Commentary

WAR IN THE MIDST OF A PANDEMIC: THE SYNERGY ACCELERATING MENTAL HEALTH DISORDERS

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Abstract

War and displacement can have long-term and disastrous repercussions on people's mental, emotional, and physical health. Bombardments, invasions, occupation desertion, and being forced to flee diminish people's sense of security. The risk of being hurt or maimed as a result of conflict causes acute dread, which sets in motion other cascades of mental illnesses such as depression, anxiety, and post-traumatic stress disorder. These mental and emotional impacts are exacerbated by a co-existing pandemic, as migration and populations forced into cramped, dangerous situations are likely to contribute significantly to disease spread, particularly given the current surge of the highly transmissible omicron variant of COVID-19. This threat to life and livelihood eventually leaves some survivors with mental health disorders.

Keywords: COVID-19, Mental Health Disorders, Pandemic, War.

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The COVID-19 (coronavirus disease 2019) pandemic has greatly affected the lives of millions of people globally, with the likelihood of mental health problems ensuing among those with no existing mental illness as well as aggravating preexisting mental health conditions.[1] Mental health impact of the COVID-19 pandemic is diverse and they differ among different populations as previous research works have recorded. In the United States, about 4 in 10 adults reported symptoms of anxiety or depression during the pandemic, and many were reporting specific negative impacts due to worry and stress over the coronavirus on their mental health and well-being such as insomnia (36%), alcohol and substance abuse (12%).[2] In the United Kingdom, about one-third of people developed high levels of anxiety from the pandemic[1] while a systematic review showed that 47% and 48% of Africans had anxiety and depression respectively during the COVID-19 pandemic.[3] As the pandemic wears on, continuous and necessary public health interventions expose many people to experiencing situations linked to poor mental health, such as physical distancing, isolation, and job loss.[2]

Generally, the COVID-19 pandemic has increased the likelihood of developing poor mental health, financial insecurity, unemployment, and panic, while protective factors such as social connection, employment, educational involvement, access to physical activity, daily routine, and health care have all declined drastically. This has resulted in a major and unprecedented deterioration in the population's mental health.[4] Across countries, unemployed persons and those suffering financial insecurity had poorer mental health than the overall population -a trend that predates the pandemic but appears to have exacerbated in some cases.[4]

The prevalence of mental health issues has remained largely stable for decades; but, with the onset of the COVID-19 pandemic in 2020, this trend began to shift. Anxiety and depression have been more prevalent after March 2020.[1] For example, the prevalence of anxiety in Europe and the United States doubled that of the previous years in early 2020.[4] This is similar to the prevalence of depression recorded in the same regions within the same year.[5]

When scarce resources are devoted to pandemic control and containment, mental health problems and treatment frequently take a backseat. An infectious disease pandemic, according to history, is followed by a substantial mental health setback. Individuals suffering from substance abuse and dependency disorders may have their mental health deteriorate as a result of a pandemic, as the healthcare system concentrates primarily on emergency services.[6]

Apart from a pandemic, war also plays a major role on the mental health status of individuals.[7] It adversely affects soldiers and civilians alike, both physically and mentally, and when a pandemic is present, this negative impact is amplified. The mental impacts of war include post-traumatic stress disorder (PTSD), depression, as well as anxiety. The terror and horror spread by war violence disrupts lives and severs relationships and families, leaving individuals and communities emotionally distressed.[7] Civilians are frequently affected by the combined effects of war, torture, and repression, particularly those caught in war zones or forced to participate in war-related activities such as murder or rape. Elbedour et al dubbed the helplessly victimized children and families caught in the experience of war as the "collaterally damaged" population.[8] Additionally, war-related emotional suffering can occur not only as a result of direct exposure to life-threatening situations and violence, but also as a result of indirect stressors such as the injury or death of relatives or caregivers, economic hardships, geographic displacement, and continuous disruptions of daily life.[8, 9]

Furthermore, the existence of war in the midst of a pandemic accelerates the spread of infectious diseases especially as a growing number of individuals are displaced and forced into cramped and dangerous situations.[5] For example, the Russian-Ukraine war has resulted in Ukraine reporting nearly 900,000 COVID-19 cases between February and March 2022, accounting for more than one-fifth of the pandemic's total cases.[5] Also, Ukraine has one of the lowest vaccination rates in Europe with less than 40% of Ukrainians fully vaccinated compared to their neighbours such as Russia, Poland, and Belarus with much higher full vaccination status.[10]

Research on the psychological effects of the COVID-19 pandemic and civil war in Libya found a high level of anxiety and depression. The findings revealed that 64.5% of participants had varying degrees of anxiety, 21.6% had moderate to severe depression, and 22.7% had suicidal ideation.[11] The high level of anxiety and depression could be linked to the civil war, as well as overwhelming worsening news that heightens their fear of the virus, its transfer to family or friends, complications, and psychological stress caused by quarantine and isolation.[11]

The effect of war existing with a pandemic is not limited to adults, children have their fair share of it as exemplified in the Democratic Republic of the Congo (DRC), more than 3 million children have been displaced, half of them in the country's eastern zone, where community health centers and schools have been looted, homes have been burned, and entire villages have been destroyed, forcing children and families to flee for survival. Children have witnessed friends and family members being hacked to death during the conflict. The DRC is known to have the world's worst health system, which has been aggravated by the country's battles with the Ebola pandemic and subsequently COVID-19.[12] Similarly, children and their families in South Sudan were facing increased protection risks as a result of rising intercommunal strife, as well as severe food insecurity and malnutrition, during the COVID-19 pandemic. Children who encounter extreme levels of distress, such as those in the DRC and South Sudan, are more likely to develop chronic mental health illnesses or psychosocial impairments. Traumatic events and toxic stress can affect a child's brain development at a young age. Children who have been exposed to a conflict are more likely to feel high levels of stress when confronted with a new crisis, which is exacerbated by previous traumatic experiences.[12]

Humans as social beings perform best in a healthy environment, and when that milieu is disrupted by war and/or epidemic, persons trapped in this quagmire risk

losing their mental health. If these risks that threaten mental health are allowed to fester, they will in the long run affect global health with reduced economic productivity as affected individuals could be maladjusted in such disabling circumstances where there is a paucity of aid to glom onto, giving to the fact that a sizable number of the affected populace would rather feign existence of such malady. Therefore, the awareness of this effect must be greatly emphasized and captured among survivors.

In conclusion, mental health is critical to the functioning of society at the best of times. It must be front and center of country's response to and recovery from the COVID-19 pandemic and civil unrest. The mental health and well-being of whole societies have been severely impacted by these crises and are a priority to be addressed urgently.

AUTHORS CONTRIBUTION

All authors contributed to the research process.

CONFLICT OF INTEREST

The authors declare no conflict of interest

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Original Article

NORMATIVE REFERENCES OF FETAL CHEST CIRCUMFERENCE IN A NIGERIAN POPULATION

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Abstract

Introduction: A linear relationship between gestational age and fetal thoracic size has been observed, with growth occurring at a regular rate from 16 to 40 weeks.

Aim: This study aimed to determine the fetal chest circumference in normal late second and third-trimester pregnancies in a Nigerian population.

Methods: This was a descriptive cross-sectional study carried out on gravid women with normal singleton pregnancies at 22 – 38 weeks gestational age. We recruited 440 eligible gravid women. The fetal gestational age was estimated from the last menstrual period and an early first trimester ultrasound report (< 10 weeks). The fetal chest circumference was measured on an axial view of the fetal chest after ensuring adequate visualisation of the four cardiac chambers, both fetal lungs and ribs. The other fetal biometric parameters were determined using the previously established guidelines. Descriptive statistics, Pearson's correlation, and regression analysis were used as appropriate. Statistical tests were considered significant at $P \leq 0.05$.

Results: The mean age of the subjects was 29.8 ± 4.6 years (range = 18-45 years). The chest circumference of the fetuses ranged from 16.56 ± 0.29 cm to 30.87 ± 6.88 cm. The fetal chest circumferences increased with advancing gestational age (16.56 ± 0.29 cm at 22 weeks to 30.87 ± 6.88 cm at 37 weeks gestational age). There was strong positive correlation between chest circumference and menstrual gestational age (r=0.85, p=<0.0001), biparietal diameter (r=0.88, p<0.0001), abdominal circumference (r=0.90, p<0.0001) and fetal length (r=0.88, p<0.0001).

Conclusion: The fetal chest circumference grew larger as the pregnancy progressed. There was a positive linear correlation between fetal chest circumference and menstrual gestational age as well as the other fetal biometric parameters.

Keywords: Normative references, Fetal Chest Circumference, Sonography, Gestational Age, Fetal Biometry.

