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Ugiagbe EE, Ugiagbe RA Causes of sudden natural death: A medico-legal autopsy study of medical cases in an African referral centre. East African Medical Journal 2012; 89: 332-338

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CHILDHOOD INTUSSUSCEPTION: PATTERN OF PRESENTATION, MANAGEMENT AND OUTCOME IN A BUDDING RURAL TERTIARY CENTRE IN SOUTH-SOUTH NIGERIA

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Abstract

Background: In a budding paediatric surgery unit of a rural tertiary centre, it is necessary to study the pattern of presentation, management and outcome of childhood intussusception considering its surgical significance. This formed the basis of this study.

Methods: This was a cross-sectional study in which all patients within the paediatric age group (0 – 17 years) managed for intussusception between September 1st, 2014 and August 31st 2021 in the paediatric surgery unit were reviewed. Data collected were analysed as frequencies and proportions using IBM SPSS Statistics version 21. The results were presented in tables, bar charts and pie charts where applicable.

Results: Thirty-nine patients were managed for intussusception with 20 males (51.3%) and 19 females (48.7%). Majority of patients (87.2%) were under 1 year old with six-month old infants mostly affected. More patients (25, 64.1%) presented after one day of onset of symptoms. The highest number of case presentations occurred in the month of December (6, 15.4%), followed by August (5, 12.8%). Twelve cases (30.8%) were initially managed as bacteria dysentery (gastroenteritis) before referral. Twenty-seven patients (69.2%) presented with the classical triad of vomiting, colicky abdominal pain and red currant jelly stools. The typical sausage-shaped mass was demonstrated in 21 patients (53.8%) and 10 patients (25.6%) among the late presenters had features of shock at presentation. Only one patient (2.6%) had prolapsed intussusception in the study. Almost all patients had operative treatment (37, 94.9%) with bowel resection and anastomosis done for 15 (38.5%). Fewer patients (11, 28.2%) had post-operative complications of which most were site infection 5 (45.5%). Number of mortalities was 2 (5.1%).

Conclusion: Continuous medical education on intussusception is required for health care workers in the rural setting as well as orientation of the populace to ensure early presentation of cases. This coupled with provision of facilities for non-operative treatment of intussusception will improve outcome in rural tertiary centres.

Keywords: Childhood, Intussusception, Presentation, Management, Outcome.

INTRODUCTION

Intussusception is the invagination of a bowel segment into an immediately adjacent distal segment; albeit invagination into a proximal segment has been reported.¹⁻⁴ It commonly affects children from 3 months to 3 years with peak at 4 – 10 months.¹⁻⁴ It is the commonest cause of intestinal obstruction in infants.¹⁻⁴ It is of utmost surgical significance because it causes a strangulating bowel obstruction which is prone to bowel gangrene when intervention is delayed.^{1,2} Seasonal variations coinciding with periods of acute viral infections has been reported.¹⁻⁴ Male children are more affected according to most reports.¹⁻⁴

Abdominal pain commonly manifested as intermittent cries with crouching, vomiting and passage of mucoid-bloody stool are the triad of symptoms of intussusception.^{1,2} A sausage shaped mass may be palpable while complicated cases manifest fever and features of peritonitis.^{1,2} Diagnosis is readily made with barium enema or abdominal ultrasound scan with the former also therapeutic as hydrostatic reduction. Non-operative reduction (hydrostatic or pneumatic) is mostly employed in developed centres for treatment of intussusception, especially as patients present early. Complicated cases usually require operative management.^{1,2,4,5}

In a budding paediatric surgery unit of a rural tertiary centre, it is necessary to study the pattern of presentation, management, and outcome of childhood intussusception considering its surgical significance. This formed the basis of this study.

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METHODS

This was a cross-sectional study in which all patients within the paediatric age group (0 – 17 years) managed for intussusception between September 1st, 2014 and August 31st 2021 in the paediatric surgery unit of Irrua Specialist Teaching Hospital (ISTH) were reviewed. ISTH, a tertiary health facility located in a rural setting, is situated in Irrua, the administrative headquarters of Esan Central Local Government Area of Edo State, Nigeria.⁶ It is a 434-bed hospital with medical and surgical wards.

Data collected included demographic characteristics, pattern of presentation, management and treatment outcome for each patient. The categorical variables were analysed as frequencies, and proportions and presented in bar charts and pie charts. All analyses were conducted using IBM SPSS Statistics version 21.

RESULTS

Thirty-nine patients were managed for intussusception in the paediatric surgery unit during the period of review. Twenty (51.3%) of the patients were male while 19 (48.7%) were female. The age and sex distribution of the patients is shown in Table 1

Table 1: Age and Sex Distribution of patients

Variable	Frequency n=39	Percent (%)
Sex		
Male	20	51.3
Female	19	48.7
Age (months)		
3	1	2.6
4	3	7.7
5	2	5.1
6	13	33.3
7	3	7.7
8	5	12.8
9	4	10.3
10	2	5.1
11	1	2.6
12 – 36	5	12.8

Clinical Presentation

The highest number of case presentations occurred in the month of December (6, 15.4%), followed by August (5, 12.8%), see Table 2. More patients (25, 64.1%) had symptoms for 2 days or more before presentation compared to 14 (35.9%), who had symptoms for a day. Twelve cases (30.8%) were initially managed as bacterial dysentery (gastroenteritis) before referral.

Twenty-seven patients (69.2%) presented with the typical triad of symptoms, including intermittent cries (colicky abdominal pain), vomiting, and mucoid-bloody (red currant jelly) stool. Twenty-one patients (53.8%) presented with the typical sausage-shaped mass. Ten patients (25.6%) had symptoms and signs of shock when they presented in the children's emergency room. There was only one case (2.6%) of prolapsed intussusception. Clinical presentation patterns are as shown in Figure 1.

Table 2: Monthly Distribution of patients during the period

Variable	Frequency n=39	Percent (%)
January	4	10.3
February	3	7.7
March	3	7.7
April	1	2.6
May	3	7.7
June	4	10.3
July	1	2.6
August	5	12.8
September	1	2.6
October	4	10.3
November	4	10.3
December	6	15.4

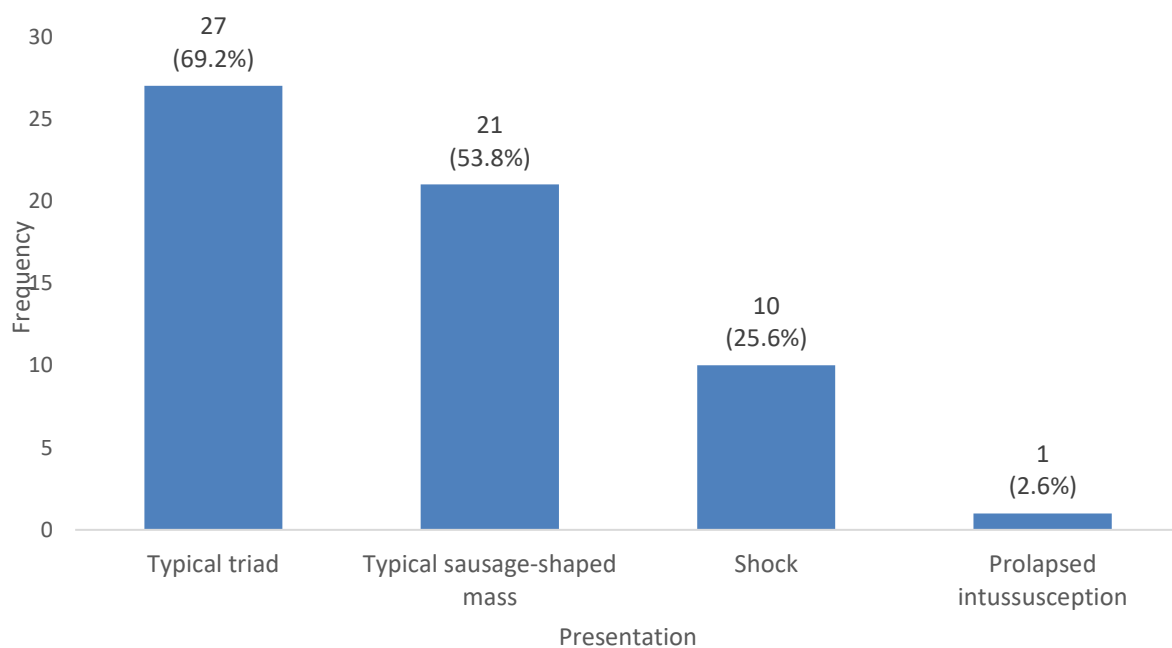
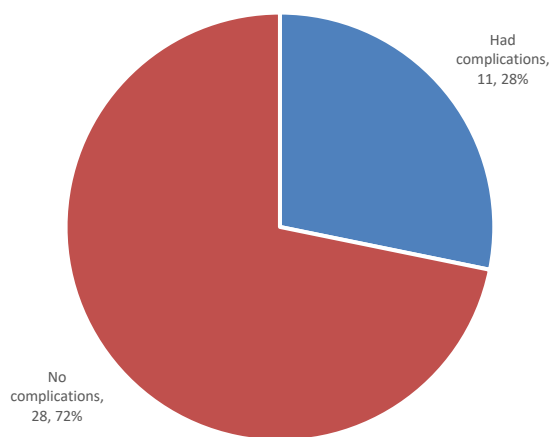


Figure 1: Different presentation patterns of patients (n=39)

Operative treatment was carried out in 37 patients (94.9%) while only 2 (5.1%) had non-operative treatment. For patients operated, 24 (61.5%) had intra-operative findings of viable bowel loops and had manual reduction but 15 (38.5%) had gangrenous bowel which necessitated bowel resection and anastomosis. The

majority of the patients (28, 71.8%) had no post-operative complications. Notable post-operative complications amongst those who had was surgical site infection SSI, 5 (45.5%). Number of mortalities was 2 (5.1%).

A. Complication status (n=39)



B. Type of complications (n=11)

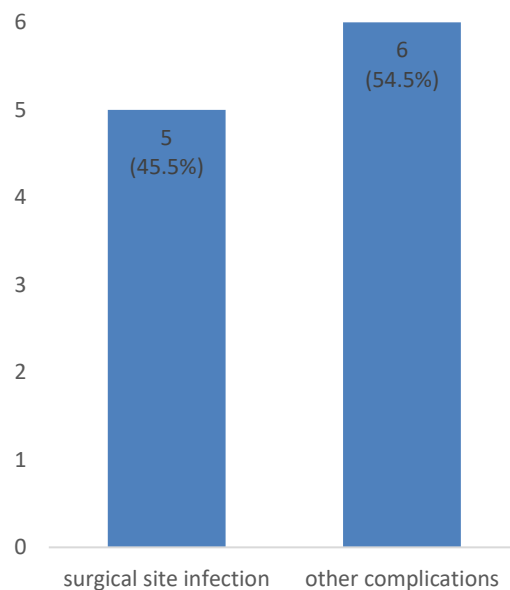


Figure 2: Post operative complications

DISCUSSION

Access to specialist care provided by the establishment of the paediatric surgery unit in our rural tertiary hospital ensured that thirty-nine patients were managed for intussusception during the study period. Although the number is small compared to other reports, it shows that cases of intussusception are thus present for medical care in the rural setting.⁷⁻⁹

The ratio of male (20) to female (19) patients in this study was almost at par (1.1:1.0). This is a marked contrast to other studies, which showed a much higher male to female ratio.⁷⁻¹⁵ However, Edino et al reported female predominance in a study carried out in Kano, Nigeria.¹⁶

It has been established that intussusception mostly affect infants, thus the majority of patients in this study (87.2%) were under 1 year old as corroborated by other studies.^{5,7,10,11,17-20} Six-month old infants were mostly affected probably because weaning is mostly carried out about that time. Unlike reports from developed countries where most patients present in the matter of hours, more patients (25, 64.1%) presented after one day of onset of symptoms.^{5,10,21}

All the patients managed in this study were cases of idiopathic intussusception. That idiopathic intussusception is much commoner among paediatric patients is further buttressed by other works reviewed.^{2,5,7,9,10,16,22} It was observed that

the drier months of August, October, November and December recorded higher number of cases. This confirms the fact that there is a seasonal variation of idiopathic intussusception with viral upper respiratory tract infection and viral gastroenteritis which tend to be commoner in the drier months.^{5,23} This phenomenon has also been observed by other researchers.^{5,7,9,10,18,24}

Twelve patients (30.8%) were initially managed as cases of bacteria dysentery (gastroenteritis) in peripheral facilities but were referred for surgical care when abdominal distention set in. Bacteria dysentery (gastroenteritis) is a close medical differential of intussusception that could easily be mistaken for intussusception where the health care provider is not well acquainted with the diagnostic criteria. These particular cases reflect the lack of awareness of the condition among health care providers in our rural setting and is corroborated by other studies in similar setting.^{7,9}

Twenty-seven patients (69.2%) presented with the classical triad of vomiting, colicky abdominal pain and red currant jelly stools. This value is quite high when compared to other studies carried out in similar setting.^{7,8,10,13} This may be due to the small number of cases involved in this study compared to the other studies. The typical sausage-shaped mass was demonstrated in 21 patients (53.8%) and this is very close to the value of approximately 60% commonly reported in literature.^{2,25} Ten patients (25.6%) among the late presenters had features of shock at presentation. This contrast with 7.69% reported by John and Siji in Kerala, India. [25] Only one patient (2.6%) had prolapsed intussusception in the study. This is not out of expectation since trans-anal protrusion of

intussusception (TAPI) is relatively uncommon.²⁶

Operative treatment was carried out in the vast majority of patients (37, 94.9%) because of lack of adequate facilities to carry out non-operative reduction of intussusception. Fluoroscopy was lacking in the research facility and so barium enema could not be done. However, saline enema (hydrostatic) reduction was attempted under ultrasound guidance in some cases that presented within one day of illness and was successful for only two cases (5.1%). This trend of operative reduction of intussusception is common in developing countries as reported in other studies.^{5,7-9,13,16,27} A sharp contrast is observed in developed centres where non-operative reduction is the norm and operative reduction is done only when bowel perforation is suspected or for failed radiological reduction.²⁸⁻³⁰ Intussusception with pathological lead points invariably require surgery but all the cases managed in this study were idiopathic ileo-colic intussusception.³¹

Bowel resection and anastomosis on account of non-viable bowel was done in 38.5% of cases operated. These were patients who presented late and had a greater level of morbidity on clinical evaluation. Our rate of bowel resection is comparable with the 39% reported by Carneiro and Kisusi in Dar es Salaam, while Chalya et al reported 46.4% in northwestern Tanzania and Kuremu reported 33% in Eldoret, Kenya.^{7,9,10}

Only 11 (28.2%) patients developed post-operative complications of which surgical site infection (5, 45.5%) was commonest. This was in keeping with the reports of some other workers.^{7-11,13,27,31} The number of mortalities was 2 (5.1%) which can be explained by the prompt response given to the patients, albeit the number of patients

involved in the study was small. In centres where very large mortality rate were recorded, it was attributed to delayed presentation, advanced peritonitis and inadequate facilities.¹⁰

CONCLUSION

Many health care workers in the rural setting still mistake intussusception for bacteria dysentery with dire consequence in some instances. Continuous medical education series should be applied to reduce this trend.

