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- Laires MJ, Monteiro CP. Magnesium and physical exercise In: Smetna R (ed) *Advances in Magnesium Research 1* England: John Libbey & Company Ltd, 1997; 325-331.

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## **ASSESSMENT OF KNOWLEDGE AND ATTITUDE ABOUT TYPE II DIABETES AMONG HAUSA-SPEAKING PUBLIC SCHOOL-GOING ADOLESCENTS IN KANO**

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### **ABSTRACT**

**Background:** Accurate knowledge of Type II diabetes Mellitus (T2DM) is important for early screening and prevention of the disease among individuals. However, evidence is limited on the knowledge and attitude about Type II diabetes among Hausa-speaking public school-going adolescents in Kano, northern Nigeria.

**Methods:** This study was cross-sectional survey with a multistage cluster sampling technique involving 425 school-going adolescents aged 11-19 years old in five public secondary schools. The Diabetes Knowledge Questionnaire (DKQ) and Diabetes Attitude Scale-3 (DAS-3) were used to assess the levels of knowledge and attitude about T2DM respectively.

**Results:** None of the participants had a good level knowledge score and only 37.9% of the participants had a satisfactory level knowledge score about T2DM. However, the participants had positive attitude to 'seriousness of Type II diabetes (3.05±0.44), 'need for special training' (4.35±0.5), 'psychological impact of T2DM' (3.93±0.41) and 'autonomy of patients'

(3.89±0.45).

**Conclusion:** Despite the positive attitude towards T2DM, the level of knowledge on T2DM among school-going adolescents is still poor. Therefore, school-based programs aimed at improving knowledge of T2DM are needed in public secondary schools in Kano.

**Keywords:** diabetes, attitude, knowledge, adolescents

### **Introduction**

Type II Diabetes mellitus (T2DM) occurs when insulin secretion is inadequate to meet the increased demand posed by insulin resistance, leading to relative insulin deficiency<sup>1</sup> and is generally associated with other metabolic abnormalities<sup>2</sup>. The chronic complications of diabetes mellitus include accelerated development of cardiovascular diseases, end-stage renal disease, loss of visual acuity, and limb amputations; all of these complications contribute to the excess morbidity and mortality in individuals with T2DM<sup>3</sup>. Unlike Type I diabetes mellitus (T1DM), there is no identified

autoimmune process leading to inadequate insulin secretion in T2DM<sup>2</sup> and inadequate insulin secretion appears to result from genetic, environmental, and metabolic causes and may differ between individuals<sup>2</sup>.

T2DM has rapidly evolved from a disease of the Western nations to a global disease; from a disease of affluence to a disease that now afflict the poor; and from an adult-onset disease to a disease that is gaining prominence in the pediatric population<sup>4</sup>. Thirty years ago, T2DM has been thought to be a rare occurrence in children and adolescents. However, in the mid-1990s, investigators began to observe an increasing incidence of T2DM worldwide<sup>5</sup>. In 2011, global estimation on diabetes mellitus shows that, on the average, diabetes affects at least 285 million people worldwide out of which two-thirds occur in developing (low-to middle-income) countries<sup>6</sup>.

In the North America, T2DM now accounts for about 15% to 45% of all newly diagnosed cases of diabetes in children and teenagers<sup>7</sup>. T2DM has also been reported in children in Australia<sup>8</sup>, United Kingdom<sup>9</sup> and Asian- pacific countries such as Japan<sup>10</sup> and India<sup>11</sup>. Although type 1 DM remains the major form of the disease in children worldwide, it is likely that T2DM will be the predominant form within a decade in many ethnic groups<sup>12</sup>. For instance, among children in Japan, T2DM is already more common than T1DM which accounts for 80% of childhood diabetes<sup>10</sup>. A recent increase in the incidence of T2DM has been reported in children and adolescents in Sub-saharan Africa<sup>13, 14</sup>. In Nigeria, specifically, the burden of T2DM among children presents with a prevalence of 0.1/1000 in 2009 and 10.1/1000 in

2013<sup>15</sup>.

This global rise in prevalence of diabetes has been attributed to lifestyle changes as a result of increasing urbanization with resultant reduction in physical activity, increased caloric intake, obesity as well as lack of information on healthy living<sup>16</sup>. Children and adolescents in Nigeria increasingly adopt western lifestyle including the consumption of junk fatty food and food additives. The eroding culture of partaking in farm work and walking long distances, poor culture of daily exercises among community members all contributes to the new era of sedentary lifestyle<sup>17</sup>.

However, most children with T2DM are obese or extremely obese at diagnosis and present with glucosuria without ketonuria, absent or mild polyuria or polydipsia and little or no weight loss<sup>18</sup>. In mildest form of type T2DM, a child may present with hyperglycaemia or glycosuria<sup>19</sup>. Whereas, in the severe form of this diabetes, the child may present with polyuria, polydipsia and weight loss<sup>19</sup>. Knowledge of developing the T2DM and understanding of its risk factors has been suggested as the greatest weapon in the fight against T2DM<sup>20</sup>. It has been reported that education is the most effective way to lessen the complication of diabetes and its management<sup>21</sup>.

In Nigeria and most developing countries, diabetes mellitus in adolescents is still a huge burden as most children die before they are diagnosed or are misdiagnosed as other childhood illnesses, which mimic diabetes mellitus<sup>22</sup>. Awareness amongst the general population about childhood diabetes is still very low and there is need for improved awareness, knowledge, and

technological capacity in the management of T2DM. Most studies on knowledge of diabetes mellitus in Nigeria have focused on adult populations<sup>22,23</sup> while few considered adolescents in South-South<sup>24</sup>, and South-West regions of Nigeria<sup>25</sup>.

However, because of the heterogeneous nature of the adolescent populations in Nigeria small sample sizes inherent in these studies have limited their generalisability to entire Nigeria populations. A recent search of existing literature showed a dearth of studies that describe the knowledge and attitude about T2DM among adolescents mainly in Kano State. Therefore, the objective of this study was to assess the knowledge, attitude and the association between demographic variables with knowledge and attitude about T2DM among Hausa-speaking public school-going adolescents aged 11-19 years in Kano municipal, Nigeria.

## **Materials And Methods**

### **Research design and setting**

The research design for this study was a cross-sectional study conducted among school-going adolescents aged 11-19 years attending government public schools in Kano metropolis. The study was conducted in Kano Municipal, the capital city of Kano State. It has area of 17 km<sup>2</sup> and 13 wards with a population of 365,525 at the 2006 census. A Hausa land where the major spoken language is Hausa and majority are Muslims. Kano municipal has 30 government secondary schools.

### **Ethical approval**

Ethical approval to conduct this study was sought

from the Health Research Ethics Committee of Kano State Hospitals' Management Board, Nigeria, according to the declaration of the Helsinki. An Introductory Letter was collected from the department of Physiotherapy and taken to the Chairman, Kano State Secondary School Management Board where letter of approval was obtained. Informed consent was obtained from the participant. Informed assent was sought and obtained from students who were less than 19 years. Participants were briefed about the objectives of the study and were allowed to withdraw themselves at any stage of the study.

### **Sample size and sampling technique**

The formula below was used to estimate the appropriate sample size to correctly determine knowledge and attitudes towards T2DM among school-going adolescents.

$N = Z^2P(1-P)/d^2$  Where:

N= sample size

Z = 1.96

P = 48.6% (proportion of undergraduate student who knew that individuals with T2DM can have good quality of life<sup>26</sup>).

D = absolute error (5%)

Base on the estimate of 48.6% of the undergraduate student who knew that individuals with T2DM can have good quality of life<sup>26</sup> at 5% margin of error of the estimate; using the formula above a sample size of 384 was deemed appropriate for this study. Taking into account a 10% non response rate due to incomplete filling of the questionnaire in part, a sample size of 425 school-going Adolescents were recruited into the study.

A cluster sampling technique was used to select five public schools at random from a cluster of 30.

The cluster K<sup>th</sup> was estimated to be six. Thus five cluster of schools (30/6 =5) were conveniently selected from the population of 30 public schools in Kano municipal. In order to know how many will be needed from each cluster; the sample size was divided by the clusters (5). Therefore,  $n = 425/5$ ; a total of 85 participants were randomly selected using simple random sampling technique (balloting) from each school from students in Junior Secondary School I (JSS I) to Senior Secondary School II (SS II). The selected schools for the study were Rumfa College, Maryam Aloma Muktar Government Girls Secondary School, Kofar Nassarawa Government Secondary School, Sabuwar kofa Government Secondary School and Hassana Sufi Government Girls Secondary School.

#### **Eligibility criteria**

The criteria for inclusion in the study were; 1) Hausa-speaking students, 2) who attend public school, 3) either in junior or senior secondary classes, and 4) within adolescents' age of 11-19 years. The exclusion criteria participants were; 1) learners with visual disability, 2) individuals who were not proficient in Hausa language, 3) individuals with mental retardation or Downs' syndrome, and 4) unable to provide consent.

#### **Translation of the Questionnaire**

The Diabetes Attitude Survey questionnaire and Diabetes Knowledge Questionnaire were translated to Hausa by experts from the Languages Department, Faculty of Arts, Bayero University Kano. The purpose of the translation was to explain the contents of the tools to the participants in their proficient language in order to ensure their good understanding and maximum co-operation.

These translated versions of questionnaires were administered, and participants who found it difficult to understand how to fill the questionnaire were assisted by the researcher.

#### **Patient's Diabetes Knowledge Questionnaire.**

The instrument used to assess the level of diabetes knowledge was adopted from Diabetes Knowledge Questionnaire (DKQ)<sup>27</sup>. The questionnaire consisted of 24 questions on knowledge of T2DM regarding causes, diagnosis, prevention and risk factors. The content validity and internal reliability have been reported as good<sup>27</sup>. The overall knowledge score is 24 and it is categorized as:

0 – 8 = poor knowledge

9 – 16 = satisfactory knowledge

17 – 24 = good knowledge

#### **Diabetes Attitude Scale questionnaire (DAS)**

The instrument used to assess the level of diabetes attitude was adopted from Diabetes Attitude Survey questionnaire (DAS-3)<sup>28</sup>. The questionnaire consist 33 questions on attitude toward type 2 diabetes mellitus regarding special training, seriousness of NIDDM, value control, psychological impact and autonomy. The content validity and internal reliability have been reported as good<sup>28</sup>.

Scoring: A five-point-Likert scale was used to measure attitude; Strongly-agree = 5; Agree = 4; Undecided = 3; Disagree= 2; Strongly Disagree = 1. Scores for items 2, 3, 7, 11, 13, 15, 16, 23, 26 and 28 were reversed. Final scores were categorized as attitude to 'Need for Special Training', 'Seriousness of T2DM', Value Control', 'Psychological Impact of T2DM' and 'Patient

Autonomy'.

### **Demographic and Anthropomorphic Measures**

Socio-demographic form was used to obtain information on age, gender, class, tribe, marital status, smoking status, history of T2DM and any chronic non-communicable disease. Weight and height were measured in light clothing using a weighing scale and stadiometer.

### **Data Analysis Procedure**

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0 software. Descriptive statistics of mean, standard deviation and percentages were used to summarize the socio-demographic characteristics, anthropometric variables, knowledge and attitude of the participants about T2DM. Chi-square test was used to examine the association between knowledge and categorical variables of attitude, gender, family history of diabetes and BMI categories. Alpha probability value was set at 0.05.

### **Results**

#### **Demographic characteristics, Attitude and Knowledge of the participants**

The study comprises of four hundred and twenty-five (425) participants with 225 (52.9%) male and 200 (47.1%) female. The mean (standard deviation (SD)) age was 15.43( $\pm$ 1.93); 32% were 11 – 14 years old, 49.4% were 15 – 17 years old and 17.9 were 18 – 21 years old. The mean (Standard Deviation (SD)) BMI was 19.07 ( $\pm$  2.43)Kg/m<sup>2</sup>; majority (52.2%) had normal BMI, a significant percentage (45.4%) were underweight, which a few (2.4%) were over-weight (Table

1).Overall, on the scale 24.0, the average knowledge score was  $7.82 \pm 2.93$  while attitude was  $3.63 \pm 0.27$  on the scale of 5.

### **Knowledge of Diabetes Mellitus**

A correct response for each of the 24 questions on Diabetes Knowledge Questionnaire are presented in Table 3.Only 36.7% of the children knew that T2DM is caused as a result of lack of sufficient effective insulin in the body. About 78% erroneously believed that eating too much sugar and sweet cause T2DM. A significant percentage of the students do not know the correct method of diagnosing diabetes as only 8.2% knew. Around 41.9% of the children knew that diabetes can be inherited from parents. Majority of the participants had no knowledge regarding the correct method of diagnosing T2DM (92%), where around 89% believed that T2DM could be cured (Table 2).

### **Knowledge of Type II Diabetes Mellitus by Age**

The knowledge of T2DM by age is presented in Table 4. For most of the questions; late adolescent (18-21) were significantly more knowledgeable about T2DM compared to early and middle adolescents (11-14 and 15-17) respectively ( $p < 0.05$ ) (Table 4). For example, half of the adolescents aged 18 years and above compared to about 26% of adolescents aged 11-14 years knew that diabetes is caused by lack of effective insulin (Table 3).

### **Relationship between Knowledge and Socio-demographic Variables**

The results of this study showed that older adolescents significantly had satisfactory knowledge compared to younger adolescents (69.7% vs. 19.4%; p-value = 0.001) (Table 5). Moreover, participants who were overweight had a significantly satisfactory knowledge compared to underweight adolescents (70% vs. 31.6%; p-value = 0.01). However, gender difference and history of T2DM were not associated with knowledge of T2DM.

### **Participants Attitude about T2DM**

Attitude toward T2DM were categorized into five categories: Special Training, Seriousness of T2DM, Value Control, Psychological Impact of T2DM and Patient's Autonomy. On the scale of 5, attitude toward special training is seen to be positive in both boys and girls ( $4.49 \pm 0.57$  and  $4.51 \pm 0.56$  respectively), while attitude toward value control is seen to be negative in both boys and girls ( $2.81 \pm 0.38$  and  $2.78 \pm 0.46$  respectively). (Table 5)

### **Relationship between Attitude and Age of the Participants**

A strong association exist between attitude and age with p-value = 0.001 in Special training, Seriousness of NIDDM, Value control, Psychological impact and a p-value= 0.006 in Autonomy. (Table 6)

**Table 1: Demographic characteristics, attitude and knowledge of the participants**

<b>Age</b>	<b>(%)</b>
11 – 14	32
15 – 17	49.4
18 – 19	17.9
Mean( $\pm$ SD)	15.43( $\pm$ 1.93)*
<b>Gender</b>	
Boys	52.9
Girls	47.1
<b>Class</b>	
JS1	20
JS2	20
JS3	20
SS1	20
SS2	20
<b>BMI</b>	
Overweight	2.4
Normal	52.2
Underweight	45.4
Mean( $\pm$ SD)	19.07 ( $\pm$ 2.43)*
<b>Knowledge</b>	
Good	0
Satisfactory	37.9
Poor	62.1
Mean( $\pm$ SD)	<b>7.82 <math>\pm</math> 2.93*</b>
<b>Attitude (M+SD)</b>	
Special training	4.35 $\pm$ 0.50*
Seriousness of NIDDM	3.05 $\pm$ 0.44*
Value control	2.79 $\pm$ 0.42*
Psychological impact	3.93 $\pm$ 0.41*
Autonomy	3.89 $\pm$ 0.45*
<b>Total</b>	<b>3.63 <math>\pm</math> 0.27*</b>

\* are averages of mean  $\pm$  standard deviation

**Table 2: Score of the Participants Knowledge of Diabetes Mellitus**

S/N	Questions	Right response (%)
1	Eating too much sugar and sweet causes diabetes	<b>22.0</b>
2	The usual cause of diabetes mellitus is lack of effective insulin	36.7
3	Diabetes mellitus is caused by failure of kidney to keep sugar out of the body	13.2
4	Kidney produce insulin	12.0
5	In untreated diabetes mellitus, the amount of sugar in the blood usually increase	69.2
6	If I am diabetic, my children have higher chance of having diabetes mellitus	41.9
7	Diabetes can be cured	<b>19.1</b>
8	Fasting blood sugar up to 210 is too high	33.6
9	The best way to check my diabetes is by testing my urine	<b>8.2</b>
10	Regular exercise will increase the need for insulin or other diabetes medication	13.6
11	There are two types of diabetes mellitus, type 1 and type 2	24.2
12	An insulin reaction is caused by too much food	21.6
13	Medication is more important than diet and exercise to control my diabetes	33.4
14	Diabetes often cause poor circulation	47.5
15	Cuts and abrasion on diabetes heal more slowly	71.1
16	Diabetics should take extra care in cutting their toenails	73.4
17	A person with diabetes mellitus should clean wound with iodine and alcohol	21.2
18	The way I prepare my food is as important as the food I eat	50.6
19	Diabetes can damage my kidney	64.5
20	Diabetes can cause loss of feeling in my hands, fingers and feet	60.9
21	Shaking and sweating are signs of high blood sugar	<b>10.1</b>
22	Frequent urination and thirst are signs of low blood sugar	<b>11.1</b>
23	Tight elastic socks are not bad for diabetics	<b>9.6</b>
24	A diabetics diet consist of mainly special food	<b>7.1</b>

**Table 3: Chi-square relationship between Knowledge of T2DM and Age among Participants**

SN	Questions	Age			p-value
		(years)			
		11- 14	15-17	18-21	
		(%)	(%)	(%)	
1	Eating too much sugar and sweet causes diabetes	14.4	24.8	28.9	<b>0.021</b>
2	The usual cause of diabetes mellitus is lack of effective insulin	25.9	39	50	<b>0.001</b>
3	Diabetes mellitus is caused by failure of kidney to keep sugar out of the body	5.8	15.2	21.1	<b>0.003</b>
4	Kidney produce insulin	10.1	11.9	15.8	0.467
5	In untreated diabetes mellitus, the amount of sugar in the blood usually increase	60.4	71.9	77.6	<b>0.016</b>
6	If I am diabetic, my children have higher chance of having diabetes mellitus	45.3	37.6	47.4	0.204
7	Diabetes can be cured	21.6	19.0	14.5	0.447
8	Fasting blood sugar up to 210 is too high	25.2	36.7	40.8	<b>0.029</b>
9	The best way to check my diabetes is by testing my urine	5.8	8.6	11.8	0.291
10	Regular exercise will increase the need for insulin or other diabetes medication	15.8	11.4	15.8	0.420
11	There are two types of diabetes mellitus, type 1 and type 2	19.4	23.8	34.2	0.053
12	An insulin reaction is caused by too much food	20.1	21.4	25.0	0.707
13	Medication is more important than diet and exercise to control my diabetes	21.6	32.9	56.6	<b>0.001</b>
14	Diabetes often cause poor circulation	37.4	48.1	64.5	<b>0.001</b>
15	Cuts and abrasion on diabetes heal more slowly	59.7	74.8	81.6	<b>0.001</b>
16	Diabetics should take extra care in cutting their toenails	62.6	75.7	86.8	<b>0.001</b>
17	A person with diabetes mellitus should clean wound with iodine and alcohol	12.9	22.4	32.9	<b>0.002</b>
18	The way I prepare my food is as important as the food I eat	34.5	56.7	63.2	<b>0.001</b>
19	Diabetes can damage my kidney	60.4	61.4	80.3	<b>0.006</b>
20	Diabetes can cause loss of feeling in my hands, fingers and feet	54.7	61.4	71.1	0.062
21	Shaking and sweating are signs of high blood sugar	10.1	9.1	11.8	0.048
22	Frequent urination and thirst are signs of low blood sugar	5.0	10.5	23.7	<b>0.001</b>
23	Tight elastic socks are not bad for diabetics	8.6	9.0	13.2	0.515
24	A diabetics diet consist of mainly special food	8.6	7.1	3.9	0.438

**Table 4: Relationship between knowledge and socio-demographic variable of the participants**

Age	Satisfactory (%)	Poor (%)	p-value
11 – 14	19.4	80.6	<b>0.001</b>
15 – 17	38.6	61.4	
18 – 21	69.7	30.3	
<b>Gender</b>			
Male	40.4	59.6	0.271
Female	35	65	
<b>BMI</b>			
Overweight	70	30	<b>0.001</b>
Normal	41.9	38.1	
Underweight	31.6	68.4	
<b>History of T2DM</b>			
History	39.3	60.7	0.614
No history	36.8	63.2	

Statistical test: Knowledge and age = Pearson correlation; knowledge and gender = Chi-square; knowledge and BMI = Spearman correlation; knowledge and history of T2DM = Chi-square

**Table 5: Association between Diabetes Attitude and Gender using the Independent T-test**

Attitude	Overall (M±SD)	Boys (M±SD)	Girls (M±SD)	p-values
Special training	4.35 ± 0.50	4.49 ± 0.57	4.51 ± 0.56	0.636
Seriousness of NIDDM	3.05 ± 0.44	3.07 ± 0.48	3.03 ± 0.39	0.323
Value control	2.79 ± 0.42	2.81 ± 0.38	2.78 ± 0.46	0.475
Psychological impact	3.93 ± 0.41	3.90 ± 0.44	3.93 ± 0.39	0.380
Autonomy	3.89 ± 0.45	3.82 ± 0.54	3.92 ± 0.46	0.047
Total attitude	3.63±0.27	3.64±0.27	3.63±0.27	0.724

NIDDM: Non Insulin Dependent Diabetes mellitus; SD: Standard Deviation. Statistical test; Independent T-test

**Table 6: Relationship between Attitude and Age using the pearson's product moment correlation coefficient**

Attitude	(r)	p-value
Special training	0.207**	0.001
Seriousness of NIDDM	0.158**	0.001
Value control	0.203**	0.001
Psychological impact	0.253**	0.001
Autonomy	0.133**	0.006
Total attitude	0.324**	0.001

\*\* significant correlation Statistical test: Pearson rho correlation

### Discussion

The study of the knowledge of diabetes in various populations has become quite significant in young people as part of measure to control the disease. However, knowledge of the disease is not sufficient to battle the menace; it presumes change in behavior, habit and attitudes<sup>29</sup>. Education is an important aspect of this process and through multidisciplinary school-based interventions to bridge the knowledge gap thereby facilitating an increase in the knowledge of T2DM.

This study examined the level of knowledge and attitude about T2DM among Hausa-speaking public school-going adolescents in Kano municipal, also explore the association between knowledge and attitude with demographic variables of age, gender, class and BMI categories. There was very low level of knowledge about T2DM which is associated with age, gender, class and BMI categories.

Majority (62.1%) of the participants had poor knowledge about T2DM, while only 37.9% had satisfactory knowledge and none of the participant had good knowledge. This is in contrast to a study that identified the knowledge gaps and risk factors

among adolescents attending a public school in Lagos State where 66% of the respondents were aware of the condition<sup>25</sup>. Another study on knowledge and awareness of diabetes mellitus among adolescents in Port-Harcourt<sup>24</sup> showed a higher level of knowledge with 90% of the respondents being aware of diabetes mellitus. This disparity in figures may be due to the fact that both studies considered only the learners from senior classes and that could explain the reason for the higher level of knowledge. The difference could also be attributed to different outcome measure (DKQ) used to assess the level of knowledge in this study.

Level of class is another factor that influenced the level of knowledge about T2DM in this study. Students at higher classes are seen to have higher level of knowledge than those at lower classes ( $p=0.01$ ). This finding is consistent with a study that showed that learners from senior classes have better knowledge as regards diagnoses of diabetes mellitus than their junior counterparts<sup>30</sup>. Similarly, it was observed from this study that increase in level of knowledge is associated with increase in age. In addition, this finding is consistent with a study that

found a relationship between higher age and increased knowledge<sup>20</sup>.

Regarding relationship with gender and knowledge of T2DM, some other studies have associated female gender with higher knowledge, while some have associated it with poorer knowledge and some have claimed that gender has no association with diabetic knowledge<sup>31</sup>. The findings of this study identified no significant difference in knowledge between boys and girls (40.3% and 35.0% respectively with  $p=0.271$ ). This view is also shared by a study conducted in Lagos that observed no gender association with knowledge of T2DM<sup>25</sup>.

As regards to the lifestyle risk factors for diabetes mellitus, 41.9% of the respondents had a family history of diabetes mellitus, which is in contrast with (62%) from Oman<sup>32</sup>. This huge discrepancy in Nigerian and International study could be attributed to the fact that the overall prevalence of diabetes mellitus in Nigeria is lower than that found in countries in other continents. And the higher percentage of participants with family history of diabetes obtained from this study in comparison to other Nigeria studies<sup>25,30</sup> may be due to the rapidity in increasing prevalence of diabetes mellitus in Kano State. Despite high percentage of participants with family history of diabetes, there was no significance difference in knowledge between those having family history and those with no family history of T2DM.

In relation to attitude the respondents in this study performed more positively. Most of them had a good attitude toward the disease. The study revealed that there is a significant relationship between age and class level with good attitude. Older students and those at higher classes are seen to have more positive attitude with  $p=0.001$ . This coincides with some other studies that have shown that level of

attitude increase in an ascending order of primary education, secondary education and tertiary education with a 0.003  $p$ -value<sup>33</sup>. In contrast to these, a study that was conducted in University of Benin Teaching Hospital, Benin city showed that higher education had no effect on diabetic knowledge and attitude<sup>3</sup>. No significant association was seen to exist between attitude and gender in this study ( $p=0.724$ ). Even though, this study considered only school-going adolescents, but the outcome corroborates with the results of a study that combined both adults and adolescents a Semi Urban Community in the South-South Region of Nigeria<sup>33</sup>.

In 2008, the Center for Disease Control and prevention in a report stated that, children and adolescents are at risk if they are obese, insulin resistant, and have a family history of this disease<sup>35</sup>. Interestingly, in this study level of knowledge is seen to increase with an increasing order of BMI which is dissimilar to previous study where no significant association was found between BMI and level of knowledge ( $p=0.913$ )<sup>25</sup>. The reason for the association between knowledge and BMI in this study could be attributed to a higher level of health consciousness among obese/overweight individuals.

### **Conclusion**

From the findings of this study it can be concluded that Hausa-speaking public school-going adolescents have poor knowledge but positive attitude towards T2DM. Therefore, a comprehensive health education and promotion program on Diabetes should be well thought-out to improve knowledge, lessen risk factors and to maintain the attitude among these public school-going adolescents.

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## **CHALLENGES OF PAEDIATRIC RADIOGRAPHY IN SELECTED HOSPITALS AND RADIO-DIAGNOSTIC CENTRES IN ANAMBRA STATE, NIGERIA**

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### **ABSTRACT**

**Background:** The difficulties experienced by radiographers in positioning and immobilizing the paediatric patient before and during radiographic examinations have been poorly documented in Nnewi metropolis.