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INTRODUCTION

The chest is an integral and vital part of the developing fetus. Although the fetal lungs are not involved in gas exchange in-utero (as this function is carried out through the placenta via the umbilical cord),[1] a well-developed lung is essential for normal extra-uterine survival.[2] Fetuses younger than 24 weeks of gestation are often deemed non-viable due to pulmonary immaturity.[2]

By 16 – 20 weeks gestation, the normal number of bronchi has formed.[3] It has also been established that the fetal thorax grows at a regular rate from 16 to 40 weeks, resulting in a linear correlation between gestational age and thoracic size.[4] In a normal pregnancy, the ratio

between the chest circumference, abdominal circumference, head circumference and femur length also remains constant, with a high correlation coefficient.[5] Hence, alteration of fetal thoracic dimensions, including chest circumference, may suggest intrathoracic pathologies which may affect the survival of the fetus postpartum.

Along with anomalies of the central nervous and skeletal systems, anomalies of the thorax constitute a major group of fetal abnormalities that are detectable prenatally.[2] Many of these abnormalities are potentially life threatening, either at the time they are observed, or by virtue of their potential to progress in severity. These intrathoracic abnormalities include congenital diaphragmatic hernia, congenital pulmonary airway malformation (formerly known as cystic adenomatoid malformation), fetal hydrothorax, congenital pulmonary sequestration, neurenteric and bronchogenic cysts, and pulmonary hypoplasia/agenesis.[6–11] Prior to the advent of non-ionizing imaging modalities such as ultrasound and magnetic resonance imaging (MRI), pathologies of the fetal thorax were diagnosed postnatally using radiography with its attendant ionizing irradiation and sometimes misguided management and fatal outcome.[12]

Although MRI is superior to ultrasound in making diagnosis and planning management of fetal chest pathologies,[13,14] the two modalities are complimentary. Overall, ultrasound remains the predominant modality for evaluating disorders related to the fetus and pregnancy largely due to its real-time nature and ready availability compared to MRI which is expensive and not readily available, especially in developing countries.[15–20]

Early in gestation, the pulmonary parenchymal appears similar to or slightly less echogenic than the liver. As gestation progresses, there is a trend towards increased homogenous pulmonary echogenicity compared to the liver.[2] The heart is usually no larger than one-third of the area of the chest and is normally deviated by about 45±20° towards the left side of the fetus.[21]

The degree of lung development is the prime determinant of fetal viability.[2] Adequate size and shape of fetal thorax, amongst other factors such as adequate amniotic fluid and fetal breathing, have also been noted to influence normal fetal lung growth. Pulmonary hypoplasia can occur when any of these factors are abnormal.[22]

Studies on the sonographic evaluation of the fetal thorax/chest in Nigerians are sparse. The aim of this study was to generate normative references of the fetal chest circumference (CC) in normal late second and third trimester pregnancies in a Nigerian population.

MATERIALS AND METHODS

Study Design: This was a descriptive cross-sectional study carried out from March 2012 to April 2013 on pregnant women with normal singleton fetuses (at 22 – 38 weeks gestation).

Study Setting: The study was conducted at the radiology department of the University of Benin Teaching Hospital, Benin City, Edo state, South-south. Nigeria.

Study Population: These were pregnant women at 22 – 38 weeks gestation referred to the radiology department of the institution. Four hundred and forty pregnant women at fetal gestational age of 22 – 38 weeks were consecutively enrolled having met the following eligibility criteria.

Eligibility Criteria: Inclusion criteria were regular menstrual cycle; known last menstrual period (LMP); and an early dating scan in the first trimester (< 10 weeks), normal live singleton gestation, and intact fetal membranes. The exclusion criteria were unsure LMP, multiple gestation, polyhydramnios or oligohydramnios, premature rupture of membranes, presence of congenital anomalies, maternal medical conditions (gestational diabetes, hypertensive disease of pregnancy, diabetes mellitus, systemic hypertension), and suspected fetal cardiac deviation from the left hemithorax (which may be due to an intrathoracic mass).

Data Collection: After a concise explanation of the study objectives and an assurance of strict confidentiality, written informed consent was obtained from each participant. A detailed medical history was obtained from each subject and documented. The fetal gestational age was determined by calculation from the last normal menstrual period and validation with an early first trimester ultrasound scan (< 10 weeks).

All the participants were scanned on a Medison Sonoace X4 scanner (Medison Co. Ltd, Gangdong-gu, Seoul,

South Korea) with a 3.5 MHz frequency curvilinear transducer. Each participant laid supine on the examination couch with adequate exposure of the abdomen from the level of the xiphisternum to the public symphysis. The ultrasound coupling gel was applied on the abdomen. The transducer was then placed on the abdomen and scanning done in different planes with minimal transducer force. At the level of the four-chamber view of the fetal heart, the transducer was orientated transversely. After ensuring adequate visualisation of the four chambers of the fetal heart, both fetal lungs and ribs on this axial plane, the image was frozen. Tracing around the fetal chest was drawn, with the aid of the electronic calliper, using the ellipse function in order to obtain the fetal chest circumference (**Fig. 1**). The biparietal diameter (BPD) measurement was obtained from a trans-axial plane of the fetal head at the level of the thalami and cavum septum pellucidum as described by Kurtz et al.[23] The abdominal circumference was measured using the umbilical vein and the fetal stomach as landmarks.[24] The femur length was measured from the greater trochanter to the distal metaphysis of the fetal femur.[25] Each measurement was taken three times and the average value was recorded to minimize intraobserver error. All the subjects were scanned by one sonologist so as to reduce interobserver variation.

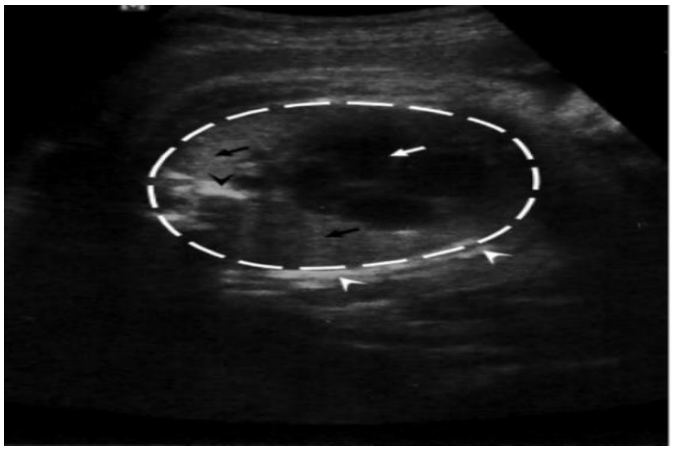

Figure 1. Sonogram of the foetal chest on a transverse view at the level of the 4-chamber view of the foetal heart. Foetal chest circumference (broken white line). Foetal heart (white arrow), foetal lungs (black arrow), foetal spine (black arrowhead) and thoracic cage (white arrowhead)

Data Analysis: The data obtained were analysed using the Statistical Package for the Social Sciences (SPSS) version 17 (SPSS Inc, Chicago, IL, USA). Normality of data was determined using the Kolmogorov-Smirnov's test. Descriptive statistics and Pearson's correlation were used as appropriate. Linear regression analysis was used to assess the relationship between chest circumference and the other fetal biometric parameters. Statistical tests were considered significant at $P \leq 0.05$.

RESULTS

A total of four hundred and forty healthy women with singleton intrauterine pregnancy were recruited. The age range of subjects was 18 – 45 years with a mean of 29.8 ± 4.6 years. The modal age group was 26-30 years (n=172; 39.1%) (Table 1). The other general characteristics of the participants are shown in Table 1.

The chest circumference of the fetuses ranged between 16.56 ± 0.29 cm to 30.87 ± 6.88 cm (Table 2). With advancing gestational age, there was a corresponding increase in chest circumferences of the fetuses.

Table 3 shows the mean chest circumference in various gestational age groups. Expectedly, the mean chest circumference was least in the 22 - 27 weeks age group (19.39 ± 2.22cm) and most in the 33 - 38 weeks gestational age group (28.23 ± 3.91 cm).

There was strong positive correlation between chest circumference and menstrual gestational age (r=0.85, p=<0.0001). Also, chest circumference correlated positively with the other fetal biometric parameters of BPD (r=0.88, p<0.0001), AC (r=0.90, p<0.0001) and FL (r=0.88, p<0.0001) (Tab. 4).

Table 5 shows the predicted chest circumference from the menstrual gestational age at 25th, 50th, 75th and 90th percentiles. Table 6 shows the regression equations for the relationships between the chest circumference and the other fetal biometric parameters.

