

**PETROLEUM POLLUTION AND AGE-RELATED DECREASE NEUROPLASTICITY  
OF THE DEVELOPING BRAIN OF THE OGONI CHILDREN IN RIVERS STATE,  
NIGERIA**

**ABSTRACT**

This study considered the influences of petroleum pollution to the age related decrease neuroplasticity of the developing brain of the Ogoni children. 383 questionnaires were retrieved of 400 that was distributed among the purposively selected communities of Gokana, Khana, Tai and Eleme LGAs in Ogoni. The retrieved data was analysed using simple frequency distribution and percentages; after which interpretations were made. The results revealed that the signs of mental illnesses like anxiety disorder, attention-deficit disorder, autism spectrum disorder, mood disorder, schizophrenia and eating disorder were noticeable among the school children. The children also exhibited behavioural challenges such as extreme fear, difficulty concentrating, self imposed injuries, aggressive behaviour, avoiding other classmates and poor academic performances. These mental and behavioural challenges were caused majorly by petroleum pollution of the communities. Other causes of these illnesses were revealed to be poverty and psychoactive substance use. It was concluded that constant exposures of the younger children to environmental pollution can gradually lead to decrease neuroplasticity of the brain.

**Keywords:** brain, children, mental illnesses, petroleum, pollution

**1. INTRODUCTION**

Pollution does not only destroy the ecosystem but is also harmful to the human health [1,3,6,7,11]. Most cancerous terminal diseases are common in petroleum polluted environment [8]. The effects of pollution are even more prevalent among on the children because their defence system is not fully developed to adapt or survive in such a corrosive environment. The effect of the polluted environment often results into many illnesses and deaths among children [5,8]. Such consequences of a polluted environment could manifest in the form of poor academic, socio-economical and functional outcomes [4,9]; showing developmental, behavioural and emotional problems in young children. Thus, early detection is necessary for appropriate treatment and referrals to counteract the negative consequences.

One the common consequence of pollution in the areas of petroleum exploration is air pollution; which has enormous influences on the human health [8]. We all breathes air, and much of the world's population breathes air that hurts their health in so many ways [16] and causes an estimate of 7 million premature deaths yearly [16]. Even the air we breathe as an adult may be mild and something our bodies could cope with; same cannot be said of our babies and children who are particularly susceptible [16]. In these young ones, air pollution can impair immune

system development in utero and impede children's cognitive development [16]. World Health Organisation released in one of the weekly report that 93% of children under 15 currently alive on the planet breathe air that is polluted enough to jeopardized their health. Environmental pollution has also being linked with respiratory infections, cardiovascular diseases, throat inflammation, chest pain, ear infections and childhood obesity [16]. Bad air from petroleum exploitation activities can negatively affect neurodevelopment resulting in lower cognitive test outcomes and the development of behavioural disorders [8,16].

Aside from the polluted environment, poverty is common in the study area; as other studies have described the people of Ogoni, as living in abject poverty in a polluted environment [4,5]. Many parents cannot afford the cost of primary education, as they have to pay for books, admission fees, exams fees, sport fees and every other chargeable fee. The Universal Basic Education (UBE) scheme that is supposed to carter for these poor children has failed in the aspect of ensuring that they get quality education for free. Most unfortunately, the teachers in this sector are the lowest paid in Nigeria, as they are placed on the poorest and specific scale, called Teachers Salary Scale (TSS). Thus, even when parents managed to put their children in schools, the available teachers are not motivated enough or are too hungry to inspire or impact on the children; leading a greater number of the these poor children dropping out school due to poor motivation.

Developing countries are adjudged as having the highest population of children that are out of school due to the different prevailing environmental factors; which could to neuroplasticity to the developing of children. Recognising any possible challenges early enough in young children about their mental problems is important in improving developmental trajectories and reduces any likely outcome that would resulted into an emotional and behavioural disorders [9]. Some of these health challenges may start early in a child even immediately after birth, but may not be easily identified at a glance. In most cases, as the child grows, some of these health challenges may begin to manifest unseen or silently except when observe closely.

