



Effects of Crude Oil Exploration Activities on Okpai Community of Delta State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Editor(s):

(1) Dr. Suprakash Chaudhury, Professor, Department of Psychiatry, Dr D. Y. Patil Medical College-Hospital & Research Center, Pune, India.

Reviewers:

(1) Opeyemi Abdulahi Ojelade, King Abdulaziz University, Saudi Arabia.
(2) Awofadeju Stephen Olajide, Obafemi Awolowo University Teaching Hospitals Complex, Nigeria.
Complete Peer review History: <http://www.sdiarticle4.com/review-history/54418>

Original Research Article

Received 01 December 2019
Accepted 05 February 2020
Published 17 February 2020

ABSTRACT

With seemingly increasing global demands for crude oil, its related products have become a major threat with preponderant deleterious effects on human environmental health. Current study investigated the effects of crude oil exploration and exploitation activities on Okpai community in Ndokwa East Local Government Area of Delta State, Nigeria. Using the purposive sampling technique, about one hundred (100) residents of Okpai community who have lived there (or in the Niger Delta) for 3 or more years were ethically recruited from an estimated population of 7, 000 inhabitants of the target community (Okpai) for this study. Participants were then recruited into three focus groups; each consisting of individuals who met the selection criteria. The groups were gathered prior to conducting an oral interview. Socio-demographic variables were then obtained after which informed consents and ethical approval was given. Participants were immediately issued questionnaires to obtain relevant information relating to oil exploration activities in their community with reference to daily changes. Group 1 consisted of equal numbers of interviewees of age 18-30 (50%); whereas, groups 2 and 3 comprised of larger proportion of participants between 31-45 (50%) and 45-60 (83%) respectively. Obtained data were then analysed and expressed as

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mean \pm Standard deviation of simple percentage, while presenting in statistical tables and chats. Following careful observation, study revealed a statistically significant ($p < 0.5$) increase in the effect of oil exploration on most of the activities of Okpai community, indicative from respondents that crude oil exploration greatly negatively affected Okpai community activities. Study also demonstrated the perception of participants on the effect of oil exploration activities on the physical health of the inhabitants within the study area. Psycho-social effect of exposure to oil-related environmental degradation amongst individuals in developing nations is also recommended for future investigations relating to this topic.

Keywords: Oil spillage; Okpai community; environment; exploration.

1. INTRODUCTION

For decades now, there has been an abrupt surge in the global demand for crude oil with increasing value on the commodity [1]. Developed nations, which represent the largest consumers of crude oil are comfortably removed from the havoc that oil discovery, drilling, and transport causes to the regions where oil is extracted [2]. Over time, the threats that crude oil exploration activities pose to health indices in humans has received a significant global attention. However, the damage caused by these spills, such as the one that affected the Gulf Coast of the United States in 2010, is disproportionate to the pollution that routinely affects the Niger Delta region of southern Nigeria [3].

Crude oil; which is also known as Petroleum or Black gold is a naturally occurring oily, bituminous liquid composed of various organic compounds in the form of hydrocarbons [4]. It is found in large quantities underneath the Earth and is used as fuel for raw materials in chemical industries. Less than 100 years ago, modern industrial societies use it primarily to achieve a degree of mobility on land, sea, and in the air. Petroleum and its derivatives are used in the manufacture of medicines and fertilizers, foodstuffs, plastics, building materials, paints cloth and to generate electricity [5].

The chemical composition of crude oil is principally hydrocarbons, although a few sulphur-containing and oxygen-containing compounds are usually present; the sulphur content varies from about 0.1 to 5 percent [6]. Petroleum contains gaseous, liquid, and solid elements, varying from liquid as thin as gasoline to liquid so thick that it will barely pour. Small quantities of gaseous compounds are usually dissolved in the liquid; when larger quantities of these compounds are present, the petroleum deposit is associated with a deposit of natural gas [7].

Available reports suggest that there exists a connection between oil abundance and low levels of development since oil discovery [8]. This traces to the exploitative effect of oil in fueling internal corruption and conflict, encourages unethical corporate behaviour, promulgation of violence against human rights, environmental degradation and health hazards on aquatic and terrestrial lives [9].

Health-wise, one of the adverse effects which accompany prolonged exposure to flared environmental gases (as seen in the case with Niger Delta) is cardio-vascular and pulmonary abnormalities. Miller (2007) reported high incidences of cardio-pulmonary morbidities in pre-disposed subjects within gas flared environs in developing countries [10]. Study carried out on women predisposed to air pollutants reportedly asserts that prolonged exposures to air pollution are linked with ischemic type of stroke instead of the hemorrhagic [10]. Polluted air has also been related (by several studies) to increased incidences of coronary and cerebrovascular ailments [11].