Table 1: Demographic of the study population

Variable	Frequency	Percentage	Cumulative Percentage
Age group (years)			
18 – 21	6	1.4	1.4
22 – 25	78	17.7	19.1
26 – 30	172	39.1	58.2
31 – 35	138	31.4	89.5
36 – 40	42	9.5	99.1
41 – 45	4	0.9	100.0
Mean Age ($\overline{X}$ ± SD) (years)	29.8 ± 4.6		
Parity			
0	167	38.0	38.0
1	112	25.5	63.4
2	96	21.8	85.2
3	45	10.2	95.5
4	10	2.3	97.7
5	8	1.8	99.5
9	2	0.5	100.0
Mean parity ($\overline{X}$ ± SD)	1.2 ± 1.3		
Menstrual Gestational age group (weeks)			
22 – 27	138	31.4	31.4
28 – 32	106	24.1	55.5
33 – 38	196	44.5	100.0
Mean Menstrual Gestational age ($\overline{X}$ ± SD) (weeks)	30.6 ± 5.5		
Educational Status			
Primary	21	4.8	4.8
Secondary	119	27.0	31.8
Tertiary	300	68.2	100.0
Ethnicity			
Bini	237	53.9	53.9
Esan	52	11.8	65.7
Etsako	36	8.2	73.9
Igbo	85	19.3	93.2
Owan	4	9	94.1
Yoruba	26	5.9	100.0

Table 2: Mean Chest circumference at specific gestational age

Menstrual Gestational age (weeks)	Chest circumference (cm) Mean ±SD	Frequency (N)	Percentage	Cumulative Percent
22	16.56 ± 0.29	23	5.2	5.2
23	17.07 ± 1.37	21	4.8	10.0
24	18.76 ± 1.62	24	5.5	15.5
25	19.40 ± 1.38	21	4.8	20.3
26	20.32 ± 1.96	21	4.8	25.1
27	21.49 ± 1.93	22	5.0	30.1
28	21.79 ± 1.89	21	4.8	34.9
29	23.03 ± 2.03	30	6.8	41.7
30	23.04 ± 2.22	21	4.8	46.5
31	24.99 ± 1.73	28	6.3	52.8
32	26.06 ± 2.40	21	4.8	57.6
33	26.41 ± 2.21	30	6.8	64.4
34	28.61 ± 2.49	34	7.7	72.1
35	27.32 ± 3.28	26	5.9	78.0
36	27.91 ± 1.97	44	10.0	88.0
37	30.87 ± 6.88	30	6.8	94.8
38	29.19 ± 3.56	23	5.2	100.0
Total		**440**	**100.0**	**100.0**

Table 3: Mean Chest Circumference for the menstrual gestational age groups

Grouped Menstrual Gestational age (weeks)	Chest circumference (cm) Mean ±SD	Frequency (N)	Percentage	Cumulative Percent
22 – 27	19.39 ± 2.22	138	31.4	31.4
28 – 32	23.82 ± 2.44	106	24.1	55.5
33 – 38	28.23 ± 3.91	196	44.5	100.0

Table 4: Correlation of CC, BPD, AC and FL with Menstrual Gestational Age

		Menstrual Gestational Age	CC	BPD	AC	FL
Menstrual Gestational Age	r	1	0.85**	0.96**	0.96**	0.96**
	P value		<0.0001	<0.0001	<0.0001	<0.0001
CC	r	0.85**	1	0.88**	0.90**	0.88**
	P value	<0.0001		<0.0001	<0.0001	<0.0001
BPD	r	0.96**	0.88**	1	0.97**	0.97**
	P value	<0.0001	<0.0001		<0.0001	<0.0001
AC	r	0.96**	0.90**	0.97**	1	0.97**
	P value	<0.0001	<0.0001	<0.0001		<0.0001
FL	r	0.96**	0.88**	0.97**	0.97**	1
	P value	<0.0001	<0.0001	<0.0001	<0.0001	

Significant correlation
CC=Chest circumference; BPD = Biparietal diameter; AC=Abdominal circumference; FL= Femur length
r = Pearson's correlation coefficient

Table 5: Predicted Chest circumference from menstrual gestational age (25th, 50th, 75th and 90th percentile)

Menstrual Gestational age (weeks)	Percentiles						
	5th	10th	25th	50th	75th	90th	95th
22	16.28	16.28	16.28	16.48	16.91	17.91	18.82
23	14.21	14.39	16.48	16.90	18.53	18.82	18.84
24	15.64	15.84	17.96	19.09	20.12	20.66	21.14
25	17.88	17.89	18.43	18.92	20.86	21.55	21.55
26	17.02	17.02	18.50	20.87	22.21	22.36	22.44
27	17.83	18.17	20.57	21.65	23.21	24.01	24.09
28	19.38	19.38	19.73	21.68	23.89	24.14	24.46
29	19.86	20.50	21.80	22.66	24.10	24.84	28.19
30	18.46	18.46	21.78	23.32	25.13	25.47	28.60
31	22.57	22.78	23.49	25.29	25.84	26.75	29.07
32	21.27	21.27	24.65	26.26	28.27	29.07	29.32
33	22.23	23.88	24.49	26.57	28.41	28.96	29.45
34	23.45	24.78	27.58	28.92	30.42	31.80	32.01
35	22.30	22.40	24.14	27.85	29.92	31.82	32.29
36	24.70	25.50	26.83	27.36	28.46	31.51	31.92
37	25.13	25.76	26.74	29.46	31.96	33.07	54.24
38	25.11	25.11	26.43	28.99	31.20	36.50	56.10

Table 6: Coefficients of determination (R^2) and regression equations using natural logarithm of Chest Circumference (InCC)

Analysis	R^2	Regression equation
CC vs GA	0.86	InCC = 1.2923 + 0.0843(GA) – 0.0007(GA)²
CC vs FL	0.80	InCC = 1.868 + 0.2854(FL) – 0.0104(FL)²
CC vs BPD	0.82	InCC = 1.6538 + 0.2505(BPD) – 0.007(BPD)²
CC vs AC	0.88	InCC = 1.6401 + 0.0814(AC) – 0.0009(AC)²

CC=Chest circumference; GA=gestational age; FL=femur length; BPD=biparietal diameter; AC=abdominal circumference

DISCUSSION

Prenatal ultrasound is an integral part of routine antenatal care, which is one pillar of the safe motherhood initiative aimed at preventing adverse pregnancy outcomes. Ultrasound is an important screening and diagnostic tool. It is safe for both the pregnant mother and her unborn fetus, mainly due to its non-ionizing property.

The fetal chest circumference has been shown to correlate positively with other routinely measured fetal biometric parameters, such as biparietal diameter (BPD), abdominal circumference (AC), and femur length (FL).[4]

Chest circumference (CC) measurements were taken between 22-38 weeks in this study. Fong et al.[4] measured the CC from 13 to 41 weeks, while Nwobi[26] enrolled pregnant women at 15-41 weeks gestational age. The chest circumference in the index study ranged from 16.56 ± 0.29 cm to 30.87 ± 6.88 cm, the upper limit of which is comparable to the 9.16 - 32.17 cm reported by Nwobi.[26] The chest circumference showed a positive linear correlation with the menstrual gestational age (r=0.85, p=0.0001). This corroborates the findings of Fong et al.[4] and Nimrod et al.[27]

The regression analysis of the association between chest circumference and other biometric parameters (gestational age, femur length, biparietal diameter, and abdominal circumference) also showed a linear relationship. This is similar to the findings of Nimrod et al.[27], Chitkara et al,[28] and Siddiqi et al.[29] However, this is contrary to the findings of Fong et al,[4] who reported that the relationship was quadratic. This disparity might be due to fewer subjects (100) in their study.[4]

The nomogram developed in this study showed an increase in variability of the normal CC range with increasing GA, BPD, AC, and FL. This is similar to the pattern seen in previous studies.[4,27,28] The predicted chest circumference values at various BPD, AC, FL, and GA are also similar to those of some previous studies.[27,28]

Although sonographic features ("small" lungs, echogenic lungs, and similar findings) in the fetal chest alone cannot solely predict pulmonary function, a correlation between pulmonary hypoplasia and a small chest circumference has been reported.[5,30] Studies have also shown the importance of fetal chest circumference in the prenatal diagnosis of pulmonary hypoplasia.[4,31,32]

Working in Ontario, Canada, Ohlsson et al.[31] studied 58 singleton pregnancies at risk of pulmonary hypoplasia. Using autopsy report to prove pulmonary hypoplasia, chest circumference had sensitivity, specificity, positive and negative predictive values of 0.55–0.80, 0.90–1.00, 0.80–1.00, and 0.87–0.91, respectively. They concluded that prenatal ultrasound measurement of fetal chest circumference is valuable in managing pregnancies at risk of lethal pulmonary hypoplasia.[31]

In Washington, USA, Songster et al.[32] evaluated ultrasonic fetal chest circumference measurements as a predictor of pulmonary hypoplasia in a group of 26 fetuses at risk. They found a 42% prevalence of autopsy-proved pulmonary hypoplasia in this population. On a nomogram of chest circumference versus head circumference, femur length, and gestational age, they noted a progressive lag in chest circumference growth among fetuses who proved to have pulmonary hypoplasia, correlating with the earlier findings of Nimrod et al.[27] and Devore et al.[30] Songster et al.[32] also indicated that fetal chest circumference is a valuable adjuvant in the diagnosis of deadly pulmonary hypoplasia.