Parents normally should be the first to identify any possible health challenges in their children but their love for their children and their bias judgement may blindfold them from the truth that is starring them on the faces. The teachers on the other hand, spend even more time with the children and this exposes them to the basic essential information that can developed them mentally, emotionally and socially. The teachers do not only build skills in the children, but they can also cultivate the desired character into them. Thus, one can conclude that teacher play an important role in early problem detection [9]. Teachers can be more objective in observing children's development and measure their performance than their parents. The teachers have this broad knowledge about the children, because so many children must have pass through their tutelage and has given them experience over time in identifying health problems easily than the parents; as they are able to compare the behaviour of every child relative to the other.

Some of the notable consequences of mental challenges are anxiety disorder (children who have anxiety disorders display attribute such as obsessive-compulsive disorder, post traumatic stress disorder, social phobia which normally interferes with their daily activities); attention deficit/hyperactivity disorder (this activities are identified easily in a child through the following signs like difficulty paying attention, hyperactivity and impulsive behaviour); autism spectrum disorder (the condition that affect the child's ability to communicate and interact with others); eating disorders (this can be seen when a child eat in a manner that is disgusting or different from

the usual manner); mood disorder (depression and bipolar disorder-the persistent feeling of sadness or extreme mood swings than the usual); schizophrenia-psychosis (the chronic mental illness that causes one to lose touch with reality, though this kind normally appear in the late teen through the 20s) [15].

## 2. OBJECTIVE OF THE STUDY

- i. Identify children with mental and behavioural challenges;
- ii. Determine how petroleum pollution can influence the development brain of children.

## 3. METHODOLOGY

### Population and sample size

The population of Ogoni is 1,302,455 (comprising 298,986; 358,418; 460,766 and 184,290 for Eleme, Gokana, Khana and Tai respectively) according to Bodo [4] projected population data.

**Table 1: Calculated Projected Population of Ogoni.**

LGAs	Population (2006)	Projected Population (2016)
Eleme	218,200	298,986
Gokana	261,570	358,413
Khana	336,267	460,766
Tai	134,495	184,290
<b>TOTAL</b>	<b>950,532</b>	<b>1,302,455</b>

Source: National Population Census, 2006/Bodo (2018) projected population.

Out of the four Local Government Areas (LGAs) in Ogoni, two oil bearing or petroleum impacted communities were selected from each of the LGA and four primary schools were chosen from these communities as shown in Table 2.

**Table 2: Selected communities**

LGA	Chosen communities	No. of selected primary schools	Nature of primary school	
			Public	Private
Gokana	Bodo	4	3	1
	Bomu	4	2	2
Khana	Kpean	4	2	2
	Sii	4	2	2
Tai	Nonwa Tai	4	3	1
	Koroma	4	2	2
Eleme	Onne	4	3	1
	Akpajo	4	3	1

Source: Fieldwork, 2018

The sample size was subsequently determined through the use of TARO YAMANE sample size determination formula [4] as shown below:

TARO YAMANE sample size determination formula:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n= sample size

N= population size

e= error terms (5%)

Hence, N=Total no. of population in Eleme, Gokana, Khana and Tai.

$$N = 298,986 + 358,413 + 460,766 + 184,290$$

$$= 1,302,455$$

Substituting into the equation, we have:

$$n = \frac{1,302,455}{1 + 1,302,455(0.05)^2} = 400 \text{ Approximately}$$

Subsequently, the 400 questionnaires were distributed equally among the chosen communities since the population sizes were fairly the same as discovered from the reconnaissance survey.