Community awareness needs to be increased so that children affected by intussusception can always be presented early to the hospital. Early presentation encourages less morbidity and better outcome.

There is need for tertiary hospitals in rural setting to be equipped with facilities for non-operative treatment of intussusception as this will reduce the unnecessary high rate of operative treatment.

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Malaria Diagnosis and Prescribing Patterns in a Nigerian Tertiary Hospital: Analysis of Patient Records and Resident Physicians' Perspectives

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Abstract

Background: Malaria remains a significant cause of morbidity and mortality in Nigeria. Accurate diagnosis and rational prescribing are essential to reduce antimalarial resistance and optimize patient outcomes. This study evaluates malaria diagnosis and treatment practices among patients admitted to the Medical Emergency Room (MER) of a tertiary hospital in Southern Nigeria and explores prescribing behaviour among internal medicine resident doctors.

Methods: A retrospective review of 536 patient case records in 2022 was conducted. Data on presenting symptoms, diagnosis, laboratory tests, and antimalarial prescriptions were analyzed. In parallel, a cross-sectional survey of 36 internal medicine resident doctors was performed to assess their prescribing decisions and awareness of national guidelines.

Results: Of the 536 patients, 108 (20.1%) were diagnosed with malaria, and 136 (25.4%) had positive malaria parasite (MP) results. Antimalarial agents were prescribed to 88 (16.4%) patients, with 68.2% having confirmed MP positivity. Fever, vomiting, and headache were significantly associated with antimalarial prescriptions. The most common agent was intramuscular alpha–beta arteether. Among residents, 97.2% routinely requested MP tests, but only 30.6% waited for the result before treatment. Oral artemether–lumefantrine was the preferred agent, but parenteral artemether was commonly used when injectables were indicated. Only 22.2% of residents had read the national antimalarial policy.

Conclusion: Although diagnostic and treatment practices show partial adherence to guidelines, presumptive treatment and the use of non-recommended parenteral antimalarials remain prevalent. Training, diagnostic support, and guideline dissemination are essential to promote rational antimalarial use.

Keywords: Malaria Diagnosis, Prescribing Patterns, Tertiary Hospital, Nigeria

Introduction

Malaria remains a major global threat to public health and well-being. In 2023, it was estimated to cause 263 million cases and 597,000 deaths across 83 countries, with sub-Saharan Africa bearing the overwhelming share of this burden.¹⁻³ According to the World Health Organization (WHO), Nigeria alone accounts for approximately 27% of global malaria cases and 23% of malaria-related deaths. Furthermore, reports indicate that malaria is responsible for 40% of hospital admissions and nearly 50% of outpatient visits in the country. This disproportionately high burden underscores the severity of the malaria challenge in Nigeria compared to other nations. In response, Nigeria revised its antimalarial treatment policy in 2005, in line with WHO recommendations.⁴ The country adopted artemisinin-based combination therapies (ACTs) for the treatment of uncomplicated malaria and artemisinin monotherapies for severe cases. While these interventions initially led to significant progress over the past two decades, recent years have seen a stagnation in these gains, particularly in regions with perennial transmission such as southern Nigeria, despite advancements in control strategies and the widespread use of artemisinin-based treatment. The emergence of partial resistance to artemisinins was first reported in 2008 in the Greater Mekong subregion of Southeast Asia.^{5,6} More recently, confirmed cases of partial artemisinin resistance have been documented in several African countries, particularly Tanzania, Rwanda, Uganda, Ethiopia, and Eritrea.⁷⁻¹¹ However, to date, there have been no reports of resistance to artemisinin-based combination therapies (ACTs) in Africa. To mitigate the looming threat and potential impact of artemisinin drug resistance on

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the continent, one key strategy advocated is the optimization of diagnostic and therapeutic practices to reduce drug pressure. Only patients with positive test results should receive antimalarial drugs.^{12,13} Rational use of antimalarials is, therefore, a critical measure not only for improving clinical outcomes but also for slowing the emergence and spread of drug resistance. In the hospital setting, adherence to evidence-based treatment guidelines is essential for ensuring optimal clinical outcomes and limiting the emergence of drug resistance. The Standard Treatment Guidelines (STG) serve as a critical reference document, outlining diagnostic criteria and therapeutic protocols for disease management. By promoting rational pharmacotherapy, STGs enhance the quality and appropriateness of care and also function as valuable educational tools for healthcare providers.¹⁴ Teaching hospitals, as tertiary referral centers, manage both uncomplicated and severe malaria cases, making them pivotal sites for assessing treatment practices and patterns of drug utilization. However, prescribing practices in such settings may vary due to factors such as prescriber preferences, diagnostic availability, patient characteristics, institutional protocols, and preconceived notions about specific medications. Notably, physicians in training—including house officers and resident doctors—frequently initiate and adjust antimalarial therapy under supervision. Their prescribing behavior, influenced by formal education and

bedside clinical experience, may not consistently align with established guidelines, particularly in resource-constrained environments where diagnostic limitations often lead to empirical treatment.

Previous studies have raised concerns regarding inappropriate antimalarial use, including the administration of monotherapies, non-guideline-based regimens, and presumptive treatments without parasitological confirmation. Such practices undermine the quality of care, increase drug pressure, and heighten the risk of resistance development. However, most existing studies have primarily focused on outpatient populations.^{15–19} There remains a paucity of data examining antimalarial prescribing patterns among medical inpatients in Nigerian teaching hospitals, with even fewer studies specifically addressing the role of trainee physicians in these prescribing decision

This study, therefore, aims to describe the patterns of antimalarial drug prescriptions among medical inpatients in a tertiary hospital in southern Nigeria, with particular emphasis on the prescribing practices of physicians in training. The findings are expected to provide insights that will guide targeted interventions to promote rational prescribing, strengthen pharmacotherapeutic education, and support antimicrobial stewardship initiatives within the hospital setting.

Methods

This study was conducted at the University of Benin Teaching Hospital, a tertiary health care facilities located in the south-south region of Nigeria, sub-Saharan Africa, a country that is endemic for malaria. This descriptive study was in two parts. First we assessed the prescription pattern on antimalarial among patients who were admitted into medical wards

through the medical emergency room for care in the UBTH in 2022 . The medical emergency room of the hospital attends to adults with medically related events and secondly an evaluative questionnaire was shared among the resident doctors in the department of internal medicine.

Procedure

All available medical admissions case records for this period were evaluated and a case reporting form was developed to capture the demographics of the patients, their presenting complaints, the common symptoms attributed to malaria, and the provisional diagnosis at the emergency. We also sought to elucidate if the patient had either a primary or secondary diagnosis of malaria, and if light microscopy for malaria parasite in thick blood film was requested at the medical emergency. The result of malaria parasite test was also recorded. Antimalarial agents prescribed at the medical emergency room was noted.

A follow-up semi-structured evaluative questionnaire (phase 2) was then distributed among internal medicine resident doctors who primarily attend to the patients at the MER. The questionnaire included their age groups, and years of training, their reasons for prescribing antimalarials; oral and parenteral agents inclusive and finally their awareness of the Nigerian national antimalarial policy.

Data Analysis: The main provisional diagnosis was categorized using the International classification of Diseases 11 (Version 02-2022) Antimalarial agents were categorized according to their generic name and ACT (artemisinin-based combination therapy) where indicated as such) and the route of administration is also noted.

Statistical analysis: Data were analyzed descriptively with frequencies, means (standard deviation) as appropriate, and associations between the patient's variables and prescriptions of antimalarial agents were conducted using chi-square, likelihood ratio as appropriate. Logistic regression was also conducted to find out which factors could predict antimalarial prescribing at the MER. Free text responses by the residents regarding their choice of antimalarial was analyzed thematically and presented descriptively. Results were considered significant if p value was ≤ 0.05 .

Ethical approval was obtained from the institution's ethics and research committee and all data kept securely in the

lead researcher's personal computer. The resident doctors gave verbal consent to participate in the study.

Results

A total of 663 patients were admitted to the medical wards through the medical emergency in 2022. Of these, 536 patient case records were successfully retrieved and analyzed, representing a retrieval rate of 80.8%. The mean age of the patients was 51.3 years (SD: 19.1), with ages ranging from 17 to 100 years. There was a higher proportion of females 308 (57.5%), compared to males. The majority of patients were employed 344 (64.2%) (Table 1).

Table 1: Demographics of patients admitted into medical wards of a tertiary hospital in Southern Nigeria.

Characteristics	Proportion n=536 (%)
Age group	
17-40 years	167(31.2)
41-59 years	179 (33.4)
60-100 years	190 (35.4)
Sex	
Male	228 (42.5)
Female	308(57.5)
Occupation	
Employed	344(64.2)
Unemployed	132(24.6)
Student	60(11.2)

At presentation to the Medical Emergency Room (MER), the most common presenting complaints were fever in 120 (22.4%) and vomiting in 82 (15.3%). Based on the ICD-11 classification, the leading diagnostic category was certain infectious and parasitic diseases, recorded in 195 (36.4%). A total of 108 (20.1%) patients had an initial diagnosis of malaria documented in their case records, either as a primary or secondary diagnosis. Light microscopy for malaria parasites (MP) was requested in 373 (69.6%) patients (Table 2).

Among those tested, 136 (36.5%) patients had a positive MP result. The degree of parasitemia was reported as mild (1+) in 130 (95.6%) cases, moderate (2+) in 5 (3.7%) cases, and severe (3+) in 1(0.73%) case, with *Plasmodium falciparum* identified in all positive samples. Of the 108 patients with an initial clinical diagnosis of malaria, 92 (85.2%) were confirmed to have a positive MP result. This association was statistically significant ($\chi^2 = 256.31$, $p < 0.001$).

Table 2: Characteristics of patients' symptoms, diagnosis, and malaria evaluation at the Medical Emergency Room of the UBTH

Characteristics	Proportion n=536(%)
Major presenting complaints	
Fever	120(22.4)
Vomiting	82(15.3)
Weakness	62(11.6)
Abdominal pains	50(9.3)
Loss of consciousness	43 (8.0)
Headaches	26(4.9)
Joint pains	12(2.2)
Nausea	6(1.1)
Cough	59(11.0)
Difficulty breathing	35(6.5)
ICD 11 Disease Classification	
Certain Infectious and Parasitic Diseases	195(36.4)
Diseases of the nervous system	74(13.8)
Diseases of the circulatory system	72(13.4)
Diseases of the digestive system	52(9.7)
Diseases of the urinary system	43(8.0)
Endocrine, nutritional or metabolic diseases	31(5.8)
External causes of morbidity or mortality	23(4.3)
Diseases of the blood or blood-forming organs	15(2.8)
Diseases of the respiratory system	12(2.2)
Mental, behavioural or neurodevelopmental disorder	6(1.1)
Neoplasms	4(0.7)
Diseases of the ear or mastoid process	3(0.6)
Diseases of the genitourinary system	2(0.4)
Diseases of the immune system	2(0.4)
Diseases of the musculoskeletal system or connective tissue	1(0.2)

Diseases of the skin	1(0.2)
Diagnosis of malaria	
Yes	108 (20.1)
No	428 (79.9)
Malaria Parasite requested	
Yes	373(69.6)
No	163(30.4)
Result of Malaria Parasite (n=536)	
Positive	136 (25.4)
Negative	216(40.3)
Result not available	21(3.9)
Not requested	163 (30.4)

Regarding the prescribing patterns of antimalarial agents, 88 (16.4%) patients received antimalarial prescriptions in the MER. Among these, 54 (61.4%) had a clinical diagnosis of malaria ($\chi^2 = 111.16, p < 0.001$), and 60 (68.2%) patients had a positive MP result. Antimalarial prescriptions were also significantly associated with presenting symptoms of fever 40 (45.5%), headache 10 (11.4%), and diagnoses classified under certain infectious and parasitic diseases 195 (36.4%) (Table 3).

The most common route of administration for prescribed antimalarial agents was parenteral 55 (62.5%). The most frequently prescribed medication was intramuscular alpha–beta arteether 46 (52.3%). Additionally, 9 (10.2%) patients received oral ACT tablets, and 3 patients (3.3%) were prescribed a combination of both oral and parenteral agents.

Table 3: Association between prescribed antimalarial and patient variables.

Characteristics	Prescribed antimalarial		Chi square (p value)
	Yes n=88(%)	No n=448 (%)	
Sex			
Male	33(37.5)	195(43.5)	1.093 (0.296)
Female	55(62.5)	253(56.5)	
Age group			
17-40 years	29(33.0)	128(30.8)	0.189 (0.910)
41-59 years	28 (31.8)	151 (33.7)	
60-100 years	31 (35.2)	159 (35.5)	
Loss of consciousness			
Yes	8 (9.1)	35(7.8)	0.163 (0.686)
No	80(90.9)	413 (92.2)	
Fever			
Yes	40(45.5)	80 (17.9)	32.24 (<0.001)
No	48(54.5)	368(82.1)	
Vomiting			
Yes	21(23.9)	61(13.6)	5.96 (0.015)
No	67 (76.1)	387 (86.4)	
Headaches			
Yes	10 (11.4)	16 (3.6)	9.68(0.002)
No	78 (88.6)	432 (96.4)	
Abdominal pains			
Yes	9 (10.2)	41(9.2)	0.101 (0.751)
No	79 (89.8)	407 (90.8)	
Weakness			
Yes	23 (26.1)	107 (23.9)	0.203 (0.652)
No	65 (73.9)	341(76.1)	
Diagnosis of Malaria			
Yes	54(61.4)	394 (87.9)	111.15,(<0.001)
No	34 (38.6)	54(12.1)	
Result of MP test			
Positive (136)	60(68.2)	76(17.0)	102.80 (<0.001)
Negative(216)	16(20.5)	198 (44.2)	
Not available(21)	2(2.3)	19(4.2)	
Not Requested (163)	8(9.1)	155(34.6)	
Classification			
Certain Infectious and Parasitic Diseases	50(56.8)	145(32.4)	41.995(<0.001) Likelihood Ratio
Diseases of the nervous system	4(4.5)	70(15.6)	
Diseases of the circulatory system	7(8.0)	65(14.5)	
Diseases of the digestive system	7(8.0)	45(10.0)	
Diseases of the urinary system	2(2.3)	41(9.2)	
Endocrine, nutritional or metabolic diseases	2(2.3)	29(6.5)	

External causes of morbidity or mortality	5(5.7)	18(4.0)
Diseases of the blood or blood-forming organs	7(8.0)	8(1.8)
Diseases of the respiratory system	2(2.3)	10(2.2)
Mental, behavioural or neurodevelopmental disorder	1(1.1)	5(1.1)
Neoplasms	1(1.1)	3(0.7)
Diseases of the ear or mastoid process	0(0)	3(0.7)
Diseases of the genitourinary system	0(0)	2(0.4)
Diseases of the immune system	0(0)	2(0.4)
Diseases of the musculoskeletal system or connective tissue	0(0)	1(0.2)
Diseases of the skin	0(0)	1(0.2)

Table 4: Antimalarial agents prescribed at the MER.