The precise incidence of pulmonary hypoplasia is not known. The current reported incidences are 0.9 to 1.1 per 1000 in all births and 1.4 per 1000 in live births. Estimates show, however, that these numbers are inaccurately low given that infants with less severe sickness survive the newborn period and are found to have respiratory issues later in life.[33]A more recent study in the United States recorded the incidence of pulmonary hypoplasia among pregnant women (15-28 weeks gestational age) with mid-trimester rupture of membranes at 12.9%.[34]

In conclusion, this study showed that the fetal chest circumference increased as the pregnancy progressed. There was a positive linear correlation between fetal chest circumference and menstrual gestational age and the other fetal biometric parameters (BPD, AC, and FL).

A limitation of this study was the difficulty sometimes encountered in obtaining the fetal chest circumference because of unclear margins of the thorax. However, the 4–chamber view of the fetal heart was used to enhance accuracy and reproducibility.

AUTHOR CONTRIBUTIONS

FFA was involved with conception, design, literature search, data acquisition, data analysis, statistical analysis,

manuscript preparation, manuscript editing and manuscript review. AA was involved with manuscript editing and manuscript review. AOO was involved with manuscript editing and manuscript review. BMI was involved with literature search, manuscript preparation, manuscript editing, manuscript review. All authors approved the final draft of the manuscript.

CONFLICT OF INTEREST

The authors have nothing to disclose.

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ETHICAL APPROVAL

The Ethics and Research Committee of University of Benin Teaching Hospital, Benin City, Edo state approved the study protocol (ADM/E 22/A/VOL. VII/779).

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Original Article

THE RADIOLOGY DEPARTMENT IN COVID-19 PANDEMIC: APPROACH AND OUTCOME AT A SEMI-URBAN TERTIARY HOSPITAL

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Abstract

Background: There has been an increase in the exposure of radiology staff worldwide in the first and second waves of the COVID-19 pandemic. To prevent the spread of disease to the frontline radiology staff, different departments have instituted diverse preventive and precautionary measures. However, the adaptability of the plethora of interventions available for the prevention of disease transmission depends partly on the socio-economic capability of the affected setting.

Objective: To outline the approach and outcome of a radiology department in a resource-constrained setting at University of Medical Sciences Teaching Hospitals (UNIMEDTH), Ondo State Nigeria, to the curtailment of disease transmission to the departmental staff.

Methodology: An observational report on the approach for curtailment of COVID-19 disease transmission to departmental staff and the outcome, at the University of Medical Sciences Teaching Hospitals (UNIMEDTH), Ondo State Nigeria. The approach utilized in such resource-constrained setting was observed between April 2020 and April 2021. This was documented and the outcome presented.

Results: Eight cases of COVID-19 infection were recorded among 66 staff of the department. This is a case rate of 12.1%.

Conclusion: Our modest preventive measures helped reduce patient-to-staff and inter-staff transmission of COVID-19 virus to the minimum.

Keywords: COVID-19, Radiology department, Personnel protection, Nigeria.

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INTRODUCTION

The global pandemic tagged Coronavirus disease-2019 (COVID-19) started in December 2019 in Wuhan, Hubei Province of the Peoples Republic of China.[1] This disease is caused by a Ribonucleic Acid (RNA) virus known as the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-Cov2). The World Health Organization (WHO) declared the disease a pandemic in January 30, 2020. Since then, it has affected over 190 countries with about 72 million cases and over 1.6 million deaths.[2–4] The confirmed index case in Nigeria was detected in the Southwestern state of Lagos on 27 February 2020; since then, the number of confirmed cases nationwide rose to 164,719 and 2,062 deaths as of 27th April 2021.[2–4] During

the first wave, there was an increased transmission to health workers with widespread panic in the health sector and many health facilities were shut down once a case was confirmed on their premises.

The index case in Ondo State, Southwest of Nigeria, was detected on 4th April 2020. As of 27th April 2021, the total number of reverse transcriptase polymerase chain reaction (RT-PCR) test confirmed cases in the state was 3,242, with 63 deaths.[4] The state-owned University of Medical Sciences Teaching Hospitals (UNIMEDTH) which comprises three hospital complexes located in Akure (the capital city) and Ondo town; predominantly suburban settings, bore the brunt of the pandemic.

Radiodiagnosis plays a key role in the management of COVID-19 cases,[5–8] especially in the tropics where communicable respiratory disease prevalence is very high and there is an emerging trend of increasing non-communicable chronic respiratory conditions.[9] High-Resolution Computerised Tomography of the Chest (HRCT), especially when the pre-test probability of the disease is high, has become a useful tool in assisting physicians to categorise risk for COVID-19 while awaiting the result of reverse transcriptase polymerase chain reaction (RT-PCR).[6]

Since the announcement of the first case in Ondo State, our department has been actively involved in the evaluation of suspected cases. The hospital's standing protocol included triaging based on clinical presentation (cough, fever, breathlessness), history of contact with a confirmed case, travel to/from an endemic region, desaturation in room air, and HRCT scan for all suspected cases.

As the disease achieved pandemic proportions in January 2020, a global biting scarcity of personnel protective equipment (facemasks, protective gloves, goggles/face shields, and protective clothing) ensued.[10,11] Gradually, industrial production of these items was ramped up, especially after the subsidence of the epidemic in China. Despite increased exports from China, there was scarcity in developing countries.[10] The combination of the developed nations massive purchase of these protective equipment as well the low financial capability of the developing nations may have been responsible for the scarcity and made the latter's frontline healthcare workers, on the average, poorly protected against the COVID-19 virus while rendering health services. There were donations of funds, protective equipment and ventilators to some African countries, which made little impact on healthcare workers needs for protection.[10,11]

This is a report of our approach to healthcare personnel and patient protection during the first wave of the COVID-19 pandemic at our department of radiology. This article should be of help to other radiology departments grappling with the COVID-19 pandemic under similar circumstances.

METHODOLOGY

This is an observational report on the approach for curtailment of COVID-19 disease transmission to departmental staff and the outcome, at the University of Medical Sciences Teaching Hospitals (UNIMEDTH), Ondo State Nigeria. The radiology department staff strength is 66 in the 3 complexes that make up our institution. The facility is resource constrained and the approach utilized to curtail COVID-19 disease transmission to departmental staff was observed between April 2020 and April 2021 by taking notes and pictures.

Below, the approach utilized is described, results are presented, discussed and conclusions and recommendations are made.

APPROACH

The general principles of radiation protection already established in radiology (Personnel Protection and Equipment, Distance, and Time)[12] were adapted to combat the pandemic.

Personnel Protection

Our hospital suffered a scarcity of protective gear. With increased role of our radiology department in the management of COVID-19 cases, wearing of facemasks by all patients and relatives passing through the Radiology department became compulsory. We also instituted the protection of the Radiology staff as follows;

Standard Protective Gear **(Fig. 1A)**

- Reusable Face Shields or protective goggles
- Disposable latex gloves.
- Face masks; N95 and KN95 varieties with respirators that were reused for up to 2 weeks

wearing cloth/non-surgical face masks underneath. The hospital infection prevention and control (IPC) team trained the staff on a procedure of dipping the masks in detergent solution, rinsing, and airing to dry. One-ply surgical grade facemasks were reused to a lesser extent.
- Non-reusable disposable surgical gowns
- Reusable surgical gowns that are worn once and sent to be cleaned in the CSSD

Specific Donning and Doffing Sequence

Because of the compact nature of the Radiology departments in the 3 complexes, there were **no demarcated 'Donning/Doffing' areas**. Each active unit/room had specific closed lid plastic bins with foot pedals that were labelled "used" (**Fig. 1B**). These were placed in a remote corner of the rooms (areas with minimal traffic) and had 1.0m^2 perimeter box drawn on the surrounding floor. The worn gowns were placed in these as soon as they were taken off. The "sterile/unused" gowns were retrieved from a central bin storage in the departmental store by a health attendant (Sterile Health Attendant (SHA) designate for the day) and handed over to the staff. The process of donning follows the WHO and NCDC protocol.