**Table 3: Questionnaire distribution**

LGA	Chosen communities	Questionnaire distribution	No. of retrieved questionnaires
Gokana	Bodo	50	48
	Bomu	50	46
Khana	Kpean	50	48
	Sii	50	47
Tai	Nonwa Tai	50	49
	Koroma	50	48
Eleme	Onne	50	48
	Akpajo	50	49
<b>TOTAL</b>		400 (100%)	383 (95.75%)

Source: Fieldwork, 2018

#### 4. RESULT AND DISCUSSIONS

##### Socio-economic characteristic of respondents

The data in Table 4 showed that the teachers that participated in this survey, cut across the four LGAs with 24.54% (94), 24.28% (93), 25.32% (97) and 25.32% (97) from Gokana, Khana, Tai and Eleme respectively. 51.95% (199) of the teachers were male while 48.04 (184) were female. Majority of the teachers are well educated 61.61% (236) and 37.59% (144) with NCE/ND and B.Ed/BSc respectively while only 0.78(3) had a master's degree. Majority of teachers (74.4%) are married, while the others are single (7.83%) and widows/widowers (17.75%). All the teachers claimed that their financial status were low as shown on Table 4.

**Table 4: Socio-demographic characteristics of primary school teachers in Ogoni**

Characteristics	Frequency (f)	Percentage (%)
<b>Age</b>		
21-30	50	13.05
31-40	150	39.16
41-50	103	26.89
51-60	80	20.88
<b>LGA</b>		
Gokana	94	24.54
Khana	93	24.28
Tai	97	25.32
Eleme	97	25.32
<b>Sex</b>		
Male	199	51.95
Female	184	48.04
<b>Educational Qualification</b>		
FSLC	0	0
SSCE(WAEC/NECO)	0	0
NCE/ND	236	61.61
B.Ed/BSc	144	37.59
MSc	3	0.78
PhD	0	0
<b>Marital Status</b>		
Single	30	7.83
Married	285	74.4
Divorced	0	0
Widow/widower	68	17.75
<b>Perceived financial status</b>		
High	0	0
Moderate	0	0

Low	383	100
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Source: Fieldwork, 2018

### Identification of children with mental and behavioural challenges

In the selected schools, the teachers through their wealth of knowledge about the children they have cared for in the past identified some children in their classes which they believe to be having mental and behavioural challenges as shown on Table 5.

**Table 5: General survey of children with and without mental and behavioural challenges in the selected communities**

LGA	No. of retrieved questionnaires	No. of pupils suspected to show signs of mental and behavioural challenges (frequency & Percentage)	No. of children free from mental and behavioural challenges (frequency & percentage)
Gokana	94	14 (14.89%)	80 (85.10%)
Khana	93	8 (8.60%)	85 (93.39%)
Tai	97	16 (16.49%)	81 (83.50%)
Eleme	97	10 (10.30%)	87 (89.69%)

Source: Fieldwork, 2018

The field data obtained in all Local Government Area (LGA) in Ogoni revealed that some of the children show signs of mental and behavioural challenges with 14.89%, 8.60%, 16.49%, and 10.30% for Gokana, Khana, Tai and Eleme respectively as shown on Table 5.

**Table 6: Multiple responses on the identification of children with mental and illnesses and behavioural challenges**

S/N	Variables	Frequency (f)	Percentage (%)
1.	<b>Mental illnesses:</b>		
	a. Anxiety disorder	8	2.08
	b. Attention-deficit/hyperactivity (ADHD)	319	83.28
	c. Autism spectrum disorder(ASD)	40	10.44
	d. Mood disorder	80	20.88
	e. Schizophrenia	5	1.30
	f. Eating disorder	111	28.98
2.	<b>Behavioural challenges:</b>		
	a. Showing less concern for one's own safety	111	28.98
	b. Poor school performance	300	78.32
	c. Noncompliant or aggressive behaviour	250	65.27
	d. Frequent complaints of physical symptoms such as headaches and stomach aches	10	2.61
	e. Self imposed injuries	5	1.03
	f. Difficulty concentrating	311	81.20
	g. Neglecting decent appearances	319	83.28
	h. Extreme fear	5	1.03

	i. Avoiding other classmates.	10	2.61
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Source: Fieldwork, 2018.

Mental illnesses were found among primary school children in Ogoni, as some of the children were of showing notable sign of these illnesses. The teachers in the selected schools believed that their children were suffering from mental illnesses such as anxiety disorder (2.08%), attention-deficit/hyperactivity (28.08%), autism spectrum disorder (10.44%), mood disorder (20.88%), schizophrenia (1.30%), and eating disorder (28.98%).