Antimalarial agents	n/ N=88(%)
IM Alpha- Beta Arteether	46 (52.3)
Tabs Artemether-Lumenfantrine	33 (37.5)
IM Artemether	5(5.7)
IM Alpha- Beta Arteether and Artemether- Lumenfantrine	2(2.2)
IV Artesunate	1(1.1)
IV Artesunate & Artemether- Lumenfantrine	1(1.1)

IM- intramuscular, IV- intravenous

A total of 36 internal medicine resident doctors responded to the survey. The majority were older than 30 years 34 (94.5%). Regarding duration of training, 9 (25.0%) residents had been in training for less than 1–3 years, 14 (38.9%) for 3–6 years, 7 (19.4%) for more than 7 years, while 6 (16.7%) did not specify their training duration. In terms of prescribing practices at the MER, 35 (97.2%) residents reported that they would routinely request malaria parasite (MP) testing before prescribing. However, only 11 (30.6%) residents indicated that they would wait for the test result prior to initiating antimalarial treatment.

When asked about their management decisions, all respondents 36 (100%) stated they would treat a patient presenting with fever and an MP result of 1+. For patients

without fever, 20 (55.6%) residents would treat an MP result of 1+, 14 (38.9%) would treat only if the MP result was 2+, and 2 (5.6%) did not provide a response. The factors influencing their choice of antimalarial agents included the patient's clinical state, specifically the presence of vomiting 16 (44.4%) and the severity of malaria 16 (44.4%). Other influencing factors were adherence to guidelines recommending oral medications 4 (11.1%) and the desire for a fast onset of action 2 (5.5%).

Regarding the preferred route of administration, 29 (80.6%) residents indicated they would prescribe an oral antimalarial. The most preferred oral agent was artemether–lumefantrine, selected by 34 (94.4%) residents. The reasons cited for prescribing oral antimalarials included the

availability of ACTs 16 (44.4%), tolerability and fewer side effects 8 (22.2%), cost considerations 7 (19.4%), severity of symptoms 6 (16.7%), adherence to guidelines 5 (13.9%), efficacy 3(8.3%), previous use by the patient 3 (8.3%), and dosing convenience 1 (2.8%).

When an injectable antimalarial was required, the residents most commonly preferred alpha–beta artemether 28 (77.8%), followed by artesunate 4 (11.1%), artemether 2 (5.6%), and artemisinin injection 1 (2.8%). The preference for alpha–beta artemether was primarily

influenced by factors such as the patient’s clinical state 7 (25%), dosing frequency and convenience of administration 5 (20%), availability 5 (20%), perceived efficacy 4 (14.3%), adherence to WHO guidelines 4 (14.3%), cost-effectiveness 2 (7.1%), and previous experience with the medicine 2 (7.1%). Among those who preferred artesunate, 18 (50%) cited its ready availability and its use in severe malaria as the primary reasons for selection. Regarding knowledge of national policy, 23 (63.9%) residents reported being aware of the National Antimalarial Policy, but only 8 (22.2%) residents had actually read it.

Table 5: Residents preferred antimalarial agents (ACT and parenteral artemisinins)

Antimalarial agents	N (%)
Routine MP request	
Yes	30(83.3)
No	1(2.8)
Sometimes	5(13.9)
Preferred Antimalarial agent Route	
Oral route	29 (80.6)
Parenteral	7 (19.4)
Preferred ACT (oral)	
Artemether-Lumefantrine	34(94.4)
Dihydroartemisin-Piperaquine	1(2.8)
Artemisinin-Combination Therapy(unspecified)	1(2.8)
Preferred Artemisinin Injections	
IM Alpha- beta arteether	28 (77.8)
IV artesunate	4(11.1)
IM artemether	2(5.6)
Injection Artemisinin	1(2.8)

IM- intramuscular, IV- intravenous, ACT- artemisinin Combination Therapy, MP- Malaria Parasite light microscopy

Discussion:

This study presents an in-depth analysis of malaria diagnosis and treatment practices among patients admitted through the Medical Emergency Room (MER) of a tertiary hospital in Southern Nigeria. The findings highlight the persistent burden of malaria in adult populations and reveal the diagnostic challenges and prescribing patterns encountered in emergency clinical settings.

Malaria is frequently diagnosed in the Medical Emergency Room (MER). Although many patients lacked a documented clinical diagnosis of malaria, the majority underwent microscopy for malaria parasites on thick blood film, with 37% testing positive, predominantly with mild parasitemia. Among patients with a clinical diagnosis of malaria, most also had positive microscopy results. The strong association between clinical diagnosis and parasite positivity indicates good diagnostic alignment in most cases. The routine screening for malaria in febrile patients further reflects the endemicity of the disease in this setting.

The study also assessed antimalarial prescription practices and found that fewer than one-fifth of patients received antimalarial treatment. Notably, not all treated patients had a documented diagnosis of malaria, and a considerable proportion lacked positive microscopy results. This finding suggests limited reliance on parasitological confirmation compared to clinical diagnosis. The observed over-reliance on clinical suspicion alone likely contributes to malaria overtreatment, a trend similarly reported by previous studies^{20,21}

Furthermore, there was a high rate of antimalarial prescriptions among patients presenting with fever, headaches,

vomiting, and certain infectious or parasitic diseases, even when microscopy for malaria parasites was negative and other differential diagnoses were considered. This practice may stem from the endemic nature of malaria in Nigeria and the delays in obtaining diagnostic results to thoroughly investigate alternative causes. These findings highlight the tendency of clinicians in malaria-endemic settings to prioritize non-specific symptoms when initiating treatment, even in the absence of diagnostic confirmation. This pattern was further supported by the views of most resident doctors, who reported a preference for empirically treating febrile patients for malaria regardless of parasitemia status. Similar trends have been documented in other studies^{22,23}. The integration of point-of-care diagnostic tools, such as procalcitonin and C-reactive protein testing, could help improve diagnostic accuracy and ensure that empirical therapies are more appropriately targeted.

The frequent use of parenteral therapy (62.5%), particularly intramuscular alpha-beta artemethers, even in cases of mild parasitemia, is noteworthy and may reflect entrenched preferences for injectable treatments in emergency settings. Although resident physicians indicated a preference for prescribing oral medications, especially artemether-lumefantrine, the choice of parenteral agents—particularly alpha-beta artemethers over the recommended intravenous artesunate—was influenced by factors such as the patient's clinical condition, the presence and severity of vomiting, perceived drug efficacy, and convenience of administration. Notably, very few residents had read the national antimalarial policy, highlighting a significant gap in policy literacy. Similar patterns of poor adherence to treatment

guidelines and policies have been documented in other studies, although with varying degrees of compliance.^{24,25}

The therapeutic decisions of the resident physicians appeared to be shaped by both pragmatic considerations and the clinical presentation of patients. In a resource-limited environment with inadequate facilities for critical care monitoring, treatment choices are often guided by the need to optimize patient outcomes despite systemic constraints. This was evident in this finding, where over 97% of residents reported requesting malaria parasite (MP) testing but initiated treatment prior to obtaining results due to diagnostic delays. Such delays, leading to treatment without parasitological confirmation, run contrary to WHO recommendations²⁶ and have been similarly reported in other studies²⁷⁻²⁹. Furthermore, more than half (55.6%) indicated they would treat cases with MP 1+ even in the absence of fever, reflecting a cautious approach but one that may contribute to irrational prescribing practices.

These findings underscore the urgent need to strengthen clinical protocols that mandate parasitological confirmation of malaria before initiating treatment. Greater emphasis should be placed on adherence to national guidelines through regulatory oversight and continuous professional development of healthcare providers. Additionally, hospital formularies must be aligned with national treatment policies, and antimicrobial stewardship programs should be implemented to monitor and optimize the use of both antimicrobial and antimalarial agents.

In conclusion, this study highlights that malaria remains a frequent consideration in the management of patients presenting with common malaria-like symptoms in

hospital settings, with many patients receiving antimalarial prescriptions even when diagnostic results are negative. Although parenteral antimalarials are not the preferred option, their use is often inconsistent with existing treatment guidelines. The continued irrational use of antimalarials in tertiary hospital settings poses significant implications for patient safety, healthcare costs, and public health. Targeted interventions to strengthen diagnostic stewardship, promote rational prescribing practices, and ensure adherence to evidence-based treatment guidelines are urgently needed.

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RESPIRATORY SYMPTOMS AND VENTILATORY FUNCTION IMPAIRMENT AMONG CAR SPRAY PAINTERS IN BENIN CITY, NIGERIA

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ABSTRACT

Background

Car spray painters are routinely exposed to organic solvents, isocyanates and aerosolized particulates that predispose them to respiratory disorders. International and African studies consistently show high levels of respiratory symptoms and impaired lung function among workers in informal automotive workshops. In Nigeria, poor ventilation and inconsistent use of respiratory protective equipment may further heighten these risks.

Objective

To assess respiratory symptoms and ventilatory function impairment among car spray painters compared with age-matched controls.

Methodology

A comparative cross-sectional study was conducted among 100 car spray painters and 100 age-matched controls in Benin City, Nigeria. Data on sociodemographic characteristics, smoking history and respiratory symptoms were obtained using a structured interviewer-administered questionnaire. Spirometric parameters including FEV₁, FVC, FEV₁/FVC ratio and PEF were measured in accordance with American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines. Data were analyzed using IBM SPSS version 25, with Student's *t*-test and Chi-square statistics applied at a 5% level of significance.

Results

Spray painters reported significantly more respiratory symptoms, including nasal discharge (52.2% vs 0%; $\chi^2=91.113$; $p<0.002$), cough with sputum (22.2% vs 5%; $\chi^2=8.220$; $p=0.004$) and chest pain (13.3% vs 1%; $\chi^2=4.749$; $p=0.040$). Mean ventilatory values were significantly lower among spray painters: FEV₁ (2.78 ± 0.79 L vs 3.01 ± 0.72 L; $p<0.001$), FVC (3.01 ± 0.08 L vs 3.65 ± 0.07 L; $p<0.001$) and PEF (311.34 ± 105.9 L/min vs 451.75 ± 153.5 L/min; $p<0.001$). Abnormal ventilatory patterns were more common in spray painters (60% vs 19%; $\chi^2=61.243$; $p=0.002$), with higher obstructive (25% vs 13%) and restrictive (35% vs 6%) defects.

Conclusion

Car spray painters demonstrated a higher burden of respiratory symptoms and significant ventilatory impairment compared with controls, reflecting the impact of chronic exposure to paint fumes and solvent aerosols. Improved respiratory protection, adequate workshop ventilation and routine spirometric monitoring are essential to safeguard workers' respiratory health.

Keywords: Spray painters, respiratory symptoms, ventilatory function, solvents, spirometry

BACKGROUND

Globally, work-related respiratory diseases account for a significant proportion of occupational morbidity. Studies estimate that over 386,000 workers die annually from occupational respiratory conditions, while more than 10 million workers worldwide are exposed to organic solvents and volatile chemicals, many of which are common in the automotive spray-painting industry, according to The National Institute for Occupational Safety and Health (NIOSH).^{1,2} In high-income countries, regulatory measures and improved engineering controls have reduced exposure, yet studies still report significant decline in FEV₁ among automotive painters with prolonged exposure compared with unexposed workers. Chemicals such as isocyanates, one of the leading causes of occupational asthma, remain a major hazard, responsible for a majority of new occupational asthma cases globally.^{3,4} Across Africa, occupational exposure limits are inconsistently implemented, and informal-sector workshops dominate the automotive repair industry. Studies from Tanzania, Kenya and Ethiopia reveal that 40–90% of painters report chronic cough, wheeze, nasal irritation and breathlessness.^{5,6,7} Spirometric assessments frequently show reduced FEV₁/FVC ratios, higher rates of obstructive defects and a noticeable decline in peak expiratory flow among exposed workers. In some African cohorts, as many as 40% of automotive painters demonstrate measurable ventilatory impairment, reflecting the limited use of personal protective equipment, poor ventilation and high solvent concentrations in small workshops.^{6,7}

In Nigeria, automotive spray painting represents a growing urban trade, largely practiced in informal settings where

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regulatory oversight is limited.⁸ Nigerian artisans are commonly exposed to high concentrations of solvents such as toluene, xylene, acetates, isocyanates and heavy metals present in paints and hardeners.⁹ Local studies have documented that over 30% of spray painters experience persistent respiratory symptoms including cough, nasal discharge, chest tightness and dyspnea.^{10,11} Spirometric findings in Nigerian exposed workers often show 20–35% prevalence of obstructive or restrictive ventilatory patterns, significantly higher than rates observed in unexposed populations, as well as poor use of appropriate respiratory protective equipment.^{12,13}

These findings highlight a pressing need to evaluate the respiratory health of car spray painters in Nigeria, where workers remain vulnerable to chronic inhalational exposures with limited occupational health support. By comparing exposed workers with age-matched controls, this study provides evidence on the magnitude of respiratory symptoms and ventilatory function impairment attributable to workplace exposure. Understanding these patterns is essential for guiding preventive strategies, strengthening occupational health policies and reducing long-term respiratory morbidity among this high-risk population.

METHODOLOGY

Study Design

This study adopted a comparative cross-sectional design to evaluate the respiratory health of car spray painters in relation to unexposed individuals of similar age and background.

Study Area

The research was conducted in Benin City, Edo State, Nigeria, where numerous informal automobile workshops operate without adequate engineering controls or ventilation systems. These workshops represent typical work environments in which artisans are exposed to solvent vapours, paint aerosols and isocyanate compounds that may predispose them to respiratory impairment.