**Objective:** To assess the challenges encountered by radiographers in conventional imaging of paediatrics in the study area.

**Methods:** This was a non-experimental prospective cross-sectional survey research. The population size was 45 and consisted of all licensed radiographers working in three selected radio-diagnostic centres with a sample size of 40. A semi-structured questionnaire was used for data collection using consecutive sampling of all radiographers in the selected facilities, who also consented to participate in the study. Obtained data was summarized and presented using frequencies, percentages, mean and standard deviation.

**Result:** This study found the challenges of paediatric radiography to include: lack of specialized skills 32(92.5%), lack of dedicated

paediatric equipment 26(26%), the inability of paediatrics to remain still for the examination 25(62.5%), excess workload/stress 19(47.5%), inadequate immobilization devices 16(40%), apprehensiveness of the paediatrics 13(32.5%), the playfulness of paediatrics 7(17.5%), and poor pain tolerance 1(2.5%). Out of these only, the apprehensive nature of paediatrics was a statistically significant challenge ( $P \leq 0.05$ ,  $F=6.845$ ,  $P=0.015$ ) to paediatric radiography. The most effective way of gaining the co-operation of paediatric patients was through the assistance of parents/caregivers 32(80%).

**Conclusion:** The significant challenges of radiographers during paediatric radiographic examinations were difficulty in positioning for skull examinations and the apprehensive nature of the paediatric patients. Other challenges included inability of the radiographer to obtain the co-operation of the paediatrics during radiological procedures, lack of specialized skills among radiographers and lack of paediatric-specific immobilization devices.

**Keywords:** challenges, paediatric radiography,

selected hospitals, radio-diagnostic centres.

### **Introduction**

Paediatric radiography is a subset within general radiography, specializing in the radiographic imaging of the paediatric population. The general principles of radiography remain the same in paediatric radiography but additional consideration needs to be taken into account when determining patient-specific exposure factors, immobilization techniques and appropriateness of examinations. Paediatric radiography is an integral part of paediatric health care which is frequently requested to assist in the diagnosis, management, and treatment of childhood diseases and illnesses. Accurate interpretation of paediatric radiographs can depend entirely on the quality of images produced by the Radiographer, yet there are few materials available on this important aspect of the radiographic practice<sup>1,2</sup>.

Although paediatric imaging and adult radiography have many similarities, including basic positioning and image quality assessment, there are some significant differences. The way to approach the child tops the list of differences. Another characteristic of paediatric imaging revolves around the increased sensitivity of children to radiation and the imperative need to take steps to reduce the dose administered every time a procedure involving X-radiation is done. The concept of 'imaging gently' has been introduced in paediatric radiography to increase the awareness of radiographers and other radiation workers in order to address the concern of parents and guardians to unnecessary radiation exposures of paediatrics<sup>3,1</sup>.

However paediatric radiography, despite being acknowledged as an imaging specialization, does not have a strong presence in either undergraduate or

postgraduate radiography education programs, and the availability of current published literature aimed at general radiographers is extremely limited. Thus, paediatric radiography is not recognized as an extended role for registered Radiographers and radiographers have no special recognition in this area. Also, Paediatric radiography has no formal career structure and thus there is little incentive for radiographers to specialize in this area<sup>1</sup>.

Imaging in paediatrics also poses challenges, especially in ultrasonography where getting the cooperation of the child and prevention of infection to infants during paediatric ultrasound scans remains an issue. There are general concerns about the amount of radiation exposure from paediatric CT due to the radiosensitivity of developing and immature tissues in children. The main challenge involved in imaging children with MRI emanates from the following; The small anatomic structures of body parts in children result in challenges with respect to the availability of signals as well as limits of resolution. The speed of image acquisition and contrast media injection rates may be affected by physiological changes in children, for example, the heart as well as pulse rates, breathing and rate of blood flow are different in neonates when compared with adult subjects, thereby requiring protocol modification with shorter times for acquisition of diagnostic images. Children often find it difficult to hold their breath during radiographic examinations and this may introduce artefacts during the process of image acquisition. Children are also increasingly aware of changes in their environment and less likely to co-operate with strangers which poses more difficulties on the time and energy of the staff<sup>2</sup>. Parents can therefore be encouraged to be as supportive as possible and to bring the child's favourite toys, blanket or books. It is preferable for

the staff to give explanations to the child with the parents listening. Great care must be taken to talk slowly, clearly and in short, succinct sentences. Oftentimes a more senior member of the department may be needed to discuss any significant problems. The parent may be present as a participator, assist with immobilization and may be asked to remain in the waiting area and not accompany the child into the radiography room. Some children who act fearful and combative in the waiting room in the presence of their parents may be more cooperative without their presence. At this time, the radiographer's communication skills and knowledge will be tested and applied to calm the child down or he/she may seek assistance from other staff in the department to solicit the child's attention and obtain quality radiographic images. This requires special considerations and treatments so as to obtain the best diagnostic results during the radiographic results<sup>4,1</sup>. Conventional radiographic examination in paediatrics presents several challenges compared to that of adults and even geriatrics. Radiographic imaging that involves children come with many difficulties because of the special nature of children both anatomically and psychologically, their tender age, and inability to comprehend the examination procedures or comprehend a change in environment. When children are ill, they follow their instincts, which is usually to cry and stay close to their parents. This presents a huge challenge to the Radiographer, who must try to gain the child's trust and cooperation<sup>5</sup>. Once this has been achieved there is another big challenge of keeping the child still or immobilized for the radiographic examination to be carried out which can be very difficult for most children. Staying still for a few seconds might translate to hours for children coupled with the fear of the hospital environment may make them very anxious

and uncooperative during the radiographic exposure. This may lead to motion blur and the production of images of poor diagnostic quality. To prevent the production of poor-quality paediatric radiographs, specialized imaging protocols, special training for radiographers and radiologists on techniques and paediatric image evaluation is required<sup>4,5</sup>. The need to prevent avoidable exposure to ionizing radiation is another facet of the challenges relevant in a radiographic examination of paediatrics<sup>6</sup>.

Repeat radiographic examinations in paediatric cases can be tracked over time to ensure its justification to avert increased radiation dose to the child or infant which may lead to radiation hazards in the future. Nevertheless, radiation dose tracking, as well as the provision of alternate radiological protocols or pathways/techniques which can be incorporated in paediatric patient management to reduce the overall cumulative radiation exposure has remained a challenge in Nigeria due to poor infrastructure and records<sup>7</sup>. Repeat also results in waste of film materials and increases patient waiting time. Therefore, overcoming these challenges through the use of appropriate skills/experience, and paediatric positioning equipment and devices is key to obtaining quality images for the management of the paediatric patient.

The production of high-quality images by the radiographer may vary from one locality to another due to several factors including the availability of relevant skills, training, equipment as well as accessories<sup>4</sup> that are suboptimal in our locality. Moreover, few studies have evaluated the challenges of conventional paediatric radiography in our locality, especially in Nnewi, Anambra State. Therefore, the aim of this study was to assess the major challenges faced by Radiographers during

paediatric x-ray examination, in Nnewi, Anambra State of Nigeria.

### **Methods**

This prospective cross-sectional study was carried out in the radio-diagnostic departments in Nnamdi Azikiwe University Teaching Hospital [NAUTH], Waves Diagnostic Centre and ObiJackson Children (both in Nnewi) and Women Hospital Okija, all in Anambra state, Nigeria. The study sampled all practising Radiographers (n = 45) working in the radiology department in Nnamdi Azikiwe University Teaching Hospital [NAUTH] Nnewi (centre A), Waves Diagnostic Centre Nnewi (centre B) and Obijackson Children and Women Hospital Okija (centre C). Ethical approval with reference number: NAU/FHST/2021/rad41 was obtained from the Ethical Review Committee of the Faculty of Health Science and Technology, Nnamdi Azikiwe University, Nnewi Campus, Anambra state. Consecutive sampling was used to enlist consenting paediatric patients for the study which involved the use of questionnaires which was administered by the researchers. The sample size of 40 was determined using the method described by Otabor and Obahiagbon, (2016) <sup>8</sup>. The Instrument for data collection was a semi-structured questionnaire divided into sections A, B and C. Section A contained information on the demographic data of respondents, section B contained questions related to challenges in paediatric radiography that the respondents must have encountered while section C contained questions related to the solution to these challenges. The questionnaire was then distributed to consenting the radiographers who were enlisted for the study. Obtained data was summarized and presented using frequencies, percentages, mean and standard deviation.

### **RESULTS**

A total of 27 (67.5%) respondents were males while 13(32.5%) were females (Table 1), mostly between the ages of 21-30 years. Centre A had the highest number of radiographers with practice experiences from 0-15 years while Centre C had the least no of radiographers with working experience (Table 2).

Most radiographers 26 (65%) did not like handling paediatric radiographic examinations. There were few specialist paediatric radiographers 3 (7.5%) and dedicated paediatric equipment 5 (12.5%). Positioning of paediatric patients did not pose a challenge to most radiographers 28 (70%) (Table 3). Additionally, 33 (82.5%) radiographers often encountered apprehensive and uncooperative paediatric patients while 24 (60%) do not get the cooperation of paediatric patients during radiographic examinations (Table 4). The use of children-friendly terms 57.5% (n=23), assistance from caregivers 80% (n=32) as well as the use of immobilization devices 62.5% (n=25) and coercion 12.5 (5%), staff assistance 15% (n=6), others 0%(0) were the main and least methods of gaining the cooperation of children during radiography examinations (Table 5).

Of the patients seen, 90% (36) and 2.5% (1) of the paediatric patients aged 2-3 years and above 5 years respectively were most and least difficult to handle during radiographic examination (Table 6).

The main challenges faced by radiographers during paediatric radiography include lack of specialized skill in paediatric imaging 92.5% (n=37), lack of dedicated paediatric unit, the inability of paediatric to remain still during paediatric examination 62.5% (n=25) while poor tolerance of pain in sick paediatric patients 2.5% (n=1) and playful nature of the paediatrics 17.5% (n=7) were the least (Table 7). The availability of Sandbags and foam pads was

100% (n=40), while the availability of head clamps, Compression bands, sheets towels, Pig-o-stat, Mummy sheet restraint, stockinette, Tam-em board and Plexi-glass hold-down paddle were 10 (10%), 37 (92.5%), 3 (7.5%), 0 (0%), 4 (10%), 0 (0%), 0 (0%) respectively (Table 8).

Radiographic imaging of the postnasal space 45% (n=18), skull 27.5% (n=11), chest 20% (n=8) and pelvis 0% (n=0) as well as spine 12.5% (n=5), were the main and least body parts in paediatric that pose a challenge during radiographic imaging (Table 9).

**TABLE 1: BIODATA OF RADIOGRAPHERS STUDIED**

Age range(years)	Gender		Educational Qualification				
	Male	Female	DIR	B.Sc	M.Sc	PhD	Others
21-30	14(35%)	9(22.5%)	0	23(57.5%)	0	0	0
31-40	12(30%)	4(10)	0	11(27.5%)	5(12.5%)	0	0
41-50	1(2.5%)	0(0)	0	0	1(2.5%)	0	0
>51	0(0)	0(0)	0	0	0	0	0
Total	27(67.5%)	13(32.5%)	0(0)	34(85%)	6(15%)	0(0)	0(0)

**TABLE 2. EXPERIENCE AND WORKSTATION OF THE RADIOGRAPHERS**

Age range	Years of Experience				Place of Work		
	0-5	6-10	11-15	16-20	Centre A	Centre B	Centre C
21-30	21(52.5%)	1 (2.5%)	0	0	21(52.5%)	0	1(2.5%)
31-40	6(15%)	10(25%)	0	0	11(27.5%)	3(7.5%)	2(5%)
41-50	0	0	1(2.5%)	0	1(2.5%)	0	0
> 51	0	0	0	1(2.5%)	0	1(2.5%)	0
Total	27(67.5%)	11(27.5%)	1(2.5%)	1(2.5%)	33(82.5%)	4(10%)	3(7.5%)

**Table 3: RESPONSES ON GENERAL AND PERSONAL CHALLENGES OF PAEDIATRIC RADIOGRAPHY IN THE STUDY AREA**

STATEMENT	FREQUENCY/PERCENTAGE (%)	
	YES	NO
1. Personally do you like handling paediatric radiography examinations?	14 (35.0)	26(65.0)
2. Do you have specially trained personnel in the department that handles paediatric radiography examination?	3 (7.5)	37(92.5)
3. Is there any dedicated functional equipment for paediatric radiography examination in your department?	5(12.5)	35(87.5)
4. Does positioning of the paediatric patient pose a challenge to you?	28(70.0)	12(30.0)

**Table 4: Experiences of radiographers during paediatric radiography**

	FREQUENCY/PERCENTAGE		
	RARELY	SOMETIMES	ALWAYS
How frequently do you encounter paediatric patients?	3(7.5%)	11(27.5%)	26(65%)
	ALWAYS	SOMETIMES	NEITHER
Are paediatric patients apprehensive and uncooperative before the examinations?	7 (17.5%)	33 (82.5%)	0 (0%)
	YES	NO	NOT ALWAYS
Ability of radiographers to gain paediatric cooperation before the examination	2(5)	24(60)	14(35)

**Table 5: METHODS OF GAINING CHILD’S COOPERATION AND IMMOBILIZATION**

METHODS OF GAINING CHILD’S COOPERATION AND IMMOBILIZATION	Frequency/Percentage		Mean+Sd
	Yes	No	
1. Using Child friendly terms to explain the procedure to the child	23 (57.5)	17(42.5)	1.42±0.50
2. Parent/Caregiver assistance	32 (80.0)	8(20.0)	1.20±0.40
3. Coercion	5 (12.5)	35(87.5)	1.87±0.33
4. Staff assistance	6 (15.0)	34(85.0)	1.85±0.36
5. Use of immobilization devices	25(62.5)	15(37.5)	1.38±0.49
6. Sedation	10(25.0)	30(75.0)	1.75±0.44
7. Others	0(0.0)	40(100)	2.00±0.00

**Table 6: AGE GROUP MOST DIFFICULT TO HANDLE**

AGE GROUP	FREQUENCY/PERCENTAGE	
	YES	NO
1. 0-1YEARS	4(10)	36(90.0)
2. 2- 3 YEARS	36(90.0)	4(10.0)
3. 4-5 YEARS	6(15.0)	33(82.5)
4. ABOVE 5 YEARS	1 (2.5)	39(97.5)

**Table 7: RESPONSES ON THE CHALLENGES FACED DURING PAEDIATRIC RADIOGRAPHY IN THE STUDY AREA**

FACTORS	FREQUENCY/PERCENTAGE (%)		MEAN_+STD.DEV
	Yes	No	
1. Lack of dedicated paediatric unit	26(65.0)	14(35.0)	1.35±0.48
2. Inadequate paediatric accessories	16(40.0)	24(60.0)	1.60±0.80
3. Excess workload	19(47.5)	21(52.5)	1.52±0.51
4. Apprehensive nature of paediatrics	13(32.5)	27(67.5)	1.67±0.47
5. Playful nature of paediatrics	7(17.5)	33(82.5)	1.83±0.38
6. poor pain tolerance in sick paediatrics	1(2.5)	39(97.5)	2.0±0.16
7. lack of specialized skill in paediatric imaging	37(92.5)	3(7.5)	1.93±0.27
8. Inability of paediatrics to remain still for their examination	25(62.5)	15(37.5)	1.38±0.49

**Table 8: LIST OF AVAILABLE IMMOBILIZATION DEVICES**

IMMOBILIZATION DEVICES	FREQUENCY/ PERCENTAGE(%)	
	YES	NO
1.Head Clamps	4(10.0)	36(90.0)
2.Compression bands	37(92.5)	3(7.5)
3.Sandbags	40(100)	0(0.0)
4. Sheet towels	3(7.5)	37(92.5)
5. Pig-o-stat	0(0.0)	40(100)
6. Foam pads	40(100)	0(0.0)
7. Mummy sheet restraint	4(10)	36(90.0)
8. Stockinette	0(0.0)	40(100)
9. Tam -em board and Plexi -glass hold-down paddle	0(0.0)	40(100)
10. Others	0(0.0)	40(100)

**Table 9: DIFFERENT BODY PARTS POSING THE GREATEST CHALLENGE IN PAEDIATRIC RADIOGRAPHY EXAMINATION**

BODY PARTS	FREQUENCY/PERCENTAGE	
	YES	NO
Extremities	3(7.5)	37(92.5)
Skull	11(27.5)	29(72.5)
Chest	8(20.0)	32(80.0)
Postnasal space	18(45.0)	22(55.0)
Paranasal sinuses	6(15.0)	34(85.0)
Cervical spine	2(5.0)	38(95.0)
Thoracic/lumbar/sacral spine	5(12.5)	35(87.5)
Pelvis/hips	0(0.0)	40(100)

### Discussion

Paediatric Radiography is a subspecialty of Radiography, which lays emphasis on diagnostic imaging of foetuses, neonates, infants, children and adolescents and has been bedeviled with various

challenges. In the present study, the main challenge of paediatric radiography in the studied population was the inability of majority of the radiographers to gain paediatric patient cooperation for variety of radiographic examinations. This was as a result of

either the child playing with things around him/her during the examination, the inability of the radiographers to get the child's trust and cooperation for proper positioning, poor communication skills between the radiographer and the child, lack of appropriate immobilization devices, apprehensiveness of the patient probably due to present state of the paediatric illness, fear of the equipment, hospital environment and staff. From our findings, there appear to be inadequacy of paediatric-specific immobilization devices in the present study. Foam pads and sand bags were recorded as the most available, followed by compression bands, head clamps, mummy sheet restraint and sheet towels. There was complete absence of Pig-o-stat, Tam-em board and Plexiglass hold-down paddle. This led to possible inefficiency in immobilization and obtaining the paediatric patient co-operation for the examinations in the three study centres. Obtaining the paediatric patient co-operation during the examination is required to obtain quality radiographic images which are required for correct diagnosis and management of the patient. The use of immobilization devices and the use of child-friendly terms were not generally effective at obtaining the cooperation of paediatrics for radiography examination in the present study. The use of immobilization devices, sedation and calling for staff assistance were also used to a lesser degree to achieve the cooperation of the paediatric patient for radiological examination in some cases. However, majority of the radiographers were able to gain the paediatric patient's cooperation through their parents or caregiver. This can be explained by the fact that the parents were well known to the paediatric patients and are willing to find trust in them, unlike the hospital staff whom they may see as

strangers. This agrees with the opinion of Breiner et al who opined that younger children, in particular, found security in having a parent close by during the examination<sup>9</sup>. This was re-emphasized by Albert et al., who suggested that a non-occupationally exposed person must be recruited for the purpose of gaining cooperation of the paediatrics and the best candidate is usually the child's parent provided the person is not pregnant<sup>3</sup>. Similarly, another factor which affected the radiographer's inability to spend quality time communicating with the paediatric patients. This involves coming down to the child's level and speaking with the paediatric patient in the language that the patient will understand and cooperate with the examinations to achieve the desired result. This finding has been corroborated by a related study in which a high workload on clinical radiographers made them less likely to spend good time on paediatric patients to ensure the production of images of diagnostic quality but rather will concentrate more at completing the examinations as quickly as possible<sup>10</sup>. This will ultimately affect the quality of the final radiographic image.

Our study also showed that majority of the radiographers in the radio diagnostic facilities studied always receive requests for paediatric radiography examinations in their various departments. Therefore, paediatric radiography examinations constitute the bulk of the day-to-day business of these radiography facilities similar to the findings of a related study<sup>11</sup>. These categories of patients should be respected and treated with utmost care<sup>5</sup>. Unfortunately, we found out that majority of the respondents who are radiographers did not like handling paediatric patients especially those between ages 2-3 years who were the most difficult to handle. Mammass et al confirmed the findings of our study stating that it is more difficult to obtain the

cooperation of younger children during radiography examinations<sup>4</sup>. Also, there was a paucity of specially trained pediatric radiographers in the three diagnostic centres studied. This could either mean that the radiographers did not show enough interest to be trained in paediatric radiography or that the diagnostic centres/hospitals did not show any special interest in developing manpower needs in the paediatric subspecialty. Radiographers may be reluctant to spend their hard-earned money or time to be trained as specialist paediatric radiographer because he/she realizes that they stand to gain no rewards or recognition from such training. This agrees with the opinion of Erondy (2013) that paediatric radiography is not recognized as an extended role for registered radiographers and paediatric Radiography has no special recognition in Nigeria<sup>2</sup>. Since Paediatric radiography has no formal career structure in Nigeria, there is little incentive for radiographers to specialize and be recognized in this area.

In addition, another challenge to paediatric radiography in the present study was the lack of dedicated and functional equipment for paediatric radiography. Dedicated radiography equipment was expected to help the radiographer in his techniques and positionings to avoid repeats as well as unnecessary irradiation of the young child. When this dedicated equipment is lacking in the department as in the present study, the tendency for the radiographer to be frustrated with the examination or engage in unsafe and unprofessional practice to obtain a near clear image arises. This agrees with the opinion of Mathers, et al., (2011)<sup>4</sup> that most radiology departments were not specially designed to meet the needs of a variety of developmental stages. The need for dedicated functional equipment for pediatric radiography

arises because of the nature and structure of paediatrics. The advances in technology and computing, often associated with radiology, has launched a new era for Pediatric Radiology training and practice necessitating the use of dedicated pediatric radiography equipment, child-friendly restraining and positioning accessories. These ensures faster sequences and protocols for image acquisition to optimize radiation dose to the paediatrics, minimize movement blur, reduce the number and duration of sedation and eventually produce images of diagnostic quality<sup>4</sup>. The price paid for lack/inadequate dedicated equipment and accessories/ restraining devices were positioning problems and repeats which will increase the radiation dose to the patient, increase patient waiting time for the examination and increase the overhead cost. The body parts that proved very difficult to position in the present study were the skull, followed by postnasal space and chest. Although positioning for postnasal space was one of the major concerns to the radiographers, as posing the major positioning challenge to paediatric imaging. The radiographer should always use relevant skills and parents assistance during paediatric skull radiographic examinations to obtain excellent diagnostic results. Another common challenge encountered in pediatric radiography as observed from the modal response on challenges was the lack of specialized skill in paediatric imaging. The tender nature of children coupled with their inability to comprehend and obey the instructions of the radiographer as well as the perceived hostile nature of the hospital environment and equipment means that they require special skills to handle them. This can be acquired through regular training and re-training programs as well as from years of clinical experience. In our study, only very few of the radiographers 1(2.5%)

had clinical experience above 10 years. Sufficient clinical experience has been reported to have been used by radiographers during radiographic examinations to alleviate any fear or stress that the child might have had<sup>10</sup>. These include spending a good time with the paediatrics communicating and explaining the procedure and equipment to them, playing along with them in a friendly manner, use of toys, beautiful colours and showing them the result of the investigations after the examinations have produced good results<sup>10</sup>. When these clinical and specific paediatric experiences are lacking as in the present study, the radiographer may fail to deliver quality diagnostic images without repeats. This agrees with the findings of Erundu (2013)<sup>2</sup> who opined that paediatric imaging requires experience, specific training and certification that guarantees the application of thorough knowledge, expertise and a variety of dedicated or adaptable equipment. We observed that when children become apprehensive during radiographic examinations, they become difficult to restrain and generally uncooperative throughout the examination which will negatively affect the quality of the final radiographic image. Paediatric patients should be handled with care especially by a specialist paediatric radiographer or where this is lacking by an experienced radiographer. This is necessary to provide the paediatric patient information and instruction for the examination that is appropriate for his/her age and development to win the child's co-operation for the investigation so as to obtain images of good diagnostic quality. Experience and skill is needed to combat the ever changing emotion and apprehensiveness of the paediatric patient in the radiology department by tactically providing strength to a child who feels defenseless in the presence of perceived strangers and hostile hospital

equipment, letting the paediatric patient know everything about the investigation and what to expect as well reassure and allay the fears and apprehensiveness of the child. This will provide strength for the child so as to feel emotionally protected and lend his or her support for the investigation. Therefore, reducing episodes of anxiety and apprehensiveness of the paediatric patient during radiographic examinations is important at mitigating the challenges of radiographers in paediatric radiography in the population.

### **Conclusion**

The significant challenge for radiographers during paediatric radiographic examinations were difficulty in positioning for skull examinations and the apprehensive nature of the paediatric patients. Other challenges include the inability of the radiographer to obtain the cooperation of the paediatrics during radiological procedures, lack of specialized skills among radiographers and lack of paediatric-specific immobilization devices.

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## **EFFECTS OF BIOMASS COOKING FUELS ON THE RESPIRATORY HEALTH OF HOUSEHOLD MEMBERS IN ENUGU STATE, NIGERIA**

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### **ABSTRACT**

**Background of the Study:** A large proportion of households rely on biomass fuels for cooking and space heating. Combustion of biomass fuels emit a mixture of health-damaging air pollutants capable of impacting negatively on the human health.

**Aim of the Study:** This study was carried out to ascertain the harmful effects which the use of biomass cooking fuels inflicts on the respiratory health of household members in Enugu State of Nigeria.

**Materials and Methods:** A multistage, stratified, and systematic random sampling was used in this cross-sectional study, which included 502 respondents from 232 households in 6 of Enugu State's 17 Local Government Areas (LGAs). A semi-structured questionnaire was used to collect information about respondents' socio-demographics, cooking fuel type, cooking apparatus/stove, and so on. Certified medical personnel observed and evaluated the respondents for nasal irritation and chronic obstructive pulmonary disease.

**Results:** Of the 502 participants in the study, 248 (49%) had respiratory health issues such as nasal irritation or chronic obstructive pulmonary diseases. Respiratory problems were more common among those who cook with biomass (48%) than those who cook with fossil fuels (0.8%). Compared to fossil fuels (liquefied petroleum gas and kerosene), 95% of the study population use biomass as the preferred cooking fuel, out of which 73% use unprocessed wood. The highest prevalence of respiratory health outcomes was observed among biomass users who cook with unprocessed wood (37.5%).

**Conclusions:** The findings of this study indicate a high reliance on biomass fuels, which may have resulted in a significant manifestation of its effects on the population's respiratory health. This study clearly shows that those who use biomass cooking fuels have worse respiratory health outcomes. This implies that these biomass cooking fuels emit high levels of air pollutants, which are harmful to the respiratory health of the users.

