

Original Article

**SPIROMETRY PATTERNS EVALUATION AMONG PATIENTS IN
NIGER DELTA UNIVERSITY TEACHING HOSPITAL
SOUTH SOUTHERN
NIGERIA**

Kiridi EG¹, Pughikumo DT¹, Joffa PPK¹ & Lelei S²

Affiliation: ¹Human Physiology, Niger Delta University

²Bayelsa State College of Health Technology

**Corresponding Author: Kiridi EG,
Human Physiology, Niger Delta University**

ABSTRACT

Respiratory distress is among health challenges causing disabilities and mortality; and studies in this area potent beneficial implication in patient care and public health initiatives. Hence this research was aimed at assessing spirometry patterns in patients presenting with respiratory illness at a tertiary health facility, with a view to ascertain the spread of some of these airway disorders. A retrospective cross-sectional study of patients' records over duration of one year formed the basis of data collection, collation, analysis and inference drawn. The spirometry findings of a total of 235 patients between age ranges 5 to 90 years were analyzed. More patients with respiratory disorders were within age range 51 - 60 years. Females were more (57.7%) than males (41.9%). Inference from this spirometry evaluation report suggests that, generally obstructive pattern and restrictive patterns were predominant amongst the patients.

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Key words: Spirometry, respiratory disorder, age, sex, residual volume

INTRODUCTION

Over the past 150 years, the lungs have been a focal point for disability and mortality due to various diseases. While some conditions have diminished in prominence, others have arisen, and still, others have fluctuated over time. Despite these changes, understanding of respiratory health keeps advancing; as modern medical technology allows exploration of the intricacies of the lungs in various ways over the 19th century ¹. There is expanding array of tools enabling enhanced comprehension and capabilities in managing respiratory health and treatments to combat respiratory disorders. For instance, the tool – spirometer; underlies spirometry which is a physiological diagnostic procedure that assesses integrated mechanical function of the lung, chest wall, respiratory muscles and airways by measuring the total volume of air exhaled from a full lung (total lung capacity) to maximal expiration (residual volume)². It measures two key factors; forced vital capacity (FVC) and forced expiratory volume (FEV) in one second. In advent of obstructed airways diseases, forced expiratory volume is reduced, translating to a lower FEV/sec and FEV1/FVC ratio.

FVC is one of the primary spirometry measurements, and it is the total amount of air that can be forcefully expired out of the lungs after maximum inspiration.

In restrictive lung disease, forced vital capacity is reduced². An abnormal forced expiratory capacity could be due to restrictive or obstructive lung disease. Patients could have an obstructive or restrictive lung disease by itself, there is also possibility of mixed restrictive and obstructive lung disease.³

Forced expiratory volume in one second is the second key spirometry measurement. This is the maximum air forcefully expired in one second. This measurement can help clinicians evaluate the severity of respiratory disease. Forced expiratory volume reading in one second which is lower than expected indicates obstruction ⁴. Forced expiratory volume/Forced vital capacity ratio is a number that represents the percentage of the lung capacity forcefully exhaled in 1 second, the absence of restrictive lung disease that affects FEV1/FVC ratio. A low ratio suggests obstructive or mixed respiratory disease ⁵.

This investigation determined spirometry patterns of individuals presenting with respiratory illness at the Niger Delta University teaching hospital (NDUTH), Okolobiri, Bayelsa State with a view of ascertaining the spread of some airway disorders. This is hoped will have far-reaching implications for both individual patient care and public health initiatives and policies.

Chronic obstructive pulmonary disease (COPD) is a common lung disease causing restricted airflow and breathing problems. It is sometimes called emphysema or chronic bronchitis. People with COPD, the lungs can get damaged or clogged with phlegm. Symptoms include cough, sometimes with phlegm, difficulty breathing, wheezing and tiredness. COPD is not curable but symptoms can improve if one avoids smoking and exposure to air pollution and gets vaccines to prevent infections. It can also be treated with medicines, oxygen and pulmonary rehabilitation ^{4,5}

A normal spirometry graph is characterized by a rapid rise in airflow, peaking quickly before a gradual decline. But a reduced peak flow and a concave curvature after the peak, signals airway obstruction that hinders air expulsion; typifying several disorders ⁵⁻⁸

Several factors can negatively influence functioning of respiratory system. They include Environmental Factors: Pollution, smokes or hazardous fumes, allergens, and other airborne irritants, these have negative effects on respiratory system and can impact lung function. Exposure to these irritants can lead to chronic conditions like asthma and bronchitis, contributing to a decline in lung capacity and efficiency⁹

Lifestyle Choices: Both active smoking (smoking cigarettes or other tobacco products) and passive smoking (inhaling smoke from others' cigarettes) can damage the lungs, increasing risks. Poor diet and lack of exercise can also contribute to respiratory issues by weakening the body's overall health and immune system, making it more vulnerable to infections and respiratory diseases ¹⁰

Medical Conditions: There are several medical conditions that can impact respiratory health. Asthma is a chronic inflammatory disease of the airways that can cause wheezing, coughing, and shortness of breath. COPD is a group of lung diseases, including chronic bronchitis and emphysema that make breathing hard. Pneumonia also leads to cough, fever, and difficulty breathing.