Air pollution has been asserted to contain bursts of toxic chemical compounds that may be dangerous and harmful to the human health upon prolonged exposures. Such compounds are unlimited to hydrogen sulphide (H_2S), carbon disulphide (CS_2), benzene, toluene, xylene, styrene, as well as oxides of Sulphur and Nitrogen. Inhalation of H_2S (for instance) in optimal concentration has been linked to spontaneous abortion. CS_2 on the other hand is a known powerful neurotoxin, with volatile aromatic compounds like benzene famous as a systemic toxicant in humans at any given concentration; with a known potency to cause such health conditions as aplastic anaemia, depression and pancytopenia [11]. Benzene, an active component of flared gases is a known carcinogen to humans, having the ability to cause leukemia (blood cancer) in a non-mutagenic fashion [11].

The effects of oil spillage on fragile communities within the region have been reportedly enormous. According to the government of the federal republic of Nigeria; there were more than 70, 000 oil spills between 1970 and year 2000 with an estimated clean-up expected to span full restoration of creeks, mangroves, aquatic lives and swamps within a 25 years duration [12,13]. With the inhabitants of the Niger Delta region reportedly often marginalized on many levels by hegemonic political powers, racism, and the destructive activities of big petroleum companies. Local inhabitants of Okpai community are voiceless against the environmental degradation and pollution to which they are exposed [14]. Although many are opposed to pollution and believe that oil-related activities, such as gas flaring, are deleterious to their health, few are willing to speak out or make any sign of protest for fear of recourse from government officials. Thus, Okpai people are largely helpless against exposure to oil-related pollution with elevated risks for associated impact on economic, environmental and daily activities of the inhabitants.

1.1 Aim of Study

The purpose of this study was to investigate the effect(s) of crude oil exploration and exploitation on daily activities of Okpai community in Ndokwa East Local Government Area of Delta State, Nigeria. Specifically, study;

- i. Addressed the gap in existing literature, drawing attention to key health issues due to oil pollution among inhabitants of target community.
- ii. Compared the incidences and severity of selected diseases with a variety of sociodemographic and environmental, factors in the target community.
- iii. Determined the environmental susceptibility to health problems by age, gender, and pre-existing health conditions in the study area.

2. MATERIALS AND METHODS

2.1 Research Design

Research design is the structuring of investigation with the view to identifying parameters and their inter-relationships [14]. It is a set of methods, principles and underlying

procedures for obtaining, sorting, and analytic measures for identified variables whilst solving a problem. The study followed a phenomenological design, adopting the quantitative and comparative descriptive approach. The design was chosen because the study involves collecting and analysing data from inhabitants of sampled community considered representative of the entire population of the Niger Delta. The design is quantitative because obtained data were analysed with statistical techniques. Subjects were selected by stratified sampling procedure using the purposive method; a total of 340 subjects were involved in the study.

Following interviews, participants were recruited into three focus groups; each consisting of individuals who met the selection criteria. The three groups were gathered for a series of focus groups prior to conducting the focus groups, demographic features and examined individually for each focus group; Group 1 consisted of equal numbers of interviewees of age 18 - 30 (50%); whereas, groups 2 and 3 comprised of larger proportion of participants between 31- 45 (50%) and 45-60 (83%) respectively.

2.1.1 Study area

This study was conducted in Okpai community in Ndokwa East Local Government Area of Delta State, Southern Nigeria. The said area is about 336 km² of land with population strength of about 7,000 as presented in the census report of the National Populations Commission of Nigeria, 2006 [15,16].

2.1.2 Population of study

The study was targeted at a population of residents in Okpai community in Ndokwa East Local Government Area of Delta State, Nigeria. The 2006 census report estimated the community with a projected population of approximately 7,000 inhabitants [14,15].

2.1.3 Scope of study

This study investigated the health implications of crude oil explorations in Okpai community, Ndokwa East Local Government Area of Delta State. The study was community based, with scope to limited assaying physical and mental health records of the residents of target area of 15 years and above; irrespective of gender and educational status. The study delimits to exploratory factors that may exacerbate health standards as perceived by residents of target area.

2.1.4 Sample and sampling technique

Using the stratified sampling purposive technique, a total of one hundred (100) participants were ethically drawn from aforementioned population after obtaining each of their informed consent.