**Key Words:** Air pollution, biomass, smoke, cooking fuel, respiratory health

## **INTRODUCTION:**

In most developing countries, including Nigeria, large proportions of households rely on biomass fuels for cooking and space heating. Almost half of the world's populations, who live in low-income regions, use biomass (wood, crop residues, and animal dung) as their primary fuel for cooking<sup>[1]</sup>. These biomass cooking fuels present a major global public health threat, resulting in an estimated 1.6 million deaths annually, women and children being the worst hit<sup>[2,3]</sup>. Combustion of biomass fuels emit a mixture of health-damaging air pollutants including

carbon monoxide (CO), sulphur dioxide, nitrogen dioxide (NO<sub>2</sub>), and many other toxic organic compounds and respirable particulate matter capable of impacting negatively on the health of man<sup>[4, 5]</sup>. According to the World Health Organization, air pollution from household fuel combustion is the most important global environmental health risk today. Almost 3 billion of the world's poorest people still rely on solid fuels (wood, animal dung, charcoal, crop wastes and coal) burned in inefficient and highly polluting stoves for cooking and heating, currently resulting in some 4 million premature deaths annually among children and adults from respiratory and cardiovascular diseases, and cancer<sup>[6]</sup>.

Chronic exposure to biomass smoke has been associated with multiple adverse health effects, including chronic bronchitis, chronic obstructive pulmonary disease (COPD), acute lower respiratory infection (ALRI), lung cancer, reduced birth weight and cataracts<sup>[7-9]</sup>. Specifically, use of biomass fuel is a significant risk factor for respiratory disease, and household air pollution (HAP)-related COPD has been estimated to result in 800,000 premature deaths per year globally<sup>[6; 8, 10]</sup>. The most vulnerable group are the women cooks who spend maximum time in the kitchen area during cooking hours and small children accompanying them during that time<sup>[11]</sup>. This dependence on solid biomass fuel leads to indoor air pollution which is now recognized as a major threat to human health. Around 42.2% of the population is exposed to household air pollution (HAP) in most of the middle and low-income countries and it ranks as the eighth greatest risk factor causing morbidity and mortality<sup>[12]</sup>.

In Nigeria, it is estimated by the WHO that 79,000 deaths per year occur from indoor air pollution, mainly caused by biomass burning<sup>[11]</sup>. Deaths from

acute lower respiratory infection in children under 5 years of age account for about 90% of the total number of deaths from indoor air pollution, with chronic obstructive pulmonary disease (COPDs) in adults of  $\geq 30$  years accounting for the rest<sup>[13,14]</sup>. Furthermore, constant search for fuel wood represents a large burden for women, particularly in rural areas<sup>[15]</sup>. This current study was therefore aimed at investigating the impact of the widespread use of solid biomass fuels for cooking and space heating on the respiratory health of communities in Enugu State, Nigeria.

#### **MATERIALS AND METHODS:**

**Scope of the Study:** This cross-sectional research studied occupants of households and their use of biomass cooking fuels, in 6 Local Government Areas (LGAs) spread across the (3) Senatorial Zones in Enugu State, Nigeria. The selected LGAs include – Enugu-East and Isi-Uzo from Enugu East Senatorial District; Nsukka and Igboeze South from

Enugu North Senatorial District; whereas Aninri and Awgu LGAs were selected from Enugu West Senatorial District.

**Study Area:** This cross-sectional study was conducted in Enugu State of Nigeria. The State is one of the states in Nigeria's southeastern region. It has 17 LGAs and a total population of 3,267,837 people<sup>[16]</sup>. Fourteen (14) of the seventeen (17) LGAs are primarily rural. Some urban towns are concentrated primarily within the State capital. The state's economy is predominantly rural and agrarian, as it is mostly covered by open grassland with occasional woodlands and clusters of oil palm trees. Farming employs a sizable proportion of the working population, but trading (18.8 percent) and services (12.9 percent) are also important<sup>[17]</sup>. Enugu State and other states in Southeastern Nigeria are commonly referred to as Igbo land because the people are primarily Igbos with distinct ingenious characteristics. Due to the abundant rainfall in the



Figure 1: Map of Enugu State Showing the 17 Local Government Areas<sup>[18]</sup>

**Sample Size:** In the determination of sample size for this research work, the Fisher's formula:  $n = Z^2 q(1-p)/d^2$  for a large population ( $>1,000$ ) was adopted<sup>[17]</sup>. Where  $n$  = minimum sample size;  $Z$  = standard normal deviation usually set at 1.96 which corresponds to the 95% confidence level;  $p$  = assumed population prevalence in % (the population of the study is estimated to be 50% to represent the target population in this study);  $q = 1-p$ ;  $d$  = maximum acceptable random sampling error in %. In this case,  $P= 50%= 0.5$ ;  $q = 1- 0.5 =0.5$ ;  $d = 5%= 0.05$ . Therefore, sample size ( $n$ ) =  $(1.96)^2 (0.50)(0.50)/(0.05)^2 = 384$ .

**Study population:** A sample size of 384 was calculated using Fisher's formula. As a result, 232 households and 502 individual respondents were sampled, which was considered a good representation of the population under study. Respondents provided information on socio-demographics, type of cooking fuel used, family structure, type of cooking apparatus/stove, ventilation status of the house, cooking hours/day and average family income. Male and female members of the selected households took part in the study. Participants under the age of 14 and those over the age of 70 were excluded from the study.

**Sampling Techniques:** In this cross-sectional study, a multistage and stratified random sampling method was used to select 6 LGAs from the state, consisting 2 LGAs from each of the 3 senatorial districts. Enugu-East and Isi-Uzo LGAs were selected from the Enugu-East Senatorial District; Nsukka and Igboeze South LGAs were selected from the Enugu-North Senatorial District; and Aninri and Awgu LGAs were selected from the Enugu-West Senatorial District. Simple random

sampling was then used to select the Wards and settlements for the study. Three (3) Electoral Wards each were selected from Enugu-East, Isi-Uzo, Igboeze-South, and Aninri LGAs, while two Electoral Wards each were selected from Nsukka and Awgu LGAs, totaling 16 Wards studied. Nine (9) settlements were selected from Enugu-East, Isi-Uzo, Igboeze-South, and Aninri LGAs, while five (5) settlements were selected from Nsukka and four (4) settlements were selected from Awgu LGA, totaling 45 settlements studied. Systematic sampling technique was used to select households within the settlements where the research instruments were administered. The households sampled in each settlement were determined using McCombes' systematic sampling technique model, in which the first household is chosen at random and the subsequent ones are chosen at intervals of 10<sup>th</sup> household in a defined order<sup>[19]</sup>. An average of 5 households from each of the 45 settlements participated in the study, making a total of 232 households. The assessment were carried out among different age groups in any selected household, namely: 14- 23; 24-33, 34-43, 44-53, 54-63, 64 - $\leq$ 70 years, involving both male and female. This study enlisted the participation of 502 people, including 146 males and 356 females. The data gathered from these sources was analyzed to arrive at the study's findings and conclusion.

**Ethical Consideration:** The Ethics and Research Committee of the Abia University Teaching Hospital in Aba, Nigeria, granted ethical approval (**ABSUTH/MAC/117/Vol.1/61**) for the study. Each respondent provided informed written consent. Respondents' confidentiality and privacy were maintained throughout the study.

**Measurement of Respiratory Health Outcomes:**

Certified medical personnel observed and evaluated the respondents for nasal irritation and chronic obstructive pulmonary disease. Shortness of breath, cough, dizziness, eye and nasal irritation, body ache, frequent headache, and visible symptoms of respiratory diseases were all taken into account.

**Statistical Analysis:** The mean values of the collected data were calculated using Statistical Package for Social Sciences (SPSS) version 21.0.

**RESULTS:**

Table 1 shows the socio-demographics of the study area. It reveals that 75% of respondents live in rural areas. It also shows that the majority of those who cook for their families are females (71%). A larger proportion (28%) of respondents were between the ages of 34 and 43, followed by 25% of respondents between the ages of 14 and 23.

The types of cooking fuels used in Enugu State are

shown in Table 2 and Figure 2. It can be seen that biomass fuels constitute 95% of cooking fuels used in the state. Unprocessed wood (firewood) was the most popular cooking fuel, used by 73% of the study population, followed by charcoal (21%). Saw dust, which was used by 1% of the respondents, was the least preferred cooking fuel. The least preferred cooking fuel was saw dust, which was used by 1% of the study population. It can also be seen that only 6% of the population uses fossil fuels, with 4% using liquefied petroleum gas (LPG) and 2% using kerosene for cooking.

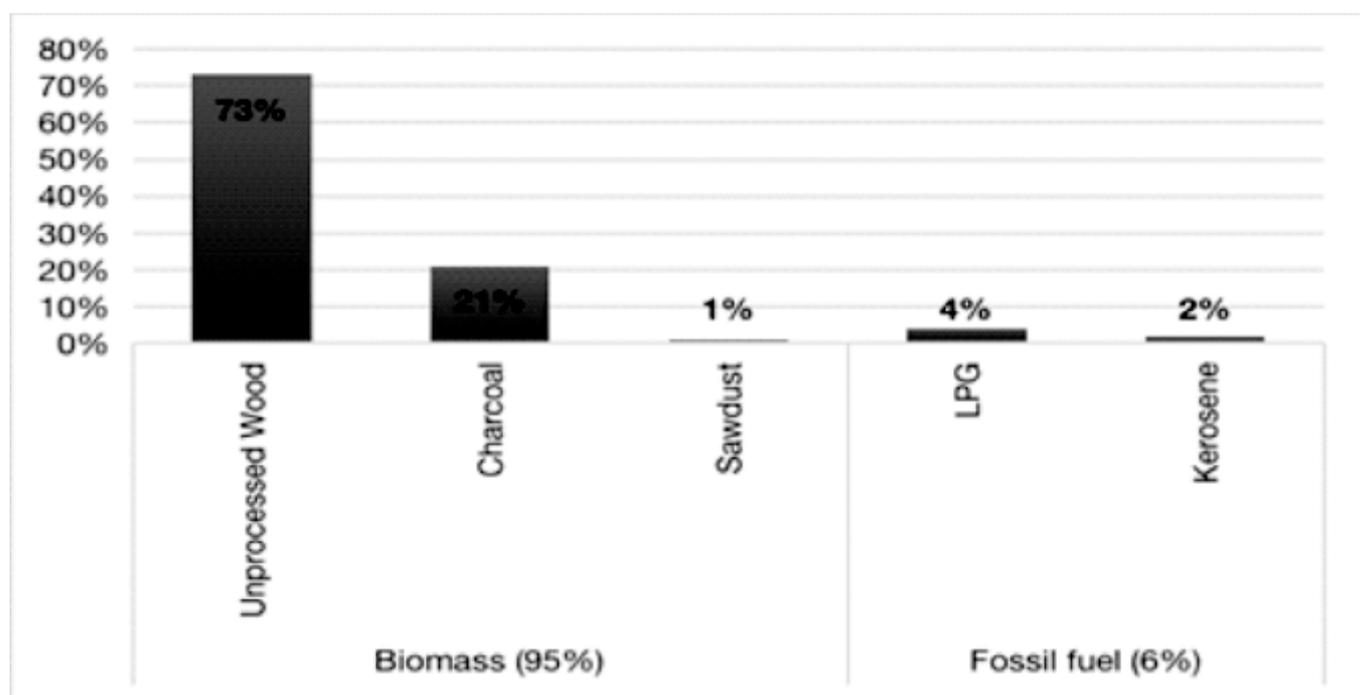
Table 3 shows the respiratory outcomes of household members who use biomass and fossil cooking fuels in Enugu State. According to the findings, 248 (49%) of the 502 participants in the study had respiratory health issues such as nasal irritation or COPD. Respiratory problems were more common among those who cook with biomass [244(48%)] than among those who cook with fossil fuels [4(0.8%)].

**Table 1: Demographics of the Sample Population**

Demographics of Respondents		Local Government Area (LGA)						Total
		Aninri	Awgu	Enugu-East	Igboeze-South	Isi-Uzo	Nsukka	
Social Setting	Rural	80(16%)	0(0%)	50(10%)	100(20%)	80(16%)	64(13%)	374(75%)
	Urban	0(0%)	40(8%)	88(18%)	0(0%)	0(0%)	0(0%)	128(25%)
	Subtotal	80(16%)	40(8%)	138(27%)	100(20%)	80(16%)	64(13%)	502(100%)
Gender	Male	22(4%)	5(1%)	38(8%)	34(7%)	27(5%)	20(4%)	146(29%)
	Female	58(12%)	35(7%)	100(20%)	66(13%)	53(11%)	44(9%)	356(71%)
	Subtotal	80(16%)	40(8%)	138(27%)	100(20%)	80(16%)	64(13%)	502(100%)
Age Distribution (in years)	14 – 23	7(1%)	15(3%)	26(5%)	44(9%)	25(5%)	8(2%)	125(25%)
	24 – 33	19(4%)	5(1%)	24(5%)	10(2%)	13(3%)	8(2%)	79(16%)
	34 – 43	19(4%)	5(1%)	46(9%)	30(6%)	19(4%)	24(5%)	143(28%)
	44 – 53	3(1%)	10(2%)	24(5%)	12(2%)	17(3%)	4(1%)	70(14%)
	54 – 63	29(6%)	5(1%)	16(3%)	4(1%)	6(1%)	20(4%)	80(8%)
	64 - <70	3(1%)	0(0%)	2(1%)	0(0%)	0(0%)	0(0%)	5(1%)
	Subtotal	80(16%)	40(8%)	138(27%)	100(20%)	80(16%)	64(13%)	502(100%)

**Table 2: Types of Cooking Fuel Used by the Respondents**

Fuel Types	Local Government Area (LGA)						Total
	Aninri	Awgu	Enugu East	Igboeze South	Isi-Uzo	Nsukka	
<b>Biomass</b>							
<b>Unprocessed Wood</b>	53(11%)	32(6%)	80(16%)	80(16%)	71(14%)	48(10%)	364(73%)
<b>Charcoal</b>	20(5%)	8(2%)	30(6%)	20(5%)	9(2%)	16(3%)	103(21%)
<b>Sawdust</b>	0(0%)	0(0%)	6(1%)	0(0%)	0(0%)	0(0%)	6(1%)
<b>Subtotal</b>	73(15%)	40(8%)	116(23%)	100(20%)	80(16%)	64(13%)	473(94%)
<b>Fossil fuel</b>							
<b>LPG</b>	3(1%)	0(0%)	18(2%)	0(0%)	0(0%)	0(0%)	21(4%)
<b>Kerosene</b>	4(1%)	0(0%)	4(1%)	0(0%)	0(0%)	0(0%)	8(2%)
<b>Subtotal</b>	7(2%)	0(0%)	22(5%)	0(0%)	0(0%)	0(0%)	29(6%)
<b>Total (n)</b>	80(16%)	40(8%)	138(27%)	100(20%)	80(16%)	64(13%)	502(100%)



**Figure 2: Primary Cooking Fuels Used by Residents of Enugu State**

**Table 3: Respiratory Outcomes Among Members of Households Using Biomass and Fossil Cooking Fuels in Enugu State**

Local Government Area (LGA)	Biomass Fuels						Fossil Fuels				
	Unprocessed Wood		Charcoal		Saw Dust		Kerosene		LPG		Total
	Nasal irritation [n(%)]	COPD [n(%)]	Nasal irritation [n(%)]	COPD [n(%)]	Nasal irritation [n(%)]	CO PD [n(%)]	Nasal irritation [n(%)]	CO PD [n(%)]	Nasal irritation [n(%)]	CO PD [n(%)]	
Aninri	16(3%)	0(0%)	7(1.4%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	23(4.4%)
Awgu	9(1.7%)	3(0.6%)	1(0.2%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	33(6.5%)
Enugu East	20(4%)	8(1.5%)	12(2.4%)	4(0.8%)	2(0.4%)	0(0%)	0(0%)	0(0%)	4(0.8%)	0(0%)	58(11.7%)
Igboeze South	24(5%)	10(1.9%)	10(1.9%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	60(11.8%)
Isi-Uzo	40(8%)	8(1.6%)	2(0.4%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	46(9%)
Nsukka	4(0.8%)	16(3%)	8(1.6%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	28(5.4%)
<b>Total</b>	140(27.8%)	51(9.7%)	34(6.7%)	13(2.6%)	2(0.4%)	0(0%)	0(0%)	0(0%)	4(0.8%)	0(0%)	248(48.8%)

**DISCUSSION:**

According to the Economic Community of West African States (ECOWAS), Centre for Renewable Energy and Energy Efficiency (ECREEE), approximately 80% of the ECOWAS population still cooks with traditional biomass. This is mostly done inefficiently, leaving children and women vulnerable to health issues that can lead to death<sup>[20]</sup>.

Nigeria is not immune to this problem, as more than 75% of the Nigerian population, particularly in rural areas, still uses the traditional cooking method of using wood fuel<sup>[21]</sup>.

According to the study population's demography (Table 1), 75% of respondents live in rural areas, and the majority (71%) of study participants who cook are women. The majority of the study population is

between the ages of 34 and 43 (28%). This reflects a very young population that, all things being equal, should be very healthy.

Table 2 and Figure 2 show that 95% of the study population uses biomass as their primary cooking fuel, with 73% using unprocessed wood. Among the three biomass fuels investigated (unprocessed wood, charcoal, and sawdust), unprocessed wood (firewood) was used as a cooking fuel by the vast majority (73%) of the sample population. Only 6% of the population uses fossil fuels (LPG and kerosene), with LPG, considered the cleanest cooking fuel in this study, being used by 4% of the study population.

Manifestation of nasal irritation and or chronic obstructive pulmonary diseases (COPD), were used as indicators of occurrence of respiratory outcome in respondents. In Table 3, it can be observed that of the 502 respondents who participated in the study, 248(49%) had respiratory health issues that were either nasal irritation or COPD. Respiratory problems were prevalent among a great proportion of the study participants who cook with biomass [244(48%)], compared to those who use fossil fuels [4(0.8%)].

The presence of nasal irritation and/or chronic obstructive pulmonary disease (COPD) in respondents was used as an indicator of the occurrence of respiratory issues. According to Table 3, 49% of the 502 participants in the study had respiratory health issues, which were either nasal irritation or COPD. The respiratory problems were more common among those who cook with biomass than among those who cook with fossil fuels.

Table 3 also shows that residents of Aninri LGA had the lowest rate of respiratory issues (4.4%). Residents of Igboeze South (11.8%) and Enugu East (11.7%) LGAs accounted for the majority of those

suffering from respiratory health problems. These two LGAs accounted for the greatest number of users of biomass fuel, with processed wood being the most popular (Table 2).

The highest prevalence of respiratory health outcomes was observed among biomass users who cook with unprocessed wood [191(37.5%)], followed by those who cook with charcoal [47(5.3%)] and those who cook with sawdust [6(1.2%)]. When compared to individuals who cook with biomass, respondents who cook with fossil fuels had significantly fewer respiratory problems. Only 0.8% of all respondents with respiratory health issues [248(49%)] used fossil fuels (Table 3).

The findings of this study indicate a high reliance on biomass fuels, which may have resulted in a significant manifestation of its effects on the population's respiratory health. This study clearly shows that those who use biomass cooking fuels have worse respiratory health outcomes. This is consistent with the findings of many other researchers who discovered that chronic exposure to biomass smoke is associated with a variety of negative health effects, including chronic bronchitis, COPD, acute lower respiratory infection (ALRI), lung cancer, low birth weight, and cataracts<sup>[7-9]</sup>. Although nasal irritation and COPDs can be a random disease in rural areas, the findings of this study show that the respiratory health issues observed in study participants were linked to biomass use. The fact that the majority of respondents stated that they only experience respiratory irritations while cooking, as well as the young and supposedly health study population, strongly suggests that these health issues are caused by the cooking fuel type.

It is recommended that government at all levels make provisions for clean, modern, and reliable

cooking fuels such as electricity and LPG to be readily available and affordable for household consumption as an alternative to biomass fuels. All of these are required for Nigeria to significantly reduce the number of deaths and illnesses caused by hazardous chemicals and air pollution, as stated in SDG 3-target 3.9.

To ensure that the negative health effects of household fuel combustion are reduced or eliminated, the guidelines for indoor air quality/household fuel combustion should be considered and adopted by households, as well as enforced by relevant authorities<sup>[22]</sup>.

Because firewood is the preferred fuel for the majority of the rural population, Nigeria and other third-world countries should implement a permanent and deliberate reforestation program that includes the planting of wood species that are ecologically suitable, socio-culturally compatible, and economically viable.

## CONCLUSION

According to the findings of this study, respondents who use unprocessed wood as their cooking fuel have the highest incidences of nasal irritation and chronic obstructive pulmonary disease, followed by those who cook with charcoal and then those who cook with sawdust. This implies that biomass cooking fuels may emit high levels of air pollutants, which may have a negative impact on the users' respiratory health. It was also discovered that respondents who cook with clean fuels have very few or no respiratory health issues.

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## **EFFECTS OF AEROBIC EXERCISE TRAINING ON WALKING ENDURANCE AND SELECTED CARDIO-RESPIRATORY PARAMETERS IN STROKE SURVIVORS**

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#### **ABSTRACT**

**Background/Objective:** Many stroke survivors continue to live with residual physical impairments which may promote a sedentary lifestyle and poor cardio-respiratory fitness. This study was aimed at determining the effects of aerobic exercise training on walking endurance and selected cardio-respiratory parameters in ambulatory stroke survivors.

**Method:** Thirty-seven stroke survivors (20 males and 17 females) completed this pre-post experimental study. They were recruited from the Physiotherapy clinics of Lagos University Teaching Hospital, and Lagos State University Teaching Hospital through a sample of convenience. Participants' walking endurance, selected cardio-respiratory parameters were measured before and after the intervention. They had 10 weeks of aerobic exercise training using bicycle ergometer. Exercise sessions were conducted two times per week at an intensity of 50-59% of heart rate reserve (HRR) for the first five weeks and later progressed to 60-69% of HRR for the remaining five weeks at a duration of 25 minutes for each exercise session. Data was analyzed using Paired t-test and Independent t-test

the <0.05 level of statistical significance.

**Results:** The mean age, height and weight of the participants were 51.59±4.86 years, 1.7±0.9m and 69.8±5.1kg respectively. There were significant improvements in the walking endurance (p=0.001), all selected cardiovascular (p=0.001) and respiratory parameters (p=0.001) of the participants after 10 weeks of aerobic training. However, there were no gender differences in the effects of aerobic exercise training on selected cardio-respiratory parameters among the participants except in the forced expiratory volume in one second (FEV<sub>1</sub>) (p= 0.037).

**Conclusion:** Aerobic exercise training is beneficial in improving walking endurance and cardio-respiratory parameters in stroke survivors.

**Keywords:** Aerobic exercise, walking endurance, cardio-respiratory response, stroke survivors.

#### **Introduction**

Stroke is one of the most common chronic conditions seen in older adults, with an incidence

approximately doubling each decade after the age of 55 years.<sup>1</sup> Most stroke survivors continue to live with residual physical impairments which may promote a sedentary lifestyle and resultant secondary complications.<sup>2</sup> One of the secondary complications commonly observed following stroke is poor cardio-respiratory fitness which contributes to the limitation of independent life and activities of daily living (ADL), increased energy cost of ambulation, and increased risk of stroke and cardiovascular disease.<sup>3-6</sup> Cardio-respiratory fitness is important for performing daily activities and mobility. Tang et al.<sup>7</sup> stated that some stroke survivors do not spontaneously recover their respiratory function after a maximal exercise test. The reduction in cardio-respiratory function might affect the recovery level of stroke survivors because they have a greater need for aerobic capacity and walking endurance.<sup>8</sup> Decreased aerobic capacity and muscle weakness impede participation in every day physical and social activities and impaired social communication further reduces quality of life.<sup>9,10</sup> It has been reported that  $VO_2$  max values below 20 mL/kg-1/min-1 is associated with limited physical function for instrumental activities of daily living.<sup>11,12</sup> Walking for stroke survivors is often slower (e.g. from 0.16 to 0.88 m/s) compared with healthy persons aged 60 to 80 years, who normally walk at speeds greater than 1.23 m/s.<sup>13</sup> The slow speed of walking is not only unsafe for some activities of daily living such as crossing streets, particularly in metropolitan regions, but also requires considerable effort because of poor walking efficiency.<sup>14,15</sup> It is also a barrier to walking independently within the community, because a person needs to be able to walk relatively long distances. As such, persons who have recovered from a stroke often have poor walking skills and endurance, usually lacking ability to walk continuously for a few minutes.<sup>16</sup> Factors

such as impaired neuromuscular control, decreased functional mobility, balance deficits, and reduced cardio-respiratory fitness make recovery from stroke difficult.<sup>17,18</sup>

Evidence suggests that exercise training in the post stroke population can facilitate improvements in the cardiovascular, respiratory, and neuromuscular systems.<sup>19,20</sup> However, many rehabilitation approaches for chronic stroke survivors rarely concern the assessment and improvement of cardio-respiratory capacity.<sup>21</sup> For a variety of reasons, aerobic exercise is not routinely prescribed for stroke survivors during stroke rehabilitation, which likely exacerbates their decline in cardio-respiratory fitness.<sup>22</sup> Research studies have confirmed that exercise intervention improves  $VO_2$  max, physical function (e.g., Timed Up and Go), walking, and psychological wellbeing.<sup>19,20,23-27</sup> Yet, many clinicians do not use aerobic exercise interventions, perhaps because of the limited amount of research that has identified appropriate screening protocols and optimal dosing of aerobic exercise for this population.<sup>28,29</sup>

It is important to understand the cardiopulmonary response to exercise in both men and women so that the physiologic and hemodynamic responses obtained from an exercise can be used to appropriately guide exercise prescription.<sup>18</sup> Also strategies to reduce the underlying impairments post-stroke and thereby improve physical ability are needed if quality of living is to be enhanced in these patients. This study evaluated the effects of aerobic exercise training on walking endurance and selected cardio-respiratory parameters in ambulatory stroke survivors.

### **Materials and Methods**

Prior to the commencement of the study, ethical approval was obtained from the Health Research and Ethics Committee of Lagos University Teaching

Hospital (LUTH) assigned Reference number: ADM/DCST/HREC//APP/1110. Introductory letters were obtained from the Department of Physiotherapy, Faculty of Clinical Sciences, College of Medicine, University of Lagos and taken to the Physiotherapy clinics of LUTH and Lagos State University Teaching Hospital (LASUTH) to obtain permission to carry out the study in their facilities. Fifty two (52) stroke survivors who were attending Physiotherapy clinics of LUTH and LASUTH were recruited for this pre-post experimental study. A continuous sample of convenience was used to recruit the participants into the study. They were screened for eligibility based on inclusion and exclusion criteria for the study. Inclusion criteria were adult stroke survivors who had a single episode of stroke at least 6 months prior to enrolment, who were independent in ambulation with or without an orthotic or assistive device, who had the ability to complete sit to stand transfer and who had no cognitive impairment by having a score of  $\geq 24$  from the Mini Mental Status Examination (MMSE).<sup>30,31</sup> Exclusion criteria were adult stroke survivors who had cardiac limitations such as uncontrolled hypertension and those that had major musculoskeletal problems such as amputation and severe incapacitating osteoarthritis. Two (2) volunteering participants were excluded. An explanation of the study purpose and the experimental method and processes were provided to the participants and written informed consent was sought and obtained from those who volunteered to participate in the study. This is because participation in the study was voluntary. Thirteen participants dropped out during aerobic exercise training and declined to come back for the follow-up assessment because of illnesses unrelated to exercise training or for personal reasons. Consequently, 37 participants completed the study.

