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Effects of Crude Oil Exploration on the Physical and Mental Health of Residents of Okpai Community, 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.

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ABSTRACT

One of the adverse effects that may accompany prolonged exposure to gas flaring (as with Niger Delta region of Nigeria) is increasing incidences of health anomalies amidst inhabitants. Current study investigated the effects of oil exploration and exploitation on the physical and mental health of residents of Okpai community in Ndokwa East Local Government Area of Delta State, southern Nigeria. A purposive sampling technique was used to draw a total of three hundred and forty (340) participants from the estimated population of Okpai community who have lived for a minimum of 3 years within the targeted area. Participants were then randomly recruited into three groups of equal number of interviewees of age range 18-30 (30%), 31-45 (37%) and 18-30 (33%) respectively. Majority of the respondents were in the age group of 18-30 (83%), with only 17% from 31-45 year

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old age group, similar to group 1. Following administration of questionnaire to participants, Socio-demographic variables were obtained after which their informed consents and approval was given. Obtained results were expressed in simple percentages, while presenting in appropriate statistical tables and graphs. Upon analysis, study observed an increase in the percentage of crude oil exploration on the physical and mental health of Okpai residents, suggesting that crude oil exploration greatly negatively affected the health status of Okpai community inhabitants. Study also established from the participants' perception that the oil companies appeared not to be concerned or cares about the area investigated. Also from participants' assertions, the consumption of contaminated fish and water created health problems. Participants also felt their healthcare needs were marginalized and ignored by representatives from oil companies and the local government. Most respondents described simply dealing with physical health ailments on their own or visiting their local chemist for treatments. Further studies aimed at corroborating these findings are highly recommended.

Keywords: Mental health; Niger Delta; crude oil; exploration.

1. INTRODUCTION

Oil production activities usually results in frequent oil spillages which are destructive to the ecology of the area and harm to the health of living organisms present [1,2]. Its impact on marine life is compounded by toxicity and training effects resulting from the chemical composition of crude oil, as well as by the diversity and variability of biological systems and their sensitivity to pollution [1]. They include destruction of wildlife and biodiversity, loss of fertile soil, degradation of farmland, damage to aquatic ecosystems and pollution of drinking water leading to serious health problems for the inhabitants.

Available reports suggest that there exists a connection between oil abundance and low levels of development since oil discovery. This traces to the exploitative effects of oil in fuelling internal corruption and conflict, encourages unethical corporate behaviour, promulgation of violence against human rights, environmental degradation and health hazards on aquatic and terrestrial lives [3].

Health-wise, one of the adverse effects that may accompany prolonged exposure to flared environmental gases (as seen in the case with Niger Delta) is cardio-vascular and pulmonary abnormalities. Miller in 2007 reported high incidences of cardio-pulmonary morbidities in pre-disposed subjects within gas flared environs in developing countries [4]. A study 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 [4]. Polluted air has also been related (by several studies) to increased incidences of coronary and cerebrovascular ailments [5].

Concerning cardio-respiratory disease, studies have focused on harmful effects of air pollutants on inflammatory blood markers, heart rates, blood pressures and respiratory rates [6]. In a cohort study by Argo, heart rate was shown to increase amongst adults of 25-64 years old during an air pollution episode that monitors the trends and factors of cardiovascular disorders [4]. In another Pilot study by Ubirantan on vehicular traffic controllers, air pollution reportedly increased blood pressures and heart rates within the metropolitan city of Sao Paulo, Brazil [7]. A more recent study by Ativie (2008) reported increased cardiovascular and respiratory markers in saw-dust and paint mist polluted air of exposed workers within Enugu Metropolis of Enugu state, south-east Nigeria. Inhalation exposure to cadmium and its compounds have also been reported to be harmful to oil spill communities and inhabitants upon prolonged exposure [8].