Study Population

The study population comprised two groups of male respondents: professional car spray painters with at least one year of continuous occupational exposure, and age-matched controls who were not occupationally exposed to organic solvents or paint fumes. Controls were selected from administrative and technical occupations within the same locality to ensure comparable socioeconomic conditions.

Sample Size and Sampling Technique

A total of 200 participants were recruited, consisting of 100 car spray painters and 100 controls. The sample size was estimated using standard formulae for comparative studies of continuous variables, assuming a 95% confidence interval, 80% statistical power and an expected difference in mean FEV₁ between exposed and control groups. Participants were selected through systematic random sampling across registered and informal auto-repair clusters, while controls were randomly drawn from nearby non-exposed occupations.

Inclusion and Exclusion Criteria

Eligible participants were adult males aged 18 years and above who had worked for at least one year in their respective occupations. Excluded were individuals with current respiratory infections, known chronic lung or cardiac diseases, or those unwilling to provide informed consent.

Data Collection Instruments

Data were collected using a structured interviewer-administered questionnaire and spirometric assessment. The questionnaire, adapted from standard occupational-respiratory survey instruments, obtained information on demographic characteristics, duration of exposure, smoking history, and respiratory symptoms such as cough, nasal discharge, chest pain and breathlessness. Spirometric measurements were obtained using a portable digital spirometer in accordance with the American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines. The parameters recorded included Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV₁), FEV₁/FVC ratio, and Peak Expiratory Flow (PEF).

Smoking Assessment

Respondents were classified as current smokers, ex-smokers or non-smokers. Current smokers were those who consumed at least one cigarette or its equivalent daily, while ex-smokers were individuals who had stopped smoking for six months or longer. Non-smokers were those who had never smoked or had smoked less than one cigarette in their lifetime. The number of pack-years was computed by multiplying the number of cigarettes smoked per day by the number of years of smoking and dividing by twenty.

Anthropometric Measurements

Weight and height were measured with standardized equipment, and Body Mass Index (BMI) was derived as weight (kg) divided by height squared (m²). These

indices served to control for body size variability in the interpretation of spirometric results.

Data Analysis

Data were analyzed using IBM SPSS version 25. Quantitative variables were summarized using means and standard deviations, while categorical variables were presented as frequencies and percentages. The Student's *t*-test was applied to compare mean ventilatory parameters between groups, and associations between categorical variables were evaluated using Chi-square or Fisher's exact test where appropriate. Statistical significance was established at a *p*-value of less than 0.05.

Classification of Ventilatory Function

Lung function outcomes were categorized based on spirometric indices. Participants with an FEV₁/FVC ratio less than 70% were classified as having an obstructive pattern, whereas those with FVC less than 80% of the predicted value but normal or elevated FEV₁/FVC ratios were considered to have restrictive ventilatory defects. Values within normal reference ranges were regarded as normal ventilatory function.

Ethical Considerations

Ethical approval for the study was obtained from the University of Benin Teaching Hospital (UBTH) Health Research Ethics Committee. Written informed consent was obtained from all participants after the purpose and procedures of the study had been clearly explained. Confidentiality and voluntary participation were ensured throughout the study in compliance with the principles of the Declaration of Helsinki.

RESULTS

Sociodemographic Characteristics of Car Spray Painters and Controls (Table 1)

A total of 200 respondents participated in the study, comprising 100 car spray painters and 100 controls. The age

distribution was similar across both groups. Among spray painters, the majority 35 (35.0%) were aged 30–39 years, followed by 31 (31.0%) aged 20–29 years, 20 (20.0%) aged 40–49 years, 11 (11.0%) aged 50–59 years, and 3 (3.0%) below 20 years. In the control group, 35 (35.0%) were aged 20–29 years, 32 (32.0%) aged 30–39 years, 17 (17.0%) aged 40–49 years, 12 (12.0%) aged 50–59 years, and 4 (4.0%) were younger than 20 years. The difference in age distribution between both groups was not statistically significant ($\chi^2 = 4.770$, $p = 0.997$).

Regarding marital status, 58 (58.0%) of the spray painters were married, 39 (39.0%) single, 2 (2.0%) divorced, and 1 (1.0%) widowed. Among controls, 48 (48.0%) were married, 48 (48.0%) single, 2 (2.0%) divorced, and 2 (2.0%) widowed. The difference in marital status between both groups was not statistically significant ($\chi^2 = 3.135$, $p = 0.792$).

A significant difference was observed in the level of education between both groups ($\chi^2 = 12.323$, $p = 0.007$). Among spray painters, most 62 (62.0%) had only primary education, while 20 (20.0%) had secondary and 18 (18.0%) tertiary education. Conversely, in the control group, 39 (39.0%) had secondary education, 48 (48.0%) primary, and 13 (13.0%) tertiary education.

In terms of religion, the majority in both groups were Christians, 90 (90.0%) among spray painters and 94 (94.0%) among controls, followed by adherents of African Traditional Religion 7 (7.0%) and 5 (5.0%) respectively, while Muslims constituted a small proportion 3 (3.0%) and 1 (1.0%) respectively. The religious distribution between both groups showed no significant difference ($\chi^2 = 0.356$, $p = 0.986$).

Anthropometric Measurements of Car Spray Painters and Controls (Table 2)

The mean anthropometric indices of car spray painters and controls were generally comparable. The mean weight of spray painters was 68.27 ± 1.7 kg, while that of controls was 67.81 ± 1.0 kg, with no statistically significant difference ($t = 0.764$, $p = 0.448$). The mean height was 1.7 ± 0.1 m among spray painters and 1.6 ± 0.1 m among controls, also showing no significant difference ($t = 0.998$, $p = 0.271$). Similarly, the mean Body Mass Index (BMI) was 24.1 ± 3.1 kg/m² among spray painters and 24.9 ± 3.8 kg/m² among controls. Although the BMI of controls was slightly higher, the difference was not statistically significant ($t = -2.112$, $p = 0.338$).

Respiratory Symptoms in the Car Spray Painters and Controls (Table 3)

Respiratory symptoms were more prevalent among car spray painters compared to controls. Among the 100 spray painters, 90 had respiratory symptoms. Out of these, over half, 47 (52.22%), reported nasal discharge, whereas none of the controls experienced this symptom, a highly significant difference ($\chi^2 = 91.113$, $p < 0.002$). Cough with sputum production was also more frequent among spray painters, occurring in 20 (22.22%) compared with 5 (83.33%) of the controls, and this association was statistically significant ($\chi^2 = 8.220$, $p = 0.004$). Chest pain was reported by 12 (13.33%) of spray painters compared to 1 (16.67%) of the controls, showing a significant difference between both groups ($\chi^2 = 4.749$, $p = 0.040$).

Breathlessness occurred in 5 (5.56%) of spray painters but in none of the controls, though this difference was not statistically significant ($\chi^2 = 2.423$, $p = 0.356$). Hemoptysis followed a similar pattern, with 6 (6.67%) cases among spray painters and none in the control group, and the observed difference remained non-significant ($\chi^2 = 2.423$, $p = 0.356$).

Mean Values of the Ventilatory Function Parameters in the Car Spray Painters and Controls (Table 4)

The mean ventilatory function indices were generally lower among car spray painters compared to controls. The mean Forced Expiratory Volume in one second (FEV₁) among spray painters was 2.78 ± 0.79 L, while that of controls was 3.01 ± 0.72 L, showing a statistically significant difference ($t = -5.30$, $p < 0.001$). Similarly, the mean Forced Vital Capacity (FVC) was 3.01 ± 0.08 L among spray painters and 3.65 ± 0.07 L among controls, also significantly lower among spray painters ($t = -5.415$, $p < 0.001$).

The mean FEV₁/FVC ratio was 0.79 ± 1.75 in spray painters compared to 0.82 ± 0.10 in controls, and this difference was statistically significant ($t = -2.44$, $p = 0.016$). In addition, the mean Peak Expiratory Flow (PEF) was markedly reduced among spray painters (311.34 ± 105.9 L/min) compared to controls (451.75 ± 153.5 L/min), and this difference was highly significant ($t = -7.48$, $p < 0.001$).

Pattern of Ventilatory Function in Car Spray Painters and Controls (Figure 1)

The distribution of ventilatory function patterns revealed marked differences between car spray painters and controls. Among spray painters, only 40 (40.0%) exhibited normal lung function compared to 81 (81.0%) of the controls. Obstructive ventilatory defects were identified in 25 (25.0%) of spray painters and 13 (13.0%) of controls, while restrictive defects were present in 35 (35.0%) of spray painters and 6 (6.0%) of controls.

These differences were statistically significant ($\chi^2 = 61.243$, $p = 0.002$), indicating that car spray painters had a substantially higher prevalence of both obstructive and restrictive ventilatory impairments than their non-exposed counterparts.

Table 1: Sociodemographic Characteristics of Car Spray Painters and Controls

Variables	Car Spray Painters n=100 (%)	Controls n=100 (%)	Chi-square (χ^2)	p-value
Age (years)			4.770	0.997
<20	3 (3.0)	4 (4.0)		
20–29	31 (31.0)	35 (35.0)		
30–39	35 (35.0)	32 (32.0)		
40–49	20 (20.0)	17 (17.0)		
50–59	11 (11.0)	12 (12.0)		
Marital Status			3.135	0.792
Married	58 (58.0)	48 (48.0)		
Single	39 (39.0)	48 (48.0)		
Divorced	2 (2.0)	2 (2.0)		
Widower	1 (1.0)	2 (2.0)		
Level of Education			12.323	0.007
Primary	62 (62.0)	48 (48.0)		
Secondary	20 (20.0)	39 (39.0)		
Tertiary	18 (18.0)	13 (13.0)		
Religion			0.356	0.986
Christianity	90 (90.0)	94 (94.0)		
Islam	3 (3.0)	1 (1.0)		
African Traditional Religion	7 (7.0)	5 (5.0)		

Table 2: Anthropometric Measurements of Car Spray Painters and Controls

Anthropometry	Car Spray Painters (Mean \pm S.D)	Controls (Mean \pm S.D)	t-test	p-value
Weight (kg)	68.3 \pm 1.7	67.8 \pm 1.0	0.764	0.448
Height (m)	1.7 \pm 0.1	1.6 \pm 0.1	0.998	0.271
BMI (kg/m ²)	24.1 \pm 3.1	24.9 \pm 3.8	-2.112	0.338

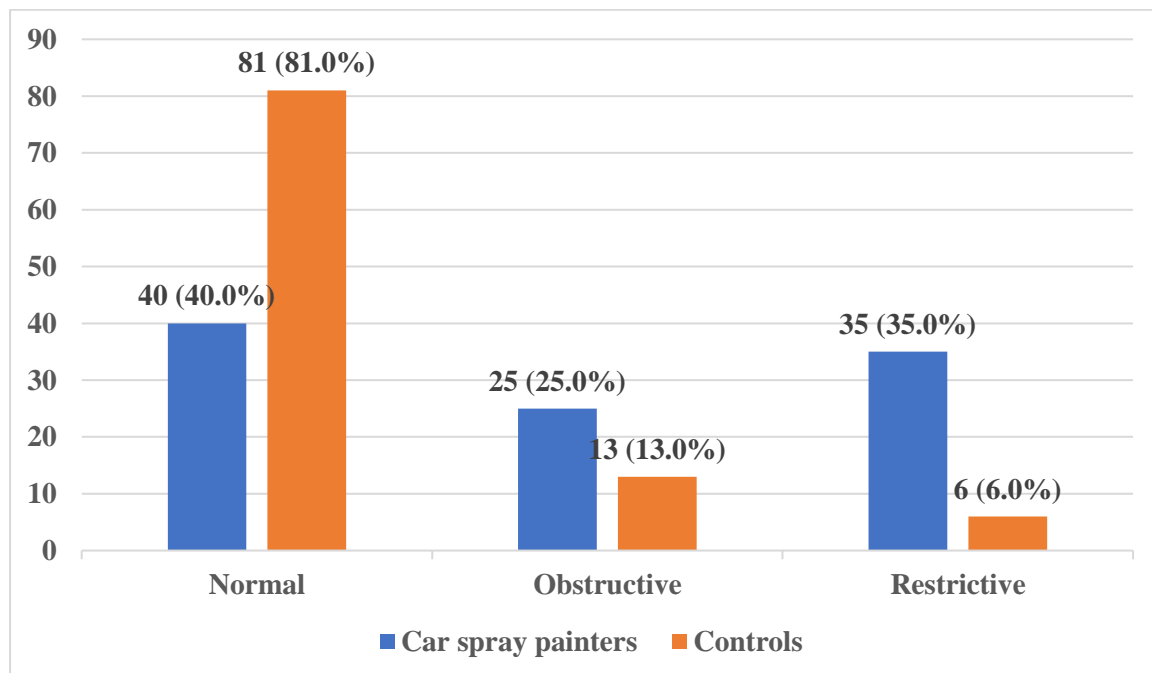
BMI = Body Mass Index, Kg= Kilogram, m=meter

Table 3: Respiratory Symptoms in the Car Spray Painters and Controls

Respiratory Symptoms	Spray Painters n=90 (%)	Controls n=6 (%)	Chi-square (χ^2)	p-value
Nasal discharge	47 (52.22)	0 (0.0)	91.113	<0.002
Cough with sputum production	20 (22.22)	5 (83.33)	8.220	0.004
Chest pain	12 (13.33)	1 (16.67)	4.749	0.040
Breathlessness	5 (5.56)	0 (0.0)	2.423	0.356
Hemoptysis	6 (6.67)	0 (0.0)	2.423	0.356

Table 4: Mean Values of the Ventilatory Function Parameters in the Car Spray Painters and Controls

Parameters	Spray Painters (Mean \pm S.D)	Controls (Mean \pm S.D)	t- test	p- value
FEV ₁ (L)	2.78 \pm 0.79	3.01 \pm 0.72	-5.30	<0.001
FVC(L)	3.01 \pm 0.08	3.65 \pm 0.07	-5.42	<0.001
FEV ₁ /FVC	0.79 \pm 1.75	0.82 \pm 0.10	-2.44	0.016
PEF(L/min)	311.34 \pm 105.9	451.75 \pm 153.5	-7.48	<0.001



Chi-square (χ^2): 61.243, p:0.002

Figure 1: Pattern of ventilatory function in car spray painters and controls

DISCUSSION

The study showed that the age distribution of car spray painters and controls was similar, with most respondents falling within the economically active 20–39 age range. This demographic pattern is important because it suggests that respiratory impairment observed later in the analysis cannot be attributed to age differences. Strengthening occupational health surveillance for young artisans is therefore essential, as this age group represents the productive workforce in many urban centres.