### **Procedure for data collection**

The study was carried out at the in the gymnasias and physiotherapy demonstration rooms (PDR) of LUTH and LASUTH. Three research assistants were co-opted to help in the study. One of them was an intern physiotherapist at LUTH, the second was a physiotherapist doing her Master's degree in Physotherapy and the third was a final year student of physiotherapy. The Socio-demographic and health profile characteristics such as age, gender, marital status, occupation, level of educational attainment, types of stroke were obtained from the participants as well as their case folders and recorded. The baseline assessments of all the outcome measures were taken prior to the aerobic exercise training. Participants were asked not to consume heavy meals or drinks (except water) and to avoid caffeinated products within two-three hours prior to the assessments. This is because they could affect the values of the outcome measures. All participants were familiarized with the Borg Rating of Perceived Exertion (RPE) scale.

On the day of assessment, participants were allowed to rest in sitting for at least 15 minutes prior to the assessment. The following were the outcome measures that were assessed as well as the procedures for assessment:

#### **Cardiovascular parameters:**

**Blood pressure (BP):** Each participant's BP was measured in sitting position using a mercury sphygmomanometer (Accoson, England) and a stethoscope (Littmann Classic II SE, UK). The systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured in mmHg.

**Heart Rate (HR):** To measure the HR of each of the participants in sitting position, the bell/diaphragm of the stethoscope was placed on the left 5<sup>th</sup> intercostals space on the lateral aspect of the mid clavicular line. With the aid of a stop clock, the heart beats were

counted for one minute and the HR recorded in beats per minute.

**Rate pressure product (RPP):** This is also known as Cardiovascular product or Double product and it is a measure of the stress put on the cardiac muscle based on the number of times it needs to contract per minute (HR) and the arterial blood pressure that it is pumping against (SBP).<sup>32</sup> It was calculated as the product of SBP and HR.

**Mean arterial pressure (MAP):** This is the average arterial pressure during a single cardiac cycle.<sup>33</sup> It was calculated as;

$$\text{MAP} = \text{DBP} + 1/3(\text{SBP} - \text{DBP})$$

### **Respiratory parameters:**

Baseline force vital capacity (FVC), force expiratory volume in one second (FEV<sub>1</sub>) and peak expiratory flow rate (PEFR) were measured using digital hand-held spirometer (CONTEC SP-10, China):

**Spirometry testing procedures:** Each of the participants sat comfortably in a chair with back rest, had the feet firmly on the ground with all constricting clothing such as braisers and waist belts loosened to prevent alteration of test results from restricted thoracic expansion and abdominal mobility. The spirometer was cleaned with an alcohol wipe and disposable mouthpiece was used for each participant. The participants were instructed to breathe in as deeply as possible (full inspiration) and hold their breath just long enough to seal their lips around the mouthpiece and to clip the nose with a nose clip. They are then instructed to blow out through the mouth (exhale) into the mouthpiece forcibly, as hard, as fast and as long as possible (full expiration), until there is no air left to expel (at least for six seconds). The procedure was repeated three times at 15 minutes intervals and the FVC, FEV<sub>1</sub> and PEFR readings were obtained. For the FVC and FEV<sub>1</sub>, the higher value between the two highest values which were within 0.150L of each other was

the accepted value. The highest value of PEFR was the accepted value.<sup>34,35</sup>

**VO<sub>2</sub> max calculation:** VO<sub>2</sub> max (also known as maximum oxygen consumption, maximum oxygen uptake, peak oxygen uptake or maximum aerobic capacity) was calculated using Uth-Sorensen-Overgaard-Pedersen estimation of VO<sub>2</sub> max for humans which is based on the ratio of maximum heart rate (HRmax) to resting heart rate (HRmin). It was created by a group of researchers from Denmark.<sup>36</sup> The equation is stated as follows: VO<sub>2</sub> max = 15.3 + HRmax/HRmin. It is measured in units of ml/kg/minute.

**Six minutes walk test (6-MWT):** The 6-MWT is a valid and reliable test of assessing physical performance for people with stroke.<sup>37</sup> It was performed on the same day on a corridor with minimal distractions. Prior to the commencement of the test, participants were informed that the objective of the test was to walk as far as possible for six minutes without to running or jogging. This was demonstrated to the participants by walking one lap (2x30m walk course). Standardized instructions and words of encouragement were given to the participants during the test as provided by the American Thoracic Society (ATS) guidelines for the 6-MWT.<sup>38</sup> The total distance covered by each participant in six minutes was calculated by multiplying the number of laps walked by 60 meters (one lap is to and fro the 30m walk course) plus the final partial lap in meters.<sup>38</sup> A stopclock was used to keep time. Participants were allowed to use their assistive device if needed during the test but were required to use the same assistive device for all testing sessions.

### **Intervention**

**Aerobic exercise training:** The following exercise

prescription guidelines were used:

1. Aerobic exercise training of participants was done using the bicycle ergometer.
2. Exercise intensity was prescribed at 50-59% of heart rate reserve (HRR) ( $HRR = HR_{max} - HR_{min}$ ) for 5 weeks and then increased to 60-69% of HRR for the remaining 5 weeks.<sup>39</sup>
3. Exercise frequency was two times per week for 10 weeks.
4. The main exercise duration for each session was 25 minutes. The warm-up and cool-down sessions were 5 minutes respectively.
5. Rate of perceived exertion (RPE) was kept between 12-16/20

Each exercise session was begun with pre-exercise vital signs assessment. Each session started with a 5 minute warm-up at a comfortable, self-selected pace. After 5 minutes, the exercise intensity was increased to the prescribed workload. The main aerobic exercise training would begin with exercise intensity for that session at the lower end-range of the targeted HRR (eg.50% of HRR for the first 5 weeks) for 15 minutes and the intensity would be increased to the upper end-range of the targeted HRR (i.e.59% of HRR for the first 5 weeks) for the remaining 10 minutes. The participants were monitored and encouraged to maintain the prescribed exercise intensity for the duration of the session. A 5-minute cool-down was employed after the main exercise session.<sup>40</sup> All exercise training was well tolerated as there were no adverse events during testing or training.

#### **Post intervention assessment of parameters:**

All the outcome variables assessed at baseline were re-assessed at the end of 10 weeks aerobic exercise training.

#### **Data Analysis**

Data was analysed using the Statistical Package for Social Sciences (SPSS) Version 21. Paired (Student)

t-test was used to determine the difference in the walking endurance, selected respiratory and cardiovascular parameters pre- and post-10 weeks of aerobic exercise training of stroke survivors. Unpaired (Independent) t-test was used to determine if there were significant differences between the mean changes of selected respiratory and cardiovascular parameters in male and female participants post 10 weeks aerobic exercise training. The level of statistical significance was set at p less than 0.05.

## **Results**

### **Socio demographic characteristics of participants**

A total of 37 stroke survivors who were attending Physiotherapy clinic of Lagos University Teaching Hospital (LUTH) and Lagos State University Teaching Hospital (LASUTH) completed this study. Twenty (54.1%) of the participants were male and 17 (45.9%) were female. The mean age, mean height and mean weight of all the participants were  $51.59 \pm 4.86$  years,  $1.7 \pm 0.9$  m and  $69.8 \pm 5.1$  kg respectively.

### **Effect of aerobic exercise training on walking endurance**

Table 1 shows the effect of aerobic exercise training on walking endurance in the participants. There was a significant improvement in the walking endurance ( $p = 0.001$ ) of stroke survivors after 10 weeks of aerobic exercise training of stroke survivors.

Table 2 shows the effect of aerobic exercise training on selected cardiovascular parameters in participants. There were significant improvements in the SBP ( $p = 0.001$ ), DBP ( $p = 0.001$ ), HR ( $p = 0.001$ ), MAP ( $p = 0.001$ ) and RPP ( $p = 0.001$ ) after 10 weeks of aerobic exercise training of stroke survivors.

Table 3 shows the effect of aerobic exercise training on selected respiratory parameters in participants. There were significant improvements in the FVC ( $p=0.001$ ), FEV<sub>1</sub> ( $p=0.001$ ), PEFR ( $p=0.001$ ) and VO<sub>2</sub> max ( $p=0.001$ ) after 10 weeks aerobic exercise training of stroke survivors.

Table 4 shows the gender variation in the effect of aerobic exercise training on selected cardiovascular parameters. There was no significant difference in the effect of 10 weeks aerobic exercise training on

selected cardiovascular parameters ( $p > 0.05$ ) between male and female stroke survivors.

Table 5 shows the gender variation in the effect of aerobic exercise training on selected respiratory parameters. There was no significant difference in the effect of 10 weeks aerobic exercise training on selected respiratory parameters ( $p > 0.05$ ) between male and female stroke survivors except in FEV<sub>1</sub> ( $p=0.037$ ).

**Table 1: Effect of 10 weeks aerobic exercise training on walking endurance**

Variable	Baseline	Post-intervention	t-value	p-value
	Mean $\pm$ SD	Mean $\pm$ SD		
6MWD	90.7 $\pm$ 43.0	172.6 $\pm$ 59.0	14.2	0.001*
(m)				

6MWD: six minutes walk distance; (Significance set at  $P < 0.05^*$ ); (m): meter

**Table 2: Effect of aerobic exercise training on selected cardiovascular parameters in the participants**

Cardiovascular Parameters	Baseline Mean ± SD	Post-intervention Mean ± SD	t-value	p-value
SBP (mmHg)	142.0 ± 14.3	121.7 ± 5.2	11.3	0.001*
DBP (mmHg)	94.5 ± 7.6	74.2 ± 7.5	15.7	0.001*
HR (bpm)	84.5 ± 12.5	70.3 ± 6.3	6.7	0.001*
MAP (mmHg)	110.9 ± 7.8	90.1 ± 6.1	18.5	0.001*
RPP (mmHgbpm)	12067.0±2111.1	8561.4±923.3	10.9	0.001*

(\*Significance set at  $P < 0.05$ ); SBP: systolic blood pressure; DBP: diastolic blood pressure

HR: heart rate; MAP: mean arterial pressure; RPP: rate pressure product; SD: standard deviation

**Table 4: Gender variation in the effect of aerobic exercises training on selected cardiovascular parameters**

Variables	Male	Female	t-value	p-value
	Mean ± SD	Mean ± SD		
SBP (mmHg)	19.9 ± 12.5	23.0 ± 10.3	0.814	0.421
DBP (mmhg)	22.6 ± 5.9	17.8 ± 9.3	1.905	0.065
HR (bpm)	16.5 ± 5.2	11.4 ± 9.2	1.207	0.236
MAP (mmHg)	21.8 ± 6.0	19.6 ± 7.7	0.978	0.335
RPP (mmHgbpm)	3766.4±2386.5	3198.8 ± 1302.4	0.875	0.388

(Significance set at  $P < 0.05^*$ ); md: mean difference.; SBP: systolic blood pressure; DBP: diastolic blood pressure; HR: heart rate ; MAP: mean arterial pressure ; RPP: rate pressure product ; SD: standard deviation

**Table 5: Gender variation in the effect of aerobic exercises training on selected respiratory parameters**

Variables	Male	Female	t-value	p-value
	Mean ± SD	Mean ± SD		
FVC (L)	1.1 ± 0.7	1.1 ± 0.6	0.178	0.860
FEV <sub>1</sub> (L)	0.9 ± 0.6	1.3 ± 0.4	2.166	0.037*
PEFR (L)	1.5 ± 0.5	1.4 ± 0.3	0.369	0.714
VO <sub>2</sub> max (mL/kg/min)	6.5 ± 6.7	14.9 ± 4.0	0.809	0.424

(\*Significance set at  $P < 0.05$ ) ; md: mean difference. ; FVC: force vital capacity, PEFR: peak expiratory flow rate, FEV<sub>1</sub>: force expiratory volume in one second ; VO<sub>2</sub> max: maximum ; oxygen consumption; SD: standard deviation

## **Discussion**

This study was aimed at determining the effects of aerobic exercise training on walking endurance and selected cardio-respiratory parameters in ambulatory stroke survivors. A ten (10) week aerobic exercise training brought about significant improvements in walking endurance and selected cardio-respiratory parameters of stroke survivors.

The finding that there was a significant improvement in the walking endurance of the stroke survivors following 10 weeks of aerobic exercise training may be explained by the fact that the weak respiratory muscles (diaphragm, intercostal and abdominal muscles on the affected side) common in patients with stroke may have been strengthened by the exercise training. This may have led to improved ventilation and oxygenation of the blood resulting in improved functional capacity. Weakness of the respiratory muscles in patients with stroke results in severe restrictive ventilatory impairment that may lead to hypoventilation and hypoxemia which implies a reduction in cardiopulmonary competence and could precipitate fatigue.<sup>41,42</sup> Post-stroke fatigue is known to be a common complication of stroke and also a contributing factor to the impairments and disabilities that negatively impairs functional performance.<sup>43</sup> This result is consistent with the report of the study by Tang et al.<sup>20</sup> that examined the benefit of structured aerobic exercise training on aerobic and functional capacity in stroke survivors and found a significant improvement in their walking endurance following a four weeks aerobic exercise training programme using treadmill. The finding is also consistent with another study that reported a significant increase in walking endurance of stroke survivors.<sup>44</sup>

The finding that there were significant improvements in all the selected cardiovascular

parameters of the participants following 10 weeks aerobic exercise training implies that aerobic exercise improved the cardiovascular competence of stroke survivors. It has been suggested that as little as a 5mm Hg decrease in SBP could reduce mortality associated with stroke by 14%.<sup>45</sup> This study recorded a 20.3mmHg decrease in resting SBP and DBP respectively and a 14.2 bpm reduction in HR. Billinger et al.<sup>30</sup> reported a reduction of 11 mmHg and 1.4 mmHg in resting SBP and DBP respectively in ten stroke survivors who carried out exercise training for eight weeks using total body recumbent stepper. There were also significant reductions of 20.8 mmHg and 3505.6 beats/min/mmHg in MAP and RPP respectively.

The finding that there was no significant difference in the effect of 10 weeks aerobic exercise training on selected cardiovascular parameters between male and female stroke survivors implies that gender did not modify the effect of aerobic exercise training on the selected cardiovascular parameters in the stroke survivors. There was no available literature on gender variation in the effect of aerobic exercise training on selected cardiovascular parameters.

The finding that there were significant improvements in all the selected respiratory parameters following 10 weeks aerobic exercise training implies that aerobic exercise improved the respiratory competence of stroke survivors. The severe restrictive ventilatory impairment in stroke survivors resulting from the weakness of the respiratory muscles on the affected side may have been improved due to aerobic exercise training leading to improved ventilation and oxygen in the blood.<sup>46</sup> This corroborates previous studies that reported improved lung function parameters in stroke survivors after aerobic exercise.<sup>21,47,48</sup> Rimmer et al.<sup>24</sup> reported a significant improvement in  $VO_2$

max after exercise intervention in stroke survivors. Duncan et al.<sup>44</sup> and Pang et al.<sup>49</sup> demonstrated a significant improvement in VO<sub>2</sub> max during a combination of aerobic and strengthening exercise intervention among stroke survivors.

The finding that there was no significant difference in the effect of 10 weeks aerobic exercise training on selected respiratory parameters (FVC, PEFR and VO<sub>2</sub> max) between male and female stroke survivors implies that gender did not have any influence on the effect of aerobic exercise training on these parameters in the stroke survivors. However, only FEV<sub>1</sub> showed significant difference between male and female gender. This is consistent with the finding of the study by Severinsen et al.<sup>50</sup> that reported a significant variation in FEV<sub>1</sub> (p=0.024) between male and female participants who combined both aerobic and resistance exercise training.

### **Conclusion**

Aerobic exercise training is beneficial in improving walking endurance and cardio-respiratory parameters in stroke survivors. There was no significant gender difference in the effect of aerobic exercise training on most of the selected cardio-respiratory parameters in stroke survivors.

### **Recommendation**

Based on the findings of this study, it is hereby recommended that Physiotherapists who specialize in the management of patients with stroke should include aerobic exercise training using bicycle ergometer in the management of this group of patients to improve their walking endurance and cardiorespiratory fitness.

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### **Conflict of interest statement**

The authors have no conflicts of interest.

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## **EFFECTS OF AEROBIC EXERCISES ON SELECTED ANTHROPOMETRIC CHARACTERISTICS OF PREGNANT WOMEN ATTENDING ANTENATAL CLINIC OF A NIGERIAN TEACHING HOSPITAL.**

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#### **Abstract**

**Background:** A substantial number of women stop exercising when they discover they are pregnant, and only few begin participating in exercise activities during pregnancy. The adoption or continuation of a sedentary lifestyle during pregnancy may contribute to the development of certain disorders. In view of the global epidemic of sedentary behaviour and obesity-related pathology, prenatal physical activity was shown to be useful for the prevention and treatment of these conditions.

**Aim:** The aim of this study was to investigate the effect of aerobics on some physical fitness parameters of pregnant women attending the ante natal clinic of Rivers State University Teaching Hospital, Port Harcourt.

**Methodology:** Sixty-four pregnant women who completed the study were simply randomized into experimental (n=38) with age

range 25 – 43years and control (n=26) with age range 19 – 41years; their pre-intervention values of hand grip strength, mid upper arm circumference and percentage body fat were taken and recorded. A ten week, three times weekly aerobic exercise (of 40– 45minutes duration) training was administered on the experimental group only. Post-intervention values was also taken from all participants and obtained data summarized using mean and standard deviations. Analysis of covariance was used to test the effects at 0.05 alpha level.

**Results:** Post-intervention Hand Grip Strength of the pregnant women was 35.87±4.09N (experimental group) and 23.62±4.09 N (for control). The mid upper arm circumference of the pregnant women in the experimental group changed from 29.15±2.85cm to 28.81±2.74cm, while that of the control group changed from 28.93±2.03 cm to 29.35±2.06cm. The percentage body fat of the pregnant women in

the experimental group increased from 39.06±10.44% to 41.80±10.30% and in the control group from 40.21±5.69% to 45.25±5.68%.

**Conclusion:** It was concluded that Aerobic Exercise Training improved the physical fitness status of the pregnant women in Rivers State University Teaching Hospital.

**Keywords:** Aerobic Exercise; Physical Fitness Parameters; Pregnant Women

### **Introduction**

Pregnancy is a combination of a series of physiological, psychological, and physical alterations. Particularly, musculoskeletal changes resulting from pregnancy are widely acknowledged, though, its magnitude is scarcely quantified. During pregnancy, the pregnant woman undergoes various anatomical and physiological changes in her body.<sup>1</sup>

Aerobic exercises is a form of [physical exercise](#) that combines rhythmic movements with [stretching](#) and [strength training](#) routines with the goal of improving all elements of fitness ([flexibility](#), [muscular](#) strength, and [cardio-vascular](#) fitness). It may be performed with music and may be practiced in a group setting led by an [instructor](#) ([fitness professional](#)), although it can be done without musical accompaniment<sup>2</sup> Regular physical activity is associated with improved physiological, metabolic and psychological parameters, and with reduced risk of morbidity and mortality from diseases such as cardiovascular disease, hypertension, diabetes mellitus, obesity,

osteoporosis, sarcopenia, cognitive disorders and some forms of cancer. Regardless of the specific physiological changes induced by pregnancy, which are primarily developed to meet increased metabolic demands of mother and fetus, pregnant women benefit from regular physical activity the same way as non-pregnant subjects.<sup>3</sup> Weight gain usually experienced during pregnancy results in postural changes that produce pain and musculoskeletal complaints in pregnant women<sup>4</sup>

Hand Grip Strength (HGS) has been reported as an indicator of the total body strength<sup>5</sup>, an objective test for physical capability<sup>6</sup> and a valid predictor of work capacity<sup>7</sup> degree of disease/injury, and rehabilitation outcomes<sup>8,9</sup>. A good performance on the HGS is associated with high functional index of nutritional status<sup>10,11</sup>, reduced risk of a series of ill health outcomes<sup>12,13</sup> and decreased functional limitations<sup>6,7</sup>, disability<sup>14,15</sup> and morbidity and mortality rates especially among older populations<sup>16</sup>.

Earlier studies conducted in Africa have generally provided evidence that women in low-income countries have a high physical workload that is sustained during pregnancy<sup>17</sup>. This high physical workload was believed to contribute to the high incidence of low birth weight<sup>18</sup>. However, there are only a few published studies on physical activity among pregnant women in low-income countries, and most are questionnaire-administered studies<sup>19</sup> There is ample and consistent evidence that promoting physical activity in women of reproductive age may be a promising approach for the prevention

of excessive weight gain, gestational diabetes mellitus and subsequent complications suffered by children born from pregnancies affected by gestational diabetes mellitus<sup>20</sup>. At least 30 min of moderate activity or 8000 steps/day equivalent to approximately 7.5 MET-h/week are recommended for beneficial results<sup>21</sup>. Meta-analysis studies suggested that women from developing countries perform similar amounts of physical activity as women from developed countries when assessed by doubled labelled water raising questions about actual physical workload. However, these data provide no insight into the patterns of physical activity. Thus, there is a need for more studies with objective methods for assessing physical activity among pregnant women in low-income countries.

Historically, pregnancy was regarded as a state of confinement. More recently, however, research has demonstrated many potential health benefits of aerobic and strength-conditioning exercise in pregnancy and the post-partum period. It is now considered safe, and even advisable, for otherwise healthy pregnant women to initiate or continue an active lifestyle during pregnancy<sup>22</sup>.

Many anatomical and physiological changes take place during pregnancy and while there is no evidence to suggest that exercise in pregnancy is associated with any maternal or fetal adverse outcomes, it is prudent to adjust exercise regimen where necessary to avoid potential harm<sup>23</sup>.

In normal healthy-weight humans, women have

a higher percentage body fat than men, a difference that commences at puberty and continues throughout adult life, suggesting that the mechanism is related to sex steroids. Therefore, female puberty and early pregnancy could be seen as states of efficient fat storage of energy in preparation for fertility, fetal development and lactation providing an obvious biological advantage according to some studies<sup>24</sup>.

However, a substantial proportion of women stop exercising after they discover they are pregnant, and only few begin participating in exercise activities during pregnancy. This study examined the effects of aerobics on some physical fitness parameters of pregnant women attending the antenatal clinic of the Rivers State University Teaching Hospital.

## **Materials and Methods**

### ***Materials:***

#### ***Participants***

The population for this study consisted of pregnant women who attended antenatal clinic at the Obstetrics and Gynaecology (O & G) Department of the Rivers State University Teaching Hospital, Port Harcourt. The research design adopted for this work was the pre test-post test experimental design. The population for this study consisted of Three Hundred and Eighteen (318) pregnant women (age range 19–43years) who were registered at the O&G departments of the hospital (parity 1 – 4) in the months of December 2020 and January, 2021. Seventy-Eight (78) pregnant women willingly volunteered for study following a health promotion talk / sensitization at the Obstetrics

and Gynaecology Department but Sixty-Four (64) completed the study. They were randomly assigned to experimental (n=38) and control (n=26) groups using the simple randomization method of tossing a coin.

The sample size for the study was determined using sample size determination for randomized controlled test.

$$n = 16 \left[ \frac{1}{\text{Effect Size}} \right]^2$$

**n = Sample Size**

**Effect Size = 0.53**

$$n = 16 \left[ \frac{1}{0.53} \right]^2$$

**= 56.96**

**= 57.**

#### **Instruments**

1. The Omron Karda Scan Body Composition Monitor (HBF-522, OMRON HEALTHCARE Co Ltd. Japan) was used to measure body weight and the percentage body fat of the participants.
2. A hand held dynamometer QF-Qingfeng (made in China) was used to measure the hand grip strength (HGS) of the

participants.

3. A tape measure FIBER-GLASS (Made in China, non-stretch)) of 60 INCH/150CM was used to measure the mid arm circumference in centimeter of the pregnant women.

#### **Methods:**

##### **Inclusion and Exclusion Criteria**

The inclusion criteria for this study was that the age of pregnancy not more than Twenty-Six (26) weeks at the commencement of the study. This was to enable the participants conclude the study while still pregnant and that there was no history of cardiovascular diseases among the participants which could endanger them and their fetus(es).

The exclusion criteria for this study were pregnant women with other medical conditions such as cervical incompetence, placenta previa, multiple pregnancies and all pregnant women on bed rest.

##### **Research Design**

The design adopted for this research is randomized pre test-post test control group design. The differences in the pre-test and post-test values represented the impact of the ten (10) weeks aerobics training on the experimental group.

##### **Procedure for Data Collection**

Ethical approval was granted by the Research Ethics Committee of the Rivers State University Teaching Hospital, Port Harcourt, Rivers State, Nigeria (RSUTH/REC/2021048). Informed consent was also obtained from the participants. The participants were volunteers who were randomly assigned into two groups – the

experimental (n=38) and control (n=26) groups. All participants went through the rigors for obtaining the baseline data of Name, age, pregnancy age, number of previous pregnancies and occupation. Also the variables – percentage body fat, mid upper arm circumference and hand grip strength were measured using their various instruments and their results recorded.

Percentage body fat was measured using the Omron Karda Scan Body Composition Monitor (HBF-511). The participants mounted on it bare footed and the indicated body weight and the percentage fat were noted.

The right mid upper arm circumference was measured by locating the acromial process (tip of shoulder) and the olecranon (tip of elbow). Measurement was done from the posterior aspect of the arm between these two (2) points. The length was divided into two (2) and the mid-point marked and read off. The tape measure sliding snugly on the skin follows the contour at this point. Measurement was recorded in centimeters (cm) using decimal point. The process was repeated three (3) times and the average taken.

For hand grip strength measurement, each participant squeezed the hand-held dynamometer with all their strength with their right hand while the indicator is facing upwards/outwards and the reading taken in newton (N). This was done three (3) times and the average score recorded.

### **The training protocol**

The exercise protocol (which lasted about 40 – 45 minutes each session) was carried out thrice weekly in the physiotherapy gymnasium of the physiotherapy department. A post-test data was

obtained from both the experimental and control groups at the end of the ten (10) weeks of the training program.