Figure 1: Radiology staff wearing reusable gowns and other protective gears in the computed tomography room (A), and a closed lid plastic bin with foot pedal marked "Used gowns" for collecting "used" reusable and non-reusable gowns (B)

The process of doffing carries the highest risk of contamination and the following modified steps were strictly adhered to:

- Another staff must observe you during the process to spot any breach of transmission prevention.
- Wash or sanitise the outer pair of hand gloves before removal into the designated bin.
- Wipe the outer part of the face shield with sanitiser/detergent solution or alcohol wearing the internal pair of gloves. Do not remove the visor yet.
- Wipe the outer part of the reusable facemask same way as above. If it is a one-ply surgical mask, do not clean as described.
- Clean internal pair of gloves with sanitiser.
- Remove the gown (disposable or reusable) by grasping the inside of the collar and pull away from

your body rolling into a bunch. Then place in the 'Used' bin using the foot pedal.
- Remove the remaining pair of hand gloves and discard into the waste bucket.
- Wash your hands
- Remove visor into your desk drawer or designated place
- Remove face masks by pulling the cords over your ears (usually at the end of duty/shift on exit from the Radiology department). This is exposed to air or placed in the hot tropical sun for a few hours as is appropriate.
- Wash hands with water and solution.

Washing of hands

The department uses an alcohol-based hand sanitiser (Sterilium®) as well as the common dishwashing gel (Morning Fresh®) as anti-lipid washes. Washing of hands follows the specific WHO infectious disease control pattern at the faucet. Washing of hands is as needed but must be performed first as soon as the staff enters the department (there is also a hand sanitiser application at the hospital entrance) before wearing and after taking off the protective gear as described. Then after each hand gloves have been taken off and at the close of duty/shift.

Equipment

Unlike in some advanced countries where there is an abundance of equipment to create two parallel pathways for the patients seen in Radiology, the equipment in our department as in most sub-Saharan countries could not be divided to cater for suspected or confirmed COVID-19 and non-COVID-19 cases. To get around this problem, our centre resorted to the following:

- Covering of the Sonographic and Computerized tomography couches with disposable sheets for each patient
- Cleaning of the computerized tomography gantry, radiographic upright and horizontal and fluoroscopy tables with alcohol/bleach solution after each patient (even without suspicion of COVID-19).
- Fumigation of each room or suite by the PHA dressed in protective gear as directed by NCDC after a suspected COVID-19 case.
- Periodical fumigation of surfaces and floor (alcohol and bleach mixture in 2 litre aerosol gallons) in 4 to 6 hourly intervals. The downtime post-fumigation is 30 minutes maximum.

Distance

- Prospective patients are seated in open corridors with good ventilation and a social distance of one meter.
- Prospective patients keep a distance of at least one meter from the Radiology department front desk. We designated this by a one metre perimeter box drawn on the floor.
- Only the 'active' member of the staff in a room stays less than 1 meter from the patient during the procedure after being properly dressed in protective equipment.
- Having such low staff strength creates problems. Unlike centres in which staff is grouped into 2 or more groups to cover the department separately, sadly this has not been tried in our centre. But the staff tries as much as possible to keep a safe physical distance between each other.

Time

The hospital has three active radiography suites. There are two separate suites in the Akure complex, one suite each in Ondo General and Main complexes (the main complex suite is a Radiographic/Specials/Fluoroscopic combination suite), five ultrasound rooms, and one computerized tomography machine/room. To prevent lengthy period of patient transit, work downtime and patient to patient and patient to staff disease transmission, the daily duties were modified, and we classified the procedures as those to run as clinics; those taken as high to low priority and those to be strictly on invitation.

The patients also spent minimal time as possible in the department for the procedures. The downtime after seeing a suspected COVID-19 case is rarely more than 30 minutes.

General procedural points

Patient Preparation

The standing hospital protocol by the Infection Prevention and Control (IPC) team is that all patients must be on a facemask, whether or not for COVID-19. Many of these patients are usually brought to the Radiology department on trolleys. The accompanying healthcare workers, usually from accident and emergency or critical

care don protective clothing. The patient is helped onto the narrow couch covered with a disposable sheet and laid supine. In the instance of a radiography procedure, the procedural room radiographer (different from the radiographer at the controls) goes into the procedure room and positions the patient and determines the planes and field of view to be taken. Patients' clinical parameters are usually monitored continuously in those critically ill. Some may require supplemental oxygen.

Post Procedure

The patient is immediately wheeled out of the Radiology department following the procedure. The disposable bedsheet is discarded safely. The gantry, couch, and floor are quickly wiped with the previously mentioned alcohol/hypochlorite solution and the suite room door is left ajar to enable ventilation. The procedural room radiographer (who would have waited in the suite anteroom with the attending healthcare workers and not the controls radiographer) being the most contaminated doffs his protective gear first. The other Radiology staff follow suit.

RESULTS

The demography of the 66 personnel is shown in Table. 1. Despite the high exposure to COVID-19 from March 2020 during the first wave of the pandemic, we recorded the first confirmed case by reverse transcriptase polymerase chain reaction (RT-PCR) test in July 2020. Subsequently, seven more were confirmed. Two of the cases developed moderately severe symptoms and HRCT findings of lung changes. This is a case rate of 12.1%.

Table 1: Demographic and comorbidity pattern among departmental staff

VARIABLES N=47	FREQUENCY	PERCENTAGE
AGE		
20-29	15	22.7
30-39	25	37.9
40-49	16	24.2
50 and Above	10	15.2
Mean Age = 37.4 ± 9.2 years		
Median = 35years		
Range = 24-67 years		
Mode = 50 years		
SEX		
Male	24	36.4
Female	42	63.6
COMORBIDITY		
Hypertension		
Yes	2	3.0
No	64	97.0
Diabetics		
Yes	1	1.52
No	65	98.48
Others		
Nil	100	100

DISCUSSION

The case rate of 12.1% is close to the 13.3% but lower than the 24% recorded among radiologists and radiology technicians at a German hospital;[13] but higher than the 5.7% case rate at an interventional radiology division in New York, USA.[14] Differences in infection rates among healthcare workers have been variously attributed to race (Black, Asian, and minority ethnic groups are more affected), spending longer time with patients, prolonged donning of gloves, age, and presence of comorbid chronic illnesses.[15–18]

It is conceivable that the age distribution of our departmental personnel put most of the staff in the not-so-vulnerable age group, coupled with significantly low comorbidities. This is evidenced by the relatively young mean age of 37.4 ± 9.2 years and a low prevalence of pre-existing medical illnesses (Hypertension = 3%, Diabetes Mellitus = 1.5% among departmental personnel).

The measures implemented in our department are consistent (though modified) with the expert guidelines issued at the outset of the pandemic.[19–22] The same pattern of modification to suit local peculiarities and varying degrees of compliance were observed at other radiology departments worldwide.[22]

The main drawback of this study is the unavailability of comparative data on infections among the staff of other departments and among the patients seen in the department during this period. These were beyond the scope of our investigation.

CONCLUSION

We can conclude that our modest preventive measures helped reduce patient-to-staff and inter-staff transmission of COVID-19 virus to the minimum, with resultant availability of diagnostic radiology support in our hospital at the height of the first wave of the COVID-19 pandemic in Ondo state, Nigeria.

RECOMMENDATIONS

1. Based on the individual departmental requirements, some of the personnel protection concepts outlined in this paper should be institutionalised and adopted for routine use in the daily workflow of local radiology departments.
2. Self-sufficient local production of PPE should be a time-bound national objective.
3. Regular training and retraining of staff on the proper donning and doffing of PPE, standard handling of infectious cases, and decontamination of rooms/ equipment.
4. Institutional planning towards obtaining dedicated imaging equipment for patients with confirmed or suspected COVID-19 or other contagious diseases.

AUTHORS' CONTRIBUTIONS

AAA conceptualised the study and contributed to manuscript review. AOO designed and supervised the study and contributed to manuscript preparation, manuscript editing and manuscript review. JIF contributed to manuscript review. BMI conducted literature search and contributed to manuscript preparation, manuscript editing and manuscript review. ESO, OSO and FFA supervised guideline implementation and data collection and contributed to manuscript review. AOB, TAO and OAA collected data and contributed to manuscript review. CAA and OBO conducted statistical calculations and contributed to manuscript review. All authors read and approved the final draft of the manuscript.

CONFLICT OF INTEREST

The authors have nothing to disclose.