The educational distribution showed that spray painters had lower levels of formal education compared with controls, with a higher proportion reporting only primary education. Similar observations have been reported in studies from Nigeria by Ojo et al.¹⁰ in Osun state, where over half of respondents had only primary levels of education. Lower education may influence awareness of chemical hazards, proper use of personal protective equipment and understanding of workplace risks. This finding is significant because limited educational attainment may further widen occupational vulnerability, making artisan workers more prone to preventable respiratory disorders. It is therefore important for regulatory agencies and unions within the informal sector to integrate safety training sessions that use simple language and practical demonstrations to improve safety behaviour among this group.

Anthropometric indices in this study were comparable between exposed workers and controls, with no significant differences in weight, height or body mass index. The lack of anthropometric disparity indicates that observed ventilatory impairments are unlikely to be confounded by variations in body habitus, thereby strengthening the internal validity of the lung function findings. Because anthropometric factors have been

associated with spirometric variability, ensuring comparability in future occupational health assessments remains important. Routine nutritional and fitness counselling could further support respiratory health among these workers.

The burden of respiratory symptoms was markedly higher among car spray painters, particularly nasal discharge, cough with sputum, chest pain, and hemoptysis. Similar trends have been reported in a study conducted in Parakou, Benin Republic by Ade et al.¹⁴, and Awodele et al.¹⁵ in Lagos, Nigeria, where more than half of spray painters experienced persistent upper and lower respiratory tract irritation. These symptoms are plausibly linked to prolonged exposure to isocyanates, xylene, toluene and other volatile organic compounds known to irritate mucosal surfaces and lower airway structures. The public health implication is considerable, as persistent respiratory symptoms may precede chronic respiratory diseases, reducing long-term lung function and productivity. Introducing workplace ventilation standards and ensuring consistent use of cartridge respirators would significantly reduce symptomatic respiratory morbidity in this population.

The study also demonstrated significantly lower mean values of key ventilatory parameters such as FEV₁, FVC and PEF among spray painters compared with controls. Similar reductions were reported in studies done in Cross-River, Nigeria by Aribo et al.¹⁶ and in India by Methre and Karandikar¹⁷, where spray painters showed a 15–25% decline in FEV₁ and FVC relative to unexposed groups. The impairment in ventilatory indices is biologically plausible because organic solvents and paint aerosols induce airway inflammation, mucus hypersecretion and direct epithelial injury. This finding carries major occupational health implications, as

reduced ventilatory capacity increases the risk of disability, reduced work capacity and progression to chronic airflow limitation. Regular spirometric screening, early referral for respiratory evaluation and substitution of high-risk chemicals with safer alternatives would help mitigate the decline in ventilatory performance.

The pattern of ventilatory impairment showed that only 40% of spray painters had normal lung function compared with 81% of controls, while obstructive and restrictive patterns were substantially higher among the exposed group. These findings are consistent with research in Nigeria, Africa and Global studies, where occupational exposure to spray fumes resulted in high rates of mixed ventilatory defects.^{11,12,13,18} The predominance of restrictive patterns may be linked to cumulative inhalation of particulate matter and chronic inflammatory processes affecting lung parenchyma, whereas the obstructive defects are consistent with the airway-narrowing effects of isocyanates.

CONCLUSION

This study demonstrated clear evidence of respiratory morbidity and ventilatory impairment among car spray painters when compared with matched controls. The exposed workers showed markedly higher rates of respiratory symptoms and significant reductions in key spirometric indices, including FEV₁, FVC and PEF.

Patterns of obstructive and restrictive defects were notably more prevalent among spray painters, indicating both airway and parenchymal involvement. These findings point to the substantial impact of chronic exposure to paint fumes, organic solvents and particulate aerosols within the automotive spray-painting environment. The results show the urgent need for improved occupational health measures to protect workers in this informal yet widely practiced trade.

RECOMMENDATION

There is a strong need to strengthen occupational safety practices among car spray painters through targeted measures that improve respiratory protection and chemical handling.

At a policy level, regulatory bodies should develop enforceable guidelines for chemical safety in informal automotive workshops and support initiatives that substitute hazardous paints with safer alternatives. Collaboration between health authorities, vocational associations and workshop owners will further reinforce long-term respiratory protection for these workers.

LIMITATIONS

The study employed a cross-sectional design, which restricts the ability to establish causality between exposure and ventilatory outcomes. Respiratory symptoms were self-reported, creating the possibility of recall bias. The assessment did not include detailed quantitative measurements of airborne solvent concentrations, which could have provided stronger exposure–response relationships. The study was conducted within a specific urban area, so findings may not fully represent spray painters in other regions with different work practices or environmental conditions. Despite these limitations, the sample size, use of spirometry and inclusion of a control group provide credible evidence of the respiratory risks faced by car spray painters.

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METABOLIC SYNDROME AND LIPID ABNORMALITIES IN NON-OBESE INDIVIDUALS: PREVALENCE AND LIMITATIONS OF BODY MASS INDEX -BASED SCREENING IN A RURAL AFRICAN COMMUNITY

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ABSTRACT:

Background:

Metabolic syndrome (MetS) is a cluster of abnormalities that heighten cardiovascular and type 2 diabetes risk. While obesity is a key driver, metabolic dysfunction can also occur in individuals with normal or low body mass index (BMI), escaping detection by BMI-based screening. This study assessed BMI distribution in MetS patients, focusing on metabolically obese normal-weight (MONW) and metabolically unhealthy lean (MUL) phenotypes, using triglycerides (TG) and high-density lipoprotein cholesterol (HDL-C) as dyslipidemia markers.

Methodology:

This cross-sectional study included 75 MetS patients at Igbinedion University Teaching Hospital, diagnosed using the World Health Organisation (WHO) criteria. BMI stratified patients: underweight (<18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25–29.9 kg/m²), and obese (≥30 kg/m²). Standard enzymatic assay assessed metabolic parameters, including TG and HDL, which were analysed across BMI categories. Statistical analysis was done using the IBM SPSS version 26, and confidence levels were set at 95% with a p-value of < 0.05 considered statistically significant.

Results:

Overweight (32.0%) and obese (9.3%) patients were fewer than normal-weight (40.0%) and underweight (18.7%) patients meeting MetS criteria. Among normal-weight patients, 33.3% had low HDL-C and 29.3% had high TG. In underweight individuals, 17.3% had high TG and 13.3% low HDL-C. TG levels varied significantly across BMI categories (p = 0.008).

Conclusion:

Dyslipidemia is prevalent among MetS patients with normal or low BMI, revealing BMI's inadequacy as a sole risk predictor. Expanded screening incorporating lipid and anthropometric measures is essential, particularly in rural African populations.

Keywords: Metabolic Syndrome, Body Mass Index, Metabolically Obese Normal Weight, Metabolically Unhealthy Lean, High-Density Lipoprotein, Triglycerides

INTRODUCTION

Metabolic syndrome (MetS) is a cluster of interrelated metabolic abnormalities, including central obesity, insulin resistance, dyslipidemia, and hypertension, that significantly increase the risk of cardiovascular disease (CVD) and type 2 diabetes mellitus (T2DM) [1]. The prevalence of MetS is increasing globally, driven by lifestyle changes, urbanisation, and dietary shifts, making it a significant public health concern. Traditionally, obesity, particularly central adiposity, has been considered a primary driver of MetS. However, emerging evidence suggests that metabolic dysfunction can occur in individuals with normal or even low body mass index (BMI), challenging the conventional notion that excess weight is the primary determinant of metabolic health [2].

The metabolically obese normal-weight (MONW) and metabolically unhealthy lean (MUL) phenotypes describe individuals who, despite having a normal or low BMI, exhibit metabolic disturbances such as insulin resistance, elevated triglycerides (TG), low high-density lipoprotein (HDL), and systemic inflammation [3]. These phenotypes are thought to arise from factors such as visceral fat accumulation, genetic predisposition, and an unhealthy lifestyle, even in the absence of overt obesity. The presence of these phenotypes underscores the limitations of BMI as a sole marker of metabolic risk. It highlights the need for broader anthropometric and biochemical assessments to accurately identify at-risk individuals [4]. Dyslipidemia, particularly elevated TG and reduced HDL levels, is a hallmark of MetS and a well-established risk factor for CVD. Studies have shown that even in non-obese individuals, high TG and low HDL levels are strongly associated with increased cardiovascular risk, insulin resistance, and

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endothelial dysfunction [5]. The present study investigates the BMI distribution among MetS patients, with a particular focus on the prevalence of MONW and MUL phenotypes.

Previous studies have exposed the failure of BMI to serve as a predictor of metabolic dysfunction, such as the study by Bradshaw *et al.* (2013), where about 24% of normal-weight adults (BMI < 25) were metabolically abnormal, placing them at elevated risk for chronic diseases despite appearing "healthy" by BMI standards. [6] Also, A landmark report in *The Lancet Diabetes & Endocrinology* declared BMI unreliable for individual health assessment. Experts instead recommend alternative metrics, such as waist-to-hip ratio or direct adiposity measurements, given the BMI's failure to accurately capture underlying health status. [7] By analysing TG and HDL levels across different BMI categories, this study aimed to highlight the presence of metabolic risk in non-obese individuals and emphasise the inadequacy of BMI as a standalone anthropometric screening tool for risk stratification for cardio-metabolic dysfunction. Furthermore, it explores the potential need for alternative anthropometric indices, such as waist circumference, waist-to-height ratio, body fat percentage, and wrist measurements,

to improve metabolic risk stratification in clinical settings.

METHODS

Study Design

This cross-sectional study was conducted at Igbinedion University Teaching Hospital, Nigeria, involving 75 patients diagnosed with Metabolic Syndrome (MetS) based on the World Health Organisation (WHO) criteria. The minimum sample size was determined and calculated using the Cochran formula [8]:

$$n = Z^2 \times p(1-p) / d^2$$

Where:

- $Z = 1.96$ (for a 95% confidence level)
- $p =$ expected prevalence of metabolic syndrome in similar rural Nigerian populations (0.30 from prior studies)
- $d =$ margin of error (0.104, chosen for feasibility in a pilot setting)

Substituting these values:

$$n = (1.96^2 \times 0.3 (1 - 0.3)) / (0.104)^2$$

$$n = (3.8416 \times 0.21) / 0.010816$$

$$n = 0.806736 / 0.010816$$

$$n = 74.58$$

Thus, the calculated sample size of 75 participants was achieved in this study.

The sample size determination was also in keeping with previous similar studies in comparable populations, such as that of Osuji *et al.* (2012), where a similar number of subjects were included in a study that assessed metabolic syndrome in newly diagnosed type 2 diabetes mellitus using National Cholesterol Education Program – Adult Treatment Panel III (NCEP-ATP III) in Nnewi, Nigeria. Also, Aşık *et al.* (2016), who

evaluated obesity and metabolic syndrome in Turkey, had a similar sample size. [9,10]

According to the WHO, MetS is identified by the presence of insulin resistance (e.g., type 2 diabetes or impaired fasting glucose) plus at least two of the following:

- Hypertension: Blood pressure $\geq 140/90$ mmHg or current use of antihypertensive medication.
- Dyslipidemia: Triglycerides (TG) ≥ 150 mg/dL and/or HDL cholesterol < 35 mg/dL in men or < 39 mg/dL in women.
- Central obesity: Waist-to-hip ratio > 0.90 for men, > 0.85 for women, or body mass index (BMI) > 30 kg/m².
- Microalbuminuria: Urinary albumin excretion rate ≥ 20 μ g/min or albumin-to-creatinine ratio ≥ 30 mg/g. [11]

Inclusion criteria included Patients aged ≥ 18 years, those who met the WHO diagnostic criteria for MetS and adult patients without chronic inflammatory conditions, pregnancy, or recent acute illnesses.

Exclusion criteria included patients < 18 years and those who didn't meet the WHO diagnostic criteria for MetS, those below 18 years and adult patients with chronic inflammatory conditions, pregnancy, or recent acute illnesses.

Anthropometric Measurements

Body Mass Index (BMI) Measurement

BMI was calculated using the standard formula: $BMI = Weight (kg) / Height (m)^2$

Weight Measurement:

- Weight was measured using a digital weighing scale (Seca 876, Germany).
- Participants were instructed to stand upright in the centre of the scale, with feet slightly apart.
- Measurements were taken with participants wearing light clothing and no shoes to minimise external weight influence.
- The weight was recorded in kilograms (kg) to the nearest 0.1 kg.

Height Measurement:

- Height was measured using a stadiometer, ensuring accuracy and reproducibility.
- Participants were instructed to stand upright, with their heels, buttocks, and upper back against the vertical board of the stadiometer.
- The head was positioned in the Frankfurt horizontal plane (where the lower orbital margin is aligned with the external auditory meatus).
- The measurement was taken at full inspiration, and the height was recorded in meters (m) to the nearest 0.1 cm.

BMI classifications:

- Underweight: $<18.5 \text{ kg/m}^2$
- Normal weight: $18.5\text{--}24.9 \text{ kg/m}^2$
- Overweight: $25\text{--}29.9 \text{ kg/m}^2$
- Obese: $\geq 30 \text{ kg/m}^2$ ^[12]

Biochemical Analysis

- Blood samples were collected after an 8–12 hour overnight fast for lipid profile analysis.
- Venous blood (5 mL) was drawn from the antecubital vein using a sterile vacutainer system.

- Samples were collected into plain (serum) tubes and allowed to clot at room temperature for 30 minutes.
- Clotted blood samples were centrifuged at 3000 rpm for 10 minutes to obtain clear serum.
- If analysis was delayed, the separated serum was immediately analysed or stored at -20°C .

Triglycerides (TG) Assay

Serum TG levels were measured using an enzymatic colorimetric method (GPO-PAP method) with a commercial kit (Roche Diagnostics, Germany). The procedure involved:

1. Hydrolysis of triglycerides by lipoprotein lipase into glycerol and free fatty acids.
2. Phosphorylation of glycerol by glycerol kinase, followed by oxidation via glycerol-3-phosphate oxidase, producing hydrogen peroxide.
3. The hydrogen peroxide reacted with 4-aminophenazone in the presence of peroxidase, forming a quinoneimine dye, which was measured spectrophotometrically at 505 nm. ^[13]

High-Density Lipoprotein (HDL) Assay

HDL cholesterol was measured using a direct enzymatic clearance method (HDL-C plus method, Roche Diagnostics, Germany):

1. Selective blocking of non-HDL lipoproteins (LDL, VLDL, and chylomicrons).
2. Enzymatic degradation of HDL cholesterol, producing a colored

complex, which was measured at 600 nm.^[14]

All assays were performed using a Roche Cobas c311 autoanalyser, following the manufacturer's protocols. Internal quality controls were conducted before each batch of analysis.

