	47.8
Use of glasses when you are at a place of high level of soot	157	39.3
Regular washing of hands after touching soot surfaces?	355	88.8
Regular bathing after prolonged time outdoor stay?	339	84.8
Covering food after dishing or cooking to prevent exposure to soot	313	78.3

Perception towards adverse health effects of exposure to particulate matter

The figure 1 below shows the perception of the respondents on the adverse effect of exposure to particulate matter.

According to the chart, 369 (92.3%) which represents majority of the respondents had poor perception, while 31 (7.9%) of the respondents had good perception of human adverse health effects of particulate matters

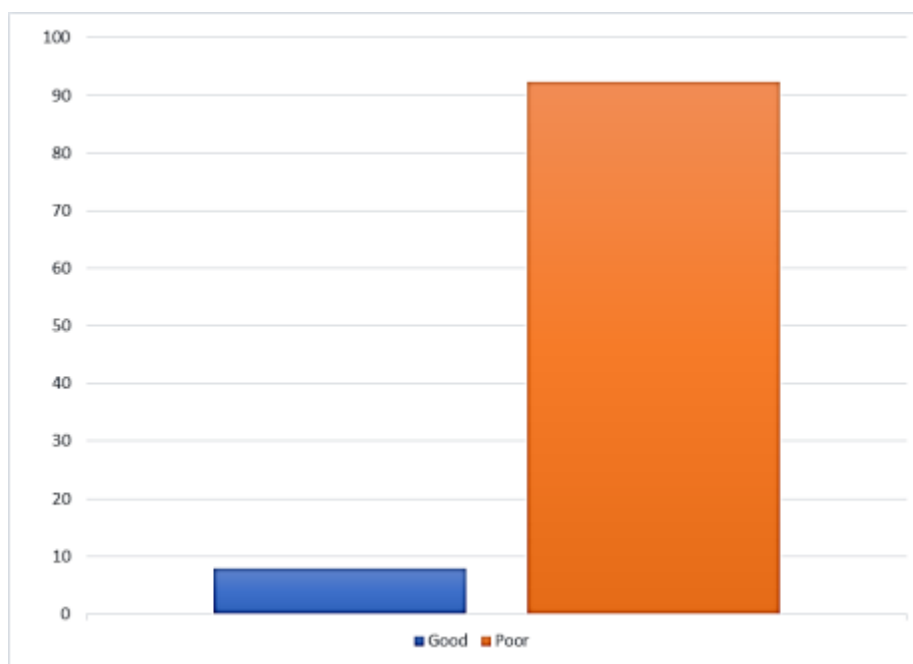


Figure 1: Perception of respondents towards adverse health effects of exposure to particulate matter

IV. DISCUSSION

Knowledge of adverse health effects of exposure to particulate matter

Breathing in good quality, clean and healthy ambient air daily, remains an essential physiological need for an effective and efficient human function and well-being.²² Hence, the presence of pollution in the form of PM constitutes a major threat to human health and environmental challenge across most cities of the world.¹³ According to the responses generated with regards to the knowledge of adverse health effects of exposure to PM, majority of the respondents knew that exposure to soot can cause chronic obstructive pulmonary disease (91.5%), skin irritation (76.5%), loss of vision (47.3%) and underweight of under-five children (51.5%). This translated only to fair

knowledge among 54.8% of the respondents. A similar study by Kanee et al.¹³ on air pollution and breathing experience of residents in Port Harcourt during COVID-19 Pandemic lock-down reported that only 24% of the respondents were very aware of health consequences of air pollution. Other similar studies conducted by Wang et al.²² and Odonkor and Mahami¹⁶ in China and Accra showed that 80% and 70.5% of their respondents, respectively, were aware of the adverse effects on health, while the studies of Afolabi et al.²⁴ and Qian et al.²⁵ recorded high level of awareness on air pollution and its health consequences. Congruent with the knowledge of the respondents on the adverse effect of exposure to soot is the growing evidence published by WHO which shows that fetus and young children are especially susceptible to PM,²⁶ while continuous exposure to it may be



implicated in the increase in the occurrence of childhood asthma, cancer, and developmental disabilities in recent decades.^{27,28}

Attitude towards adverse health effects of exposure to particulate matter

The respondent's attitude towards preventing the adverse health effects of exposure to particulate matters is poor (75.5%). According to the responses, to close their doors (82.5%) and windows (78.3%) at night to reduce the amount of black soot entering the room, while 58.3% do not remember or try to wear protective cloths or use nose mask (52.3%) and glasses (60.8%) when at a place of high level of soot. However, 88.8% try to wash their hand regularly after touching soot surfaces while 84.8% try to bath regularly after being exposed to soot or spending time outside their room respectively. Contrary to this, majority of the respondents in the study of Qian et al.²⁵ were reported to have developed some practices that indicated some certain self-protection consciousness such as using air purifiers, putting up green plants, reducing outdoor exercise and weekend travel, as well as wearing face masks. In the study of Majumder et al.²⁹ over 50% of the respondents never avoided outdoor activities and only 30% regularly reduced window opening time to air the room, while only about 40% use facemasks on a regular basis. Furthermore, evidence according to Morishita, Thompson & Brook³⁰ did show that measures such as air filtration, closing windows and air conditioning, using a particulate respirator feasible and effective in reducing air pollutant.

Perception towards adverse health effects of exposure to particulate matter

Most of the respondents in this study have poor perception towards the adverse effect of exposure to particulate matter (92.3%). The findings revealed that majority believe that exposure to soot can cause cough (85.8%), irritation to the eyes/nose/throat (92.0%), skin irritation (80.3%), worsen already existing allergies (89.5%), asthma (91.0%), bronchitis (86.0%) and lung cancer (86.3%) as well as lead to breathlessness (76.0%), or blurry vision (66.8%). Comparing this finding with the report in the study of Whyte et al.³¹ which assessed the perception of residents of Rivers state on soot pollution revealed that 69.9% and 64.2% perceived that the soot exposure caused them chronic cough and irritation to eyes, nose and throat respectively. Another study carried out in Delta State also showed that most respondents had strongly agreed that air pollution had negative harmful effects on health.³² Also, the result in the study of Omanga et al.³³ showed that 80% of study participants in rural Kenya perceived that air pollution posed a serious risk to their health, while Gany et al.²³ reported that 81% of the Taxi drivers in New York city thought that air pollution in general causes health problems.

V. CONCLUSION AND RECOMMENDATION

The overall outcome from this study revealed that knowledge of the adverse health effects of PM among the respondent is fair and this translated to poor attitude towards preventive activities and perception towards its adverse health effects. Hence, an intense sensitization is required to boost the knowledge of the populace on the adverse effect of exposure to soot so as to increase their attitude towards preventive measures and perception of the adverse effect of the menace. Also, the government and policy makers should implement complementary policies that will arrest the increase in the emission of soot in the environment.

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