The Niger Delta region, location in Nigeria where largest underground deposits of oil and gas resources are highest is a great example of such an area where flaring activities occur on a regular basis. The area is reputed for petroleum-rich oil, making up 7.5% of Nigeria's landmass. Often pillaged by industrial waste activities of major oil exploration, the region spans 70,000 km^2 (27,000 sq mi) area of land within the southern coast of the country, Nigeria [1]. The effects of oil in 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 [9,10]. Although research exists on the environmental consequences of oil extraction and transport in the region [11,12,13]. Few researchers have investigated the consequences of these effects on the health of local inhabitants [13]. With little or no available record(s) on the detrimental physical and mental health consequences of environmental degradation among inhabitants of Okpai community, Delta State, Nigeria; even though demand for oil continues to increase throughout the world. Most literatures on the effects of oil discovery, extraction, and transport in the Niger Delta have focused on environmental consequences, rather than health implications [14]. Most available researches are often limited to the effects on human health from oil accidents, especially in developed regions of the world. This study will hitherto addressed the gap in the literature, providing a foundation for future researches on the health consequences of oil pollution on inhabitants of Okpai community in the Niger Delta region of southern Nigeria.

Current study aimed at investigating the effect(s) of crude oil exploration and exploitation on the health indicators of inhabitants of Okpai kingdom in Ndokwa East Local Government Area of Delta State, Nigeria. Specifically, the study examined the Mental and Physical health consequences of oil-related environmental degradations on the inhabitants of Okpai community in the Niger Delta region of Nigeria.

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 [15]. 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; Focus Group 1 consisted of equal numbers of interviewees of age 18-30 (50%) and 31-45 (50%). Whereas focus group 2 comprised of a larger proportion of participants in the age group 18- 30 (83%), In focus group 3, 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.

2.2 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 [16,17].

2.3 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. A 2006 census report estimated the community with a projected population of approximately 7,000 inhabitants [16,17].

2.4 Scope of Study

This study investigated the health implications of crude oil explorations in Okpai community in 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.

2.5 Sample and Sampling Technique

Using the stratified sampling purposive technique, a total of three hundred and forty (340) participants were ethically drawn from aforementioned population (7,000) after obtaining each of their informed consent.

2.6 Sample Size Determination

The decision to sample 340 participants was informed and guided by the 2004 statistical relation of Lord Nick (Lord, 2010), 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 340 sampled participants.

Lord's sample size equation is given by;

$$SS = \frac{Z^2 P \times (1 - P)}{C^2}$$

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).

2.7 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.

2.8 Research Instruments

2.8.1 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.

2.9 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 (see Appendix 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.

2.10 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.

2.11 Method of Analysis

Results were presented with statistical tables and graphs, while comparative differences across groups in simple percentages. Obtained Data

were represented in simple percentage of sampled opinion. All analyses were performed using statistical package for social sciences (SPSS version 22).