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Original Article

SPIROMETRIC PARAMETERS AND THE RELATIONSHIP BETWEEN PEAK EXPIRATORY FLOW (PEF) MEASURED WITH PEAK FLOW METERS AND FORCED EXPIRATORY VOLUME IN ONE SECOND (FEV1) AMONG A SAMPLE OF ASTHMATICS IN SOUTH WEST NIGERIA

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Abstract

Background: Although forced expiratory volume in one second (FEV_1) which is measured in spirometry is the gold standard for functional airway obstruction measurement, it is not available to most clinicians managing asthmatic patients in Nigeria. Peak expiratory flow (PEF) is useful in assessing bronchial airway calibre and it is used frequently in monitoring response to treatment of asthmatic patients.

Objective: To investigate the spirometric findings and the relationship between PEF measured with peak flow meter and FEV_1 among asthmatic patients.

Materials and Methods: A cross-sectional descriptive study of asthmatic patients seen at the medical outpatient clinics of Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife and the OAUTHC, Wesley Guild Hospital, Ilesa. A proforma was used to record information on socio-demographic data, clinical features and spirometric parameters of each patient. Spirometry was carried out according to the American Thoracic Society (ATS) guidelines and PEF, FEV_1, FVC and FEV_1/FVC were measured.

Results: The mean pre-bronchodilator FEV_1 was 1.97 ± 0.87 (L), and the post bronchodilator FEV_1 was 2.32 ± 0.95 (L). The mean pre-bronchodilator PEF was 286 ± 107(L/ Min) and the post bronchodilator PEF was 348 ± 114(L/Min). Males had higher values when compared with females in FEV_1 and FVC and the differences were statistically significant. There was a significant correlation between PEFR and FEV_1.

Conclusion: There was statistically significant correlation between PEF and FEV_1 among the patients with asthma studied.

Keywords: Peak expiratory flow (PEF), Forced expiratory volume in one second (FEV_1), Asthmatics, South West Nigeria.

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BACKGROUND

Asthma is diagnosed by a combination of positive family history of allergy or asthma, a history of cough which worsens at night, wheeze, difficulty in breathing, and chest tightness. However, the medical history may not be reliable in diagnosing asthma. Furthermore, the physical examination may be normal as asthma symptoms are characteristically episodic. An objective measure is needed to diagnose asthma accurately and to monitor response to treatment. Objective documentation of variable and reversible airflow obstruction can be obtained through measurement of forced expiratory volume (FEV), Peak expiratory flow (PEF) or hyper-responsiveness to methacholine inhalation challenge. A reversibility of 15% in forced expiratory volume in one second (FEV_1) following inhaled short acting bronchodilator or after a 7 to 14 days course of inhaled glucocorticoid or oral prednisolone is diagnostic of asthma.[1]

A diurnal variation in PEF of more than 20% is also considered to be diagnostic of asthma. Mean morning PEF provides information about current clinical control of

asthma, and peak flow variability provides independent information about risk of future exacerbations. When PEF variability increases it is associated with an increased risk of asthma exacerbations.[2] It was suggested by The British and International guidelines that the PEF is an alternative to FEV_1 when expressed as percentage of normal value. PEF is a simple reproducible measure that correlate well with FEV_1.[3,4] The PEF is widely used in different settings such as home monitoring,[5] emergency departments[6] and its role is increasing in the diagnosis and management of asthma. In ambulatory lung function monitoring, PEF is highly responsive to inhaled corticosteroid (ICS) or long-acting B-agonist (LABA) treatment, with morning PEF more responsive than evening PEF compared to FEV_1.[7,8]

However, some investigators have demonstrated that there is a considerable disagreement between FEV_1 and PEF in estimating the degree of airway obstruction.[9,10] They added that PEF is inferior to FEV_1 as a clinic-measured parameter of airways obstruction and may underestimate airway obstruction in individuals with airway remodelling. Peak expiratory flow can be measured with a simple peak flow meter without spirometry. On the other hand, FEV_1 measured in spirometry is the gold standard for airway obstruction because it has less intra subject variability,[11] but it is not available to most Clinicians managing asthmatic patients in Nigeria. It is thus necessary to understand how PEF measures relate with FEV_1.

The aim of this study is to investigate the spirometric findings and the relationship between PEF measured by Wright peak flow meter and FEV_1 among asthmatic patients and to compare them as absolute and as percentage of predicted values.

MATERIALS AND METHODS

This was a cross-sectional descriptive study carried out in the medical outpatient clinics of Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife and the OAUTHC, Wesley Guild Hospital, Ilesa, from February 2011 to July 2011. These hospitals provide primary, secondary and tertiary health care services. Ile-lfe and Ilesa are both semi-urban towns in South-West, Nigeria.

Patients with asthma were selected from among the patients attending the Outpatient Clinic. Asthmatics included in the study were aged between 16-55 years without acute severe asthma in the prior 4 weeks and with spirometric evidence of asthma as defined by a bronchodilator reversibility test with change in FEV_1 > 15% and/or 200ml, 20 minutes after inhalation of 400 microgram of short-acting B- agonist (salbutamol).[12] All asthmatics who had comorbid conditions like hypertensive heart failure and COPD and patients with uncertain diagnosis of asthma were excluded from the study.

The study procedure was explained to the patients and a proforma was used to document information on socio-demographic data, clinical features and spirometric parameters of each study subject. Spirometry was performed according to the ATS guidelines.[12] PEF was measured using a Peak Flow meter after thorough explanation and practical demonstration of the procedure. The best out of three satisfactory readings was recorded. FEV_1 and Forced Vital Capacity (FVC) were measured using a standardized spirometer which utilizes a turbine sensor and is therefore not affected by temperature, pressure or gas density and does not require calibration. Inhalation of bronchodilator was withheld for a minimum of 12 hours before spirometry was performed. The lung function indices were assessed before and 20 minutes after the inhalation of 400ug of salbutamol using Metered Dose Inhaler (MDI) which is attached to a spacer device.

The highest lung volume values were accepted for calculation. The measured value of FEV_1 and PEF obtained were changed to percent predicted based on the race, sex, age, height and weight of the patient and were compared. Data analysis was done using a statistical computer software, IBM-SPSS version 15.0. Categorical variables were expressed as percentages, and student t-test was used for the continuous variables. P-value of less than 0.05 was recorded as statistically significant.

RESULTS

Shown below on table1 is the spirometric parameters among the subjects. Mean pre-bronchodilator FEV_1 was 1.97 ± 0.87L, while the post-bronchodilator FEV_1 was 2.32 ± 0.951. Mean pre-bronchodilator PEF was 286 ± 107 (L/ Min) while the post-bronchodilator PEF was 348 ± 114(L/Min). The predicted pre-bronchodilator FEV_1 was 75±25.7L. Table 2 shows the distribution of the study subjects based on predicted FEV_1. As shown, 60% of the study population had predicted FEV_1 of less than 80%. There was a significant correlation between PEF and FEV_1 as shown on table 3 below. Table 4 shows the sex differences in the spirometric parameters of the participants. The males had higher values when compared with females in FEV_1 and FVC. The difference was statistically significant.

Table l: Lung function values for the subjects

Variables	Prebronchodilator (Mean +SD)	Postbrochodilator (Mean +SD)
PEF (L/Min)	286.0 ± 107.0	348.0 ± 114.0
FEV_1	1.97 ± 0.87	2.32 ± 0.95
FVC (L)	2.67 ± 1.02	2.87 ± 0.97
FEV_1/FVC (%)	75.22 ± 10.8	79 ± 11.0
Reversibility FEV_1 (%)	----------	20.13 ± 11.26
Reversibility PEF (%)	----------	22.73±12.71
FEV_1 predicted	75.0 ± 25.7	82.0 ± 24.3

Table 2: Percentage predicted FEV_1 and PEF values of the study subjects.

% Predicted lung function values	FEV_1 Predicted frequency (%)	PEF Predicted frequency (%)
< 59	23 (35.4)	23 (35.4)
60 – 79	16 (24.6)	19 (29.2)
80 – 99	20 (30.8)	17 (26.2)
>100	6 (9.2)	6 (9.2)

Table 3: Lung function values obtained before and after bronchodilator inhalation

Lung function parameters	Pearson correlation (r)	
	Pre-bronchodialator	**Post-bronchodialator**
Measured FEV_1 Vs PEF	0.83	0.85
Predicted FEV_1 Vs PEF	0.85	0.67
Measured FVC Vs PEF	0.79	0.77
Predicted FVC Vs PEF	0.80	0.72

Table 4: Gender differences in the lung functions test of the subjects

Pulmonary Function Tests	Male Mean ± Standard Deviation	Female Mean ± Standard Deviation	Independent t-test	*p*-value
PEF (L/Min) pre	310.0±123.0	268.0±82.0	I .65	0.103 (NS)
PEF(L/Min) post	380.0±147.0	326.0±89.0	I .84	0.070 (NS)
FEV_1 (L) pre	2.29± I .08	1.75±0.59	2.59	0.012 (S)
FEV_1 (L) post	2.73±1.18	2.03±0.60	3.14	0.0036 (S)
FVC (L) pre	3.13±1.28	2.34±0.60	3.33	0.001 (S)
FVC (L) post	3.46±1.15	2.45±0.54	0.54	0.0000 (S)

NS = Not Significant, S= Significant

DISCUSSION

Spirometry is often used in determining the extent of airways impairment. Spirometric parameters used for the estimation of pulmonary functions are FVC, FEV_1 and PEF. Both FEV_1 and PEF are useful in the assessment and monitoring of asthmatic patients on treatment. Spirometry is the gold standard in the evaluation of pulmonary function, but it is observed that most health facilities in Nigeria still do not have Spirometers to carry out spirometry on patients with respiratory diseases, likely due to cost. On the other hand, peak flow meter is portable, less expensive and the simplest of the tools of lung function measurement.