2.1.5 Sample size determination

The decision to sample 100 participants was informed and guided by the 2004 statistical relation of Lord Nick [16], which returned minimum sample size of 94 for aforementioned population (7,000) in calculation. However, to avoid any “unforeseen error” due to sample size, provision was made for attrition, adding an extra sixteen (6) subjects to make 100 sampled participants.

Lord's sample size equation is given by;

$$SS = (Z^2P \times (1 - P))/C^2$$

Where →

SS = Sample Size

Z = Confidence level as z-score (95% = 1.96 from z-table)

P = Population proportion variance. (Maximal at 0.5 from binomial distribution table)

C = Confidence interval or margin of error (0.05).

2.1.6 Selection criteria

Participants who lived in Okpai community of the Niger Delta Region of Nigeria, who were older than 18 years and have lived in the community for a minimum of 3 years and/or in the Niger Delta Region for at least, 5 years were selected for participation, irrespective of their occupation.

2.2 Research Instruments

2.2.1 Oral interview

Being a phenomenological research, an in-depth, semi-structured interview was orally conducted on selected participants. The interview was carefully conducted in such a way that emanating questions were, explicate only centering on the topic of study. The interview explored participants' descriptions of a phenomenon within specific context. Such phenomena were however made intricate, employing divergent views differently from selected participants. The

interview lasted approximately 60 minutes for each participant, and was conducted face-to-face under a relaxed setting of participants' choosing. An interview protocol with questions developed based on the existing literature regarding perceptions of the effects of oil pollution on physical and mental health was incorporated. Sufficient space was provided in each protocol for field notes after the interview. Audio records were taken for each interview with the prior knowledge and agreement of participants. Each audio recording and field notes were clearly labelled with such information as date, location, time, interviewer, and the participant identifier code for interviewee identification.

2.2.2 Questionnaire

Data collection was also achieved by way of questionnaire. The carefully structured questionnaire contained 20 items (questions), patterned after 2 point rating scale of Yes and No. Two sections were provided in the questionnaire; Section A and Section B. while section A contained information on respondents' bio-data, section B served as actual questions that explains respondents' level of perception about crude oil exploration activity with their physical and mental health status; based on existing literature regarding perceptions of the effects of oil pollution on physical and mental health. Also, the interview questions were all tested through a previously conducted pilot study and were designed to be open-ended, encouraging respondents to freely volunteer their views on questions. The questions were designed to elicit information on opinions, feelings, meanings, and experiences of the participants, which are areas of interest to the study. The goal was to explore the individuals' understanding of the physical and psychological effects of oil spillage and to determine if these occurrences have affected their personal lives.

2.3 Method of Data Collection

Primarily, data was collected by method of survey, using research questionnaire and oral interview. The questionnaires were administered to members of Okpai community in Ndokwa East Local Government Area of Delta State. Furthermore, direct interview method also assisted in the completion of the forms where eligible respondents lacked requisite literacy skill. Also, direct observation was used in guiding respondents on how to fill the forms or questionnaire to enhance data collection.

2.4 Method of Analysis

Results were presented with statistical tables and graphs, while comparative differences in mean between and within groups were performed with the Student t-test. Obtained Data were represented in simple percentage of sampled opinion and expressed in mean \pm standard deviation. Statistical analysis was done using statistical package for social sciences (SPSS version 22). A p-level < 0.05 was considered as statistically significant.

3. RESULTS

Results are shown in the tables below, following data sorting and analysis.

4. DISCUSSION

The growing demand for oil across the world has fuelled its discovery and extraction, creating a bevy of human health issues [16]. Some of the acute effects of exposure to crude oil include nausea, vomiting, dizziness, headaches, and respiratory problems [17,18]; more serious, long-term effects include cancer, respiratory diseases, skin diseases, and death [19]. The health problems caused by oil pollution can take multiple forms, including maladies related to air pollution from gas flaring [20]; water and land pollution from spills and pipeline damage; and mental health problems from the stress caused by physical and economic hardships that result from living in oil polluted regions [20]. In view of

Table 1. Percentage responses of effects of crude oil exploration on socio-demographic variables

	Sample (n)	Perc. (%)
Gender		
Male	8	53
Female	7	47
Age (Years)		
18–30	6	40
31–45	2	13
46–60	6	40
61–90	1	7
Educational level		
Elementary school	3	20
College	6	40
Secondary education	6	40
Occupation		
Fishing	12	80
Student	1	6.6
Self-employed	1	6.6
Unemployed	1	6.6