3. RESULTS

Results are presented in graphs and tables below

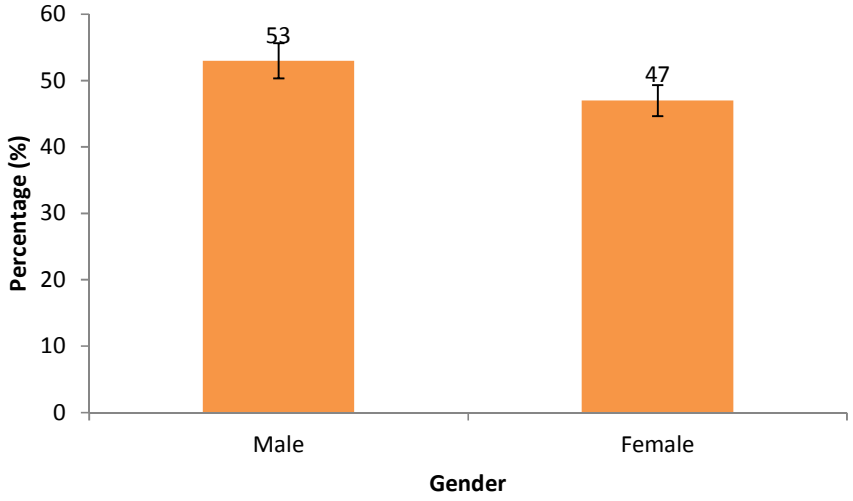

Fig. 1. Percentage distribution of interviewed participants by gender

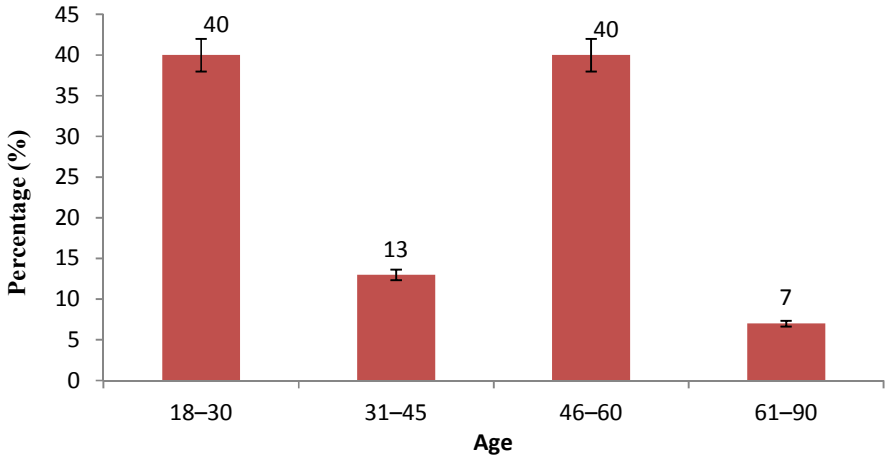

Fig. 2. Percentage distribution of interviewed participants by age

Table 1. Percentage responses for effect of oil spill on daily activities

Responses	Groups			Total (%)	Mean	SD
	1	2	3			
No	15	32	24	71	23.67	2.12
Yes	19	6	4	24	8.00	1.24

Values are expressed in simple percentages of mean and Standard Deviation. n = 340 sampled respondents. The Yes and No responses are indicative from responses weather or not crude oil explorative activity hindered daily activities in Okpai community