Lung cancer is a type of cancer that starts in the lungs and can spread to other parts of the body

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Genetics: Genetic factors can play a role in respiratory health. Some people may inherit genes that predispose them to certain respiratory conditions, such as asthma or cystic fibrosis. Additionally, genetic variations can influence how an individual's respiratory system responds to environmental factors like pollution or allergens¹²⁻¹⁵

Age: As people age, their lung function naturally declines. Lung tissue becomes less elastic, and the muscles that support breathing may weaken, making it harder to breathe efficiently. This age-related decline in lung function makes older adults more susceptible to respiratory infections and diseases.

Occupational Hazards: Exposure to certain chemicals or particles in the workplace can damage the respiratory system. Workers in industries such as mining, construction, agriculture, and manufacturing may be exposed to dust, fumes, chemicals, or other pollutants that can irritate the lungs and lead to respiratory problems over time.

Allergies: Exposure to certain chemicals or particles in the workplace can damage the respiratory system.

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Physical Activity: Regular exercise can improve lung function and overall respiratory health by strengthening the muscles involved in breathing and increasing lung capacity. Aerobic activities such as to walk, run, swim and cycle can enhance heart health with lung efficiency. Conversely, sedentary behavior can lead to decreased lung function and respiratory problems over time.

METHODOLOGY

The investigation was done in lung unit at NDUTH Delta, Okolobiri, Bayelsa. It involved a retrospective cross-sectional study over duration of one year, (Jan to Dec 2023) review of patients' records that had spirometry during the course of evaluation for respiratory diseases.

Data were retrieved via electronic health records and information included sex, forced expiratory capacity (FVC), forced expiratory volume in second (FEV1), peak flow volume. All spirometry tests were conducted using a Standard Spirometer (MIR Spirolab III)

The study was a hospital base retrospective cross-sectional one that examined spirogram of one-year period in 2023.

Standard Spirometer (MIR Spirolab III) investigation for both young and old patients' records in cardiorepiratory unit was accessed. The findings of were classified as normal

pattern, mild /severe obstructions, severe restrictive diseases, moderate restrictive diseases, mild restrictive diseases, mixed diseases. Data was analyzed using SPSS version 17.0 and results illustrated in pie chart, bar chart and table.

RESULTS

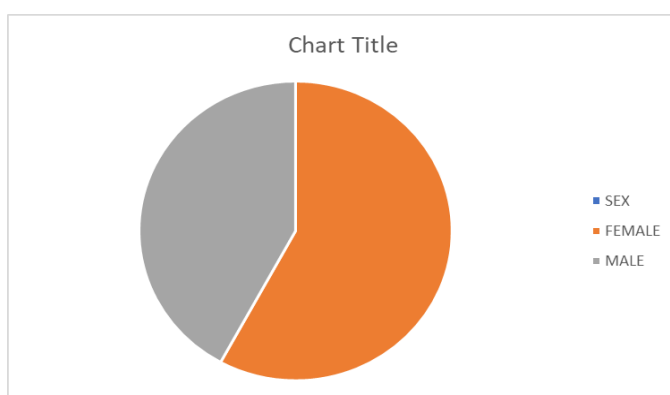


Fig 1: Pie chart of gender spread.

