

Factors associated with nocturnal, productive and dry cough in the young adult population of Nigeria^{*, **, ***}

Fatores associados à tosse seca, tosse produtiva e tosse noturna em adultos jovens na Nigéria

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Abstract

Objective: The aim of this study was to determine the factors associated with nocturnal, productive and dry cough among young adults in Nigeria. **Methods:** We evaluated 498 subjects, 20–44 years of age, in Ilorin, Nigeria, using the European Community Respiratory Health Survey (ECRHS) questionnaire, administered by trained interviewers. **Results:** Nocturnal cough was associated with asthma (OR = 10.87; $p < 0.01$), nasal allergy (OR = 6.33; $p < 0.01$), smoking (OR = 3.10; $p < 0.01$), skilled manual and non-manual work (OR = 2.86 and 2.10, respectively; $p < 0.01$ for both) and female gender (OR = 1.33; $p = 0.17$). Productive cough was associated with skilled manual and non-manual work (OR = 3.82 and 3.03, respectively; $p < 0.01$ for both), smoking (OR = 3.10; $p < 0.01$), asthma (OR = 3.27; $p < 0.01$) and nasal allergy (OR = 5.81; $p < 0.01$). Dry cough was associated with asthma (OR = 5.18; $p < 0.01$) obesity (OR = 1.88; $p = 0.19$), smoking (OR = 1.77; $p = 1.44$), nasal allergy (OR = 1.45; $p = 0.26$) and female gender (OR = 1.36; $p = 0.33$). Age, gender, type of residence and obesity were not significantly associated with any type of cough ($p > 0.05$). **Conclusions:** Early prevention and treatment of conditions associated with cough, as well as the modification of social factors commonly associated with cough, are needed in order to reduce respiratory morbidity.

Keywords: Cough; Smoking; Asthma; Rhinitis; Nigeria.

Resumo

Objetivo: Determinar os fatores associados à tosse seca, tosse produtiva e tosse noturna entre jovens adultos na Nigéria. **Métodos:** Foram avaliados 498 indivíduos com 20–44 anos de idade em Ilorin, Nigéria, utilizando-se o questionário *European Community Respiratory Health Survey* (ECRHS), administrado por entrevistadores treinados. **Resultados:** A tosse noturna apresentou associações com asma (OR = 10,87; $p < 0,01$), alergia nasal (OR = 6,33; $p < 0,01$), tabagismo (OR = 3,10; $p < 0,01$), trabalho manual e trabalho não manual especializados (OR = 2,86 e 2,10, respectivamente; $p < 0,01$ para ambos) e gênero feminino (OR = 1,33; $p = 0,17$). A tosse produtiva apresentou associações com trabalho manual e trabalho não manual especializados (OR = 3,82 e 3,03, respectivamente; $p < 0,01$ para ambos), tabagismo (OR = 3,10; $p < 0,01$), asma (OR = 3,27; $p < 0,01$) e alergia nasal (OR = 5,81; $p < 0,01$). A tosse seca apresentou associações com asma (OR = 5,18; $p < 0,01$) obesidade (OR = 1,88; $p = 0,19$), tabagismo (OR = 1,77; $p = 1,44$), alergia nasal (OR = 1,45; $p = 0,26$) e gênero feminino (OR = 1,36; $p = 0,33$). A idade, o gênero, o tipo de residência e a obesidade não se associaram significativamente a nenhum tipo de tosse ($p > 0,05$). **Conclusões:** A prevenção precoce e o tratamento de condições associadas à tosse, assim como a modificação de fatores sociais comumente associados à tosse, são necessários a fim de reduzir a morbidade respiratória.

Descritores: Tosse; Tabagismo; Asma; Rinite; Nigéria.