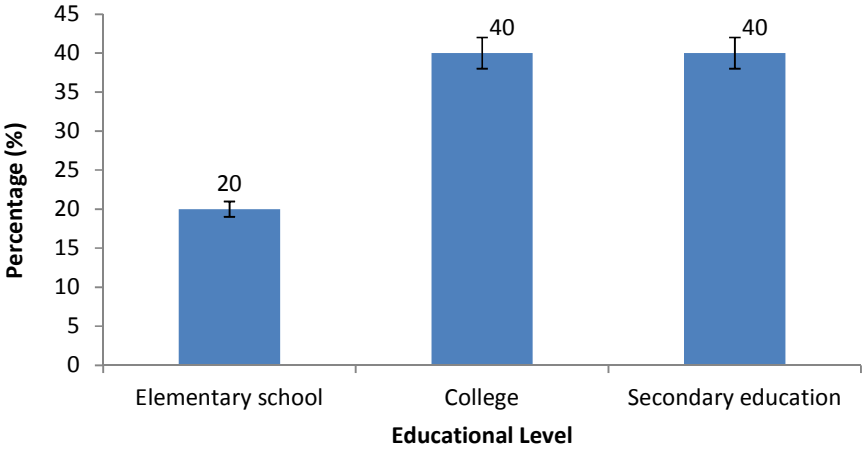

Fig. 3. Percentage distribution of interviewed participants by educational level

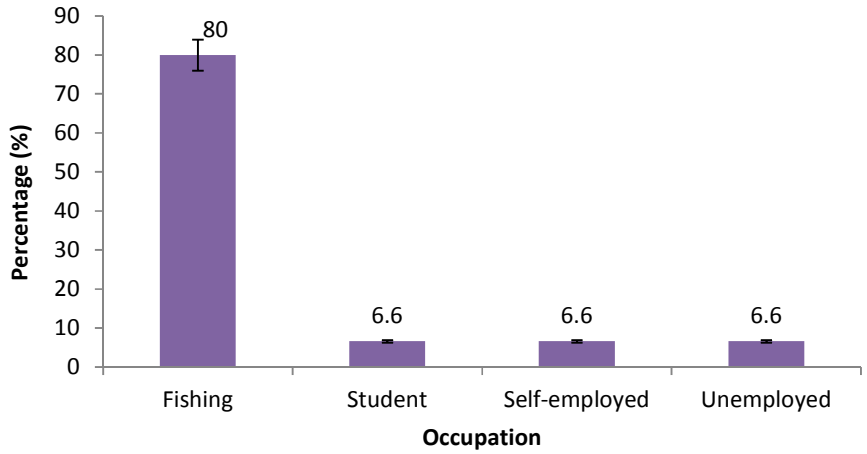

Fig. 4. Percentage distribution of interviewed participants by occupation

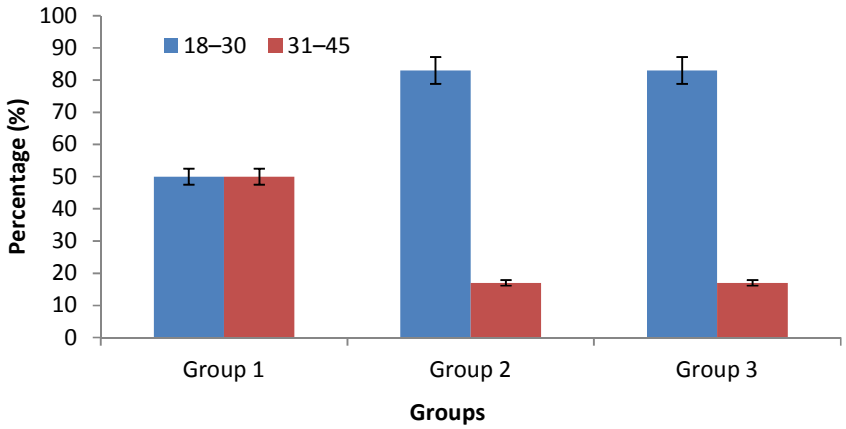

Fig. 5. Comparative distribution of participants' age across groups

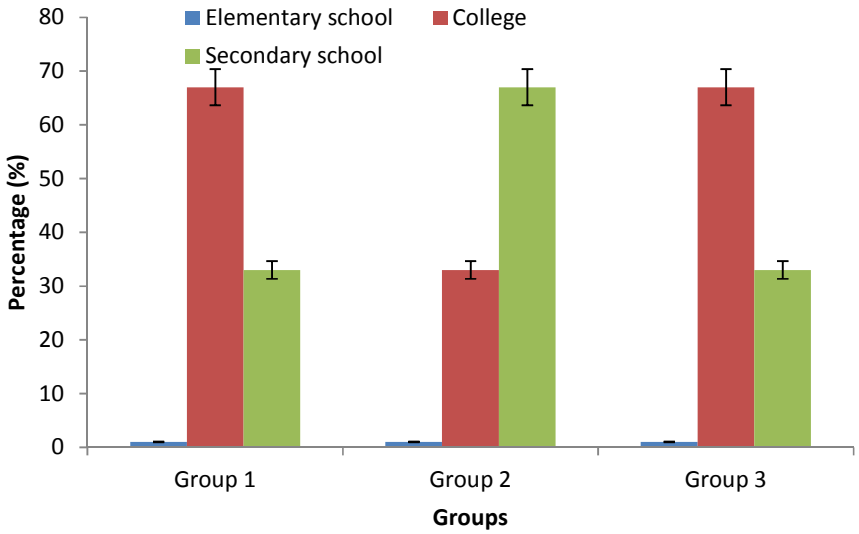

Fig. 6. Comparative distribution of participants' educational status across groups