Aside from the already noticed mental illnesses, the children were also exhibiting behavioural challenges like showing less concern for their safety (28.98%), poor school performance (78.32%), aggressive behaviour (65.27%), frequent complaints of headaches and stomach aches (2.61%), self imposed injuries (1.03%), difficulty concentrating (81.20%), neglecting decent appearances (83.28%), extreme fear (1.03%) and avoiding classmates (2.61%) as shown on Table 6.

### Petroleum pollution influences on the developing brain

**Table 7: Multiple responses to petroleum pollution influences on the developing brain**

Variable	Frequency (f)	Percentage (%)
<b>Knowledge of the environment</b>		
(a) Oil exploration is going on in the communities.		
YES	363	94.7
NO	20	5.22
(b) The community environment is polluted.		
YES	383	100
NO	0	0
(c) Illnesses in the communities are linked with petroleum pollution.		
YES	375	97.9
NO	8	2.08
<b>Perceived causes of mental and behavioural illnesses</b>		
(a) Polluted environment	363	94.7
(b) Poverty	45	11.74
(c) Heredity	0	0
(d) Psychoactive substance use	50	13.05
(e) Others, please specify	0	0
<b>Common complaints from petroleum exposures</b>		
(a) Headache	383	100
(b) Nausea	311	81.20
(c) Dizziness	343	89.55
(d) Respiratory diseases	111	28.98

(e) Skin rashes and irritations	311	81.20
(f) Others, please specify	0	0

Source: Fieldwork, 2018

The teachers in the study recognised the influences on petroleum pollution and other environmental factors on the developing brain of the children. The field data revealed that oil exploration is currently on-going in the chosen communities as 94% of the teachers agreed to this opinion, while 5.22% of the teachers believe that there are no current oil explorations in the communities. The results further revealed that the communities are massively polluted as a result of previous and currently oil explorations activities with many associated mental illnesses. The field data revealed that root causes of the mental and behavioural challenges among primary school children in Ogoni are petroleum pollution (94.7%), poverty (11.74%) and psychoactive substance use (13.05%) as shown on Table 7. The exposures of the children to petroleum pollution, which is the major causative factor of the mental illnesses in the communities (94.7%) has resulted into common complaints like headaches (100%), nausea (81.20%), dizziness (89.55%), respiratory diseases (28.98) and skin rashes and irritations (81.20%).

## 5. CONCLUSION

There are links between petroleum pollution and decrease neuro-plasticity of the developing brain of children as some mental and behavioural behaviour exhibited in very young children are resulted from their environment which previous scholars has also acknowledged [2,8,14]. Most of these mental challenges are always overlooked or may not be identified without close attention and that is why teachers who built skills, knowledge and morals into these children play a key role in detection. In the case of Ogoni, there are reports of mental illnesses and behavioural challenges in all the Local Government Areas which have drastically affected the children's performance in school as many have showed signs like aggressive behaviour, poor hygiene, eating disorder, attention deficit and many other challenges. Though, poverty and psychoactive substance use were also mentioned as the some of the contributors of mental illnesses in these school children, but the main causes were said to be petroleum pollution of the environment. Previous scholars also confirms this assertion as psychoactive substance use, poverty and environmental pollution has been recognised as causative factors of mental illnesses in Ogoniland [5,8,13].

In this study, pollution has been recognised as the key causative factor of decrease neuro-plasticity of the developing brain of the primary school of Ogoni. Exposure to pollution has adverse effects on the pulmonary and cardiovascular systems which have been well established in series of major epidemiological and observational studies [1,10]. Constant exposures of the younger children to environmental pollution can gradually lead to decrease neuroplasticity of the brain.