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*** The appendix mentioned in the present study is fully available in the online version of the journal at www.jornaldepneumologia.com.br

Introduction

Cough is the symptom for which most patients most often seek medical attention and affects a large proportion of the general population.^(1,2) It can be benign and self-limiting but can also be a warning sign of an impending disease. Cough is an important defense mechanism of the respiratory system. It is responsible for clearing excessive secretions, foreign material and infectious organisms from the airways.⁽¹⁻³⁾ Paradoxically, it also plays an important role in the spread of infection.⁽³⁾ Coughing can result in syncope, abdominal hernia, incontinence or pneumomediastinum. Apart from these physical complications, coughing is an unpleasant and distressing symptom, which, if prolonged, is associated with anxiety, depression and significant impairment in quality of life.⁽³⁻⁵⁾ Cough is induced by various inflammatory or mechanical changes in the airways, as well as by inhalation of chemical or mechanical irritants, typically to upper airway sites, especially the larynx, the carina and other points where the proximal airways branch.⁽⁶⁾ The mechanisms by which clinical cough develops are at present poorly understood.⁽⁷⁾ Studies have discovered a female predisposition to cough and have shown that angiotensin-converting enzyme inhibitors induce cough more often among women than among men.⁽⁸⁻¹⁰⁾ The greater female predisposition to cough has been attributed to increased cough reflex sensitivity.^(11,12) Awareness of demographic and environmental factors associated with the development of cough could promote early identification, increase prevention of such factors and improve treatment of respiratory conditions. Although the determinants of the different types of cough (nocturnal, productive and dry) in other parts of the world are known,⁽¹³⁾ there is a paucity of data on factors associated with cough in Nigeria. Therefore, in this study, we aimed to determine the factors associated with nocturnal, productive and dry cough among young adults in Nigeria.

Methods

This was a cross-sectional study, carried out from October of 2005 to April of 2006 in Ilorin, Nigeria. The study sample was composed of subjects ≥ 18 years of age. The city of Ilorin is in western Africa, at 80°30'N latitude and 40°30'E

longitude. The minimum sample size was arrived at through the use of a Cochran formula⁽¹⁴⁾:

$$N = Z^2 pq / d^2$$

where N is the sample size, p is the prevalence of cough in Nigeria (taken to be 50%, since the prevalence was unknown), $q = (1 - p)$, Z is the standard normal deviation (usually set at 1.96, which corresponds to the 95% confidence interval), and d is the desired degree of accuracy (set at 0.05 to tolerate a 5% error, $N = 384$). The minimum sample size was determined to be 368.

The study area consists of twelve electoral wards, as defined by the state electoral commission. Based on the equality and homogeneity of the wards, multistage cluster sampling was adopted in this study. The electoral wards became the clusters, a sample frame containing a list of the twelve clusters was drawn up, and nine clusters were selected from the sampling frame by simple random sampling. Within each selected cluster, a list of the households was also drawn up. Subsequently, a random selection of households was made, and, in the selected households, willing individuals who met the inclusion criteria were recruited. The inclusion criteria were being ≥ 18 years of age and having resided in Ilorin for at least one year.

Questions were taken from the English-language version of the European Community Respiratory Health Survey (ECRHS) questionnaire.⁽¹⁵⁾ English is the official language spoken by the inhabitants of Ilorin, and the adult literacy level is 60-70%. However; Nigeria has about 250 local languages, and the Yoruba language is widely spoken in the study area. For the 10-15% of the subjects who could not communicate in English, members of the research team translated the English-language questionnaire into Yoruba. The questionnaire was then back-translated into English to ensure accuracy. We tested the questionnaire for face validity, reliability and clarity in a pilot study of 20 subjects for one week. The face validity of the questions on COPD and gastroesophageal reflux disease (GERD) was poor (weighted kappa ≤ 0.50) among the pilot-study subjects, and those questions were therefore excluded. Questions related to pulmonary tuberculosis (PTB) were also excluded because of the social stigma attached to self disclosure of PTB, especially to non-family

members. Subject reluctance to disclose information to the interviewers at intervals can lead to poor reliability and underreporting. Questionnaires were administered directly to the subjects in face-to-face interviews conducted by trained interviewers. The differences between the interviewers were not significant, interviewer rating variability showing a kappa statistic of 0.88. The survey was constantly supervised and regularly monitored by investigators.