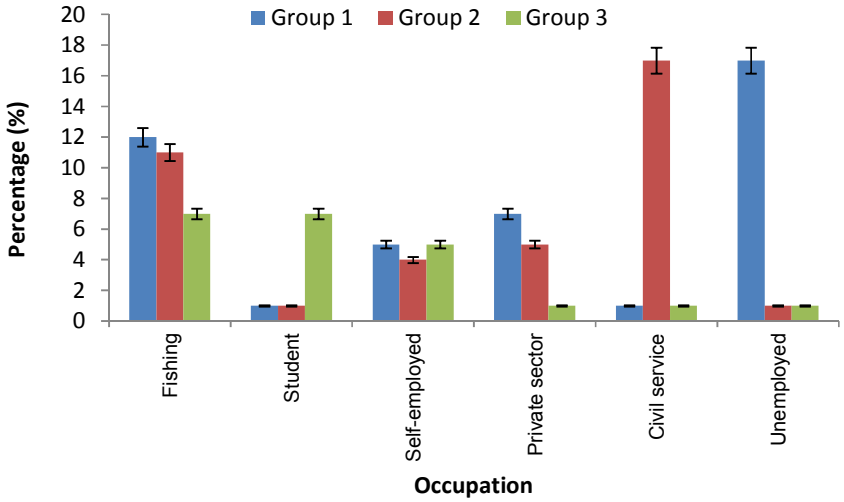

Fig. 7. Comparative distribution of participants by occupation across groups

Table 2. 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 weather or not crude oil explorative activity affected physical and mental health of residents in Okpai community

4. DISCUSSION

Overtime, the living conditions of the inhabitants of oil-producing regions have resulted in social unrest, health hazards, to mention a few. Politically masterminding powerless and experiences with no benefits from the oil production that has changed the environment,

health, and livelihoods of the inhabitants of such communities, a sense of deprivation among the marginalized people of the Niger Delta has led many to take matters into their own hands. Groups devoted to sabotaging oil-extraction efforts move from village to village, hacksaws in tow, to loosen pipeline manifolds and release crude oil into farmlands, streams, swamps, and fishing grounds. These acts have often promoted defiant behaviours and grounds for demanding payment from oil companies, as well as exacerbate health problems in exploited communities. Current study sought to investigate the physical and mental health effect(s) that crude oil exploration and exploitation has on the inhabitants of Okpai community in Ndokwa East Local Government Area of Delta State, Nigeria. The study devised a structured questionnaire and interview for inhabitants of target community following ethical approval from appropriate authorities. A major question raise for this study was; what are the perceptions experiences of the villagers of Okpai community regarding the effect of oil pollution on their physical and mental health?

In response to this question, obtained data revealed two superordinate themes, Physical effects of the oil spills on local population (Physical effects) and Psychological Effects (Psychological effects) as a result of dealing with the aftermath of the oil Spills on local community. The theme Physical effects of the oil spills on local population was made up of 4 subordinate themes;

a. People suffered from illnesses,
b. Children's Health declined,
c. Mortality in the local community, and
d. Lack of care available to the local population after the oil spill.

The superordinate theme of Psychological effects as a result of dealing with the aftermath of the oil spills in local population was made up of 2 subordinate themes: Feelings of worry and anxiety and Feelings of fear and depression.

The Physical effects of the oil spill on the local population describe the physical consequences of the oil spill on the respondents and their families. All participants had data that were used to construct the theme. Also included were the challenges and experiences associated with participant's attempts to access and receive medical care in the aftermath of oil spill on the land. Participants described a wide range of health issues that began at the time of the spill and continued on to the present. They also spoke about the health of their families and children. Many of them had difficulties in accessing basic health care. Overall, these participants spoke about the difficulties they endured and their feelings of abandonment; believing that they had been forgotten and that no one in the government or the oil companies cared about what would happen to them.