## REFERENCES



1. Bandyopadhyay, A (2016). Neurological disorder from ambient (urban) air pollution emphasizing UFPs and PM<sub>2.5</sub>. *Current Pollution Reports*. 2(3): 203-211.
2. Beauchaine, T.P., Gatzke-Kopp, L., and Mead, H.K. (2007). Polyvalgal theory and development psychopathology: Emotion dysregulation and conduct problems from preschool to adolescence. *Biological Psychology*, 74(2), 174-184.
3. Bodo, T (2019). Deep Issues behind the Crisis in the Niger Delta Region: The Case of Oil Exploration in Ogoniland, Rivers State, Nigeria. *Asia Journal of geographical Research*. 2(1):1-12
4. Bodo, T (2018). Community Understanding of the Environmental and Socio-economic Consequences of Petroleum Exploitation in Ogoni, Rivers State, Nigeria. *International Journal of Advanced Research and Publications*. 2(11): 51-55
5. Bodo T. and David L.K (2018). The Petroleum Exploitation and Pollution in Ogoni, Rivers State, Nigeria: The Community Perspective. *European Scientific Journal*. 14 (32):197-212.
6. Bodo, T and Bodo C.B (2019). The Applicability of the Rule in Rylands V. Fletcher to Petroleum Activities in Nigeria. *Asian Journal of Advance Research Reports*. 3(1): 1-10
7. Bodo, T and Gimah, G.B (2018). Government Programmes in checking the occurrence of habitat loss and their implications for maintaining sustainable environment in Ogoni, Rivers State, Nigeria. *European Journal of Biomedical and Pharmaceutical Sciences*. 5(12): 64-71.
8. David, L. K and Bodo, T (2019). Environmental Pollution and Health Challenges of the Ogoni People, Rivers State, Nigeria. *International Journal of Advanced Research and Publication*. 3(2): 28-32
9. Desta M., Deyessa N., Fish I., Maxwell B., Zerihun T., Levine S., Fox C., Giedd J., Zelleke G.T, Alem A., and Garland A.F (2017). Empowering preschool teachers to identify mental health problems: A task-sharing intervention in Ethiopia. *Mind, Brain and Education*. 11(1): 32-42
10. Genc S., Zadeoglulari, Z., Fuss, S.H and Genc K (2012). The adverse effects of air pollution on the nervous system. *Journal of Toxicology*. Volume 2012, Article ID 782462, 23 pages <http://dx.doi.org/10.1155/2012/782462> (retrieved February 16, 2019)
11. Gimah, B.G and Bodo, T (2018) Creation of Awareness through Environmental Adult Education as a solution to the Problem of Habitat Loss in Ogoni, Rivers State, Nigeria. *International Journal of Advanced Research and Publications*. 2(12):8-15.
12. National Population Census of Nigeria (NRC), 2006

- 237 13. Vidona W.B, Wadioni A, Okeke S. N, and Bodo T. (2017). Evaluation of Psychoactive  
238 Substance use and its risk factors among Public School Students of Rivers State, Nigeria.  
239 *Asian J. Pharm. Res.* 7(3): 175-182.  
240
- 241 14. Ozonoff, S. (2015). Editorial: Early detection of mental health and neurodevelopment  
242 disorders: The ethical challenges of a field in its infancy, *Journal of child Psychology and*  
243 *Psychiatry*, 56, 933-935.  
244
- 245 15. Some notable consequences of mental challenges. [https://www.mayoclinic.org/health-](https://www.mayoclinic.org/health-lifestyle/children-health/in-indepth/mental-illness-in-children/art-2004657)  
246 [lifestyle/children-health/in-indepth/mental-illness-in-children/art-2004657](https://www.mayoclinic.org/health-lifestyle/children-health/in-indepth/mental-illness-in-children/art-2004657) (Retrieved  
247 February 16th, 2019).  
248
- 249 16. Zoe Schlanger. Air pollution is impeding our children's brain development.  
250 [http://www.google.com/amp/s/qz.com/1446353/air-pollution-is-making-our-children-](http://www.google.com/amp/s/qz.com/1446353/air-pollution-is-making-our-children-dumber/amp/)  
251 [dumber/amp/](http://www.google.com/amp/s/qz.com/1446353/air-pollution-is-making-our-children-dumber/amp/)(Retrieved February 16th, 2019).  
252  
253