For each of the subjects, we obtained sociodemographic data, including the type of dwelling, as well as data related to respiratory symptoms, smoking status, nasal allergy and history of asthma. We also calculated BMI by dividing weight in kilograms by height in meters squared (kg/m^2).

Subjects were classified as having a cough if answering “yes” to the question “Do you usually cough, either during the day or at night?”

Subjects were classified as having nocturnal cough if answering “yes” to the question “Have you been woken by an attack of coughing at any time in the last 12 months?”

Subjects were classified as having productive cough if answering “yes” or “not sure” to the question “Do you usually cough up phlegm from your chest, either during the day, at night or first thing in the morning?” and then answering “yes” to the question “Do you cough up phlegm like this on most days for as much as three months each year?”

Subjects were classified as having dry cough if answering “no” or “not sure” to the question “Do you usually cough up phlegm from your chest, either during the day, at night or first thing in the morning?” and then answering “no” to the question “Do you cough up phlegm like this on most days for as much as three months each year?”

Subjects were classified as having asthma if answering “yes” to the question “Have you ever had asthma?” Obesity was defined as a $\text{BMI} \geq 30 \text{ kg}/\text{m}^2$. Subjects were classified as having nasal allergy if answering “yes” to the question “Have you had two or more recurrent nasal symptoms such as excessive sneezing, nasal itching, nasal discharge or nasal congestion/obstruction that are reversible spontaneously or with treatment over the preceding 12 months?” Subjects were classified as smokers if answering “yes” to

the question “Have you ever smoked tobacco (cigarettes, cigars or a pipe)?”

The data were analyzed with the Statistical Package for the Social Sciences, version 15 (SPSS Inc., Chicago, IL, USA). Descriptive and frequency statistics were generated in order to determine the characteristic of the study population. The Chi-square test was used in order to test the statistical significance, and values of $p < 0.05$ were accepted as statistically significant. Multivariate logistic regression analysis was performed in order to determine the factors associated with nocturnal, productive and dry cough. The ORs were adjusted for age, gender, occupation (See Appendix 1 on line), level of education, type of dwelling, smoking, asthma and nasal allergy.

We obtained institutional approval for the study from the Research Ethics Committee of

Table 1 - Characteristics of the respondents.

Characteristic	n = 498
Age (years), mean \pm SD	30.8 \pm 6.8
BMI (kg/m^2), mean \pm SD	24.9 \pm 3.7
Age bracket, n (%)	
20-29 years	221 (44.4)
30-39 years	200 (40.0)
40-44 years	77 (15.5)
Gender, n (%)	
Female	300 (60.2)
Male	198 (39.8)
Level of education, n (%)	
Primary/Arabic/none	126 (25.3)
Secondary	212 (42.6)
Undergraduate	71 (14.3)
Graduate	89 (17.9)
Occupation, n (%)	
Homemaker/unskilled/student	271 (54.4)
Professional	71 (14.3)
Intermediate	61 (12.2)
Skilled manual worker	52 (10.4)
Skilled non-manual worker	43 (8.6)
Type of dwelling, n (%)	
Single room/slum apartment	331 (67.1)
Apartment/flat/luxury housing	164 (32.9)
Ever smoked, n (%)	80 (16.1)
Ever had asthma, n (%)	59 (11.80)
Nasal allergy, n (%)	152 (30.5)
Types of cough in the last 12 months, n (%)	
Nocturnal cough	136 (27.3)
Productive cough	84 (16.9)
Dry cough	48 (9.6)

the University of Ilorin Teaching Hospital. All participating subjects gave written informed consent.