The training protocol used for this study was researcher-designed but followed the recommendations of the American College of Sports Medicine (ACSM), 2014.<sup>25</sup> The class of pregnant women were instructed to perform the following:

### **Warm Up**

- i. Move around the gym
- ii. On a spot, Swing arms forwards & backwards x 5
- iii. Side and Upward Swings x 5
- iv. Put hands on waist and rotate slowly x 5
- v. Hold unto the parallel bars, Swing right legs forward and backwards x 5
- vi. Then Swing the Left also x 5

**Exercise i:** Hopping on the spot slowly for 2 minutes

**Exercise ii:** Alternate leg raises in standing (at least 6" above the floor) x 5 each leg

**Exercise iii:** Reach out to something far above your height (can use chalk as marker) tip-toe x 5

**Exercise iv:** With clenched fist and outstretched arms, swing arms beyond your frontal midline x 5 each hand.

**Exercise v:** In sitting on an armless chair with a (1.5 kg wt), swing arms from the back mode to above your heads and return x 10.

### **Exercise vi – in Sitting**

#### **Head/Neck Movements:**

- i. Forward looking, bring your chin to touch your chest and return x 5
- ii. Forward looking, look up to see a bit beyond the centre of your head and return x 5

- iii. Forward looking, turn your head/neck to the right as far as you can go and return x 5
- iv. Forward looking, turn your head/Neck to the left as far as you can go and return x 5

#### ***Exercise vii – in Lying***

##### ***Supine (Face up)***

- i. With both legs together, separate them as far possible as you can go and return x 5.
- ii. Alternate Straight leg raises to about 45° above the floor 5 x each (in the last 5wks, increase to 10 x each leg)
- iii. Bicycling in the air (better done with the rhythm of a metronome) for 2 – 3 minutes.

#### ***Exercise viii – Side Lying***

- i. Right side lying: raise the left leg from the hip x5
- ii. Left side lying: raise the right leg from the hip x5  
(In the last 5wks, increase to 10 x each leg)

#### ***Exercise ix – Kegels***

Still lying on your left side, try and hold back as if trying to prevent urine/faeces from coming out, hold it to the count of 10; rest for 1 minute, and hold again to the count of 15.

#### ***Exercise x – Cool Down***

- i. Gentle Spot hopping, while raising and dropping both upper limbs.
- ii. Deep breathing exercises

#### ***Data Analysis***

All statistical analyses were done using Statistical Package for Social Science (SPSS) for windows version twenty-One (21). Data were summarized using descriptive statistics

such as Mean (x) and Standard Deviation (SD). The efficacy was the aerobic exercise training was tested using inferential statistics Analysis of Covariance at 0.05 alpha level. Cohen criterion for interpretation of the partial eta value was used to interpret the effect size of the exercise on the pregnant women with 0.20 – 0.49 as small effect, 0.50 – 0.79 as medium effect and  $\geq 0.80$  as large effect.<sup>26</sup>

#### **Results**

In terms of the hand grip strength, Table 1 shows that the pre-test experimental group had a mean of 29.16 $\pm$ 6.34N with a mean difference of 5.97N when compared with the control. Following the training, the post-test experimental group had a mean value of 35.87 $\pm$ 4.09N, and a mean difference of 12.25N when compared with the post-test control value of 23.62 $\pm$ 4.04N. This mean difference when compared with the pre-test value elucidated the possible effect of the aerobics training on the hand grip strength of the participants. Also, the partial eta square statistics was calculated to determine the effect of the aerobics training on the hand grip strength of the participants. Table 2 shows the Analysis of CoVariance (ANCOVA) test which compared the effect of Aerobic Exercise Training on grip strength of the participants. The participants' grip strength reading on the pre-intervention was used as the covariate. Preliminary checks were conducted to ensure that there was no violation of the assumptions of normality, linearity, homogeneity of variance, homogeneity of regression slope and reliable measurement of covariance. After adjusting for pre-intervention grip strength reading, aerobic exercise had a

significant effect on grip strength ( $F(1,61)=166.32, p=0.000$ , partial eta square=.732).

For mid-upper arm circumference, the results of the study (Table 3) showed that at baseline (pre-test), the experimental group had a mean score of  $29.15 \pm 2.85$  cm. At post-test, the experimental group had a mean score of  $28.81 \pm 2.74$  cm and when compared with the control whose mean value was  $29.35 \pm 2.06$  cm; the mean difference at pre- and post-tests were 0.22 cm and -53 cm respectively. The post-test mean being less indicated that the aerobic training had an effect on the mid arm circumference of pregnant women in Rivers State University Teaching Hospital. Table 4 shows a One-way between groups Analysis of CoVariance (ANCOVA) test was which compared the effect of Aerobic Exercise Training on mid upper arm circumference of the participants. The dependent variable consisted of readings of mid upper arm circumference after the intervention. The participants' mid upper arm circumference score on the pre-intervention was used as the covariate. Preliminary checks were conducted to ensure that there was no violation of the assumptions of normality, linearity, homogeneity of variance, homogeneity of regression slope and reliable measurement of covariance. After adjusting for pre-intervention mid upper arm circumference value, aerobic exercise had a significant effect on mid upper arm circumference ( $F(1,61)=.67.92, p=0.00$ , partial eta square=.527).

For percentage body fat, the result obtained from the study showed (Table 5) that the pre-test

experimental mean value was  $39.06 \pm 10.44\%$  with a mean difference of -1.15%. The post intervention mean score was higher at  $41.80 \pm 10.30\%$  with a mean difference of -4.45%. The post intervention mean score was higher than the pre-intervention, hence the aerobic exercise had effect on the percentage body fat of the pregnant women. Notice also, that the elevated mean score was in the negative direction, which showed that there was a reduction in the percentage body fat of the experimental group. One-way between groups Analysis of CoVariance (ANCOVA) was conducted to compare the effect of Aerobic Exercise Training on Percentage Fat among the participants (Table 6). The dependent variable consisted of readings of percentage fat after the intervention. The participants' percentage fat on the pre-intervention was used as the covariate. Preliminary checks were conducted to ensure that there was no violation of the assumptions of normality, linearity, homogeneity of variance, homogeneity of regression slope and reliable measurement of covariance. After adjusting for pre-intervention percentage fat reading, aerobic exercise had a significant effect on weight ( $F(1,61)=83.10, p=0.00$ , partial eta square=.577).

**Table 1: Mean and Standard Deviation on the effect of Aerobic Exercise Training on Hand Grip Strength among Pregnant Women in Rivers State University Teaching Hospital.**

<b>Grip strength</b>	<b>Group</b>	<b>N</b>	<b>MEAN</b>	<b>SD</b>	<b>Mean difference</b>
Pre intervention	Experimental	38	29.1579	6.34	5.97
Pre intervention	Control	26	23.19	4.16	
Post intervention	Experimental	38	35.8684	4.09	12.25
Post intervention	Control	26	23.62	4.04	

**Table 2: One-way Analysis of CoVariance (ANCOVA) on the effect of Aerobic Exercise Training on Hand Grip Strength among Pregnant Women in Rivers State University Teaching Hospital.**

<b>Source</b>	<b>Type III Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>	<b>Partial Eta Squared</b>	<b>Decision</b>
Corrected Model	3014.46 <sup>a</sup>	2	1507.23	278.80	.000	.901	
Intercept	521.84	1	521.84	96.53	.000	.613	Reject Ho
Pre-GripStr	696.72	1	696.72	128.87	.000	.679	
Group	899.18	1	899.18	166.32	.000*	.732	
Error	329.78	61	5.41				
<b>Total</b>	<b>64415.00</b>	<b>64</b>					
<b>Corrected Total</b>	<b>3344.23</b>	<b>63</b>					

**a. R Squared = .901 (Adjusted R Squared = .898)**

**P<0.05, \*Significant**

**Table 3: Mean and Standard Deviation on the effect of Aerobic Exercise Training on Mid Upper Arm Circumference among pregnant women in Rivers State University Teaching Hospital.**

Mid Upper Arm Circumference	Group	N	MEAN	SD	Mean difference
Pre intervention	Experimental	38	29.1474	2.85	.22
Pre intervention	Control	26	28.93	2.03	
Post intervention	Experimental	38	28.8132	2.74	-.53
Post intervention	Control	26	29.35	2.06	

**Table 4: ANCOVA on the effect of Aerobic Exercise Training on Mid Upper Arm Circumference among Pregnant Women in Rivers State University Teaching Hospital.**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Decision
Corrected Model	380.97 <sup>a</sup>	2	190.48	1508.12	.000	.980	Ho
Intercept	.48	1	.48	3.78	.056	.058	Rejected
Pre-MUAC	376.58	1	376.58	2981.52	.000	.980	
Group	8.58	1	8.58	67.92	.000*	.527	
Error	7.71	61	.13				
<b>Total</b>	54322.93	64					
<b>Corrected Total</b>	388.67	63					

a. R Squared = .980 (Adjusted R Squared = .980)

P<0.05, \*Significant

**Table 5: Mean and Standard Deviation on the effect of Aerobic Exercise Training on Percentage Fat among women in Rivers State University Teaching Hospital.**

Percentage Fat	Group	N	MEAN	SD	Mean difference
Pre intervention	Experimental	38	39.06	10.44	-1.15
Pre intervention	Control	26	40.21	5.69	
Post intervention	Experimental	38	41.80	10.30	-4.45
Post intervention	Control	26	45.25	5.68	

**Table 6: ANCOVA on the effect of Aerobic Exercise Training on Percentage Fat among Women in Rivers State University Teaching Hospital.**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Decision
Corrected Model	4913.20 <sup>a</sup>	2	2456.602	1196.04	.000	.975	Ho
Intercept	84.39	1	84.39	41.09	.000	.402	Rejected
Pre-% Fat	4606.97	1	4606.97	2242.99	.000	.974	
Group	170.68	1	170.68	83.10	.000*	.577	
Error	125.29	61	2.05				
<b>Total</b>	126752.26	64					
<b>Corrected Total</b>	5038.49	63					

**a. R Squared = .975 (Adjusted R Squared = .974)**

**P<0.05, \*Significant**

### Discussion

The result of this study indicated a significant effect of the aerobics training on hand grip strength of pregnant women in line with Seong and others who investigated the association between aerobic exercise and hand grip strength in adults<sup>27</sup>. It is important to remark that there is dearth of information and research on the influence of aerobics on the hand grip strength of pregnant women despite the toll of pregnancy on the musculoskeletal system and the lower hand grip strength recorded in pregnant females when compared with non-pregnant females.<sup>28</sup> Also, in the study of the effects of aerobic exercise and strength training on the hand grip strength and functional fitness in the middle aged and elderly women, Zhang and others concluded that aerobic exercise and strength training can enhance the middle aged and elderly women's hand grip strength and improve

their functional fitness confirming the results of this study.<sup>29</sup> Hand grip strength is a predictor of upper extremity function, and changes in muscle strength and physical function and capabilities to undertake activities of daily living.<sup>30</sup>

Mid upper arm circumference is a screening tool for obesity, and can be used in combination of other arm anthropometry to derive the arm indices; arm muscle area (AMA), arm fat area (AFA), and arm fat index (AFI).<sup>31,32</sup> There is paucity of research papers to validate this finding but suffice to say that Aerobic Exercise Training significantly impacted mid upper arm circumference of pregnant women and also helped to identify and moderate their arm girth.

Results also indicated a moderate effect (0.577%) of moderate aerobic training on percentage body fat of pregnant women. The result of the present study showed a significant difference in the body fat percentage score of the participants in the training

group when compared with the control group. The findings of this study are consistent with the report of McDonald and others whose findings suggested that aerobic exercise has a beneficial impact on neonatal skin fold thickness and percent body fat at one month of age delivered of women who exercised. Participation in the recommended levels of aerobic exercise (150 minutes, moderate-intensity per week) throughout the prenatal period may serve as an effective strategy to reduce the risk of overweight or obesity in the early post-natal period.<sup>33</sup> The findings of this study were inconsistent to that of Cavalcante and others who evaluated water aerobic exercises, maternal body composition and prenatal outcome after a program for low risk pregnant women. They found no significant differences between the groups regarding maternal weight gain, BMI or percentage body fat during pregnancy.<sup>34</sup> Similarly, Dekker and others found that exercise did not alter the maternal lipid profile. This was possible due to the low level of physical activity achieved in the obese women in the exercise intervention arm.<sup>35</sup>

### **Conclusion**

Participating in a planned aerobic exercise training can lead to an overall improvement in the some anthropometric measures of pregnant women (mid upper arm circumference, and percentage body fat) while hand grip strength improved significantly following ten weeks of moderate intensity Aerobic Exercise Training regimen.

### **Conflicts of interest**

The authors declare that there is no conflict of interest regarding the publication of this article

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## **KNOWLEDGE, ATTITUDE AND PRACTICE OF COMMUNITY PHYSIOTHERAPY AMONG PHYSIOTHERAPISTS IN SOUTHEASTERN NIGERIA: A CROSS-SECTIONAL STUDY**

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### **Abstract**

**Background:** Community-dwellers are often in need of physiotherapy and rehabilitation for non-communicable disease conditions particularly chronic low back pain and cerebrovascular accidents. However, the access to physiotherapy and rehabilitation in rural areas is grossly inadequate.

**Aim of the study:** This study aimed to ascertain the level of knowledge, attitude and practice of community physiotherapy amongst physiotherapists in southeastern Nigeria.

**Materials and Methods:** In this cross-sectional study, a total of 81 physiotherapists possessing at least 2 years of clinical experience were consecutively sampled from 10 conveniently selected hospitals in the 5 southeastern states. We assessed participants using a validated self-administered Knowledge, Attitude and Practice (KAP) questionnaire. We summarized data using the statistics of percentage, mean and standard deviation. Mann-Whitney and Kruskal-Wallis tests

were used to test the influence of selected socio-demographic characteristics on knowledge, attitude and practice of Community Physiotherapy. Spearman rank-order correlation was used to test for the relationship among knowledge, attitude and practice of community physiotherapy.

**Results:** The mean age of participants (females = 57, males = 43) was  $36.3 \pm 6.5$  years. Good knowledge ( $84.30 \pm 6.79\%$ ) and attitude ( $84.35 \pm 5.85\%$ ) and fair practice ( $74.76 \pm 9.33\%$ ) of community physiotherapy were observed among the study participants. There were significant correlations among knowledge, attitude and practice of community physiotherapy among physiotherapists ( $p < 0.05$ ). Factors constituting a hindrance to the assimilation of community physiotherapy were poor remuneration and lack of basic social infrastructure.

**Conclusions:** There is good knowledge and a good attitude and fair practice of community physiotherapy among physiotherapists in our

settings. Efforts should be made to address the hindrances to community physiotherapy.

**Keywords:** Physiotherapy, community, knowledge, attitude, practice

### **Introduction**

Community physiotherapy tackles acute and chronic illnesses in the adult population in settings such as the community and the patient's home after discharge from the hospital as part of the community-based rehabilitation program.<sup>1</sup> In rural areas, 52% of Nigeria's population lives in poverty, with the majority of the population being elderly and disabled.<sup>2,3</sup> Thus, the greatest need for physiotherapy and rehabilitation treatments is among the community residents. However, access to physiotherapy and rehabilitation in rural areas is extremely limited.<sup>1, 4</sup> According to the Australian Physiotherapy Association, physiotherapist employers in remote areas have trouble hiring and retaining physiotherapists.<sup>5</sup> Some residents of the community turn to quacks and other out-of-date medical procedures when their health deteriorates.<sup>6</sup> Disability, hence, remains a global challenge.<sup>7</sup> Only a few Nigerians have access to physiotherapy services, which are increasingly available in major cities.<sup>6</sup>

Many individuals cannot afford to relocate to larger cities, so instead of receiving quality physiotherapy, they turn to quacks and traditional medical services, which simply worsen or complicate the condition that could have been avoided with early physiotherapy care.<sup>6</sup> The majority of Nigerians reside in rural areas, where living conditions are poor, with the majority being the aged population suffering from disabilities.<sup>8</sup> Many elderly people and people with disabilities in rural areas are

vulnerable to communicable and non-communicable diseases, necessitating regular healthcare, but there are no set plans to ensure their independence in Nigeria.<sup>6</sup> Rural residents' experiences of disability, according to reports of expanding global demand for physiotherapy services, is a significant factor that may contribute to greater usage of health care services, including physiotherapy.<sup>9</sup> Many individuals living with disabilities in rural Nigeria lack access to physiotherapy and rehabilitation, which has serious socioeconomic implications if the situation does not improve.<sup>10</sup>

The presence of a disability is a source of concern for many international organizations, including the United Nations Educational, Scientific, and Cultural Organization, the International Labor Organization, and the World Health Organization, leading to many international initiatives from these organizations.<sup>7</sup> Physiotherapists are crucial to the success of community-based rehabilitation. Physiotherapists who want to work in rural areas need a unique set of skills that can only be acquired through hands-on experience in the rural setting.<sup>5</sup> Many physiotherapists are not willing to work in rural health institutions, while others have never worked as community physiotherapists in remote areas.<sup>11</sup> The Chartered Society of Physiotherapy advocates community physiotherapy owing to the growing demand for care outside of hospitals and in communities.<sup>12</sup> This demand is becoming more difficult to meet as the population ages and the number of people with numerous long-term conditions rises.<sup>13</sup> The practice of community physiotherapy is almost non-existent in Nigeria's rural communities as well as in Enugu, Nigeria.<sup>1</sup>

Investigating existing models of care can be vital in

service improvement. However, we can only practice and become proficient at what we have the right attitude towards, and attitude is often driven by knowledge of such a variable. Few studies have looked into community physiotherapy knowledge, attitudes, and practice in Southwest and Northwest Nigeria.<sup>14,25</sup> The present study focused on the whole states in southeast Nigeria unlike that of Igwesi-Chidobe and Okafor<sup>16</sup> which was restricted to only Enugu State. Our study examined the knowledge, attitudes, and practice of community physiotherapy amongst physiotherapists in the South-East region.

### **Methodology**

This study was a cross-sectional survey conducted in 10 hospitals in the 5 states of South East, Nigeria. Two tertiary hospitals were conveniently selected from each of the states. Consecutive sampling was used to recruit 81 physiotherapists from the selected hospitals. We excluded physiotherapists who possessed less than 2 years of clinical experience, those engaged in the National Youth Service Corps, and intern physiotherapists were excluded. Ethical approval was sought and obtained from the ethical review committee of the Faculty of Health Sciences and Technology, Nnamdi Azikiwe University. Informed consent was equally obtained from all the participants after explaining the aim and nature of the study. Socio-demographic data of the study participants were taken. We assessed participants' knowledge, attitude and practice.

A self-administered, Knowledge, Attitude and Practice (KAP) model questionnaire was adapted from the study community physiotherapy and rehabilitation outcomes in Nigeria: Knowledge, attitude and practice of Physiotherapists in Enugu State developed by Igwesi-Chidobe and Okafor<sup>16</sup> was used. The KAP model questionnaire, comprised

of 8 knowledge questions, 8 attitude questions, and 9 questions on the participant's practice of community physiotherapy. The items used a 5-point Likert scale with the following response options: "strongly agree", "agree", "neutral", "disagree" and "strongly disagree" with scores of 5, 4,3,2,1 respectively. The total scores for each of knowledge, attitude and practice were converted to percentages. Descriptive statistics of percentage, frequency count, mean and standard deviation were used to summarize participant characteristics. Mann-Whitney U and Kruskal-Wallis tests were used to test the influence of socio-demographic variables of the participants on their knowledge, attitude, and practice of Community Physiotherapy. Spearman rank-order correlation was used to test for the correlation between the knowledge, attitude, and practice of community physiotherapy among the participants. SPSS version 10.0 was used and the Alpha level was set at 0.05.

### **Results**

The mean age of participants was 36.25±6.54 years. Forty-six (57%) and 43% were females males respectively, 67 (83%) were married, and 62 (77%) had MSc and about half (51%) possessed 6-10 years of practice experience (Table 1).

Participants had good knowledge (84.3±6.8%) and attitude (84.5±5.9%) of community physiotherapy while having a fair practice (74.76±9.33%) of community physiotherapy (Table 2). There was no significant difference in knowledge of community physiotherapy based on gender ( $U = 718.50$ ;  $p = 0.404$ ), educational qualification ( $U = 0.350$ ;  $p = 0.839$ ) and years of experience ( $U=1.672$ ;  $p = 0.643$ ). There was no significant difference in attitude based on gender ( $U = 675.0$ ;  $p = 0.211$ ), educational qualification ( $U = 5.569$ ;  $p = 0.062$ ) and

years of experience ( $U=5.842$ ;  $p = 0.05$ ). Similarly there was no significant difference in practice based on gender ( $U = 345.0$ ;  $p = 0.119$ ), educational qualification ( $U = 3.023$ ;  $p = 0.221$ ) and years of experience ( $U=6.692$ ;  $p=0.082$ ) (Table 3).

There were significant correlations between age and each of knowledge and attitude ( $r = 0.51$ ;  $p = 0.650$ ) and practice of community physiotherapy ( $r = -$

$0.045$ ;  $p = 0.634$ ) among physiotherapists. There were significant correlations between knowledge and each of attitude ( $r = 0.247$ ;  $p = 0.026$ ) and practice ( $r = 0.277$ ;  $p = 0.012$ ) of community physiotherapy. There were significant correlation between attitude and practice ( $r = -0.120$ ;  $p = 0.284$ ) (Table 4).

**Table 1: Socio-Demographic variables of participants**

Variable	Frequency	Percentage (%)
Gender		-
Male	35	43
Female	46	57
Marital status		-
Single	14	17
Married	67	83
Qualification		-
BSc.	11	14
MSc.	62	77
PhD.	8	10
Years of experience		-
2-5 years	31	38
6-10 years	41	51
11-15 years	2	3
>15 years	7	9

**Table 2: Level of knowledge, attitude and practice of community physiotherapy**

Variables	Mean±SD (%)	Range (%)
Knowledge	84.30±6.79	5.63-96.88
Attitude	84.35±5.85	70.00-97.50
Practice	74.76±9.33	62.22-100.00

**Table 3. Influence of socio -demographic variables on knowledge, attitude, and practice of community physiotherapy among physiotherapists**

Variables	Knowledge			Attitude			Practice		
	MR	U	p	MR	U	p	MR	U	p
<u>Gender</u>									
Male	38.53	718.50	0.404	44.71	675.0	0.211	37.91	345.0	0.119
Female	42.88			38.17			43.35		
<u>Marital status</u>									
Single	33.00	357.0	0.157	36.86	411.0	0.465	32.14	697	0.300
Married	42.67			41.87			42.85		
<u>Years of experience</u>									
2-5 years	37.89	1.672	0.643	43.35	5.842	0.05	34.95	6.692	0.082
6-10 years	37.44			37.44			47.54		
11-15 years	22.00			22.00			28.00		
>15 years	50.07			56.86			33.21		
<u>Education</u>									
BSc	38.18	0.350	0.839	26.23	5.569	0.062	33.95	3.023	0.221
MSc	41.04			42.65			43.48		
PhD	44.56			48.56			31.50		

MR; mean rank; U: Man-Whitney U test

**Table 4: Inter -variable correlation among age of participants, knowledge, attitude and practice of community physiotherapy**

Variables	Knowledge	Attitude	Practice
Age	r = 0.80 p = 0.48	r = 0.51 p = 0.65	r = -0.045* p = 0.634
Knowledge	r = 1.000 p = -	r = 0.247* p = 0.026	r = 0.277 p = 0.012*
Attitude	r = 0.247* p = 0.026	r = 1.000 p = -	r = -0.120 p = 0.284

\*=significant at  $p < 0.05$

### Discussion

The physiotherapists in this study possessed good knowledge and attitude towards community physiotherapy. This contradicts the findings of Igwesi-Chidobe & Okafor<sup>16</sup>, which reported poor knowledge, attitude, and practice of community physiotherapy. Our study was conducted eight years later than Igwesi-Chidobe and Okafor<sup>16</sup>, hence the advocacy for community physiotherapy seems to yield some benefits. In this present study, only 12.3% of the participants indicated that they needed a training course on how to practice community physiotherapy in clinical work. This could mean that they had prior training or exposure to the concept of community physiotherapy. This implies there is an increasing level of awareness of community physiotherapy among physiotherapists of the southeastern Nigeria extraction, and the tertiary institutions in southeastern Nigeria may be embracing the idea of community physiotherapy thus incorporating community rehabilitation into

the curriculum. We found that knowledge correlated with attitude, hence we can say that the level of knowledge seen in this study influenced the level of attitude towards community-based physiotherapy. No previous study explored the relationship of knowledge, attitude, and practice of community physiotherapy. However, our finding is consistent with Bhatt et al.<sup>17</sup> who reported a positive association of knowledge and attitude towards evidence-based physiotherapy among physiotherapists.

Despite having a good knowledge and attitude towards community physiotherapy among physiotherapists in southeastern Nigeria, we observed a fair level of practice of community physiotherapy. Although the level of practice of community physiotherapy achieved in our study was higher than the value obtained by Igwesi-Chidobe and Okafor<sup>16</sup> who reported poor practice of community physiotherapy, physiotherapy services were mostly available in tertiary institutions and

less accessible to the communities, due to travel costs and lack of resources/facilities for physiotherapy<sup>15</sup>. Notwithstanding, the increasing knowledge, attitude, and practice of community physiotherapy among physiotherapists in our studies signify an important milestone regarding the effort to incorporate physiotherapy into primary healthcare services in Nigeria. This is further strengthened by the increasing utilization of community physiotherapy in communities<sup>15</sup> that we may consider less developed than ours. Interestingly, most all of the physiotherapists, our study identified the need for physiotherapy services in rural communities. Unfortunately, more than half of the physiotherapists in our study indicated unwillingness to work in a rural-based physiotherapy centres. However, this implies a fairer degree of acceptance of community physiotherapy amongst our study participants compared to Igwesi-Chidobe & Okafor<sup>16</sup> who reported that almost all of the physiotherapists in their study were unwilling to work in rural-based physiotherapy outfits. It is important to state that reasons for the unwillingness of physiotherapists to engage in community physiotherapy borders on poor remuneration and lack of social infrastructure in these areas. Hence, care models targeting promotion and implementation of community physiotherapy must consider factors of improved remuneration and basic social amenities. Our study revealed a positive correlation between knowledge and practice of community physiotherapy suggesting that the more educated a physiotherapist is about community physiotherapy, the better attitude and hence the practice. This is consistent with [Boakye et al.](#)<sup>18</sup> which revealed a positive correlation between knowledge of health promotion and practice among physiotherapists in Ghana.

Overall, stakeholders may leverage on the high rate of employment in the country to stimulate younger physiotherapists' interest in community physiotherapy. However, a persuasive care model which targets improved community physiotherapy education, remuneration, and provision of basic social amenity is warranted.