Statistical Analysis

Data were analysed using IBM SPSS version 26.0 (IBM Corp, USA).

- Categorical variables were analysed using the chi-square test, while Kendall Tau-b was used for ordinal variables.

- A p-value <0.05 was considered statistically significant.

RESULTS

BMI Distribution among MetS Patients

Among the 75 MetS patients, 32.0% were classified as overweight, while 9.3% were obese. Notably, a considerable proportion of patients fell within the normal-weight (40%) and underweight (18.7%) categories, showing the prevalence of metabolically obese normal-weight (MONW) and metabolically unhealthy lean (MUL) phenotypes

Table 1: BMI Distribution among MetS Patients

BMI Category	Percentage (%)
Underweight (<18.5 kg/m ²)	18.7%
Normal weight (18.5–24.9 kg/m ²)	40.0%
Overweight (25–29.9 kg/m ²)	32.0%
Obese (≥30 kg/m ²)	9.3%

Dyslipidemia across BMI Categories

Relationship between BMI and TG in Patients with MetS

Among normal-weight individuals (40%), 29.3% exhibited elevated triglyceride (TG) levels, while among underweight individuals, 17.3% had elevated TG. In contrast, overweight patients demonstrated a lower prevalence of elevated TG (13.3%), with the lowest occurrence observed in obese patients,

where only 2.7% had elevated TG levels. Statistical analysis revealed a significant variation in TG levels across BMI categories ($\chi^2 = 17.412$, $df = 6$, $p = 0.008$), suggesting that dyslipidemia occurs independently of obesity status. Furthermore, the negative Kendall's tau-b value ($\tau = -0.223$, $p = 0.031$) indicates an inverse correlation between BMI and TG levels, implying that higher BMI does not necessarily correlate with higher triglyceride concentrations.

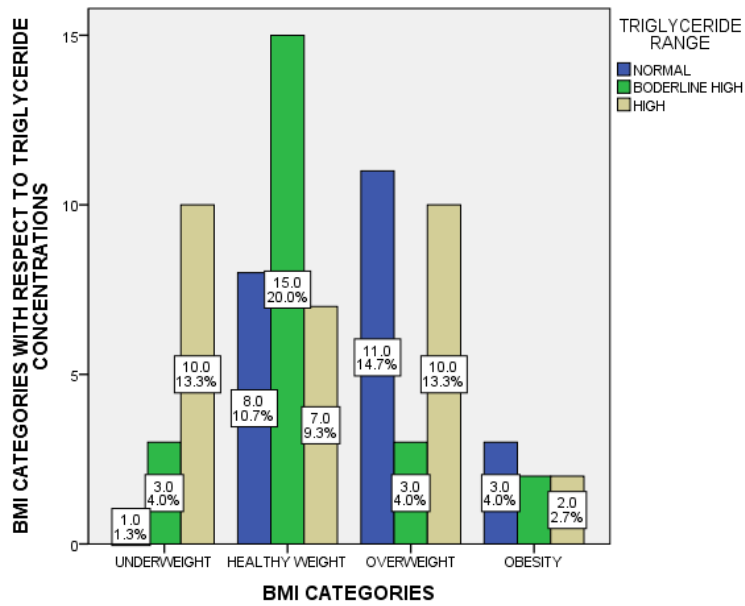


FIGURE 1: Relationship between BMI and TG in Patients with MetS

Underweight (<18.5 kg/m²), Normal weight (18.5–24.9 kg/m²), Overweight (25–29.9 kg/m²), Obese (≥30 kg/m²),

Normal TG: <150 mg/dL, Borderline High TG: 150–199 mg/dL, High TG: ≥200mg/dL

Relationship between BMI and HDL in Patients with MetS

In this study population, low concentrations of high-density lipoprotein (HDL) cholesterol, a well-established risk factor for metabolic and cardiovascular diseases, were observed across all BMI categories, with a statistically significant difference in prevalence ($\chi^2 = 24.153$, df =

6, $p < 0.05$). Among underweight individuals, 13.3% exhibited low HDL levels, while 33.3% of normal-weight individuals had reduced HDL concentrations. The prevalence of low HDL was lower in overweight individuals (32%), with 21.3% affected, and was least common in obese individuals (9.3%), where only 2.7% had reduced HDL levels.

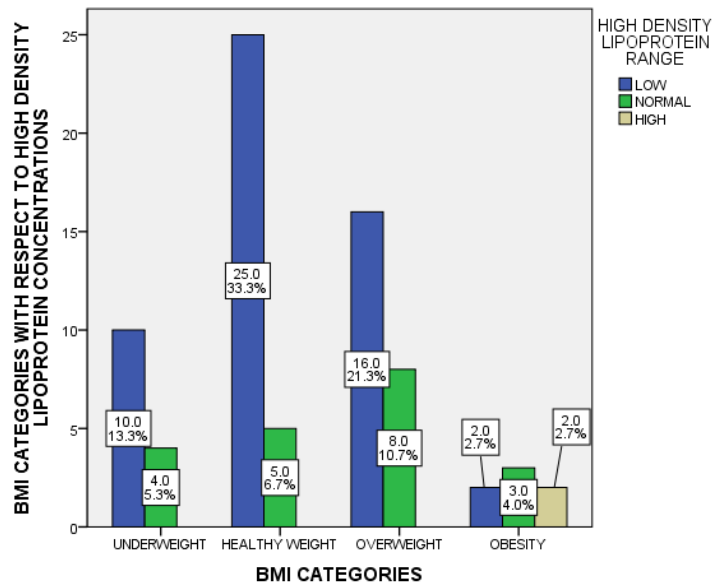


FIGURE 2: Relationship between BMI and HDL in Patients with MetS

Underweight (<18.5 kg/m²), Normal weight (18.5–24.9 kg/m²), Overweight (25–29.9 kg/m²), Obese (≥30 kg/m²),
Low HDL = < 40 mg/dL, Normal HDL: 40–59 mg/dL High HDL: ≥ 60 mg/dL

DISCUSSION

BMI Distribution among MetS Patients

This study highlighted the significant proportion of non-obese individuals with MetS, reinforcing that BMI alone may not be sufficient for metabolic risk assessment. The distribution challenges the conventional reliance on BMI as a singular indicator of metabolic health and highlights the complex and multifaceted nature of metabolic syndrome, where individuals with lower BMI may still exhibit significant metabolic dysfunction. The MONW and MUL phenotypes observed in this study align with a previous finding that normal-weight individuals can exhibit metabolic dysfunction.^[15] This paradox is often attributed to underlying factors such as insulin resistance, visceral adiposity, dysregulated adipokine secretion, genetic susceptibility, and sedentary lifestyles, all of which contribute to an increased cardiometabolic risk despite an ostensibly healthy weight. These findings reinforce the necessity of incorporating additional anthropometric indices (e.g., waist circumference, body fat percentage, and wrist circumference), alongside comprehensive metabolic profiling, to improve early detection and risk stratification for MetS, particularly in resource-limited settings.^[15]

Dyslipidemia across BMI Categories

Relationship between BMI and TG in Patients with MetS

This study revealed that higher BMI does not necessarily correlate with higher triglyceride concentrations ($\tau = -0.223$, $p = 0.031$). This unexpected trend challenges the conventional understanding of obesity-driven dyslipidemia and highlights the need for a more detailed metabolic risk assessment that extends beyond BMI, particularly in populations where lean individuals may still exhibit significant lipid abnormalities.

One possible explanation for the pattern is the metabolically obese normal-weight (MONW) phenotype, a condition in which individuals classified as normal-weight based on BMI exhibit metabolic features characteristic of obesity, including insulin resistance and visceral adiposity. Studies have shown that MONW individuals are predisposed to dyslipidemia, including elevated TG levels, despite having a normal BMI. Karelis *et al.* found that metabolically healthy obese (MHO) individuals had significantly lower plasma triglycerides and higher HDL-cholesterol compared to insulin-resistant counterparts despite similar total body fat ($p < 0.05$).^[16] Also, Snijder *et al.* reported that greater trunk fat mass was strongly associated with higher fasting glucose (standardized $\beta \approx 0.44$ in men) and post-load glucose ($\beta \approx 0.41$), while greater leg fat mass showed inverse associations ($\beta \approx -0.24$ for fasting glucose, $\beta \approx -0.12$ for post-load glucose), exposing how fat distribution, not BMI per se, predicts metabolic outcomes. This shows the limitations of BMI as a sole indicator of metabolic health, as it does not distinguish between lean mass and fat mass, nor account for fat distribution.^[17]

Individuals with normal BMI but high visceral fat may exhibit metabolic disturbances similar to those observed in obesity.

Genetic and lifestyle factors could also contribute to the observed trend. Genetic predisposition plays a crucial role in lipid metabolism, with certain polymorphisms influencing TG concentrations independent of BMI. Kathiresan *et al.* demonstrated that individuals in the highest genetic risk score quintile exhibited triglyceride levels approximately 26 mg/dL higher than those in the lowest quintile, a clear genetic influence independent of BMI. [18] Additionally, dietary habits, particularly high intake of simple carbohydrates and saturated fats, as well as physical inactivity, have been strongly linked to elevated TG levels. Parks & Hellerstein observed that individuals consuming a low-fat, high-carbohydrate diet experienced a ~60% elevation in fasting triglyceride concentrations and a 37% decrease in VLDL-TG clearance compared to baseline values. [19] These factors may disproportionately affect normal-weight individuals with a genetic predisposition to dyslipidemia. The findings of this study contrast with previous research, such as a study conducted among civil servants in Abakaliki, South Eastern Nigeria, where overweight and obese individuals had significantly higher TG levels than their normal-weight counterparts. [20] This discrepancy highlights potential population-specific variations in lipid metabolism, likely influenced by genetic, dietary, and environmental factors.

Another critical consideration is the reliance on BMI as a measure of adiposity. BMI fails to differentiate between subcutaneous and visceral fat, the latter being a stronger predictor of metabolic

disturbances. Previous research has suggested that individuals with central obesity, even at a normal BMI, are more likely to develop dyslipidemia and other metabolic disorders. [21] Therefore, alternative markers such as waist-to-hip ratio or body fat percentage may provide more accurate assessments of metabolic risk. The inverse association between BMI and TG levels challenges the conventional view of obesity-driven dyslipidemia and shows the importance of comprehensive metabolic assessments. The findings suggest that lean individuals are not necessarily metabolically healthy and highlight the need for targeted screening strategies that extend beyond BMI.

Relationship between BMI and HDL in Patients with MetS

This study suggests that low HDL cholesterol is not exclusively associated with higher BMI, but is also prevalent among non-obese individuals ($\chi^2 = 24.153$, $df = 6$, $p < 0.05$). This can be attributed to the role of physical activity. Regular aerobic exercise has been shown to increase HDL levels, while a sedentary lifestyle is associated with reduced HDL concentrations. [22] The decreasing prevalence of low HDL from normal-weight to obese individuals in our study may reflect differences in lifestyle habits rather than inherent metabolic advantages. Some overweight and obese individuals may engage in more physical activity than their normal-weight counterparts, thereby improving their HDL profile. Additionally, paradoxical findings in obesity research suggest that certain obese individuals maintain a healthier metabolic profile, a phenomenon referred to as metabolically healthy obesity (MHO). [23]

This inverse relationship between BMI and low HDL levels suggests that HDL dysregulation extends beyond obesity-driven metabolic dysfunction, as discussed

earlier, with genetic and lifestyle factors playing a key role. Comparing our findings with existing literature, similar patterns have been reported in other populations. A study by Heianza et al. [24] found that lean individuals with MetS exhibited significantly lower HDL levels compared to overweight individuals without metabolic abnormalities. Similarly, a study conducted in South Asian populations showed that a high prevalence of low HDL was observed even in individuals with normal BMI, likely due to genetic predisposition and dietary habits. [25] These findings, again, support the argument that BMI alone is an inadequate predictor of metabolic health and that a more comprehensive assessment, including lipid profile evaluation, insulin sensitivity, and body composition analysis, is necessary.

CONCLUSION

This study exposes the inadequacy of BMI as a sole determinant of metabolic health, highlighting the significant proportion of non-obese individuals who exhibit metabolic syndrome (MetS). The presence of metabolically obese normal-weight (MONW) and metabolically unhealthy lean (MUL) phenotypes reinforces the complexity of metabolic dysfunction, which extends beyond conventional obesity markers. Factors such as insulin resistance, visceral adiposity, dysregulated adipokine secretion, and genetic predisposition contribute to increased cardiometabolic risk, even among individuals with normal BMI. A multifaceted approach to metabolic risk assessment, integrating easy anthropometric indices such as waist circumference, is essential for early detection and targeted intervention. This approach is particularly crucial in resource-limited settings, where early identification of at-risk individuals can improve preventive strategies and reduce the

burden of cardiovascular disease and metabolic disorders. Future research should explore population-specific variations in lipid metabolism and the interplay between genetic and environmental factors in shaping metabolic risk.

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PREVALENCE AND DETERMINANTS OF TINNITUS AMONG OLDER ADULTS IN NIGERIA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background

Tinnitus, the perception of sound without an external source, is a frequent complaint among older adults, often linked to hearing loss, hypertension, and noise exposure. Despite its impact on quality of life, tinnitus remains under-recognized in Sub-Saharan Africa. This study aimed to determine the prevalence and determinants of tinnitus among elderly patients in a tertiary hospital in southern Nigeria.

Methods

A hospital-based cross-sectional study was conducted among 423 adults aged ≥ 60 years attending the General Practice Clinic of the University of Benin Teaching Hospital, Benin City, between December 2017 and June 2018. Participants were recruited consecutively and assessed using a structured questionnaire, otologic examination, and audiometric testing. Data were analyzed with IBM SPSS version 22, and logistic regression identified independent predictors of tinnitus. Statistical significance was set at $p < 0.05$.

Results

The mean age of respondents was 67.5 ± 7.3 years, and females comprised 64.8% of the sample. The prevalence of tinnitus was 32.4% (137 of 423). Logistic regression revealed that hypertension (OR = 2.96; 95% CI: 1.89–3.62; $p = 0.039$), vertigo (OR = 1.35; 95% CI: 1.77–5.68; $p = 0.043$), and noise exposure (OR = 2.24; 95% CI: 1.03–5.99; $p = 0.044$) were significantly associated with tinnitus. Age, sex, marital status, and diabetes were not statistically significant predictors.