Results

We enrolled 498 subjects, of whom 300 (60.2%) were male and 198 (39.8%) were female. In the sample as a whole, the mean age was 30.8 ± 6.7 years. Of the 498 subjects, 136 (27.3%) reported nocturnal cough and 362 (72.7%) reported no nocturnal cough ($p < 0.001$), whereas 80 (16.0%) reported productive cough and 48 (9.6%) reported dry cough. Among the subjects who reported cough, the mean age was 31.0 ± 7.0 years (Table 1). The multivariate logistic regression showed that subjects who had ever had asthma were eleven times more likely to have nocturnal cough, those with nasal allergy were six times more likely to have nocturnal cough, and those who had ever smoked or had engaged in skilled manual work were three times more likely to have nocturnal cough. Subjects who were between 30 and 39 years of age were more likely to report nocturnal cough, as were those who were female, those who had only a primary school education and those living in a single room or in a slum apartment, although the differences were not statistically significant (Table 2). Skilled manual workers were four times more likely to report productive cough. Subjects engaged in skilled non-manual work were three times likely to report productive cough, as were those who had ever had asthma, those who had nasal allergy and those who had ever smoked. Males and those with only primary school education were more likely to report productive cough, although the differences were not statistically significant (Table 3). Females were more likely to have dry cough, as were obese subjects, unskilled workers, homemakers, subjects living in a single room or in a slum apartment, subjects who had ever had asthma and subjects with nasal allergy, although the association was statistically significant only for asthma.

Discussion

In the present study, nocturnal cough was found to be strongly associated with skilled occupations, asthma, nasal allergy and smoking. Our data are similar to those reported in a survey

Table 2 – Multivariate logistic regression of the factors associated with nocturnal cough in an adult population in Nigeria.

Factor	Adjusted OR (95% CI)	p
Age bracket		
20-29 years	1.00	
30-39 years	0.86 (0.57-1.29)	0.47
> 39 years	1.20 (0.70-2.06)	0.50
Gender		
Female	1.00	
Male	1.33 (0.71-1.96)	0.17
Level of education		
Graduate	1.00	
Primary/Arabic/none	1.23 (0.80-1.97)	0.32
Secondary	1.12 (0.75-1.71)	0.55
Undergraduate	0.87 (0.47-1.60)	0.65
Occupation		
Homemaker/unskilled worker/student	1.00	
Skilled manual worker	2.86 (1.52-5.40)	< 0.01
Skilled non-manual worker	2.10 (1.17-3.80)	0.01
Professional worker	0.57 (0.29-1.14)	0.11
Intermediate-level worker	0.88 (0.47-1.64)	0.68
Type of dwelling		
Apartment/flat/luxury housing	1.00	
Single room/slum apartment	1.33 (0.84-2.10)	0.23
Ever smoked		
No	1.00	
Yes	3.10 (1.89-5.05)	< 0.01
Ever had asthma		
No	1.00	
Yes	10.87 (5.26-22.73)	< 0.01
Nasal allergy		
No	1.00	
Yes	6.33 (3.83-8.60)	< 0.01
Obesity		
No	1.00	
Yes	1.02 (0.49- 2.12)	0.98

conducted in Europe.⁽¹³⁾ Nocturnal cough is one of core symptoms of asthma, and nasal allergy is a risk factor for asthma. Asthma and nasal allergy are concurrent diseases; both disorders are manifestations of the chronic allergic respiratory disease, or “united airways disease”.⁽¹⁶⁾ This might explain the strength of the associations that both conditions showed with nocturnal

Table 3 – Multivariate logistic regression of the factors associated with productive and dry cough.