### **Conclusions**

There is good knowledge and attitude towards community physiotherapy among physiotherapists in our settings. The practice of community physiotherapy among physiotherapists in our settings was fair. It is recommended that the hindrances to community physiotherapy be addressed by the relevant stakeholders. This will help kindle interest in this area.

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## **MANAGEMENT PATTERN OF LOW BACK PAIN AT THE SPINE UNIT OF PHYSIOTHERAPY DEPARTMENT, UNIVERSITY OF PORT HARCOURT TEACHING HOSPITAL, NIGERIA**

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### **Abstract**

**Background of the study:** Low back pain (LBP) has been described as the single most significant contributor to musculoskeletal disability worldwide, and a major cause of decreased efficiency and well-being in the working populace. It is a common complaint in general outpatients and orthopaedic clinics. To mitigate attendant problems while aiding recovery, the Treatment-Based Classification system has been identified as an efficient and effective method of management.

**Aim of the study:** This study was aimed at analyzing the pattern of occurrence of low back pain and the nature of the Treatment-based classification system used for patients that presented at the spine unit of the physiotherapy department of the University of Port Harcourt Teaching hospital.

**Material and methods:** Data for this retrospective study were obtained from the case notes of the patients and documented into a spreadsheet specifically designed for the study. These include

demographic factors, history of LBP, physician diagnosis (if available), physiotherapy diagnosis, treatments offered and further signs/symptoms (flags). Data obtained were summarized using descriptive statistics of mean, frequency counts and percentages

**Results:** Data of a total of 86 patients treated for complaints of low back pain were utilized in this study. The male to female ratio was 1:1.77 with age range between 16 to 65 years. Most patients were females, adults and were civil servants. Majority presented with a variety of accompanying complaints such as pain in one or both legs. The global stabilization component of motor control and function optimization was the intervention of choice as most patients fell into this treatment category following the outcome of classification with only one per cent requiring manipulation.

**Conclusion:** Record-keeping in the clinic need to be enhanced especially in the presence of comorbidities in determining which patients are fit for standard rehabilitation and which should be

attended to along with or restricted to only medical management are being recorded. Also, results of this study indicate the need to be pay primary prevention of LBP in working population to forestall its occurrence.

**Keywords:** low back pain, treatment-based classification, stabilization, manipulation

### **Introduction**

Approximately about 85% of primary health consultations presents with “non-specific” back pain wherein the specific underlying disease or pathology remains unidentified<sup>1</sup>. Low back pain (LBP) is considered a public health issue as it affects everyone regardless of age, gender or socioeconomic status<sup>2,3</sup>. A systematic review of the prevalence of low back pain in Africa revealed the average lifetime prevalence of LBP among adolescents was 36% and among adults was 62%<sup>4</sup>. Among men and women, there are mixed findings on the prevalence of LBP. While a study by Wang et al.<sup>5</sup> reported that females had a higher prevalence of LBP across all age groups, similar prevalence rates among women and men have also been reported<sup>6</sup>.

Historically, LBP was perceived as a problem confined to western countries, but research performed during the one and a half-decade ago clearly showed that it is also a significant problem in low- and middle-income countries<sup>7,8,9,10</sup>. Commonly reported risk factors associated with low back pain are personal factors, work factors and environmental factors<sup>11</sup>. Personal factors consist of age, gender, body mass index, work time, smoking, educational status, levels of income, activity and trauma. Work factors include heavy workload, work position, repetition, and duration. It was found that continuous sitting significantly increased perceived discomfort (particularly in the upper and lower back), trunk flexion and metrics of localized muscle fatigue<sup>12,13</sup>. Heavy workload on workers is a leading

cause of low back pain. Environment factors are noises and whole-body vibration. More so, commonly reported personal risk factors include low educational status, stress, anxiety, depression, job dissatisfaction, low levels of social support in the workplace, whole-body vibration, tobacco use and poor general health or functional level<sup>14,15</sup>. Also, studies reported that the obese have an increased risk of developing back pain and that the rate of obesity increases with age at least up to 50 or 60 years old<sup>16,17,18</sup>.

Likewise, although LBP is considered a major cause of morbidity in high, middle and low-income countries, yet, to date, research on effective interventions has been relatively under-prioritized and under-funded. One important reason may be the low ranking it has received relative to many other conditions included in the previous Global Burden of Disease studies, due in part to the paucity of suitable data<sup>15, 19</sup>. In 2019, LBP was ranked eight (47%) amongst the top ten contributors to increasing health loss worldwide over the past thirty years, measured as the largest absolute increases in the number of disability-adjusted life years (DALY)<sup>10</sup>. It has been demonstrated that diagnosis, as noted in the patients' medical records, has been used to estimate the prevalence of LBP in the real-world<sup>20</sup>. It is therefore hoped that this study will add to the body of knowledge in this regard.

Despite the feats already achieved in the study of low back pain, most of the literature demonstrates difficulty with finding a specific cause of low back pain and this is suggestive of clinical guidelines which lack evidence-based means of identifying the intervention being put into practice by clinicians. For patients with acute, work-related low back pain, the use of the treatment based classification approach resulted in improved disability and return to work status after four weeks, as compared with

therapy based on clinical practice guidelines<sup>21</sup>. The Treatment based classification (TBC) system of low back pain management, a concept which uses high-level evidence in assessing, evaluating and planning treatments has been demonstrated to be effective and efficient<sup>22,23</sup>. Applying this method, patients are grouped into one of four treatment categories: Stabilization category, Passive mobilization and manipulation category, Specific exercise category or Sustained positions or traction category to guide an effective clinical decision making process. In the study presented here this original classification was the mode used in categorization. This primary purpose of the TBC has been updated and modified. The current TBC has two levels of triage, the level of the first contact health care provider competent in LBP care charged with the responsibility of determining the appropriate approach of management<sup>24</sup> and the level of the rehabilitation provider.

In the first level of triage, the patient is screened for and cleared of any serious pathology and placed in either rehabilitation or self-care management. Risk profiling instruments such as the STarT Back Tool are used to determine patients who will benefit from self-care management<sup>25</sup>. Such patients are predicted unlikely to develop disabling LBP during the current episode. The second level is determining appropriate rehabilitation management determined by symptom modulation during presentation and history taking with recent symptoms/signs or recurrent episodes of LBP that is currently causing significant symptomatic features, decision is made on they benefit from intervention with the use of manual therapy, directional preference exercises, traction or immobilization to modulate pain.

The rehabilitation professional through assessment determines where patients might fit. the criteria of two or more treatment classifications, which

requires prioritization of treatment. For example, in the symptom modulation approach, a patient may satisfy the criteria for manipulation and directional exercises. In that case, directional exercises take priority over manipulation. Directional exercises should be the treatment of choice until the patient's status plateaus. At that moment, manipulation may ensue. Similarly, in the movement control approach, a patient may have motor control impairment and reduced muscle performance. In that case, motor control deficit takes priority over the muscle reduced performance. When the control deficit is corrected, muscle performance training in the form of stabilization exercises can ensue<sup>24</sup>.

To guide the classification, information from the clinical examination, patients' self-reports on pain severity scale and functional disability scale, flags they seem to be presenting with (red flags: signs and symptoms related to some pathology eg endometriosis; yellow flags: psycho-social factors eg depression and green flags: related to rehabilitation intervention eg neuro-musculoskeletal) are analysed and clinical decision is arrived at based on them. Factors suggestive of flag history are deduced from subjective history and physical examination.

Treatment based classification system is the main assessment and treatment approach used in managing low back pain patients in the University of Port Harcourt (UPTH) spine clinic. The TBC system was initially proposed by Delitto et al<sup>26</sup> and has evolved over the greater part of two decades. Different revisions have been attempted since then with Alrwaily et al.<sup>24</sup> adding considerations for biopsychosocial aspects of low back pain. This classification system has been rigorously evaluated and has come out with moderate to good inter-rater reliability regardless of clinician experience or expertise. Managing individuals with low back pain

using a treatment-based classification approach significantly reduces disability and pain compared with current clinical practice guideline standards<sup>27</sup> and enhance clinical decision making<sup>28</sup>. The treatment-based classification approach has been validated<sup>28</sup> and is widely used in the United States of America.

Even though LBP has since 1990 ranked number one leading cause of disability by the Global Burden of Disease Study<sup>29</sup>, it has not been identified as a priority area for non-communicable disease management<sup>30</sup>. With a focus on getting the needed attention on the prevention and management of LBP, studies in Nigeria have reported on the prevalence of LBP using self-reported measures<sup>31,32,33</sup>. However, to our knowledge, no published research has reported the prevalence and risk factors of LBP using a patient's case note in a hospital in the south-south part of Nigeria. Hence, specific information on associated risk factors in LBP, its assessment and physiotherapy treatment patterns from the patient's case notes are needed for evidence-based interventions aimed at reducing musculoskeletal complaints to be better targeted.

### **Methodology**

A retrospective study of specifically selected hospital records of individuals attending the spine subunit of the orthopaedic unit in the Physiotherapy Department, of the University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria. This subunit is an outpatient clinic that is run by Certified Spine Specialists who manage patients presenting with spinal pain, and also involved in training students, interns and physiotherapists on rotations. The study utilized case notes of patients who were treated for low back pain in the unit. To carry out this study, case notes of the patients managed in the unit between January 2013 to June 2019 were retrieved,

from which the cases of low back pain were identified and reviewed.

Information obtained from the case notes were then recorded into a spreadsheet specifically designed for the study, these were: hospital number, sex, age, a major complaint of the patient at presentation to the unit, low back pain, physician diagnosis (if available), physiotherapy diagnosis, and treatments offered. Further signs/symptoms (flags), LBP treatment classification, and treatment sessions were extracted. Presenting patients were grouped based on Flags -red, yellow and green. Collected data were collated and summarized using mean and percentages. Continuous variables (e.g., age) were presented in means and standard deviation, while categorical variables (e.g., sex, flags) were represented in percentages and frequencies.

### **Results**

A total of 86 case reports of patients that had presented for LBP were obtained for data extraction. Out of these, the rehabilitation treatment approach/impression involved in the physiotherapy management of 78% (67) of the patients were indicated. The remaining case reports were, however, included in the analysis to determine the population of patients that were attended to in the unit during the period under consideration.

The respondents' backgrounds are summarized in table 1. The male patients were (n=31, 36%) and the female patients were (n=55, 64%). The participants' ages ranged from 13 to 77 years. The majority of the patients were either overweight 16(18.6%) or obese 25(29.1%). Thirty eight (44.2%) were civil servants, followed by 31(36%) traders. The predominant age group 23(27.4%) was the age group between 51 and 60.

The presentation pattern of LBP in this study is presented in Table 2. The patients managed with stabilization were the majority 57(66.3%) while only one individual (1.2%) fell under the class of manipulation. Most cases were reported in March 2019.

**Table 1. Socio-demographic characteristics of participants (N = 86)**

<b>Variables</b>	<b>Frequency</b>	<b>Percentage (%)</b>
<i>Age category</i>		
-	7	8.3
31-40	16	19.0
41-50	17	20.2
51-60	23	27.4
61-70	18	21.4
71-80	3	3.6
<i>Sex</i>		
Male	31	36
Female	55	64
<i>Occupation</i>		
Student/Applicant	6	7.0
Business/Trade	31	36.0
Civil Servant	38	44.2
Retiree	9	10.5
<i>Body mass index category</i>		
<18	1	1.2
18-24	2	2.3
25-29	16	18.6
30 and above	25	29.1
<i>Flag</i>		
Red	41	47.7
Yellow	7	8.1
Green	25	29.1

**Table 2. Prevalence of LBP from January 2013 to June 2019 among Patients Visiting the Spine Unit of the Physiotherapy Department, UPTH (N = 86)**

	Frequency	Percentage (%)
<u><i>Treatment based classification</i></u>		
<u><i>(Impression)</i></u>		
Stabilization	57	66.3
Others (Unidentified)	19	22.1
Traction	5	5.8
SCI	4	4.7
Manipulation	1	1.2
<u><i>Month</i></u>		
January	5	5.8
February	6	7
March	12	14
April	10	11.6
May	11	12.8
June	6	7
July	6	7
August	4	4.7
September	2	2.3
October	1	1.2
November	11	12.8
December	6	7
<u><i>Year</i></u>		
2013	1	1.2
2014	4	4.7
2015	2	2.3
2016	5	5.8
2017	21	24.4
2018	18	20.9
2019	28	32.6

## **Discussion**

Low back pain has been described as the most common musculoskeletal disorder affecting the general population<sup>32,34</sup>. As part of the Global Burden of Disease Study (GBD) 2019, the Expert Group demonstrated that low back pain is one of the top ten high burden diseases and injuries, with an average number of disability-adjusted life years (DALYs) higher than HIV, road injuries, tuberculosis, lung cancer, chronic obstructive pulmonary disease and preterm birth complications<sup>10</sup>. The prevalence of low back pain has been reported to vary according to definitions, study populations and also from country to country<sup>9</sup>. A systematic review of the prevalence of low back pain in Africa revealed the average lifetime prevalence of LBP among adolescents was 36% and among adults was 62%<sup>4</sup>. Though not carried out in the general population, adults still form the larger percentage of individuals attended to in the spine clinic during the study period with close to 50% of number recorded being in the overweight category. Studies have reported likely relationship between overweight, obesity and LBP; the obese have an increased risk of developing back pain and that the rate of obesity increases with age at least up to 50 or 60 years old<sup>35,36</sup>. These studies' findings agree with ours as shown by the majority of individuals being adults in different overweight categories.

Among men and women, there are mixed findings on the prevalence of LBP. While a study by Wang et al.<sup>5</sup> which agrees with the present study reported that females had a higher prevalence of LBP across all age groups, similar prevalence rates among women and men have also been reported<sup>6</sup>. The assertion by Duthey et al<sup>37</sup> that LBP is present at any age, from children to the elderly and is a common reason for medical consultations is evident in this study as most

age groups are represented in this study. Studies have found the incidence of low back pain is highest in the 30-year-olds, the overall prevalence increases with age until the 60-65 year age group and then gradually declines<sup>15,38,39</sup>. The majority of individuals treated in the spine clinic were 31 to 70 years which encompass the general working population of the country. This is further evident by the 80.2% of the patients who were civil servants and in trade occupations.

In addition to age and gender, the risk factors and impact of low back pain on an individual's quality of life and productivity, as a matter of necessity have been given some attention in the literature<sup>31,9,32</sup>. This aspect is referred to as flags in this study. Unfortunately, specific details of diagnosis or factors were not clearly detailed. For instance, the individuals (47.7%) who were reported to present with comorbidities labelled as red flags and yellow flags with no clear record of how these were defined or managed is an identified limitation of this study. LBP with attendant complexities is reported to be a major cause of decreased efficiency and well-being in the working populace<sup>32</sup>, its various consequences such as financial instability, increased medical costs, and other socioeconomic implications affecting individuals, employers of organizations, and society at large<sup>40</sup>. Indeed, the burden of LBP is immense with regards to the quality of life, productivity, and employee absenteeism, making these common conditions the single most significant contributor to musculoskeletal disability worldwide<sup>19,9</sup>.

Stabilization was the major treatment method employed in the management of the patients. Lumbar stabilization targets the local stabilisers in the lumbar region especially the lumbar multifidus

muscle in synergy with other muscles of core stabilization using bracing methods. The stabilization method was employed in the management of most of the patients reported in the study by de Oliveira et al<sup>41</sup> which agrees with our study. This method as described by Smith et al<sup>42</sup> has strong evidence and not more effective than any other form of active exercise in the long term. The 12% treated with the same method in Burns et al.<sup>28</sup> is at variance with ours. This could be due to similarity in the age bracket attended to in the earlier versus the largely geriatric population in the latter. Manipulation was the least applied approach in our study, and this is related to the view in the study by de Oliveira et al.<sup>41</sup> in which only 5.13% were treated with manipulation. This is likely because most of the participants in their study just like those in our current study had symptoms which have lasted more than 16 days since onset.

### **Conclusion**

This study indicates that low back pain was a common health problem among the patients visiting the spine unit of the physiotherapy department in the University of Port Harcourt Teaching Hospital studied. It was more prevalent in the middle age brackets, among females and civil servants. The findings of this study suggest that primary prevention of LBP should be considered especially by forestalling conditions that may affect the spine. There is a need to enhance record-keeping in the clinic and take into consideration the comorbidities in determining which patient are fit for standard rehabilitation and which should be restricted to only medical management.

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## **PHYSICAL ACTIVITY PARTICIPATION, EXERCISE SELF-EFFICACY AND SELF-MOTIVATION AMONG STUDENTS IN A NIGERIAN UNIVERSITY**

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### **Abstract**

**Background of the study:** Despite the well-known benefits of physical activity (PA) participation, college students rarely meet the recommended benchmarks.

**Aim of the study:** This study was aimed to examine the relationships among PA participation, exercise self-efficacy and motivation among college students.

**Material and methods:** This cross-sectional study involved a simple random sample of 244 (122 males and 132 females) university students from Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria. PA, exercise self-efficacy, and exercise self-motivation were assessed using International Physical Activity Questionnaire-short form, Self-Efficacy for Exercise measure and exercise motivations inventory-version 2 respectively. Descriptive and inferential statistics of Spearman's rank order correlation and Mann

Whitney U tests were used to summarize and analyze data.

**Results:** The mean age of the respondents was 23.12±0.2 years. More than half of the respondents were moderately active (63.3%), had moderate exercise self-efficacy (54.9%), and moderate exercise self-motivation (59.4%). PA and exercise self-motivation were significantly correlated ( $r=0.145$ ;  $p=0.023$ ). Also, exercise self-efficacy and exercise self-motivation were significantly correlated ( $r = 0.282$ ;  $p=0.001$ ). Higher participation in strenuous exercise among the male participants ( $U=6909.5$ ;  $p=0.040$ ) was observed.

**Conclusions:** Moderate PA was predominant among Nigerian University Students. PA involvement was linked to increased exercise self-motivation.

**Key words:** Physical activity, exercise, self-efficacy, self-motivation, university student

## **Introduction**

Inadequate physical activity is a major risk factor for non-communicable diseases, as well as a cause of death, poor mental health, and a reduction in quality of life<sup>1,2</sup>. Physical activity includes exercise, sports, and other activities that are performed as part of daily life, employment, recreation, and active transportation<sup>3</sup>. Regular physical activity improves health, reduces the risk of chronic diseases and death and improves self-esteem, concentration, and academic performance<sup>1,4</sup>. Additionally, physical activity lessens the likelihood of developing mental health issues such as sadness and anxiety<sup>2,5</sup>.

The World Health Organization<sup>6</sup> suggested that adults should engage in at least 150 minutes of moderate intensity physical activity or 75 minutes of vigorous intensity physical activity or a combination of moderate and vigorous intensity physical activity on a weekly basis. There is however, a reluctance to engage in physical activity, with approximately 20% of men and 27% of women aged 18 years and above reported as being inadequately active in 2010<sup>7</sup>. Physical activity levels fall significantly during the transition to early adulthood, with the largest decline occurring at the time of entrance to the university<sup>8,9,10</sup>. Sedentary time has been observed to be high among students of healthcare professions, owing to long hours of mental labor such as sitting through lectures, completing assignments, reading, and browsing the internet for additional information<sup>11</sup>.

Numerous methods have been studied for increasing physical activity and ensuring its advantages, including therapies based on a few cognitive-behavioral theories<sup>12</sup>. Albert Bandura coined the term "self-efficacy," which he defined as "confidence in one's ability to successfully

undertake a given behaviour"<sup>13</sup>. Individuals with a higher sense of self-efficacy are more willing to face difficulties and persevere with their assigned task despite hurdles, especially when the advantages outweigh the drawbacks<sup>13,14</sup>. Self-efficacy is required for making choices that affect the pursuit of a healthy lifestyle, such as physical activity<sup>15</sup>. Additionally, one of the primary reasons for low physical activity participation may be lack of self-motivation, which is described as the 'willingness to exert significant effort toward organizational goals in exchange for the effort and ability to meet certain individual requirements'<sup>16,17</sup>.

It seems important to consider individuals' exercise-related self-efficacy and self-motivation when pursuing increased physical activity participation, especially among young people. Remarkably, college students represent a cluster of young people who are frequently predisposed to mental activities and sedentary life pursuits which rank as the tenth biggest cause of death and disability, accounting for nearly 2 million fatalities every year<sup>7</sup>. This study was aimed to examine the relationships among PA participation, exercise self-efficacy and motivation among college students.

## **Materials and Methods**

This cross sectional study was carried out in Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria. A random sample of 244 consenting students from the Faculty of Health Science and Technology at Nnamdi Azikiwe University, Nnewi, Anambra State, Nigeria were recruited. The ethical review committee of the Faculty of Health Science and Technology, Nnamdi Azikiwe University, Nnewi Campus gave approval for this study.

## **Instrument**

i. The International Physical Activity Questionnaire-short form was used to assess Physical Activity. This condensed version included seven items focusing on three distinct facets of physical activity: walking, moderate intensity activity, and vigorous intensity activity. Participants were required to pay close attention and recall their physical activity behaviors and experiences within the seven days preceding the questionnaire administration. The total amount of physical activity measured in MET (metabolic equivalent of task) was used to categorize activity levels as low, moderate, or high. The instrument's validity was established, with the most widely used being the 12-country reliability and validity test<sup>18</sup>. Correlation coefficients for criterion validity varied between 0.15 and 0.26<sup>19</sup>.

ii. The Self-Efficacy for Exercise measure (SEES) was used to assess Exercise Self-Efficacy. The SEES has been shown to be valid and to have a good level of internal consistency (Cronbach's alpha = 0.92). It is a nine-item self-administered psychometric scale intended to assess confidence in relation to physical activity and exercise on a regular basis. Each item refers to successful coping and suggests a consistent internal assessment of success. The replies were graded on a 0-10 point scale, and their accumulation resulted in a total composite score ranging from 0-90. Higher scores showed a greater sense of self-efficacy for exercise.

iii. The exercise motivations inventory-version 2 (EMI-2) was used to assess exercise self-motivation. The EMI-2 is a 51-item self-report questionnaire that assesses a variety of various exercise motivations. It has demonstrated satisfactory psychometric properties with an internal consistency of 0.68 to 0.95<sup>20</sup>. EMI-2 is divided into 14 subscales, including stress

management, revitalization, enjoyment, challenge, social recognition, affiliation, competition, health pressures, ill health, avoidance, good health, weight management, appearance, strength and endurance, and nimbleness<sup>20</sup>. The subscales were rated by adding the numerical equivalents of each item associated with the subscales and then dividing by the total number of items in each subscale.

Assessed socio-demographic information included participants' age, gender, course of study, and year of study.

### **Data analysis**

Descriptive statistics of frequency counts, percentages, mean, and standard deviation were used to summarize data. Spearman's rank order correlation test was used to assess the interrelationship between each pair of physical activity, exercise self-efficacy and self-motivation, while Mann Whitney U test was used to compare scores between sexes. The level of significance was set at 0.05. Statistical Package for Social Sciences (SPSS) version 24 was used for data analysis.

### **Results**

Of the 224 respondents, majority (78.8%) were between the ages of 19 and 24 and a little more than half (54.1%) were females. (Table 1). Moderate PA was reported among majority (63.3%) of the participants, while a small percentage (13.7%) reported physical inactivity. Slightly more than half reported moderate level of self-efficacy, while as much as 33.98% reported a low self-efficacy for exercise. However, most of the participants showed moderate to high levels of self-motivation. (Table 2).

There was a weak positive correlation between physical activity participation and exercise self-

motivation ( $r=0.145$ ;  $p=0.023$ ), but no correlation between physical activity participation and exercise self-efficacy ( $r=0.101$ ;  $p=0.117$ ). A weak positive correlation between exercise self-efficacy and self-motivation to exercise was also observed ( $r=0.282$ ;  $p=0.001$ ) (Table 3).

While there was no significant influence of gender on total PA scores ( $p=0.174$ ,  $U=6645.000$ ), males engaged in more strenuous activity ( $p=0.040$ ,  $U=6909.5$ ). Likewise, females engaged in considerably more sitting activities than males ( $p=0.042$ ,  $U=6285$ ). Furthermore, no significant gender-difference was observed in self-efficacy ( $p=0.760$ ;  $U=7220$ ) or self-motivation scores of participants ( $p=0.587$ ,  $U=7093.5$ ) in exercise (Table 4).

**Table 1: Sociodemographic characteristics of the participants (N=244)**

Variables	Categories	Frequency (n)	Percent (%)
Age	19-24	192	78.8
	25-30	52	21.2
Gender	Male	112	45.9
	Female	132	54.1
Department	Physiotherapy	96	39.3
	Medical laboratory	48	19.7
	Radiography	35	14.3
	Nursing	28	11.5
	Environmental health	37	15.2
Level of study	200 level	57	23.4
	300 level	45	18.4
	400 level	89	36.5
	500 level	53	21.7

**Table 2: Participants distribution based on physical activity level, exercise self -efficacy and self-motivation (N 244)**

Categories	Frequency	Percent (%)
<b>Physical activity</b>		
Low	31	12.7
Moderate	169	69.3
High	44	18.0
<b>Self-efficacy</b>		
Low	97	39.8
Moderate	134	54.9
High	13	5.3
<b>Self-motivation</b>		
Low	31	12.7
Moderate	145	59.4
High	68	27.9

**Table 3: Correlation between physical activity, exercise self-efficacy and self-motivation**

Variable	r	p
Exercise self- efficacy and PA	0.1 01	0.117
Exercise self- motivation and PA	0.145	0.023*
Exercise self- efficacy and self-motivation	0.282	0.001*

*r= correlation coefficient; p= level of significance; \*: significant at  $\alpha=0.05$ ; PA-Physical activity.*

**Table 4: Mann -Whitney U test showing the influence of gender on exercise self -efficacy, exercise self-motivation and physical activity**

Variable	p value	Z value	U-value
Exercise self- efficacy	0.760	-0.360	7224.000
Exercise self- motivation	0.587	- 0.543	7093.500
Total PA and gender	0.174	-1.360	6645.000
Vigorous PA and gender	0.040	-2.054	6909.500
Sitting and gender	0.042	-2.038	6282.500

PA - Physical activity.

## **Discussion**

Most of the respondents in this study reported moderate level of physical activity, this aligns with the findings of Odunaiya, Ayodele, and Oguntibeju<sup>21</sup>, who reported that the majority of college students engaged in moderate physical activity. This finding could be due to community arrangement setting of the college under study where the students have to walk to and from lecture halls, religious gatherings, and other events. Notably, the majority of campus lodges were multi-storey structures, requiring students to use the staircase to participate in various events. Male respondents reported higher mean vigorous activity scores, while female individuals scored higher on the mean for sitting. This is congruent with the findings of Nelson, Kocos, Lythe, and Perry<sup>22</sup> and the University of Exeter<sup>23</sup>, who reported that men have a higher proclivity for strenuous physical activity than females. Females spend a greater amount of time engaged in sedentary activities, implying that female gender is a risk factor for inactivity<sup>24</sup>. Contrary to the findings of this study, the University of Exeter<sup>23</sup> discovered that males spend a greater amount of time sitting than females. This was ascribed to conventional family roles, in which women, despite their low levels of exercise, stroll around attempting to complete everyday duties, in contrast to their male counterparts. It however also could be that the male respondents of the present study engaged less in indoor recreational activities such as video games, compared to their University of Exeter<sup>23</sup> counterparts due to the constant power outage and therefore leaned more towards outdoor activities for recreation.