The theme on People suffered from illnesses comprised of data from two of the focus groups and all fifteen of the participants. The participants reported that their families and friends suffered from a host of medical issues in the aftermath of the January, 2012 following oil spillage. The health issues were immediate and long term, adding that people become sick after drinking the water and from breathing the polluted air from the oil spill". Participants also indicated that difficulty breathing was accompanied by their coughing, tightness in the chest and dry throat, indicating also that they or family member(s) had high blood pressure.

Other health issues mentioned during the interviews included diseases such as cholera, stomach issues which included bloating and diarrhoea, as well as, catarrh and stroke. The reported physical illnesses experienced by the participants were connected to the vascular, digestive, epidermal, or respiratory systems. Many of the digestive issues were attributed to the lack of potable water and the lack of untainted fish.

Table 3. Percentage responses to effect of oil spill on mental health indicators

Responses	Groups			Total (%)	Mean	SD
	1	2	3			
Negative	32	28	18	78	26.00	4.32
Positive	8	8	6	22	4.33	7.33

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

Participants spoke at length on the effect of oil spill on the health of the children who resided in Okpai community. Five of the participants and 2 of the 3 focus groups spoke about the area of children's health declining in relation to the oil spill. When speaking about the January, 2012 oil spill, in Focus Group 1, a participant said, "Our children fell sick as a result of consumption of the contaminated water and fishes." The participant noted that the damage to the surrounding area was great and because of this, the parents who had lost their livelihood (as the majority of the population had relied on fishing to support their families) had no choice but to use the available water and fish, in spite of the contamination associated with those resources. Another focus group member went into great detail about this and stated that great percentage of the sickness experienced by their children resulted from oil spill, adding that they were not used to sickness but because of the hunger, they still eat polluted fish from the river and their children have become asthmatic. Some have skin and respiratory diseases, eye problem(s), diarrhoea and others as a result of oil spill on their land over the years. This indicates that the health issues faced by children and the surrounding community were uncommon, even though they previously had good health without any form of complications.

The long term Psychological effects as a result of dealing with the aftermath of the oil spills on the people of Okpai community will precede the analysis of Physical Effects of the oil spill on the people of Okpai community. However there is an explicit connection between the physical effects and the mental effects that this oil spill has had on the People of Okpai community.

The fact that parents observed their children becoming ill and die was echoed by a member of Focus Group 2 who said that children from within the community died from various illnesses due to lack of resources necessary to provide interventions or pay for health care interventions that were necessary for these children. The other impact on physical health was due to simple lack of uncontaminated food and water, causing inhabitants to require adequate nourishment to thrive. The oil spill had already affected family's ability to support themselves and subsequently provide for their children. Many households lacked the basic funds necessary to provide food before the oil spill; with majority of the population being fishermen who relied on the sea for income and food. The oil spill destroyed the local economy, which has still not recovered. The surrounding land and water are still contaminated, making it hazardous to imbibe the water or food.

Participants asserted that the consumption of contaminated fish and water created health problems, an effect well documented in other studies. For example, lack of access to clean water, and pollution associated with unsafe water; create a toxic load in quantities too large for the environment to attenuate, naturally [18]. Adedeji and Adetunji (2011) reported that water pollution was a significant cause for concern in developing nations, and researchers have substantiated the poor water quality in relation to oil-related environmental degradation in the Niger Delta [13,19]. As pollutants are absorbed by plants and animals that people eat, water pollution contaminates the food supply [12,16].

Data provided by respondents on illness revealed that of previous research on the acute and long-term health effects of exposure to oil-related pollution. For example, Solomon and Janssen (2010) reported that common human health effects of oil spills include nausea, vomiting, dizziness, headaches, and respiratory problems [20]. While some research exists on the short-term health consequences, less is known about the long-term health effects of exposure to oil pollution in developing nations. As Woodward [20] explained, far fewer studies have documented the long-term health effects of oil pollution [21]. According to Mc Caskill [21], the reasons for the dearth of research on the long-term physical effects of oil pollution include (a) seeking out subjects for studies; (b) unreliable reports from medical facilities; (c) difficulty obtaining provisional care for those in need; and (d) unreliable self-reports [22].