Note. Due to rounding error some percentages may not sum to 100%

Table 2. Socio-demographic information of participants by group

Age	Group 1		Group 2		Group 3	
	n	%	n	%	n	%
18–30	3	50	5	83	5	83
31–45	3	50	1	17	1	17
Elementary school	0	0	0	0	0	0
College	4	67	2	33	4	67
Secondary school	2	33	4	67	2	33
Occupation Fishing	3	50	3	50	1	17
Student	0	0	0	0	4	67
Self-employed	1	17	1	17	1	17
Private sector	1	17	1	17	0	0
Civil service	0	0	1	17	0	0
Unemployed	1	17	0	0	0	0

Table 3. Effects of oil spills on activities in Okpai Community

Questions	Responses	Mean (x)	Percentage (%)
Oil Spillage negatively affects the Health of Okpai people	Yes	3.53	83
	No		17
Do you know anyone with Health Challenge(s) due to Oil Spillage	Yes	4.23	76
	No		24
Has any family member of yours had any Health Challenge due to Oil spillage?	Yes	2.43	66
	No		34
If yes, how long has this been?	< 1 year		41
	1 - 3years		43
	> 3 years		17
Does oil Spillage negatively affect daily activities in the community?	Yes	5.22	17
	No		83
Does oil Spillage negatively affect environmental activities	Yes	7.13	17
	No	2.24	83

Values are expressed in percentage. One way t-test proved significant ($p < 0.5$); indicative from responses that crude oil explorative activity negatively affected activities in Okpai community

Table 4. Percentage responses for effect of oil spill on physical health activity

Responses	Groups			Total (%)	Mean	SD
	1	2	3			
No	22	28	37	87	29.00	4.32
Yes	2	5	6	13	4.33	3.46

Values are expressed in simple percentages of mean and Standard Deviation. $n = 340$ sampled respondents. The Yes and No responses are indicative from responses whether or not crude oil explorative activity affected physical health of residents in Okpai community

this, current study investigated the effect(s) of crude oil exploration and exploitation on the inhabitants of Okpai kingdom in Ndokwa East Local Government Area of Delta State, Nigeria. The study devised a structured interview for inhabitants of target community following ethical approval from appropriate authorities.

From the result of the study, two sub-samples were obtained for use in the study. Contacted individuals consisted of 100 Okpai community residents of which 40% had completed a university bachelor's degree, 40% had a secondary school education, and 20% did not complete their elementary school education (Table 2). Males represented 53% of the sample, whereas women represented 47% of the sample. The age distribution was 46-60 years (40%), 18-30 (40%), 31-45 (13%) and over 60 years (7%). Roughly 40% of this sample had had a Secondary School education, and 20% had never had any formal education. Almost all considered themselves to be either unemployed or in the fishing industry.

Following administration of structured interviews on participants, subjects were then grouped into three of six individuals each who have met the

stipulated selection criteria. Next, three groups of six interviewees each was gathered for a series of focus groups. Demographic features were examined individually for each focus group; Focus Group 1 comprised of equal numbers of interviewees age 18- 30 (50%) and 31-45 (50%). In this group, four (67%) participants earned College Degrees, while 2 (33%) had earned a secondary education. Half of this group were fishermen (50%), and others were either self-employed (17%), worked in the private sector (17%), or were unemployed (17%). Focus group 2 consisted of a larger proportion of participants in the age group 18- 30 (83%). Two in this focus group had a college education (33%), while the remaining four had secondary school education (67%). Similar to focus group 1, this group consisted of three (50%) fishermen, and assorted other occupations such as private sector (17%) or civil service (17%). One of the participants in this group was self-employed (17%). In focus group 3, a majority were in the age group of 18-30 (83%), with only 17% from the 31-45 year old age group. Similar to focus group 1, this group consisted of four with a college education (67%), and two with a secondary school education (33%). In this focus group, the most common occupation was student (67%), with one

fisherman (17%) and one who was self-employed (17%). Demographic information for all three focus groups can be found in Table 1.

Participants described a wide range of health issues began at the time of the spill and continued on to the present. They also spoke regarding the health of their families including children. Many of them had difficulties in accessing basic health care. Overall, these participants spoke regarding the difficulties they endured and their feelings of abandonment. They believed that they had been forgotten and that no one in the government or the oil company cared about what would happen to them.

5. CONCLUSION

This study addressed a major lacuna in research on the potentially hazardous physical health implications of oil exploration and exploitation activities on inhabitants of the Niger Delta region; specifically focusing on Okpai community in Ndokwa East Local Government Area of Delta State, southern Nigeria. From observations of obtained records, a major effect on physical states of inhabitants was noticed. Findings from this study largely concur, and were reflective of those of previous investigations on the implications of oil-related environmental degradation on human physical health. Though, more sophisticated approach to current study is needed to better the understanding. Thus, current study provides a local standing for future based investigations as it affects human.