Conclusion

Tinnitus affected about one-third of older adults studied, underscoring a substantial geriatric health concern. Hypertension, vertigo, and chronic noise exposure were key determinants. Incorporating tinnitus screening into routine geriatric care, optimizing cardiovascular health, and promoting hearing health could help reduce the burden of tinnitus in Nigeria's aging population.

Keywords: Tinnitus, Elderly, Hypertension, Vertigo, Noise exposure, Geriatric hearing health, Nigeria

BACKGROUND

Tinnitus, commonly defined as the perception of sound in the absence of an external auditory stimulus, is a significant global public health concern, particularly among older adults.¹ The global pooled prevalence of tinnitus among adults has been estimated at approximately 14%, with severe tinnitus affecting about 2% of the population.^{2,3} The condition is strongly age-dependent, with prevalence increasing from around 10% in younger adults to 24–30% in older age groups.³ Age-related auditory degeneration, cumulative lifetime noise exposure, metabolic disorders, and vascular changes are key contributors to this heightened risk among the elderly.^{4,5}

The global burden of tinnitus extends beyond auditory impairment, as it is frequently associated with anxiety, depression, insomnia, and reduced quality of life.⁶ In older adults, tinnitus often coexists with presbycusis (age-related hearing loss), complicating communication, social engagement, and cognitive function.⁷ Furthermore, the use of ototoxic medications such as aminoglycosides, loop diuretics, and non-steroidal anti-inflammatory drugs, which are commonly prescribed in older age groups, further heightens vulnerability.⁸ Despite advances in diagnosis and management, tinnitus remains under-recognized and undertreated globally, particularly in low- and middle-income countries.

In Africa, auditory health disorders, including tinnitus, represent an underappreciated and growing burden. According to the World Health Organization (2023), more than 40 million Africans currently live with hearing loss, a number projected to reach 54 million by 2030 if current trends persist.⁹ While epidemiological data on tinnitus remain

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limited across sub-Saharan Africa, available studies suggest a prevalence ranging from 13% to 20% among adults.^{10,11}

Moreover, the scarcity of audiological services and inadequate public health prioritization of hearing care compound the challenge of early identification and management in elderly populations.¹²

In Nigeria, tinnitus poses a notable though often under-documented challenge in geriatric health. Several hospital-based studies have reported prevalence rates between 14% and 42% among adults and older patients.^{13,14} Contributory factors identified in these populations include occupational and environmental noise exposure, hypertension, diabetes mellitus, hyperlipidemia, and use of ototoxic medications, conditions that are increasingly prevalent among Nigeria's aging population.

Despite its frequency and potential for significant psychosocial distress, tinnitus remains a neglected aspect of geriatric care in Nigeria. Awareness is low, screening is seldom routine, and rehabilitative options are limited by cost and availability. As the Nigerian population continues to age, projected to be the world's third most populous country by 2050,¹⁵ the need to understand modifiable and non-modifiable risk factors for tinnitus among the elderly becomes increasingly urgent. Identifying these risk determinants is crucial for designing preventive strategies,

informing clinical management, and reducing the broader public health impact of auditory disorders in the elderly.

METHODOLOGY

Study Area

This hospital-based study was conducted at the General Practice Clinic of the University of Benin Teaching Hospital (UBTH), Ugbowo, Benin City, Edo State, Nigeria. UBTH is a major tertiary referral center serving southern Nigeria. Benin City is cosmopolitan, with Bini as the predominant ethnic group alongside Esan, Etsako, and other Nigerian ethnicities; the population comprises civil servants, traders, artisans, farmers, and students. The clinic operates Monday to Friday from 08:00 to 16:00 and attends to approximately 15–20 geriatric patients daily.

Study Design and Population

We employed a hospital-based cross-sectional design with prospective enrollment of patients aged ≥ 60 years who attended the General Practice Clinic between December 2017 and June 2018. Inclusion required clinical stability and provision of written informed consent. Exclusion criteria were critical illness, cognitive impairment or unstable mental state, and acute otologic infection at presentation.

Sample Size and Sampling

Using the Leslie Kish formula for cross-sectional studies with an expected prevalence (P) of 0.50, 95% confidence ($Z=1.96$), and precision of 0.05, the minimum sample was 384.16. Allowing 10% for attrition yielded a target sample size of 423. Eligible participants were recruited consecutively until this sample was achieved.

Data Collection

An interviewer-administered, pre-tested questionnaire obtained socio-

demographic data; tinnitus characteristics (onset, duration, laterality, perceived severity); exposures (lifetime noise, ototoxic medications, head injury); and comorbidities (e.g., hypertension, diabetes). After consent, each participant underwent general and otologic examination. Otoscopy assessed the external canal and tympanic membrane; Rinne and Weber tests screened for conductive versus sensorineural patterns. Pure-tone audiometry (air conduction 250–8000 Hz; bone conduction 500–4000 Hz) was performed in a sound-attenuated room; the pure-tone average (PTA) was calculated from thresholds at 500, 1000, 2000, and 4000 Hz. Tympanometry evaluated middle-ear status. Tinnitus was defined as a subjective perception of sound without an external source persisting for ≥ 5 minutes. Hearing thresholds were classified using WHO categories current to the study period (≤ 25 dB normal; 26–40 mild; 41–60 moderate; 61–80 severe; ≥ 81 profound).

Data Analysis

Data were entered into IBM SPSS Statistics version 22. Categorical variables were summarized as frequencies and percentages; continuous variables as means and standard deviations or medians with interquartile ranges, as appropriate. Associations with tinnitus were examined using logistic regression models to identify independent predictors. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the University of Benin Teaching Hospital Research and Ethics Committee, and written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout. All data were anonymized and stored securely to ensure confidentiality. Participants found to have otologic

disorders were appropriately referred for management.

RESULTS

Sociodemographic Characteristics of Respondents

A total of 423 elderly patients participated in the study. The mean age was 67.5 ± 7.3 years. More than half of the respondents, 235 (55.6%), were aged 60–69 years, 132 (31.2%) were 70–79 years, and 56 (13.2%) were 80–89 years old. Females accounted for most participants, 274 (64.8%), while males comprised 149 (35.2%).

Most respondents were Christians 385 (91.0%), with smaller proportions

practicing Islam 12 (2.8%) and African Traditional Religion 26 (6.1%). The majority were married 319 (75.4%), while 37 (8.7%) were widowed, 29 (6.9%) single, 22 (5.2%) divorced, and 16 (3.8%) separated.

Among the 361 participants who disclosed their income, 182 (50.4%) earned less than ₦20 000 per month, 99 (27.4%) earned ₦20 000–₦40 000, and only 10 (2.8%) earned more than ₦150 000. The Bini ethnic group predominated 230 (54.4%), followed by Esan 90 (21.3%), Yoruba 33 (7.8%), Igbo 17 (4.0%), Etsako 14 (3.3%), Hausa 5 (1.2%), and others 34 (8.0%).

Table 1: Sociodemographic characteristics of respondents

Variables	Frequency (n=423)	Percentage (%)
Age		
60-69	235	55.6
70-79	132	31.2
80-89	56	13.2
Mean ± S.D	67.52 ± 7.3	
Sex		
Male	149	35.2
Female	274	64.8
Religion		
Christianity	385	91.0
Islam	12	2.8
African Traditional Religion	26	6.1
Marital status		
Married	319	75.4
Widowed	37	8.7
Single	29	6.9
Divorced	22	5.2
Separated	16	3.8

Monthly income (₦)**(n = 361)**

<N20,000	182	50.4
N20,000-40,000	99	27.4
N40,000-60,000	39	10.8
N60,000-80,000	25	6.9
N80,000-150,000	6	1.7
>150,000	10	2.8

Ethnicity

Bini	230	54.4
Esan	90	21.3
Other	34	8.0
Yoruba	33	7.8
Igbo	17	4.0
Etsako	14	3.3
Hausa	5	1.2

**Some respondents did not answer the question*

Prevalence of Tinnitus (Figure 1)

Out of the 423 respondents, 137 (32.4%) reported experiencing tinnitus, while 286 (67.6%) did not.

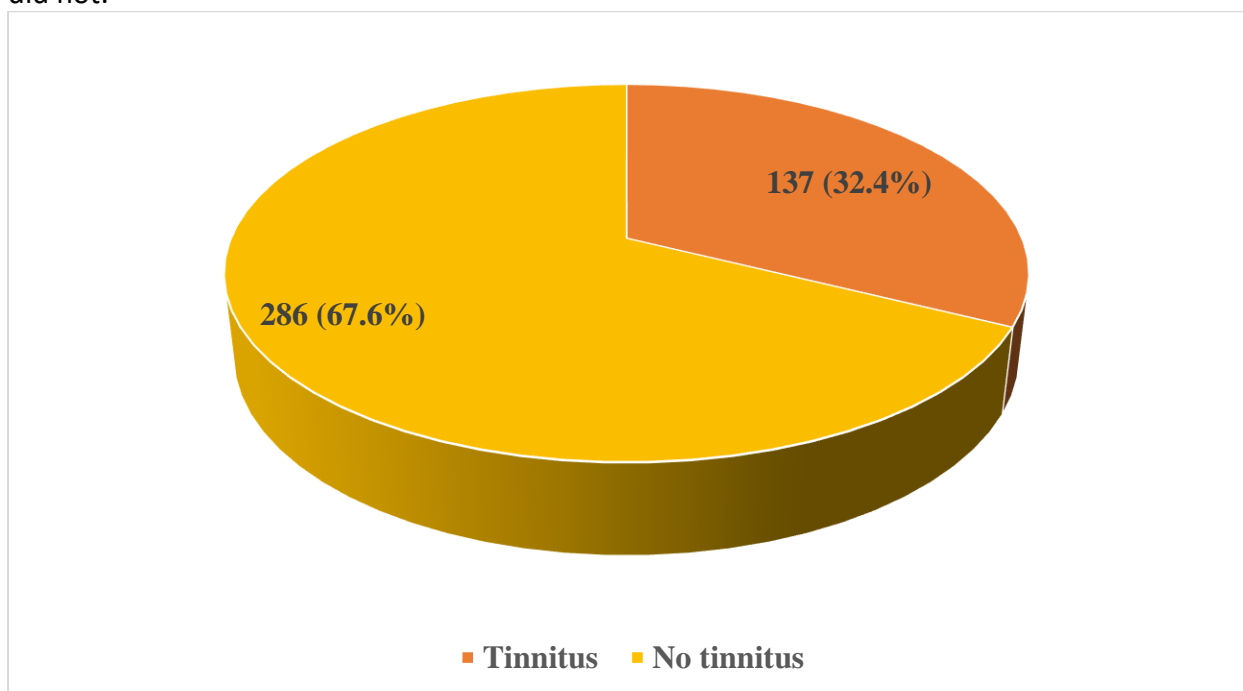


Figure 1: Prevalence of tinnitus among respondents

Socio-Demographic Factors Associated with Tinnitus

Although the odds of tinnitus were higher among respondents aged 80–89 years (OR = 2.17; 95% CI: 0.62–8.06) compared with those aged 60–69 years, this association was not statistically significant ($p = 0.205$). Females also had greater odds of tinnitus (OR = 1.90; 95% CI: 0.52–2.92) compared

with males, but the difference did not reach significance ($p = 0.063$).

Income level and marital status showed no significant relationships with tinnitus ($p > 0.05$). Respondents earning ₦40 000–₦60 000 monthly had slightly higher odds (OR = 1.52; 95% CI: 0.19–3.29) compared with those earning below ₦20 000, but the association was not significant ($p = 0.502$).

Table 2: Logistic Regression of Socio-Demographic Risk Factors for Tinnitus in the Elderly

Variables	OR (95% CI)	p value
Age		
60-69*	1	
70-79	1.311 (0.304-5.130)	0.083
80-89	2.171 (0.617-8.062)	0.205
Sex		
Male*	1	
Female	1.90 (0.518-2.918)	0.063
Income level		
<N20,000*	1	
N20,000-40,000	0.254 (0.246-3.079)	0.105
N40,000-60,000	1.521 (0.190-3.290)	0.502
N60,000-80,000	0.835 (0.296-6.696)	0.225
N80,000-150,000	0.471 (0.084-3.175)	0.527
>150,000	0.237 (0.107-1.880)	0.126
Marital status		
Single*	1	
Married	0.260 (0.036-4.098)	0.442
Separated	0.259 (0.029-2.810)	0.211
Divorced	0.300 (0.126-3.068)	0.110
Widowed	0.189 (0.033-6.164)	0.526

*Reference category

Clinical and Exposure-Related Predictors

Significant predictors of tinnitus in the elderly included vertigo (OR = 1.35; 95% CI: 1.77–5.68; p = 0.043), hypertension (OR = 2.96; 95% CI: 1.89–3.62; p = 0.039), and noise exposure (OR = 2.24; 95% CI: 1.03–5.99; p = 0.044).

Although family history of ear disease (OR = 1.34; p = 0.052) and other chronic

medical conditions (OR = 0.54; p = 0.073) showed borderline associations, they were not statistically significant. Diabetes, ototoxic drug use, and previous ear or head trauma had no significant correlation with tinnitus (p > 0.05).

Table 3: Clinical and Exposure Predictors of Tinnitus in the Elderly

Variables	OR (95% CI)	P value
Vertigo	1.350 (1.768 - 5.678)	0.043
Hypertension	2.960 (1.891 - 3.623)	0.039
Diabetes	1.111 (0.621 - 2.112)	0.203
Other chronic medical condition	0.541 (0.293 - 2.050)	0.073
Family History of ear disease	1.343 (0.724 - 4.125)	0.052
History of trauma to ear	1.950 (0.117 - 2.261)	0.662
History of trauma to head	0.217 (0.029 - 3.317)	0.527
Noise exposure	2.240 (1.031 - 5.990)	0.044
Ototoxicity	1.721 (0.181 - 4.154)	0.146
Previous ear disease	0.291 (0.408 - 3.122)	0.531
Previous air or sea travel	1.391 (0.161 - 6.410)	0.790
Throat complaint	0.181 (0.710 - 1.910)	0.390

Discussion

This study investigated the prevalence and risk factors associated with tinnitus among elderly patients attending the General Practice Clinic of the University of Benin Teaching Hospital, Benin City. The findings revealed a tinnitus prevalence of 32.4%, indicating that nearly one in three elderly individuals experienced the symptom. This figure shows tinnitus as a significant geriatric health concern in Nigeria.