As more than half of the respondents showed a moderate level of exercise self-efficacy, this implies that they were somewhat inclined to confronting

themselves with specific exercise behavior as necessary<sup>25</sup>. The moderate exercise self-efficacy recorded among these respondents also corresponds with the PA level which ranged from moderate to high among the study respondents. However, Self-efficacy showed no significant correlation with PA level, which means that the PA level of the respondents was not necessarily influenced by their exercise self-efficacy; it is more likely that most of the moderate physical activities and walking the respondents engaged in were as a matter of necessity as they needed to walk to and from classes, places of worship or leisure and to also perform their chores. One can assume from these findings that the respondents engaged more in necessary day to day physical activities (activities of daily living) and less of planned and/or prescribed exercise participation.

Furthermore, the high level of self-motivation observed among the respondents could also explain the PA level among this group as motivation plays an important role in one's state of mind, as well as in one's willingness to engage in normal or healthy activities. Lindberg<sup>26</sup> defines motivation as "what propels an individual to pursue or maintain goals." Hence, the reported levels of exercise self-motivation among the participants of the current study is encouraging and indicates a greater possibility of achieving physical activity goals once initiated<sup>26</sup>. The positive correlation between physical activity and exercise self-motivation indicates that college students with a stronger sense of self-motivation were more likely to engage in physical activity, and that successful physical activity experiences contribute to the development of a more potent sense of exercise self-motivation. This finding is consistent with Lauderdale et al.<sup>27</sup>, who discovered a robust relationship between self-determined motivation and increased physical

activity participation. Exercise self-motivation and exercise self-efficacy also demonstrated significant positive correlation, showing that people with a strong sense of self-motivation believed in their ability to overcome obstacles and maintain established physical activity levels. A high level of exercise self-efficacy might affect one's motivation to begin an exercise regimen, stick with it for an extended period of time, and complete it<sup>28</sup>. The observation that gender had no significant influence on exercise self-motivation contrasts the findings of Egli et al.<sup>29</sup>, as well as Lauderdale et al.<sup>27</sup>, who discovered gender differences in exercise self-motivation. This may reveal the behavioral/psychological aspects that influence physical activity participation and so serve as a point of reference when strategizing for enhanced physical activity participation.

## **Conclusions**

In college students with a modest degree of PA, increased PA involvement was connected with exercise self-motivation but not with exercise self-efficacy and while gender had no significant influence on the constructs under study, a significant positive correlation exists between exercise self-efficacy and exercise self-motivation,

## **Recommendation**

Hence to improve PA participation, addressing self-motivation could prove useful, and building or boosting an individual's exercise self-efficacy may be a way to also improve individual's motivation, which would in turn translates to increased PA participation.

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## SEROPREVALENCE OF *TREPONEMA PALLIDUM* INFECTION AMONG WOMEN WITH HISTORY OF MISCARRIAGE AND STILLBIRTH IN A FERTILITY HOSPITAL IN NNEWI, NIGERIA

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### ABSTRACT

**Background:** Untreated sexually transmitted infections caused by spirochetes in pregnant females are associated with miscarriage and still-birth.

**Aim:** This study was aimed at screening, confirming and investigating the seroprevalence of *Treponema pallidum* infection among women with history of miscarriage and still-birth in a private fertility hospital in Nnewi, Nigeria. Also, to assess the association between pregnancy outcome in relation to *T. pallidum* infection and determine the association between risk factor variables for *T. pallidum* infection among women with history of miscarriage and still birth in the study group.

**Methodology:** This cross-sectional study involved 150 pregnant in- and outpatients of aged 20 to 49 years, randomly and who gave consent to participate. *Treponema pallidum* antibody was screened with serum using VDRL (Venereal Disease Research Laboratory) agglutination test and confirmed with *Treponema palladium* hemagglutination ELISA kit spectrophotometric

method. Risk-factor variables investigated. Data analyzed using chi-square analysis with level of significance set at <0.05.

**Results:** Seropositive *T. palladium* was 2.0 %, higher among the age range of between 30 – 34 (0.7%) years old. All results from VDRL screening were confirmed positive by TPHA test. Risk factors like marriage, gestational age, marital background (polygamy), blood transfusion, were important in disease transmission as 3(2.1%), 1 (1.3%), 1 (14.3%), 1 (8.3%), 2 (2.5%) and 1 (10%) of the participants. There was a significant association ( $X^2 = 15.224$ ;  $p = 0.002$ ) between presence of the disease and gestational age ( $p < 0.05$ ).

**Conclusion:** *T. palladium* infection was present in pregnant women in the study group, though the 30-34 years old groups were more affected. Gestational age, especially 3<sup>rd</sup> month, seemed to be important in encouraging occurrence of the disease in the group studied.

**Key words:** seroprevalence, *Treponema pallidum*, women, stillbirth, miscarriage, Nnewi.

## **Introduction**

Syphilis is a sexually transmitted disease (STD) caused by the bacterium *Treponema pallidum*. Syphilis can cause serious health effects without adequate treatment [1]. *Treponema pallidum* is able to cross the placenta of women and result in fatal infections such as still-birth, miscarriages and childhood diseases [2]. It can be symptomatic and asymptomatic, but it is easy to treat if detected early but may lead to grave consequences or death if left untreated. Recently, the number of syphilis cases in the United States has slightly increased. [3] reported a devastating surge in congenital syphilis. They noted that during 2019–2020 the rate of primary and secondary syphilis increased 24% among women aged 15–44 years. In 2020, there was an increase of 16% from 2019 with 5,726 cases of syphilis (all stages) diagnosed among pregnant women [4]. The three main causes of three-quarters of neonatal death in Nigeria (birth asphyxia, pre-term birth complications, and infections) are easily preventable by healthy practices and simple case-management [5], but awareness about their importance and likely curable causes is low, especially in underdeveloped countries.

A pregnant syphilitic woman can transmit *Treponema pallidum* to the foetus through the placenta from gestation period of 4 weeks, as risk of foetal infection increases with gestational age [6]. Some of the infected foetus die or is miscarried, while some die in-utero. Failure to ensure maternal screening in routine antenatal care may lead to congenital syphilis. [7] stated that the disease can cause Hutchinson's teeth, which affect the baby may result to neurosyphilis with a lot of complications like damage to womb, salpingitis, neonatal death and stillbirth.

There is a paucity of literature on reported stillbirths and miscarriages in syphilis-infected women in Nigeria. Reported prevalence of stillbirth according to [8] among mothers in rural communities in Anambra Central Senatorial Districts of Anambra state Nigeria who gave birth between January 2012 and December 2016 was 313 cases (74 cases of stillbirth; 38.07 per 1000 total births in 2016), highest in 2012, while *Treponema pallidum* seroreactivity of 1.7% was found in Nigerian women attending gynaecology clinic in Ilorin [9]. The major causes of neonatal deaths in tertiary hospitals in South-west Nigeria include birth asphyxia (46.6%), prematurity (23.1%), and sepsis (17.8%) [10].

In a review of stillbirth in countries of low and middle income, the population attributable fraction was greater than 50% for five risk factors associated with stillbirth, of which two factors, syphilis and chorio-amnionitis, were infection-related [11]. [12] noted that information regarding syphilis infection in Nigerian women shows a wide geographical variation in seroprevalence. A 5-year multicentre, retrospective descriptive study by [13] stated that of all stillbirths delivered in the south-eastern Nigerian hospitals from January 2013 to December 2017, the overall SBR was 56.1 per 1000 deliveries, higher than 42.9 per 1000 deliveries previously reported in Nigeria.

Late or lack of prenatal care is the main challenge for preventing congenital syphilis and its sequels, and even in those receiving care, early detection and treatment of maternal syphilis occurs often too late in pregnancy to prevent its in vitro and after birth adverse effects. Therefore, it is necessary that health departments, in partnership with prenatal care

providers and other local organizations should work together to address the barriers, factors that affect the outcome and effects in women [14].

Syphilis can be symptomatic or asymptomatic, and is considered a sexually transmitted disease not too common due to broad spectrum antibiotic use. It however can cross the placenta and infect the foetus with grave consequences like mental disorders, cognitive disorders, and death [15]. It is the source of major health-cases in neonates and is 100% preventable. Unfortunately, most screenings in Nigeria are carried out just before child-birth, and if detected late or left untreated in pregnancy, leads to adverse outcomes among more than half of the women with active disease, including early foetal loss, stillbirth, prematurity, low birth weight, neonatal and infant death and congenital disease.

There is a paucity of literature on the association of syphilis with miscarriage and still - birth in Nigeria due to several undocumented cases and beliefs of spiritual involvement. According to [16], Nigeria was ranked second position worldwide with an estimated 313, 700 stillbirths in 2015. [17] stated that stillbirths are one of the most neglected tragedies in today's global health system; with approximately 2.6 million stillbirths occurring each year with 98 recorded in low and middle-income countries. Nigeria accounts for 12% of this 2.6 million [18].

[9] noted the importance of routine STD screening in pregnant women especially among young and illiterate women in Nigeria. The Federal Ministry of Health Nigeria (FMoH) recently reviewed the situation of maternal, new-born, and child health (IMNCH) strategy aimed to address gaps in health care, and from zonal, state and local government authority levels. Strategies were rolled out hoped at helping to bring to recognition the massive burden

of new- born death in Nigeria, especially with regards to the causes in each geographical area. Their main objective was to provide a more comprehensive understanding of new born survival and health in Nigeria as well as to analyse data of relevance by state to present a concrete step to accelerate action to save new born lives in Nigeria, [19]. Fortunately, if causes of new-born death are discovered early, as the infection is treatable, death is preventable especially when the risk factors are association with miscarriage or still birth. Test type and methodology is a very important determining factor for seropositivity. [20] suggested adjusting reported maternal syphilis seropositivity by test type to ensure accuracy. Hence, there is a need to study the seroprevalence of *Treponema pallidum* infection among women with history of miscarriage and stillbirth attending ante-natal care in Nnewi, a sub-urban city in Anambra state using standard methods.

### **Methodology**

The study area is a private fertility hospital situated at Nnewi in Anambra state, South-eastern Nigeria. The study was a cross - sectional research. The study population consisted of one hundred and fifty (150) in- and out-patients of child-bearing age of age-range of 20 – 49 years old, attending antenatal care in a private fertility hospital in Nnewi, Anambra State, Nigeria. Consecutive random selection was used for subject recruitment. Selection was based on age and pregnancy status. Only women who were attending antenatal care, and had been confirmed pregnant in the hospital by laboratory and radiological scan tests, as well as by clinicians' symptomatic assessment were selected. The sample size was calculated using sample size formula by [21]. The prevalence of syphilis in pregnant women

in Anambra state is 0.08 % [22]. Sample size is approximately 122.9 that is 123 samples, but a total sample of 150 was used for the study. The ethical approval for the research was obtained from the Ethical Review Committee of Faculty of Health Science and Technology, College of Health Science, Nnamdi Azikiwe University, Awka, Nnewi campus. Informed consent was signed by participants. The hospital's name was also not mentioned to maintain confidentiality as agreed on. Inclusion criteria were age as well as laboratory and clinical proven pregnancy status (any trimester) obtained from the hospital records.

Five (5) millilitre syringe (BD, India) was used to collect whole blood from the cubital fossa and sent immediately to the laboratory. Serum was extracted after blood was left to clot, labelled, stored at 4° C and assays carried out after two hours of collection. Samples were collected according to the method described by [23]. Additional demographic information was also obtained from the subjects. The serum samples and test reagents were allowed to equilibrate to room temperature before use.

Screening for *T. pallidum* was screened using qualitative VDRL agglutinating test (Venereal Disease Research Laboratory) (Acumen Diagnostic, USA), according to methods described by [24]. Confirmation was done using quantitative ELISA method with *Treponema pallidum* passive haemagglutination test kit (TPHA) (Linear chemicals, Spain) as described by [25]. The absorbance was measured with a spectrophotometer plate reader (Agilent technologies, USA) calibrated and read at 450nm. The cut-off value was calculated and interpretations done as instructed by the manufacturers. In - built internal positive and negative controls were used for both tests. Tests were performed and evaluated according to

manufacturer's instructions.

**Data analysis:** Data was presented as frequencies, percentages, while student's T-test analysis and chi-square test was used to investigate association of risk-factors with presence or absence of *T. pallidum*. The level of significance was set at  $\leq 0.05$ .

## Results

Out of a total of 150 pregnant women tested for *T. pallidum* infection with a mean age bracket of  $37.6 \pm 5.1$  years old, only 3 were seropositive (2.0%). The highest positive cases were from age- range of 35 – 39 years which had 2 (1.3%), followed by the 30 – 34 years which had 1 (0.7%). No participant tested positive in the other age brackets (see table 1).

Most of the women 110 (73.3%) had a history of miscarriage, 28 (18.7%) had both miscarriage and still-birth, and 12 (8.0 %) having had stillbirth alone. There was a higher sera-positivity with *T. pallidum* antibody in those with stillbirth alone (8.3%), more than those with miscarriages and stillbirth 1(3.6%), and miscarriages alone 1(0.9%); out of a total of 3 (2.0%) participants who were syphilis seropositive. Table 2 presents the association between pregnancy outcome and *T. pallidum* infection and showed no significant association  $X^2 = (3.476; p = 0.175)$ , though positive cases were higher among those with miscarriage 1(8.3%).

Table 3 presents an association table between presence or absence of *T. pallidum* infection and risk factor variables among women with history of miscarriage and still birth in the study participants. There was a significant association among the three gestational age variables and syphilis status only ( $X^2 = 15.224; p=0.02$ )  $p < 0.005$  with those in 3<sup>rd</sup> trimester having highest positive status 1 (14.3). No significant association was observed in between other variables and syphilis status, however, highest

prevalence was observed among the variables as stated; among those who had received blood transfusion in the past 1(10.0%) ( $X^2 = 3.499$ ;  $p=0.061$ ); had pregnancy outcome of miscarriage only 1(8.3%) ( $X^2 = 0.234$  ;  $p=0.063$ ); were from polygamous marital background 3(5.6%) ( $X^2 = 3.398$ ;  $p = 0.183$ ); attained tertiary educational status 3(3.7%) ( $X^2 = 2.041$ ;  $p = 0.564$ ); were from Anambra state origin 3(3.3%) ( $X^2 = 1.531$ ;  $p=0.997$ ); resided in urban area 3( 2.3%) ( $X^2 = 0.391$ ;  $p=0.532$ );

had symptoms of syphilis 3(2.1%) ( $X^2 = 0.150$ ;  $p=0.697$ ); were not on any antibiotics 3(2.1%) ( $X^2 = 0.195$ ;  $p=0.659$ ); were married 3(2.1%) ( $X^2 = 0.171$ ;  $p=0.679$ ); and employed 3(2.1%) ( $X^2 = 0.128$ ;  $p=0.721$ ),  $p > 0.05$ .

**Table 1 Seroprevalence of *T. pallidum* infection in relation to age among women with history of miscarriage and still-birth**

Age (years)	No tested for <i>T. pallidum</i>		No positive for <i>T. pallidum</i>		Percentage (%)
	(n)	percentage (%)	(n)	percentage (%)	
20 – 24	1	0.7	0	0.0	0.0
25 – 29	1	0.7	0	0.0	0.0
30 – 34	46	30.7	1	0.7	0.7
35 – 39	48	32	2	1.3	1.3
40 – 44	39	26	0	0.0	0.0
45 - 49	15	10	0	0.0	0.0
<b>Total</b>	<b>150</b>	<b>100</b>	<b>3</b>	<b>2.0</b>	<b>2.0</b>

$X^2 = (2.300; P = 0.806)$  ( $P > 0.05$ , not significant)

**Table 2: association between pregnancy outcome in the pregnant women in relation to *T. pallidum* infection.**

Type of Pregnancy Outcome	Number who said YES (n)	Percentage (%)	Number sero-positive (n)	Percentage sero-positive (%)	Number sero-negative (n)	Percentage sero-negative (%)	$X^2$	P-value
Miscarriages only	110	73.3	1	(0.9)	109	(99.1)	3.476	0.175
Still birth only	12	8.0	1	(8.3)	11	(91.7)		
Miscarriages and stillbirth	28	18.7	1	(3.6)	27	(96.4)		
<b>TOTAL</b>	<b>150</b>	<b>100.0</b>	<b>3</b>	<b>(2.0)</b>	<b>147</b>	<b>(98.0)</b>		

**Key:**

n = number

% = percentage

$X^2$  = chi-square

p = p- value at 0.05 level of significance.

**Table 3: Association between presence or absence of *T. pallidum* infection and risk factor variables among women with history of miscarriage and still birth in the study participants.**

<b>Risk factor variables</b>	<b>Number who said YES (n)</b>	<b>Percentage (%)</b>	<b>%Sera-positive cases (n)</b>	<b>Percentage sera-negative cases (n)</b>	<b>X<sup>2</sup></b>	<b>p-value</b>
<b>Marital status</b>						
Married	142	94.7	3 (2.1)	139 (97.7)	0.171	0.679
Single	8	5.3	0 (0.0)	8 (100.0)		
<b>Gestational age</b>						
1 <sup>st</sup> trimester	77	50.7	1 (1.3)	76 (98.7)	<b>15.224</b>	<b>0.002</b>
2 <sup>nd</sup> trimester	55	36.7	0 (0.0)	55 (100.0)		
3 <sup>rd</sup> trimester	7	4.7	1 (14.3)	6 (85.7)		
Full term still birth	12	8.0	1 (8.3)	11 (91.7)		
<b>Employment status</b>						
Employed	144	96	3 (2.1)	141 (98.0)	0.128	0.721
Unemployed	6	4	0 (0.0)	6 (100.0)		
<b>Educational status</b>						
None	4	2.7	0 (0.0)	4 (100.0)	2.041	0.564
Primary	12	8	0 (0.0)	12 (100.0)		
Secondary	53	35.3	0 (0.0)	53 (100.0)		
Tertiary	81	54	3 (3.7)	78 (96.3)		
<b>Marital background</b>						
Monogamy	110	73.3	1 (0.9)	109 (99.1)	3.398	0.183
Polygamy	36	24	2 (5.6)	34 (94.4)		
Single	4	2.7	0 (0.0)	4 (100.0)		
<b>State of origin</b>						
Anambra	99	66	3 (3.3)	93 (94.0)	1.531	0.997
Imo	11	7.3	0 (0.0)	11 (100.0)		
Abia	5	3.3	0 (0.0)	5 (100.0)		
Enugu	20	13.3	0 (0.0)	20 (100.0)		
Delta	7	4.7	0 (0.0)	7 (100.0)		
Edo	3	2	0 (0.0)	3 (100.0)		
Rivers	2	1.3	0 (0.0)	2 (100.0)		
Jos	1	0.7	0 (0.0)	1 (100.0)		
Ilorin	1	0.7	0 (0.0)	1 (100.0)		
Kaduna	1	0.7	0 (0.0)	1 (100.0)		
<b>Residence</b>						
Urban	133	88.7	3 (2.3)	130 (97.7)	0.391	0.532
Rural	17	11.3	0 (0.0)	17 (100.0)		
<b>Blood transfusion</b>						
Yes	10	6.7	1 (10.0)	9 (90.0)	3.499	0.061
No	140	93.3	2 (1.4)	138 (98.6)		
<b>Pregnancy outcome</b>						
Miscarriages only	110	73.3	1 (0.9)	109 (99.1)	0.234	0.063
Still birth only	12	8	1 (8.3)	11 (91.7)		
Miscarriages and stillbirth	28	18.7	1 (3.6)	27 (96.4)		
<b>Presence of symptoms</b>						
No	7	4.7	0 (0.0)	7 (100.0)	0.150	0.697
Yes	143	95.3	3 (2.1)	140 (97.9)		
<b>On antibiotics</b>						
No	141	94	3 (2.1)	138 (97.9)	0.195	0.659
Yes	9	6	0 (0.0)	9 (100.0)		

## Discussion

The total number of sera-positive syphilis in pregnant women in this study was (2.0%). This means the disease still exists in the study area and is high. This could be associated with individual's immunity, sexual and life-style habits of the subject, geographical variation, level of adherence to pre-natal care by the individual as well as intervention care in the hospital. Awareness, presence and management of sexually transmitted diseases (STDs) practice like HIV infection, antibiotic use by the individuals in the area, and time of intervention are also possible contributors.

This is however much higher than the national average for syphilis in pregnant women in Nigeria (0.3%) recorded by [26]. [27] in a hospital-based cross-sectional study in ante-natal clinic of the Federal Medical Centre, Yola, North-Eastern Nigeria, confirmed a seroprevalence of 0.4% out of 231 pregnant women, lower than (2.0%) obtained in this research. [28] obtained a seroprevalence of 2.97% in Oshogbo, South-western Nigeria, similar but slightly higher than that obtained in the present study.

Reports from this study showed that more of the women (73.3%) experienced more of miscarriage than miscarriage and still-birth 28(18.7%) and stillbirth alone 12(8.0 %) in table 2. Reasons for higher rate of miscarriage in pregnancy outcomes could be because they may have been exposed to risk- factors that resulted to the outcome. Individual awareness, gestational age at study time, duration and stage of the infection, virulence, concentration of the spirochete bacteria, treatment received and foetal immunological status, interventions by ante-natal cares, time-lag before reporting health issues in pregnancy, drugs taken, stress, hormonal states, other concomitant infections, likely geographical

life-styles and habits in women in the study area could be contributory. [29] also noted that the clinical manifestations of congenital syphilis were influenced by most of the listed factors in their study. Higher sera-positivity with *T. pallidum* antibody 1(8.3%) observed in those with stillbirth alone in those with miscarriages and stillbirth 1(3.6%) and miscarriages alone 1(0.9%) ( $p>0.05$ ) could be because of compounding factors. The infection may have occurred at an early gestational stage, may have been severe, causing maternal fever and other systemic reactions that might have been intolerable to the foetus and resulted to death of the foetus, or a direct foetal infection or placental damage of organs like liver may have occurred [6]. Early gestational infection has been found to cause foetal death at later stages of pregnancy. Also, maternal infection of the genital tract as well as infection on other body parts have been found to cause preterm labour as the effects on the foetus becomes intolerable [26]. In placental infections, spirochetes have been found to cross into the foetus from 14 weeks, reducing blood flow to the foetus, resulting to foetal death [6]. [16] in a previous Nigerian study noted that age, household wealth, higher birth order, facility delivery, Caesarean delivery, rural residence, and contraceptive use are cardinal risk factors for stillbirth in Nigeria. In another systematic review by [30], studies associated the cause(s) of stillbirth in low and medium-income countries with poverty, lack of education, maternal age ( $>35$  or  $<20$  years), parity ( $1, \geq 5$ ), lack of antenatal care, low birth weight and previous stillbirth. Besides, [31] confirmed the relationship between untreated early syphilis in pregnancy and stillbirth, neonatal death or infant disorders. In a prospective hospital study in Enugu state, South-east Nigeria, the prevalence of still - birth was 40.3 per 1000 births in pregnant

women with syphilis. Maternal age, marital status, educational levels and booking status affected the prevalence of still birth in a study by [32] (Nwoga *et al.*, 2021).

All seropositive were from polygamous homes 3(5.6%) suggesting an association between multiple sexual habit associated with polygamy and transmission of syphilis in pregnant women. The possibility of one sexual partner in the marriage circle carrying the disease will be a sure factor for transmission to others. [33] and [34] also noted this in their study as a risk- factor for syphilis in pregnant women in a China. All the positive subjects attained tertiary educational level maybe because by the time an individual attains tertiary level of education, there is a very high chance of having been exposed to sexual contact or to have come in contact with a positive case by cohabitation in school environment. As the bacteria can be latent and run a chronic course, such infected individual may remain asymptomatic until their pregnancy status demanded that they run a test and hence the late detection. Pregnancy also lowers immunity, allowing most infections to be established.

All subjects that tested seropositive were from Anambra state (3.3%) because the study site was situated in a city in Anambra state. Recruited subjects were attending the anti-natal clinic as of the time of study. Reasons for high prevalence in those who have lived in urban areas (2.3%) observed in the present study is unclear but it could be that the effects of social life-style, increased travel, immigration and possibly higher promiscuity observed in urban dwellers due to social exposures affected their health dynamics. All positive subjects in this study were married, (5.6%). Marital disharmony could create chances of infidelity increasing disease contamination risk for female

subjects in this research. This is contradictory to findings by [34] who found the odds of infection ten times higher in divorced than in married women.

All positive cases in the study were employed (2.1%). Being employed may give an added advantage of having enough financial backing to encourage free-will living and promiscuity. Though being educated and employed have long since been considered protective factors against risk behaviors and sexually transmitted infections [36], [35] found racial differences, geographical differences as well as individual choices as factors that accounted to deviations from expected norms. [37] however did not find school enrolment and academic skills to be significantly associated with sexually transmitted infections, in line with findings in this research. Generally speaking, variation in socio-demographic variables could also differ demographically. Variations in socio-demographic variables, sexual practices, community behaviour, inaccessibility of treatment of STD, and cultural practices are amongst risk factors which [38] noted to be associated with syphilis, agreeing with findings in this research. All seropositive cases (2.1%) showed symptoms of varying degree and none of them (2.1%) were on antimicrobial regimen as of the time of study. Non-antibiotic usage also increases chances of seropositivity since if one does not use antibiotics empirically recommended at times and is infected, this will increase chances of testing positive to syphilis. Reasons for high positive status associated, though non-significantly with individuals that had symptoms of syphilis 3(2.1%) ( $X^2= 0.150$ ;  $p=0.697$ ); and were not on any antibiotics 3(2.1%) ( $X^2= 0.195$ ;  $p=0.659$ ), could vary from individual life styles, geographical settings and habits.