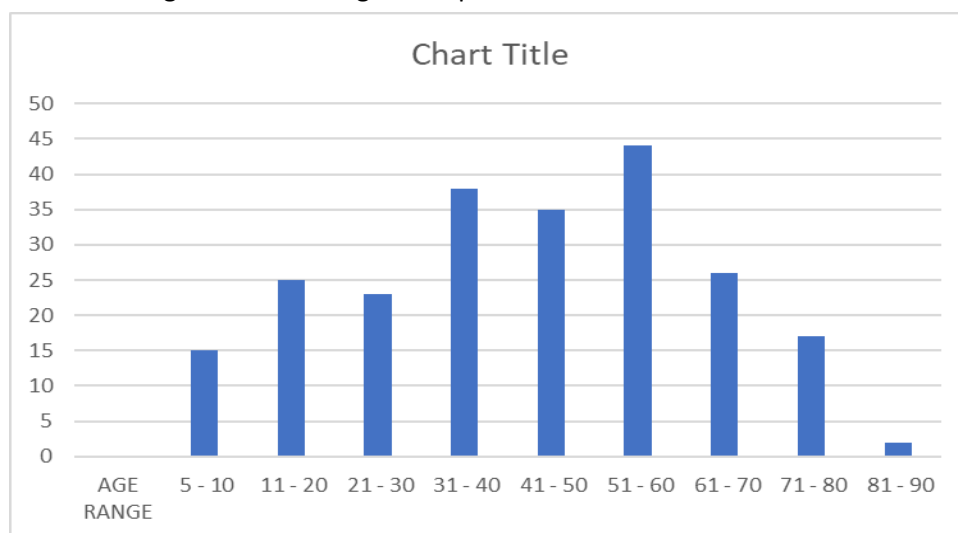


Fig 2: Bar chart of age spread

Table 1: Test Indication

Outcome	No of patients
Bronchial asthma	25
COPD	18
Difficulty in breathing	18
Asthma	15
Chronic cough	5
Chest infection	1
Total	63

Table 2: Spirometry pattern along age ranges

Age Range (Years)	SPIROMETRY PATTERN					
	Normal	Possible severe restriction	Moderate restriction	Mild restriction	Mild/severe Obstruction	Obstruction& possible Restriction
5 – 10	3	3	2	0	1	4
11 – 20	5	4	3	1	4	8
21 – 30	3	2	1	3	11	5
31 – 40	3	4	10	3	12	8
41 – 50	8	6	5	1	7	14
51 – 60	6	6	1	4	15	15
61 – 70	3	4	0	0	9	9
71 – 80	1	5	0	0	8	3
81 – 90	0	0	0	0	2	0
Total	32	34	22	12	69	66

Table 3: Percentage of Diagnosed Diseases

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	possible severe restriction	36	14.6%	14.8	14.8
	possible moderate restriction	21	8.5%	8.6	23.5
	restriction				

possible mild restriction	16	6.5%	6.6	30.0
obstruction and possible restriction	68	27.6%	28.0	58.0
severe/mild obstruction	70	28.5%	28.8	86.8
normal spirometry	32	13.0%	13.2	100.0
Total	243	98.8%	100.0	
Missing System	3	1.2%		
Total	246	100.0%		

Indications for Spirometry

Results for 235 patients analyzed, reflecting indication for spirometry in Table 1 shows 25 patients had bronchial asthma, 18 patients had chronic obstructive pulmonary disease, 18 patients had difficulty in breathing, 15 patients had asthma, 5 patients had chronic cough, 1 patient had chest infection.

Age and Sex Distribution of Patients

As observed, severe restrictive patterns were much for age range forty-one to 50 years, 51 - 60, while moderate restrictive patterns are more among age range 31-40 years, normal pattern is more among age range 51- 60years. Mild severe obstruction is more among 51-60 years, obstruction and possible restrictive pattern is more among 51-60 years.

The distribution of patients by sex was comparable, though females were more (57.7%) than males (41.9%) as seen in figure 1.

DISCUSSION

The present study assessed the spirometry patterns in patient at NDUTH. A total of two hundred and fourth-six spirometry test were carried out between January and December 2023. And investigation reveals the highest spirometry forms of mild severe obstruction, then obstruction and possible restriction in that order of prevalence; corroborating report of Jumbo et al, (2021) stating that obstruction pattern is the most predominant abnormality in spirometry requests in the south-south part of the country.

This study appears to give credence to obstructive and restrictive patterns/diseases being more common / prevalent; although the study also shows that some patients had the disease at varying levels - mild, moderate and severe. Mild restriction generally implies slight limitations that have minimal impact on daily activities, while moderate restriction indicates more noticeable limitations that require greater adjustments and can affect daily life more significantly.

This study also shows normal evaluation for age 41- 50.

Although, the rest patterns mild/severe obstructive, obstructive and possible restrictive patterns was observed in older subpopulation (51 – 60 years) while severe restrictive was observed within age range 41 – 50 and 51 – 60 years. This appears to implicate aging as risk (Table 2). Considering the age range for normal spirometry patterns, wherein relatively young subpopulation had normal values, it may be inferred that functioning of lungs is healthier in younger population.

Patterns related to sex shows that majority of the diseases were found among female (57.7%) than males (41.9%); implying that females may be more prone to these diseases than male.

In conclusion, it may be inferred from this spirometry evaluation report that, generally obstructive pattern and restrictive patterns were the predominant seen amongst patients. This current study population captured all six patterns among which mild / severe obstructive pattern was the commonest alongside restrictive pattern (mild, moderate, severe). Although the investigators adopted records as accessed, and there could be typographical errors and some parameters not written down at some point constituting limitations.

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