The prevalence obtained in this study is higher than the 14.1% reported by Lasisi et al.¹⁶ among community-dwelling elderly

Nigerians and exceeds the global pooled prevalence of approximately 14% estimated by Biswas et al.² The observed difference may reflect variations in study design, setting, and diagnostic criteria. Whereas community-based studies often include individuals with milder or undiagnosed auditory complaints, hospital-based populations such as ours are more likely to include patients with chronic diseases and otologic symptoms that predispose to tinnitus. Similar elevated rates have been documented in hospital-based studies in Ghana and South

Africa, where prevalence values ranged from 20–55%.^{17,18} These findings collectively highlight the increasing burden of tinnitus in sub-Saharan Africa's aging population.

Although the present study found a higher frequency of tinnitus among females, the association was not statistically significant. Gender differences in tinnitus have been inconsistently reported; some studies observed a male predominance attributed to occupational noise exposure,¹⁹ whereas others noted higher prevalence among females, possibly due to hormonal and psychosocial influences.²⁰ The lack of significance in this study may suggest that, beyond gender, other factors such as comorbid conditions and environmental exposures play a greater role in tinnitus manifestation in older adults.

Age showed a positive but non-significant association with tinnitus, with participants aged 80 years and above having the highest odds. This aligns with the well-recognized influence of aging on cochlear degeneration, neural reorganization, and cumulative noise exposure.^{21,22} The absence of statistical significance could result from sample distribution or overlapping comorbidities that mediate age-related auditory dysfunction.

Three factors, namely hypertension, vertigo, and noise exposure, emerged as significant predictors of tinnitus. The strong association with hypertension supports previous reports linking vascular compromise and altered cochlear microcirculation to tinnitus generation.²³ Elevated blood pressure may induce oxidative stress and endothelial damage within the inner ear, exacerbating cochlear pathology. The relationship with vertigo likely reflects shared inner-ear pathophysiology, including labyrinthine or vestibulocochlear dysfunction. Similarly, noise exposure has long been established as a leading environmental cause of

tinnitus; chronic exposure to loud sounds can damage cochlear hair cells and auditory nerve fibers, producing both hearing loss and phantom auditory perception.²⁴

Other factors such as diabetes, ototoxic drug use, and previous head or ear trauma showed no significant associations in this study. While these variables are known risk factors, their effects may vary depending on duration, cumulative exposure, and co-occurring systemic illnesses. The near-significant association with family history of ear disease suggests a possible genetic or hereditary predisposition that merits further investigation.

The observed high prevalence and clustering of vascular and environmental risk factors emphasize the need for targeted screening and preventive strategies in geriatric care. Regular blood pressure monitoring, early detection of hearing loss, and public education on noise avoidance could substantially reduce the burden of tinnitus in this population. Moreover, clinicians should maintain a high index of suspicion for tinnitus among hypertensive or noise-exposed elderly patients, as timely intervention may improve quality of life and reduce psychological distress.

A limitation of this study is its hospital-based cross-sectional design, which restricts generalization to community populations and precludes causal inference. Self-reported noise exposure and medical history may also introduce recall bias. Nonetheless, the study provides robust baseline data on tinnitus burden and associated factors in an elderly Nigerian cohort.

Conclusion

Tinnitus was found to be a common otologic complaint among elderly patients attending the University of Benin Teaching Hospital, affecting about a third of respondents. Hypertension, vertigo, and

noise exposure were identified as significant predictors, suggesting that both systemic vascular and environmental factors contribute to its occurrence. Routine auditory screening, aggressive control of cardiovascular risk factors, and community education on noise prevention are essential to reduce the burden of tinnitus in Nigeria's aging population. Integrating tinnitus evaluation into geriatric care services could improve early diagnosis, enhance quality of life, and reduce the psychosocial impact of this often-neglected condition.

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PAEDIATRIC SURGICAL MORTALITIES: PRIMARY CAUSES OF DEATH IN A RURAL TERTIARY HOSPITAL IN SOUTH-SOUTH NIGERIA

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ABSTRACT

Background: The knowledge of the primary causes of death in a particular practice locality can influence health systems interventions for better outcome among paediatric surgical patients. This formed the basis of this study.

Methods: This study was a cross-sectional study in which all paediatric surgical (0 – 17 years) mortalities from August 2016 to April 2022 in Irrua Specialist Teaching Hospital (ISTH) were reviewed. The categorical variables were analysed as frequencies and proportions, and presented in tables.

Results: Sixty-one mortalities were recorded for paediatric surgery patients during the period of review. Thirty-six (59.0%) of the patients were males while 25 (41.0%) were females. The paediatric surgical mortalities constituted 15.4% of all childhood deaths (61 of 396 childhood deaths) in the period of study. Of the 13,952 children admitted in the hospital during the period, the percentage of paediatric surgery mortalities is 0.4%. Injuries/accidents (18, 29.5%), Congenital disorders (16, 26.2%), Gastrointestinal diseases (9, 14.8%), Cancers (9, 14.8%), Surgical infections (8, 13.1%) and Cardiac diseases (1, 1.6%) are the commonest primary causes of paediatric surgical deaths in this centre.

Conclusion: Policy makers in this senatorial district should be guided by the observed common primary causes of death in decision making as regards the necessary investment in paediatric surgical care relevant to improve outcomes.

Keywords: Paediatric surgery, Primary cause of death.

INTRODUCTION

The knowledge of the primary causes of death in a particular practice locality can influence health systems interventions for better outcome among paediatric surgical patients.¹ Many factors have been postulated to contribute to the higher mortality rate recorded among children managed for paediatric surgical conditions in third world countries.²⁻⁵ Factors that increase mortality risk include neonatal age, pre-existing conditions, delayed presentation, emergency surgery, multiple procedures, malnutrition, lack of adequate intensive care amongst others.²⁻⁵

The commonly reported primary causes of death in paediatric surgical practice

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include sepsis, especially in post-operative patients, congenital anomalies like Tracheoesophageal fistula (TEF)/ Esophageal atresia (EA), Gastroschisis, and Intestinal atresia.

Others are surgical and post-operative complications, intestinal/anastomosis failure, hypovolemia, peritonitis, notably

from perforated viscus, respiratory failure, and complications from conditions like obstructed inguinal hernias.²⁻⁵

The assessment of the pattern and the primary causes of death will help to identify the indicators of poor outcomes in order to improve overall outcomes in paediatric surgical cases, hence the need for this study.

MEHODS

This study was a cross-sectional study in which all paediatric surgical (0 – 17 years) mortalities from August 2016 to April 2022 in Irrua Specialist Teaching Hospital (ISTH) were reviewed. ISTH, a tertiary health facility located in a rural setting, is situated in Irrua, the administrative headquarters of Esan Central Local Government Area of Edo State, Nigeria.⁶ It is a 434-bed hospital with medical and surgical wards.

Data collected included demographic characteristics, primary cause of death and

managing unit for each patient. The categorical variables were analysed as frequencies, and proportions and presented in tables.

RESULTS

Sixty-one mortalities were recorded for paediatric surgery patients during the period of review. Thirty-six (59.0%) of the patients were males while 25 (41.0%) were females. The paediatric surgical mortalities constituted 15.4% of all childhood deaths (61 of 396 childhood deaths) in the period of study. Of the 13,952 children admitted in the hospital during the period, the percentage of paediatric surgery mortalities is 0.4%.

The age and sex distribution of the patients is shown in Table 1. The primary causes of death are shown in Table 2 while mortalities recorded in each managing units are shown in Table 3. Figure 1 shows the primary causes of death in each age group.

Table 1: Age and sex distribution of paediatric surgery mortalities

Age group	Male	Female
Neonate 0 – 28 days	11	13
Infant >1mth – 12mth	4	2
Toddler >1yr – 3yrs	2	0
Preschool >3yrs – 5yrs	2	1
School >5yrs – 12yrs	8	4
Adolesct >12yrs – 17yrs	9	5
TOTAL	36	25

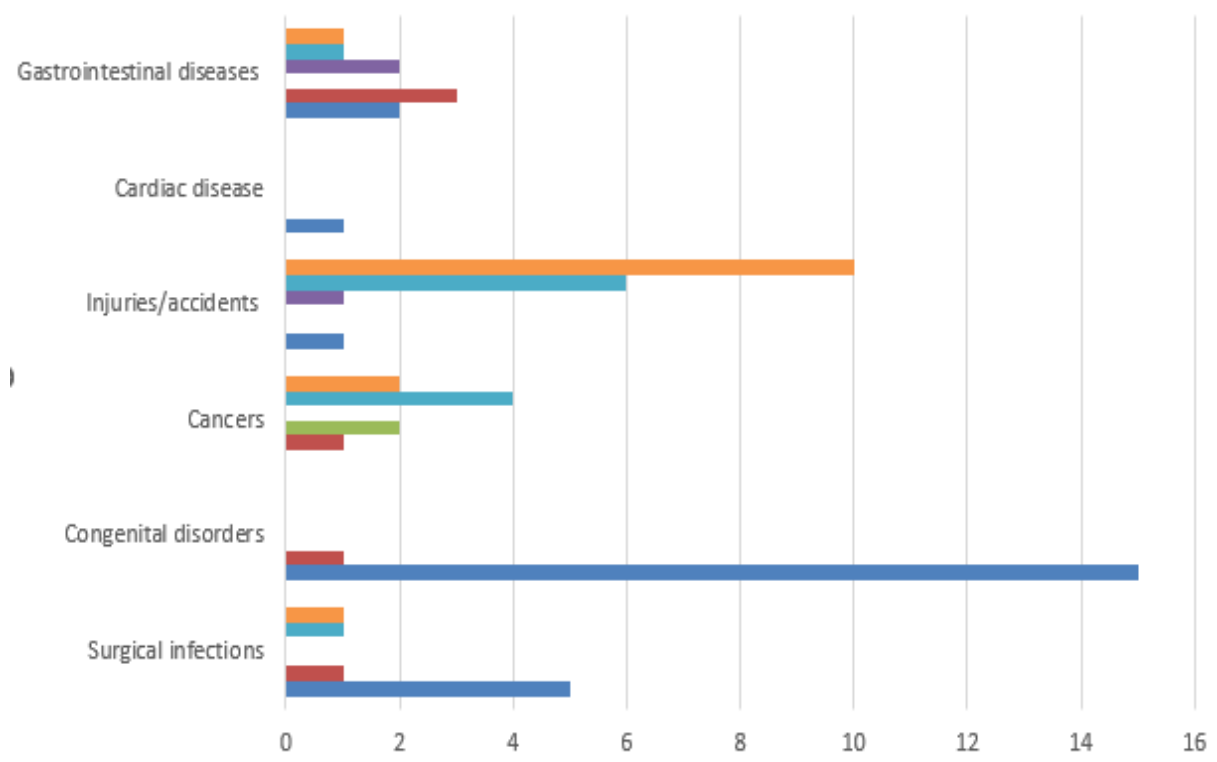
Table 2: Primary causes of death by gender distribution

Category	Male	Female
Surgical infections	4	4
Congenital disorders	8	8
Cancers	6	3

Injuries/accidents	13	5
Cardiac disease	0	1
Gastrointestinal diseases	5	4
TOTAL	36	25

Table 3: Mortalities recorded in each managing units

Managing Unit	Number of deaths recorded
Neonatology	24
Neurosurgery	17
Trauma	15
Cardiothoracic	4
Gastroenterology	17
Plastic Surgery	8
Oncology	7
Orthopedics	2
ENT	1









KEY	
	Neonate
	Infant
	Toddler
	Pre-school Child
	School Child
	Adolescent

Figure 1: Primary causes of death in each age group

DISCUSSION

Adequate organisation and investment in paediatric surgical care are generally expected to reduce mortality and morbidity in paediatric surgical practice in any part of the world; much more in the rural setting.^{1,3} It thus becomes very important to know the common primary causes of death in the rural setting as this will influence the necessary investment in paediatric surgical care relevant to improve outcomes.^{1,3}

The 61 paediatric surgical mortalities recorded during the period of study constituted 15.4% of all the 396 childhood deaths. This poses a significant challenge and shows that paediatric surgical mortalities are a key, but not the dominant, contributor to overall childhood deaths in the centre. In a study on mortality by admission diagnosis in children 1-60 months of age admitted to a tertiary care government hospital in Malawi, Choi et al reported that the highest mortality rates by diagnosis were found in children with surgical conditions.⁷ Generally, various reports have shown that childhood mortality rates are still quite high in lower-middle-income countries (LMICs), especially in parts of Africa and south Asia.^{2,4,8-13}

More male deaths (36, 59.0%) were recorded in the period of study. This can be explained by the fact that injuries/accidents were the commonest

primary cause of death in the study and boys are more likely to be involved because of their more adventurous nature. Chowdhury et al in their study on Mortality from Surgical Conditions in Children in Bangladesh recorded Male to female ratio of 1.95:1 which is comparable to the finding in this study.¹³ However, Gharavifard et al reported that females were more likely than males to die after an operation (52.8%).¹⁴

Among all the paediatric age group stratifications, neonates had the highest number of deaths (24, 39.3%). This is a common report in almost all studies on paediatric surgical mortalities.^{3,5,9,12,13,15,16} The high mortality rates among neonates have been attributed to factors like delay in presentation, delay in making diagnosis of surgical conditions, delay in the provision of care once at a medical facility, inadequate facilities, limited and inexperienced man power.^{12,13,15-18} The adolescent age group (14, 23%) was second to the neonatal age group in terms of number of deaths. This is likely due to the fact that adolescents were involved in injuries/accidents more than other age groups. Many authorities have reported injuries/accidents as the commonest cause of death among the adolescent age group.¹⁹⁻²²

Injuries/accidents were the commonest primary cause of death in the study, followed by congenital disorders. The study carried out by Choi et al in 2020

revealed similar findings regarding the primary causes of death among children. Their report showed that the majority of paediatric surgical deaths are due to injuries, followed by congenital conditions, tumours and abdominal conditions.²³ Globally, prematurity and congenital anomalies are more commonly associated with mortality in paediatric surgery.²⁴ However, some available regional data show that neonatal/infant age group and emergency surgeries are the main predictors of mortality, while the most frequent direct cause of death is said to be sepsis, particularly in neonates and infants.^{3,4,25}

Apart from the neonatology unit (24, 39.3%), significant paediatric surgical deaths were recorded in Neurosurgery unit (17, 27.9%), Gastroenterology unit (17, 27.9%) and Trauma unit (15, 24.6%). Most of the cases in Neurosurgery and Trauma units were as a result of injuries/accidents.

In conclusion, this study demonstrated that, in descending order, Injuries/accidents, Congenital disorders, Gastrointestinal diseases, Cancers, Surgical infections and Cardiac diseases are the commonest primary causes of paediatric surgical deaths in this centre. Policy makers in this senatorial district should thus be guided in decision making as regards the necessary investment in paediatric surgical care relevant to improve outcomes.

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