The highest number of positive-case in the study

was observed among those at gestational period of 3<sup>rd</sup> trimester 1 (14.3), with significant association among gestational age and syphilis status in the study ( $X^2 = 15.224$ ;  $p = 0.002$ )  $p < 0.005$ . This was followed with those who had received blood transfusion in the past 1 (10.0%) ( $X^2 = 3.499$ ;  $p = 0.061$ ) and had pregnancy outcome of miscarriage only 1 (8.3%) ( $X^2 = 0.234$ ;  $p = 0.063$ ). Significant association found between gestational age and positive status for syphilis ( $p = 0.002$ ) could be because vertical transmission of syphilis to foetus from the mother is largely dependent on duration of the infection in the mother. Pregnancy has no known effect on the clinical course of the infection. Effect therefore could probably depend on the time and duration of infection, cervical changes in pregnancy and immune status. Time lapse between conception may have been enough to establish antigenic response for a positive reaction at 3<sup>rd</sup> trimester in the infected subjects. A self-programmed weakening of the immune system or immunosuppression which occurs in pregnancy leaves both the mother and the foetus susceptible to infectious diseases [39], though scarce data on congenital syphilis in Africa suggests that 1-3% of neonates under 6 months of age are seropositive and may have signs of congenital syphilis [40]. Again, clinical manifestation and result is dependent on gestational age causing miscarriage, premature birth, foetal growth restriction and low birth weight, problems with the placental cord, stillbirth, neonatal birth or serious lifelong health conditions [41]. Cervical changes in pregnancy like hyperaemia, eversion, and friability that occur in pregnancy may have facilitated entry and infection [42].

Finally, syphilis antibodies were observed in people with history of transfusion in this research (10%). Transfusion is a potentially hazardous process. In

unscreened blood, non- inactivated blood or blood in which syphilis is still in a window phase, the risk of contamination remains high if transfused. [43] found certain risk factors like maternal age, husband's occupation, late antenatal care, illiteracy, unemployment, habitual drug use, husband's habitual drug use, husband's extramarital relation, and unscreened blood transfusion associated with a high prevalence of syphilis. More so, syphilis is mostly transmitted through blood contact and blood transfusion [12].

**Conclusion:** In conclusion, syphilis remains a significant gynaecological and public problem with neglected consequence in general. VDRL screening serological test and a confirmatory TPHA test or its equivalent gave the same result, and 3<sup>rd</sup> month of pregnancy was associated with higher risk of contacting the infection in the area.

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## **SOCIO-ECONOMIC BURDEN IN THE SUSTENANCE OF SANITATION RELATED DISEASES IN EBONYI STATE, SOUTHEAST, NIGERIA**

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### **Abstract**

**Background:** Sanitation related-diseases have affected millions of people, mostly in developing countries. This study aimed to determine the socio-economic burden in the sustenance of sanitation related-diseases in Ebonyi State, Nigeria.

**Materials and Methods:** The study was conducted in Ebonyi State, Southeast, Nigeria and adopted a descriptive cross-sectional design; sample size was 461 obtained from primary source. The descriptive statistics of frequency, percentage, mean and standard deviation were used to present the obtained data.

**Results:** Majority (180 or 39%) of the participants reported the size of their household to consist of 3-4 people followed by 150 (33%) who reported having

5-6 people. Out of the 461 participants, 258 (56%) reported that some children within their household had visited health centre due to sanitation-related diseases (such as stomach pains, fever, headache, blood in stool, watery stool), while 219 (48%) paid ₦1,000-₦3,000 for medical services (drugs, nursing services, doctor's services, laboratory services). Also, 294 (64%) reportedly paid less than ₦1,000 for transportation to and from a health facility due to sanitation-related diseases. Also 253 (55%) reported they spent total estimate of ₦1,000-₦5,000 as cost of treatment of sanitation-related diseases. Majority (291 or 55%) spent less than 5 days in a health facility due to sanitation-related-diseases, 177 (38%) recorded 5-10 days absence from work, and 306 (66.4%) claimed they lost less than ₦1,000 per day because of a child's admission in the health facility. On weekly basis, 300 (65.1%)

reported they lost <₦10,000.

**Conclusion:** The participant were shown to incur some he financial burden due to sanitation-related diseases. Also, sanitation-related diseases has impacted on the life of people in the Ebonyi State with respect to their average level of income. Consequently, it is recommended that sanitation be accorded necessary attention.

**Key words:** burden, community, sanitation, socio-economic burden, sanitation related-diseases.

### **Introduction**

Sanitation can be referred to the activities that ensure safe disposal of excreta, solid waste and other liquid waste, pest and vector control and personal hygiene and the prevention of disease vectors to ensure a hygienic environment<sup>1,2</sup>. It can also be regarded as a process whereby people demand for hygienic and healthy environment for themselves and sustain it by erecting barriers to prevent the transmission of disease agents<sup>1,2</sup>.

This usually includes hygienic management of human and animal excreta, refuse and wastewater, the control of disease vectors and the provision of washing facilities for personal and domestic hygiene. According to World Health Organization (WHO)<sup>3</sup>, sanitation involves both behaviors and facilities base which work together to form a hygienic environment. Mainly looking at rapid rate of infectious diseases globally, sanitation remains a major problem in developing countries like Nigeria, because wherever humans gather, their waste also accumulates and Government and other stakeholders are unable to provide good sanitation through proper drainage

systems, excreta and wastewater disposal. Improved good health condition could be attributed to progress in good sanitation but many people still have inadequate means of appropriately disposing of their waste. Improper waste disposal contributes to the risk of infectious disease among children, young and elderly people, mostly in heavy populated areas in low income countries. Consequently, poorly controlled waste is a source of daily exposure to an unpleasant environment for the people.

Sanitation related diseases have affected more than a billion of people in the whole world's population, mostly in low income countries where one or more people are infected with the sanitation-related diseases (SDs). Several national and international programs such as the World Health Organization's Global NTD Programs, the Centers for Disease Control and Prevention's Global NTD Program, the United States Global Health Initiative, the United States Agency for International Development's NTD Program, and others) are focusing on sanitation related diseases, NTDs, and fighting to control or eliminate them<sup>4</sup>.

Despite the efforts made by the different non-governmental organization, sanitation has not received the priority it deserves. It has not been widely recognized by local, national and international on how good sanitation policies and practices can support socio-economic development and environmental protection. According to Water and Sanitation Program (WSP) [5], each year equivalent to US\$3 billion was spent on water, sanitation and hygiene. This sum is the equivalent of US\$20 per person in Nigeria per year or 1.3% of the national GDP

because 70 million Nigerians use unsanitary or shared latrines, while 32 million have no latrine at all and defecate in the open place and the poorest quintile is 10 times more likely to practice open defecation than the richest. Health-related productivity costs which measures an average length of time spent incapacitated was 2 days (diarrhea), 5 days (respiratory infection) and 4 days (malaria). While infants are not productive, their sickness leads to diversion of caregivers from other activities<sup>5</sup>.

In assessment of community sanitation status, food hygiene, excreta, refuse and water supply should be consider as the basic amenities people must practice because good sanitation and hygiene practice mitigate contamination of water and soil, and thereby prevent diseases mostly communicable/infectious diseases such as cholera, typhoid, dysentery and others. These disease conditions could contribute to stunting and impaired cognitive function and impacts on well-being through school attendance, anxiety and safety with lifelong consequences, especially for women and girls. Improving sanitation in households, health facilities and schools underpins progress on a wide range of health and economic development issues including universal health coverage and combating antimicrobial resistance through personal hygiene practice, institutional sanitation (like school, health care, homes, etc) practice, safe water, refuse disposal, excreta disposal and waste water disposal<sup>6</sup>. Therefore, this study was aimed to determine the socio-economic burden in sustenance of sanitation related diseases in Ebonyi State, Nigeria.

### **Materials and Methods**

This study adopted a descriptive cross-sectional design to determine the socio-economic burden in sustenance of sanitation-related diseases in Ebonyi State, Nigeria. Ebonyi state is one the state in the southeast of Nigeria. Abakaliki is the state capital and largest town in the state. The second largest town is Afikpo. Other towns are Ikwo, Izzi, Onicha, Edda, Onueke, Ezzamgbo, Nkalagu, Uburu, Ishiagu, Amasiri and Okposi. This research design employed assisted to gather information across the state. The study objective was achieved from participants attended primary health facilities at community levels of every selected LGA with the aid of harmonized questionnaire and checklist.

The sample size was determined based on the information from participants otherwise known as caregivers that attended primary health facilities with their child due to sanitation-related diseases [may due to stomach pains, fever, headache, blood in stool, watery stool etc] were studied. The criteria used for selection of participants must be that the child was taken by a caregiver to the health facilities at the selected areas. The variables associated with community sanitation were determined using sample size formula by Kish and Leslie for cross-sectional descriptive studies needed to be representative of the given population. The same formula used by Fisher et al., (1998) for a population > 1,000 was adopted for this study.

$$n = \frac{z^2 pq (1-P)}{d^2}$$

n - Minimum sample size

Z - Standard normal deviation usually set at 1.96 which corresponds to the 95% confidence level.

p - Assumed population prevalence in %  
Population of the study is estimated to be 50% to represent the target population in this study

q = 1-p

d - Maximum acceptable random sampling error in %

In this case,

P= 50%= 0.5

q = 1- 0.5 =0.5

d = 5%= 0.05

Therefore,

Sample size (n) =  $(1.96)^2 (0.50) (0.50)$

$$(0.05)^2$$

n = 384

Adding an iteration of 20% to cover for non response (20% X 384) = 76.8 sample size to the nearest hundred= 384+76.8=460.8. For more clarity and coverage, the figure was rounded up to 461 for easy computation.

A multistage sampling was used to select the samples included in the study area. At first, stage Ebonyi state was divided into three senatorial zones (Ebonyi North, Central and South) with 13 Local Government Areas and a total of 6 Local Government Areas (LGAs) were randomly

selected through balloting which covered at least 46% of the LGAs. Ebonyi North and Central has 4 LGAs each while Ebonyi south contained 5 LGAs each, hence two LGAs namely Abakaliki LGA and Ebonyi LGA were selected from Ebonyi North; Ezza South LGA and Ikwo LGA were randomly selected from Ebonyi Central senatorial zones and Afikpo North LGA and Ohaozara LGA were randomly selected from Ebonyi South senatorial zones. The selected LGAs include Abakaliki LGA, Ebonyi LGA, Ezza South LGA, Ikwo LGA, Afikpo north LGA and Ohaozara LGA were randomly selected from all the senatorial zones in Ebonyi State.

The second stage of the sampling involved random selection of communities from the sampled LGAs. Two communities were selected from six (6) sampled LGAs which gave a total of 12 communities. At stage three, purposive sampling method was used to select two primary healthcare centres (PHCs) in each community given a total of 24 primary health centers (PHCs). In order to get the sample size of the study, 20 persons attended primary healthcare facility for treatment were interviewed in each PHC with the aid of harmonized questionnaire and checklist and it gave a total of 480 but 461 was valid.

#### **Ethical Approval and Consent to participate:**

The study received ethical approval from the Department of Environmental Health Sciences, College of Medicine and Health Sciences, Abia State University Uturu. Also, ethical approval was sought (for procedural reasons) and obtained from the Primary Healthcare Directors in Ebonyi State, Nigeria. Verbal consent was collected from all the people within the selected communities in the selected LGAs and those who gave verbal consent were ticked and interviewed and those

who refused were skipped. Participation was voluntary.

### **Data Analysis**

The data collected with the research instrument were summarized using descriptive statistics of frequency distribution, percentage and charts.

### **Results**

Table 1 presents the socioeconomic burden of sanitation-related diseases on direct cost. The number of participants in household recorded as follows: 115 (25%) recorded 1-3 people in the household; 180 (39%) were 4-6 people; 150 (33%) reported 7-9 people and 16 (3%) reported above 10 people in the household. Concerning the child visitation to primary healthcare centre in general, 258 (56%) responded YES while 203 (44%) said NO. The issue of child admission in primary healthcare centre, 194 (42%) said YES and 267 (58%) said NO. As for payment for medical services (drugs, nursing services, doctor's services, laboratory services; in all the LGAs), 36 (8%) paid less than ₦1,000; 219 (48%) paid between ₦1,000 and ₦3,000; 162 (35%) paid between ₦4,000 and ₦6,000; 24 (5%) paid between ₦7,000 and ₦10,000; 17 (4%) paid ₦11,000 and ₦13,000; and only 3 (06%) paid above ₦14,000. As for paying for transportation to and from primary healthcare centre due to sanitation-related diseases, 294 (64%) paid less than ₦1,000; 126 (27%) paid ₦1,000; 36 (8%) paid ₦2,000; 5 (1.1%) paid ₦3,000 and above. On total amount spent as cost of treatment, 48 (11%) paid less than ₦1,000; 253 (55%) paid between ₦1,000 and ₦5,000; 155 (34%) paid between ₦6,000 and ₦10,000; 5 (1.1%) paid ₦11,000 and above.

**Table 1: Socioeconomic Burden of Sanitation Related-Diseases on Direct Cost**

Variables	Abakaliki		Ebonyi		Ezza South		Ikwo		Afikpo		Ohaozara		Total
	LGA		LGA		LGA		LGA		North LGA		LGA		
	F	%	F	%	F	%	F	%	F	%	F	%	
<b>Size of People in household</b>													
1-3	21	18.3	20	17.4	20	17.4	20	17.4	14	12.2	20	17.4	115(25%)
4-6	35	19.4	29	16.1	30	16.7	26	14.4	32	17.8	28	15.6	180(39%)
7-9	24	16.0	10	6.7	28	18.6	30	20.0	32	21.3	26	17.3	150(33%)
Abv 10	0	0.0	2	12.5	2	12.5	4	25.0	2	12.5	6	37.5	16(3%)
<b>Has any child within the household visited primary healthcare centre (may due to stomach pains, fever, headache, blood in stool, watery stool etc)</b>													
Yes	55	21.3	29	11.3	40	15.5	46	17.8	50	19.3	38	14.7	258 (56%)
No	25	12.3	32	15.8	40	19.7	34	16.7	30	14.8	42	20.7	203 (44%)
<b>Have you ever been admitted in any primary healthcare centre within your community</b>													
Yes	34	17.5	19	9.8	39	20.1	37	19.1	35	18.0	30	15.5	194 (42%)
No	46	17.2	42	15.7	41	15.4	43	16.1	45	16.9	50	18.7	267 (58%)
<b>Payment for medical services (drugs, nursing services, doctor's services, laboratory services etc)</b>													
--	2	5.6	5	13.9	10	27.8	6	16.7	3	8.3	10	27.8	36(8%)
₦1-3,000	38	15.1	35	16.0	42	19.2	36	16.4	37	16.8	32	16.4	219(48%)
₦4-6, 000	28	17.8	16	9.9	25	15.4	34	20.9	27	16.7	32	19.8	162(35%)
₦7-10,000	6	25.0	4	16.7	2	8.3	2	8.3	7	29.7	3	12.5	24(5%)
₦11-13,000	4	23.5	2	11.8	1	5.9	2	11.8	5	29.4	3	17.6	17(4%)
Abv ₦14,000	2	66.7	0	0.0	0	0.0	0	0.0	1	33.3	0	0.0	3(06%)
<b>Payment for transportation to and from health facility due to sanitation related diseases</b>													
<₦1,000	49	16.7	39	13.3	53	18.0	49	16.7	51	16.9	53	18.0	294(64%)
₦1,000	20	15.8	15	11.9	23	18.3	26	20.6	21	16.6	21	16.6	126(27%)
₦2,000	8	22.2	6	16.7	4	11.1	5	13.9	7	19.4	6	16.7	36(8%)
Abv ₦3,000	3	60.0	1	20.0	0	0.0	0	0.0	1	20.0	0	0.0	5(1.1%)
<b>Total amount spent in cost of treatment</b>													
<₦1,000	2	4.2	6	12.5	11	22.9	12	25.0	7	14.6	10	20.8	48(11%)
₦1-5,000	39	15.4	21	8.3	49	19.3	51	20.1	38	15.0	55	21.7	253(55%)
₦6-10,000	37	23.9	32	20.6	20	12.9	17	10.9	34	21.9	15	9.7	155(34%)
Abv ₦11,000	2	40.0	2	40.0	0	0.0	0	0.0	1	20.0	0	0.0	5(1.1%)

**Table 2: Socioeconomic Burden of Sanitation Related-Diseases on Indirect Cost**

Variables	Abakaliki		Ebonyi		Ezza Sout h		Ikwo		Afikpo		Ohaozara		Total
	LGA		LGA		LGA		LGA		North LGA		LGA		
	F	%	F	%	F	%	F	%	F	%	F	%	
<b>Duration of stay in the health facility because of the sanitary-related-diseases</b>													
<5 days	57	19.5	33	11.3	53	18.2	48	16.5	52	17.8	48	16.5	291(55%)
5-10 days	16	14.8	19	17.6	17	15.7	18	16.7	17	15.7	21	19.4	108(23%)
11-15days	7	12.3	8	14.0	10	17.5	12	21.1	10	17.5	10	17.5	57(12%)
Abv15 days	0	0.0	1	20.0	0	0.0	2	40.0	1	20.0	1	20.0	5(1.1%)
<b>In last month, number of days record absent in work place by a caregiver</b>													
<5 days	21	17.1	16	13.0	21	17.1	24	19.5	17	13.8	24	19.5	123(27%)
5-10 days	28	15.8	20	11.3	29	16.4	32	18.1	38	21.5	30	16.9	177(38%)
11-15days	20	22.2	15	16.7	18	20.0	11	12.2	15	16.7	11	12.2	90(20%)
16-20 days	6	15.4	6	15.4	7	17.9	7	17.9	5	12.8	8	20.5	39(9%)
21-25 days	5	15.6	4	12.5	5	15.6	6	18.8	5	15.6	7	21.8	32(7%)
<b>Amount of money lost per day because of the child's admission in the health facility</b>													
<₦1,000	48	15.7	34	11.1	51	16.7	67	21.8	46	15.0	60	19.6	306(66.4%)
₦1-2,000	18	18.0	12	12.0	22	22.0	10	10.0	19	19.0	19	19.0	100(21.7%)
₦2-4, 000	7	23.3	9	30.0	3	10.0	2	6.7	8	26.7	1	3.3	30(6.5%)
₦5-6,000	4	28.6	3	21.4	2	14.3	1	7.1	4	28.6	0	0.0	14(3.0%)
Abv 7,000	3	27.3	3	27.3	2	18.2	0	0.0	3	27.3	0	0.0	11(2.4%)
<b>Amount of money lost per week because of the child's admission in the health facility</b>													
<₦10,000	45	17.3	27	17.6	54	16.0	64	15.7	43	17.0	67	16.3	300(65.1%)
₦10-19,000	24	18.6	25	19.4	25	19.4	16	12.4	26	20.2	13	10.1	129(28.0%)
₦20-29, 000	8	33.3	7	29.2	1	4.2	0	0.0	8	33.3	0	0.0	24(5.2%)
₦30-39,000	3	37.5	2	25.0	0	0.0	0	0.0	3	37.5	0	0.0	8(1.7%)
Abv ₦40,000	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0

*Abv = Above; Frequency (F) and Percentage (%)*

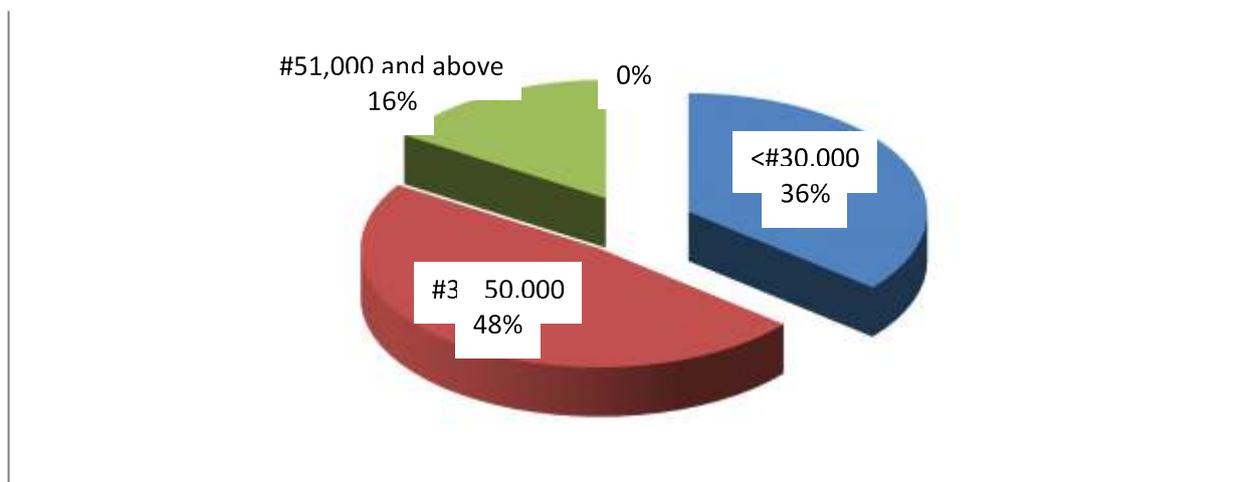
**Table 3: Monthly income of a Caregiver by LGAs**

Variables	Ebonyi North		Ebonyi Central				Ebonyi South				Total		
	Abakaliki	Ebonyi	Ezza		Ikwo		Afikpo		Ohaozara				
	LGA	LGA	South		LGA		North		LGA				
			LGA		LGA		LGA		LGA				
	F	%	F	%	N	%	N	%	N	%	N	%	F
---	24	14.5	12	7.2	34	20.6	36	21.8	21	12.7	38	23.0	165(36%)
₦31-40,000	23	18.6	28	22.7	16	13.0	14	11.4	25	20.3	17	13.8	123(27%)
₦41-50,000	9	8.8	6	5.8	23	22.5	23	22.5	21	20.6	20	19.6	102(22%)
₦51-60,000	13	28.9	9	20.0	5	11.1	5	11.1	9	20.0	4	8.8	45(10%)
₦61-70,000	7	38.9	4	22.2	2	11.1	2	11.1	2	11.1	1	5.6	18(4%)
₦71-80,000	4	50.0	2	25.0	0	0.0	0	0.0	2	25.0	0	0.0	8(2%)
₦81&above	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0
<b>Total</b>	<b>80</b>	<b>17.3</b>	<b>61</b>	<b>13.2</b>	<b>80</b>	<b>17.3</b>	<b>80</b>	<b>17.3</b>	<b>80</b>	<b>17.3</b>	<b>80</b>	<b>17.3</b>	<b>461(100%)</b>

*Frequency (F) and Percentage (%)*

**Table 4: Monthly income of a Caregiver in the household by Zones**

Monthly income of a Caregiver in the household	Ebonyi North Zone	Ebonyi Central Zone	Ebonyi South Zone	Total
---	36(26%)	70(44%)	59(37%)	165(36%)
₦31-40,000	51(36%)	30(19%)	42(26%)	123(26%)
₦41-50,000	16(11%)	46(29%)	40(25%)	102(22%)
₦51-60,000	22(16%)	10(6%)	13(9%)	45(10%)
₦61-70,000	11(8%)	4(2%)	3(2%)	18(4%)
₦71-80,000	5(3%)	0	3(1%)	8(2%)
₦81&above	0.0	0.0	0.0	0.0
<b>Total</b>	<b>141(30.5%)</b>	<b>160(34.7%)</b>	<b>160(34.7%)</b>	<b>461(100%)</b>



**Figure 1: Monthly income of a Caregiver in Ebonyi State**

### Discussion

In relation to the socioeconomic burden of sanitation-related diseases, looking at the cost associated with illness and disease, public health workers such as health economists try to allocate scarce resources in treatment and prevention because the individual household with fixed resource endowment is made to share the limited resources on the consumption of two commodities in health and commodity markets<sup>7</sup>. Majority of the children within the household visited health facility may due to symptoms like stomach pains, fever, headache, blood in stool, watery stool, e.t.c. while some of them were even admitted because of the disease conditions. The amount paid for medical services (drugs, nursing services, doctor's services, laboratory services, e.t.c.) was high, between ₦1,000 and ₦6,000 for 83% of the participants and less than ₦1,000 for 64% of the participants was paid for transportation. Considering the financial status of the people in Ebonyi State in which 48% earned between ₦31,000 and ₦50,000 per month, this has contributed to the higher incidence of sanitation-related disease (e.g. cholera, diarrhoea, dysentery, malaria, typhoid, infectious hepatitis).

They spent directly or indirectly on sanitation related-diseases because, there is practically no national health insurance scheme readily available to the people in the rural area compared to hospitals operated on a cash and carry basis, therefore, the insufficient amount of money may deprive mothers and care-givers access to good and standard health facilities or intervene appropriately<sup>8</sup>.

In the opinion of Igberaese and Iseghohi<sup>7</sup>, disease infection does not come without its outcome(s) and this/these could be in different forms that may limit the individual from productivity which may result in both the individual and the society suffering losses. From the findings of the study, indirect cost was measured by days, weeks and months spent in the health facility due to sanitation-related disease occurrence. Majority spent less than five days in the health facilities. Based on the number of days, weeks or months spent in the health facility may lead to long term or permanent disability, which can be measured by Activities of Daily Living (ADL), with the worst case being mortality and at times a premature death causing a burden of disease (BoD). Havelaar et al<sup>9</sup> and other researchers like Murray-Lopez<sup>10</sup> have used the Disability Adjusted Life Years

(DALYs) as a single composite measure of the different disease outcomes, and it is the summation of the number of years of life lost due to mortality (YLL) and the number of years lived in disability (YLD). It is a health gap measure extending potential years of life lost due to premature death to include equivalent years of healthy life lost in a state of less than full health<sup>9</sup>. Therefore, it is important to consider lost days under indirect cost as the negative effect of sanitation-related diseases when reducing or preventing the burden of disease (BoD). Oostenbrink et al<sup>11</sup>, further stated the other measure is cause of illness (CoI), which is the summation of direct health care costs, direct non-health care costs, and indirect non-health care costs and excluding indirect health care costs.

Carabin et al<sup>12</sup> also stated that to estimate the socioeconomic burden of a disease, some methods are needed to combine the adverse effects on society of disease and reduced productivity in livestock with those of disease and lower levels of well-being and productivity in people. Then, the direct costs to human health include the costs of death, sickness and injury and the costs of treating the disease as observed in this study. Indirect costs include the loss of wages to workers/caregivers who are overseeing the health condition of the sick person and the reduced productivity of workers who may have sub-clinical effects of disease.

### **Conclusion**

The findings in this study have showed how sanitation-related diseases caused socio-economic burden on the life of people in the State compared to their average level of income as average income level of families may not really take care of household needs such as feeding, children school fees, electricity bill, sanitation and hygiene

materials in addition to the cost of care.

Thus, it is important to give sanitation necessary attention, in order to reduce the prevalence of sanitation-related diseases and the financial cost of the treatment of the diseases on families.

**Consent for publication:** All contributing authors have gave consent for this publication

**Availability of data and materials:** The collected data and materials were made available before the contributing authors and they were approved before statistical analysis.

**Competing interests:** All authors of this article report no conflicts of interest throughout the work.

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