Worry, anxiety, fear, and depression were reported by participants concerning the effects of oil-related environmental degradation on their mental health. While the physical effects discussed above are likely to have direct effects on health, the mental effects may be more indirect. For example, oil-related damages to the environment had a significant negative effect on the livelihoods of many participants whose income relied on fishing. In turn, this reduced their abilities to earn income, placing them and their families in poverty. Impoverished living, in turn, created high levels of anxiety and depression for respondents. Anxiety was created over the fear of the future. Participants described

feeling anxious about their lack of control over the environmental damage caused by oil companies**.** Participants also worried about their livelihoods, physical health, food shortages, and lack of sleep. The anxiety created by the environmental damage seemed to have a significant impact on the villagers' quality of life. Perhaps worsening their worry and anxiety, respondents reported dealing with psychological distress on their own, rather than seeking mental health services.

Participants also relayed feelings of fear and depression related to the same concerns that created anxiety and worry. Respondents discussed economic stress related to their inabilities to make money due to the environmental pollution. The general feelings of depression throughout the region were described by some respondents who said, "The Niger Delta people are all in a state of depression." Another common cause of fear and depression described by participants related to the physical health consequences of living in the polluted environment of Okpai community. The mental health effects described by participants in this study were significantly different from those described by previous researchers who explored the psychological effects of oil-related environmental degradation. Grattan et al., [22] findings agree with that of this study [22]. The researchers found that participants experienced increased levels of anxiety, depression, and distress, mostly due to the economic losses incurred due to resource reductions or job losses. While Grattan et al., (2010) found that economic losses were the greatest causes of negative mental effects linked to the spill, the economic damage felt by businesses in a developed nation are significantly different from those experienced by the villagers. Doubtless, economic hardships faced by participants in Grattan's et al., (2010) investigation may have created financial challenges and temporary hardships, but for people of the Niger Delta, such hardships can be deadly. Without the ability to earn an income and provide for their families, villagers reported extreme levels of poverty. These individuals do not have a social welfare safety net to protect them when their livelihoods are compromised due to environmental degradation created by large oil companies and corrupt governments, which are both outside of the villagers' control. Other studies on the mental health consequences of oil-related environmental degradation conducted prior to the current investigation also focused on litigation procedures and substance abuse issues [23, 24].

5. CONCLUSION

This study deals with a tragic story of environmental degradation and exploitation in an often neglected area of the world. This issue surely deserves attention and merit international diffusion. The stories reported in this manuscript are truly hearth-breaking and the suffering of Niger delta population cannot be ignored any longer. The study revealed from participants' assertions that the consumption of contaminated fish and water created health problems. Furthermore, the poor water quality in relation to oil-related environmental degradation in the Okpai community is absorbed by plants and animals that people consume to contaminate food supplies. Largely, participants also felt their healthcare needs were marginalized and ignored by representatives from oil companies and the local government. Most respondents described simply dealing with physical health ailments on their own or visiting their local chemist for treatments. In general, the study revealed that the physical and mental health problems are due to lack of availability of the related facilities and poor management of the healthcare and environmental sectors, coupled with other socio-economic problems, not necessarily due to oil exploration activities.

6. RECOMMENDATIONS

Following results from current study; it is recommended that;

i. More sophisticated approach is employed on current research with higher sample size and wider target areas other than Okapi kingdom.
ii. More thorough evaluation of critical mental and physical health parameters from the clinical view point should suffice in future investigations relating to this study.
iii. In the event of an oil spill, trained professionals/experts are made available to help curtail the excesses of its spread and resultant effects; regardless of whether spillage occurs in a developed, underdeveloped or developing nation.

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. Respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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