CONSENT AND ETHICAL APPROVAL

Prior to data collection, ethical clearance was sourced from the Department of Public and Community Health, Novena University, Ogume, Delta State. Eligible participants were treated in accordance with specified ethical guidelines of the American Psychological Association and Walden University's. Also, a letter of introduction was obtained to facilitate the rapport or understanding with the respondents.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Nashawi IS, Malallah A, Al-Bisharah M. Forecasting world crude oil production using multicyclic Hubbert model. *Energy Fuels*. 2010;24(3):1788-1800.
2. Amodeo C. Top 10 largest energy consumers: Million tonnes of oil equivalent, 2002. *Geographical*. 2006;78(4).
3. Safina C. The 2010 Gulf of Mexico oil well blowout: A little hindsight. *PLoS Biology*. 2011;9(4).
4. Owen NA, Inderwildi OR, King DA. The status of conventional world oil reserves – Hype or cause for concern? *Energy Policy*. 2010;38(8):4742-4749.
5. Oyesola D. Toxicology and sustainable development discourse: Challenges for Toxicologists in Nigeria. *Archives of Basic and Applied Medicine*. 2014;2(1):1-8.
6. Al-Jahdali MO, Bisher AS. Sulfur dioxide (SO₂) accumulation in soil and plant's leaves around an oil refinery: A case study from Saudi Arabia. *American Journal of Environmental Science*. 2008;4(1):84-88.
7. Dell M. The devil's excrement: The negative effect of natural resources on development. *Harvard International Review*. 2004;26(4):38-41.
8. Sako EB. Public health implications of oil pollution in Koluama: Nigeria. Dissertation thesis, Walden University; 2017.
9. Miller KA, Siscovick DS, Sheppard L, Sheppard K, Sullivan JH, Anderson GL, Kaufman JD. Long-term exposure to air pollution and incidence of cardiovascular events in women. *The New England Journal of Medicine (Research Support, NIH. Extramural Research Support, U.S Govt Non-PHS)*. 2007;356 (5):447-458.
10. Anderson GL, Kaufman JD. Long-term exposure to air pollution and incidence of cardiovascular events in women. *The New England Journal of Medicine (Research Support, NIH. Extramural Research Support, U.S Govt. Non-PHS)*. 2007; 356(5): 447-458.
11. Olobaniyi SB, Efe SI. Comparative assessment of rainwater and groundwater quality in an oil producing area of Nigeria: environmental and health implications. *Journal of Environmental Health and Res*. 2007;6(2):111-118.
12. Oseji OJ. Environmental impact of gas flaring within Umutu-Ebedei gas plant in Delta State, Nigeria. *Archives of Applied Science Research*. 2011;3(6):272-279.
13. Akpomovie OB. Tragedy of commons: Analysis of oil spillage, gas flaring and sustainable development of the Niger Delta of Nigeria. *Journal of Sustainable Development*. 2011;4(2):200-210.

14. Heubeck M, Camphuysen KCJ, Bao R, Humple D, Sandoval A, Cadiou B, Brager S. Assessing the impact of major oil spills on seabird populations. *Marine Pollution Bulletin*. 2003;46(7):900-902.
15. McMichael AJ. Population health as the "bottom line" of sustainability: Contemporary challenge for public health researchers. *European Journal of Public Health*. 2006;16(6):579-582.
16. Lord Nick. Binomial averages when the mean is an integer, *mathematical gazette*. 2010;94:331-332.
17. Zhang L, Wang XD, Baccarelli A. Environmental chemical exposures and human epigenetics. *International Journal of Epidemiology*. 2011;41(1):1- 27.
18. Ana GR, Sridhar MK, Bamgboye EA. Environmental risk factors and health outcomes in selected communities of the Niger delta area, Nigeria. *Perspectives in Public Health*. 2009;129(4):183-191.
19. Abdul-Wahab S, Sappurd A, Sardar S, Irfan N. Impacts on ambient air quality due to flaring activities in one of Oman's oilfields. *Archives of Environmental and Occupational Health*. 2012;67(1):3-14.
20. Grattan LM, Roberts S, Mahan WT, McLaughlin PK, Otwell WS, Morris G. The early psychological impacts of the Deepwater Horizon spill on Florida and Alabama Communities. *Environmental Health Perspectives*. 2011;119(6):838-843.

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Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/54418>