In this study the mean pre-bronchodilator FEV_1 was I .97 ± 0.87L, as against the post bronchodilator FEV_1, value of 2.32 ± 0.951. The mean pre-bronchodilator PEF was 286 ± 107 L/min while the post-bronchodilator PEF was 348 ± 114L/min. The predicted pre-bronchodilator FEV_1 was 75 ±25.7L. Only 40% of the study subjects had normal predicted FEV_1 values as against 35.4% for PEF. Sixty percent of the respondents had predicted FEV_1 value of < 80% in contrast to 64.4% for PEF. One of the significant findings of this study was that the same number of subjects, 23 (34.6%) had FEV_1 and PEF predicted values of <59%.

These results demonstrated the usefulness of PEF monitoring in the assessment of airways obstruction although it is not an equal alternative to FEV_1. PEF and FEV_1 represent function of airway portions different from each other[13] and PEF may underestimate or overestimate the severity of airway obstruction. A study had shown that in asthma clinical trials, FEV_1 is better than PEF as a clinic-measured physiologic parameter, but PEF is useful in ambulatory monitoring.[7]

Pulmonary function is affected by various factors including sex, age, height, weight, environment and ethnicity.[14,15] Our study revealed that the males had higher values when compared with females in FEV_1 and FVC and the difference was statistically significant. Spirometric indices for the study subjects showed a mean pre-bronchodilator FEV_1 of 2.29± 1.00 and 1.75 ± 0.59L, FVC of 3.13± I.28L and 2.34 ± 0.60L for males and females respectively. Generally, the lung volumes and capacities of males were higher than females. When males and females were matched for height, weight and age, males were found to have higher lungs volumes and capacities than females. This could be explained by the gender-dependent lung size differences.

In this index study, there was a significant correlation between PEF and FEV_1. These findings are similar to the work of Gautrin, et al[16] who found a high correlation between FEV_1 and PEF among their study subjects. A study among acute asthmatics in Korea by Iseon, et al[17] also revealed a high correlation between PEF and FEV_1, but PEF was found to underestimate severity of bronchial obstruction in acute asthma. However, change in FEV_1 was only moderately associated with change in PEF in another study.[18]

CONCLUSION

This study showed a statistically significant correlation between PEF and FEV_1 among the study subjects. Since PEF correlates with FEV_1 and peak flow meter is portable, affordable and accessible, the use of peak flow metres should be encouraged as self-monitoring tools of airway obstruction and a tool for monitoring the response to a bronchodilator therapy among patients with bronchial asthma.

STUDY LIMITATIONS

The relatively small sample size of this study could limit the generalization of the findings to the general population of asthmatics.

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AUTHOR CONTRIBUTIONS

Author JJ conceptualized the research, collected data and wrote the draft of the manuscript. Author ATE conducted data analysis. Author IPO prepared the final draft of the manuscript. All authors read and approved the final draft of the manuscript.

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None.

COMPETING INTERESTS

The authors declare that there are no competing interests.

ETHICAL CONSIDERATION

Ethical clearance was obtained from the Research and Ethical Clearance Committee, OAUTHC and informed consent was obtained from all the study subjects.

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Original Article

EXAMINATION OF BREAST CANCER SCREENING BEHAVIOUR AMONG FEMALE SECONDARY SCHOOL TEACHERS IN RIVERS STATE

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Abstract

Background: Female secondary school teachers play a very important role in creating basic awareness about breast cancer screening among their students.

Objective: To examine breast cancer screening behaviour among female secondary school teachers in Rivers State.

Materials and Methods: This was a descriptive survey conducted among female secondary school teachers in Rivers State. A multistage sampling technique was used to select 720 participants from ten LGAs in the two areas (upland and riverine area) of the State. A validated semi-structured questionnaire with a reliability coefficient of 0.85 for screening practice was used to collect data. Data collected were analysed using IBM SPSS Statistics version 21 and presented in tables and percentages.

Result: About 60% of female secondary school teachers in Rivers State had a low extent of breast cancer screening practice.

Conclusion: Female secondary school teachers in Rivers State have a poor breast cancer screening behaviour.

Keywords: Breast cancer, Female teachers, Screening and screening behaviour.

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INTRODUCTION

The breast is a mammary gland, it lies within the pectoral region. Breast cancer is a disease that affects the breast and it occurs due to the over proliferation of breast cells. Screening is the examination of individuals without symptoms of any form, in order to detect disease or find out if they are at increased risk of a specific disease. It is often the first step in making a definitive diagnosis. The purpose of breast cancer screening is to find women who have breast cancer before the appearance of any symptom, in order to offer treatment early. It aims at detecting the disease at an early stage to improve treatment outcome.[1,2] The screening practice of individuals is very important for the effective control of breast cancer. Early detection of breast cancer which is key to positive treatment outcome can be achieved through good screening practice. Early detection of breast cancer through regular screening activities such as mammography/breast self-examination (BSE), clinical breast examination (CBE) and magnetic resonance imaging (MRI) have been found to decrease mortality rates by 25-30%.[3]

Screening mammography is a low dose X-ray examination modality with high resolution that reveals changes in the breast that may be cancerous.[4,5] Breast self-examination as a breast cancer screening method is a process whereby women examine their breast regularly to detect any abnormal lumps or swelling in order to seek prompt medical attention. It is a noninvasive adjuvant screening method for detection of early breast cancer.

When mammography screening facilities are not available in the rural and poor urban areas, breast self-examination becomes a useful measure for the detection of breast cancer. Though the procedure of breast self-examination is simple, and requiring little time, it can only be practiced with the right attitude in order to sustain it and achieve the desirable goal of early diagnosis and treatment before metastasis, which is a prerequisite for better outcome. Breast self-examination is an important method for the prevention of breast cancer when it is being carried out accurately and appropriately. Breast self-examination carried out once monthly between the 7th and 10th day of menstrual cycle helps individuals in detecting breast cancer at the early stages of growth when there is low risk of spreading, ensuring a better prognosis when treated.[6,7] A woman who correctly performs BSE monthly is more likely to detect a lump (if any) at early stage of breast cancer development.[8,9]

Clinical breast examination is a breast cancer screening method which involves a thorough physical examination of the breast by a medical practitioner. The physical examination include; visual inspection, palpation to examine for breast tenderness, breast lump and axillary lymph nodes.[10] Magnetic resonance imaging as a form of breast cancer screening method utilizes magnetic fields to create detailed cross-sectional images of tissue structures, providing very good soft tissue contrast.[4,5,6] MRI utilizes magnetic fields to cause changes in the movement of protons in fat and water and creates images of the breast by measuring the differences in tissue relaxation characteristics. MRI may particularly be helpful in certain situations. The use of MRI for breast cancer detection is based on the concept of tumor angiogenesis or neo-vascularity.[11]

There are several factors that can influence breast cancer screening behaviour, these factors include; lack of knowledge about where to go for screening, inconvenience, cost of screening, feeling embarrassed to seek such service, worry, fear of the screening outcome, unwillingness to adhere to doctors' recommendations, fear of pain from the screening procedure, provider unavailability, cultural beliefs about fate, the absence of support from friends; family members and spouse, absence of signs of breast tumour, unavailability of screening facilities. Others are not knowing the breast self-examination technique, not trusting one's own examination, concerns about lack of recognition, and forgetting the schedule of BSEs.[12-14] In addition, socioeconomic status, distance of screening facilities, age of the individual, health and disability, lack of breast cancer awareness, stigmatization, beliefs about breast cancer, religion and unemployment can also influence breast cancer screening.[15,16] Women of higher socioeconomic status participate more in breast cancer screening programmes than women of low socioeconomic status.[15,16]

The access factor is a multidimensional concept based on five major dimensions which are; availability of health facilities, accessibility of care facilities, affordability of health services, accommodation and acceptability.[17] Availability and accessibility are spatial in nature. Availability is about the handiness of health care facilities and the adequacy of supply of health care providers while accessibility is about travel barriers to health care facilities and health care providers. The travel obstacles include; travel distance to health facilities, cost and duration. When the locations of the breast cancer screening sites are not accessible for women, especially those living in low-income countries, they will not develop the interest of subjecting themselves to breast cancer screening. For example, most mammography screening centres are located in far areas and they are not accessible for people living in rural areas.[17,18] Fear of costs of screening has been an obstacle to participation in screening programme among women with low income.[19] Most women who are unemployed do feel unwilling to ask for financial assistance from their husband and kids to go for screening.[20,21,22]

Language barrier is also one of the factors that determine the participation of individuals in screening programme. Many women face significant language difficulties when they access health facilities, including seeing practitioners and attending a mammography screening programme. This barrier can keep women away from learning about programmes for the early detection of breast cancer. Some women, who do not understand certain general language perfectly, find it difficult to explain their health concerns to their health care providers in deep detail. Many also lacked confidence about seeking help from health professionals as they are confused by medical

terminologies. Most require an interpreter to explain their concerns to the providers and to understand what the providers' offers are.[23]

There are some benefits of participation in breast cancer screening and these include early detection of breast cancer. Treatment for early-stage cancer is mild with less complication and higher rates of successful treatment. Successful treatment will prevent the occurrence of advanced cancer.[1] In Nigeria, like other underdeveloped countries, breast cancer cases are characterized by late presentation of patients at advanced stages of the illness when nothing rewarding can be done in order to prevent the death of the patient.[24,25] Female secondary school teachers play a very important role in creating basic awareness about breast cancer screening among the younger generation. Previous school-based studies highlighted the knowledge and practice of breast cancer screening among female secondary school teachers.[3,26] This study sought to examine breast cancer screening behaviour among female secondary school teachers in Rivers State.

METHODOLOGY

This was a descriptive survey conducted in secondary schools in Rivers State, Nigeria. Rivers State is one of the 6 states in the south-south region of Nigeria. There are both government owned and privately owned secondary schools in Rivers State spread across the local government areas (LGAs). The study population were female teachers in government secondary schools in Rivers State. Ethical approval and a letter of introduction was obtained from the Department of Human Kinetics Health and Safety Studies, Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt.

A minimum sample size of 381 was derived for the study using Taro Yamane formula[27] as follows:

Sample size, $n = N/((1+Ne^2))$

Where N = Population size = 7939

e = precision/level of significance = 0.05

$$n = \frac{7939}{1 + 7939(0.05)^2}$$

$= 380.8130 \sim 381$

A multistage sampling technique which included cluster sampling technique, simple random sampling technique and purposive sampling techniques was used to select respondents. In the first stage, the study area was clustered into two (upland and riverine area). Upland area had fourteen (14) LGAs and four hundred and forty (440) government secondary schools with six thousand, eight hundred and twenty-four (6,824) female teachers. The riverine area consisted of nine (9) LGAs and one hundred and forty-six (146) government secondary schools with one thousand, one hundred and fifteen (1,115) female teachers. In the second stage, five (5) LGAs were randomly selected from each of the clustered areas through balloting (with non-replacement method). The selected LGAs were Tai LGA, Ahoada West LGA, Obio/Akpor LGA, Etche LGA, Ikwere LGA, Ogu Bolo LGA, Okrika LGA, AkukuToru LGA, Abua/Odual LGA and Degema LGA. In the third stage, all the female teachers in the government secondary schools in each of the selected LGA, who were capable of responding and who gave consent to participate were selected. This eventually resulted in a final sample size of 720.

Permission was sought to carry out the research through the letters to the heads/principals of the schools. The instrument for data collection was a semi-structured questionnaire titled Examination of Breast Cancer Screening Behaviour Questionnaire (EBCSBQ). The aim and procedure of the research was explained to the teachers and consent obtained from them before administering the questionnaires. The questionnaire was administered directly to the respondents by the researcher with the help of two experienced research assistants. Instructions regarding the filling of the instrument were intensively explained to the respondents, and the filled instruments were collected on the spot. A total number of 720 copies of questionnaire were administered and retrieved with a return rate of 100%. It took an hour to fill a questionnaire, and two and half months to gather data.

The data collected were entered into a spreadsheet and cleaned for easy analysis, it was then transferred to IBM SPSS Statistics version 21 for descriptive analysis and results presented using percentages.

RESULTS

Table 1 shows that generally, majority of the respondents practiced breast cancer screening to a low extent (52.2%). Only 47.2% of the respondents did perform breast self-examination 7-10 days after their menstrual cycle, 51.3% had never performed breast self-examination ever, and 50.7% had not gone for clinical breast examination for breast cancer detection. Also, 53.5% of the respondents never had a mammography. Thus, overall female secondary school teachers in Rivers State had poor breast cancer screening behaviour.

Table 1: Screening behaviour of female secondary school teachers

S/N	Screening Practice	Yes	No	Population Verdict
1	Have you ever performed a breast self-examination?	351 (48.7%)	369(51.3%)	**Low Extent**
2	Do you practice breast self-examination 7-10 days after your menstrual cycle?	340(47.2%)	380(52.8%)	**Low Extent**
3	Have you ever gone for clinical breast examination for breast cancer detection?	355(49.3%)	365(50.7%)	**Low Extent**
4	Do you go for clinical breast examination once every three years?	350(48.6%)	370(51.4%)	**High Extent**
5	Do you go for clinical breast examination annually?	351(48.7%)	369(51.3%)	**Low Extent**
6	Have you ever had a mammography screening?	335(46.5%)	385(53.5%)	**Low Extent**
7	Did you have mammography at least once in three years?	329(45.7%)	391(54.3%)	**Low Extent**
	Population Screening Behaviour	**47.8%**	**52.2%**	**Poor**

DISCUSSION

The findings of the study in Table 1 indicated that secondary school female teachers in Rivers State had poor breast cancer screening behaviour. The findings of this study were not expected, thus surprising because the respondents were expected to have a good screening behaviour due to their educational status. The findings of this study are similar to that of Parsa et al,[28] who carried out a study on factors associated with breast self-examination among Malaysian female teachers who had a low rate of practice of breast self-examination. Only 19% of the women performed BSE regularly. Izanloo et al[29] conducted a study on knowledge and attitude of women regarding breast cancer screening test in eastern Iran and found that the attitude of Iranian women towards breast cancer screening was poor and the lack of knowledge of the respondents was the main barrier to their participation in breast cancer screening practices. More than 84% of the respondents were not well informed about breast cancer and its screening tests. Korkut,[30] undertook a study on assessment of knowledge, attitudes, and behaviours regarding breast and cervical cancer among women in western Turkey and found that almost all the women (95.5%) had inadequate frequency of performing screening tests. Birhan et al,[9] conducted a study on practices of breast self-examination and associated factors among female Debre Berhan university students and found that the respondents had poor screening behaviour. Nde et al,[31] reported on the knowledge, attitude and practice of breast self-examination among female undergraduate students in the University of Buea, where majority of female students did not practice breast self-examination as a screening method for early detection of breast cancer. They also found that majority of the female students had never been to any health facility for clinical breast examination; only 3% performed BSE regularly.

The findings of the study differ from that of Sreedharan et al[32] who conducted a study on breast self-examination: knowledge and practice among nurses in United Arab Emirates, where the nurses had a satisfactory knowledge (96.1%) of BSE and this was reflected in their practice of BSE. A high proportion (84.4%) of the respondents, reported performing BSE. Yakubu et al[33] undertook a study on knowledge, attitudes, and practice of breast self-examination among female nurses in Aminu Kano teaching hospital, Kano, Nigeria, where the nurses were

aware of breast self-examination, with 91.2% practicing it, but there was appallingly poor knowledge of its method, timing, and frequencies among the female nursing staff included in the study. The variation between the finding from this study and that of Sreedharan et al[32] and Yakubu et al[33] could be due to the profession of the respondents who were nurses, and nurses are likely to have more knowledge on general health than teachers.

CONCLUSION

Based on the findings of the study, it was concluded that female secondary school teachers in Rivers State had poor breast cancer screening behaviour.

AUTHOR CONTRIBUTIONS

Author IME designed the study and wrote the protocol which was reviewed by all authors; led data collection and analysis and wrote the initial draft of the manuscript. Authors MAK and KPL managed literature search and attended all manuscript revisions. All authors read and approved the final draft.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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ETHICAL APPROVAL

Ethical approval was obtained from the Department of Human Kinetics Health and Safety Studies, Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt.

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