Factors	Productive cough		Dry cough	
	OR (95% CI)	p	OR (95% CI)	p
Age bracket				
20-29 years	1.00		1.00	
30-39 years	0.94 (0.58-1.52)		0.85 (0.36-2.05)	
> 39 years	1.02 (0.53-1.96)	0.95	1.15 (0.51-2.56)	0.73
Gender				
Male	1.00		1.00	
Female	0.86 (0.53-1.41)	0.55	1.36 (0.73-2.56)	0.33
Level of education				
Graduate	1.00		1.00	
Primary/Arabic/none	1.61 (0.93-2.97)	0.09	0.76 (0.37-1.58)	0.47
Secondary	1.18 (0.74-1.89)	0.74	1.23 (0.67-2.25)	0.50
Undergraduate	0.59 (0.47-1.60)	0.19	1.47 (0.68-3.20)	0.33
Occupation				
Professional worker	1.00		1.00	
Homemaker/unskilled worker/student	0.36 (0.21-0.60)	< 0.01	1.50 (0.78-2.86)	0.22
Skilled manual worker	3.82 (1.97-7.42)	< 0.01	0.98 (0.33-2.87)	0.97
Skilled non-manual worker	3.03 (1.61-5.68)	< 0.01	0.44 (0.09-1.45)	0.14
Intermediate-level worker	1.13 (0.56-2.27)	0.74	0.86 (0.33-2.25)	0.75
Residence				
Single room/slum apartment	1.00		1.00	
Apartment/flat/luxury housing	0.75 (0.41-1.38)	0.36	0.74 (0.46-1.81)	0.79
Ever smoked				
No	1.00		1.00	
Yes	3.10 (1.68-5.71)	< 0.01	1.77 (0.82-3.80)	1.44
Ever had asthma				
No	1.00		1.00	
Yes	3.27 (1.78-6.03)	< 0.01	5.18 (2.57-10.41)	< 0.01
Nasal allergy				
No	1.00		1.00	
Yes	5.81 (3.42-9.86)	< 0.01	1.45 (0.76-2.76)	0.26
Obesity				
No	1.00		1.00	
Yes	0.69 (0.25-1.77)	0.42	1.88 (0.73-4.88)	0.19

cough in the present study. Female gender and a low level of education were also associated with nocturnal cough, although the associations were not statistically significant. Previous attempts at establishing the determinants of cough have associated female gender with all types of cough,⁽¹³⁾ which differs slightly from our investigation, in which female gender was associated with nocturnal and dry cough only. Although the cause of female predominance is unknown, most studies have attributed it to females having cough receptors that are more sensitive than are those of males.^(10-13,17) Other researchers have attributed it to the modulating effect that estrogen and progesterone have

on airway smooth muscle tone and bronchial responsiveness, as well as to differences in the deposition of tussigenic agents in the airways due to the smaller airway size in females.⁽¹⁸⁻²⁰⁾ Our study also revealed that the frequency of the three types of cough decreases with age. Age was negatively associated with all types of cough, which is in agreement with the findings of other investigators.^(9,13) Notably, the multivariate logistic regression conducted in the present study showed that subjects over 39 years of age were more likely to report cough (nocturnal, productive or dry), although the associations were not significant. We found nocturnal and productive cough to be more common among

skilled workers and among poorly educated individuals. Socioeconomic class, which is a function of the level of education, income and type of occupation, was negatively associated with cough, subjects classified as belonging to the lower socioeconomic classes being more likely to report cough. This is in agreement with the findings of a study conducted in Italy, in which productive cough was also associated with lower socioeconomic class.⁽²¹⁾ This might be attributable to the fact that the majority of individuals in the lowest socioeconomic classes are engaged in blue-collar jobs, which are associated with indoor or outdoor occupational exposure to dust or noxious agents that are toxic to the airways. In addition, in low-income countries, there is poor occupational surveillance and inadequate environmental protection of the workforce from occupational exposure in this kind of job. In the present study, smoking was strongly associated with nocturnal, dry and productive cough. After adjusting for confounding variables, the association with dry cough was not significant. Other studies have obtained similar results.^(13,21) The inhalation of tobacco smoke (active or passive smoking) often leads to irritation of the lungs, causing inflammation that is amplified by free radicals that further damage the microscopic structures of the lung. The effects of tobacco smoke also include altered mucous composition and inability of non-ciliated metaplastic epithelial cells to remove small particles and microorganisms. Respiratory tract infections, such as bronchitis, pneumonia, infectious exacerbations of chronic respiratory disorders and even PTB, occur much more often in smokers.⁽²²⁾ The incidence of asthma and acute asthma exacerbations is higher in smokers than in nonsmokers, and there is a dose-response relationship between smoking and asthma exacerbations.⁽²²⁾ Our data also show that the three types of cough were more likely to occur in individuals living in a single room or in a slum apartment than in those living in a self-contained dwelling or luxury apartment, although the associations were not statistically significant. Overcrowding and poorly ventilated housing are risk factors for the spread of airborne infection and frequent exposure to higher dose of inhalable particles from biomass gas and indoor pollutants. In the present study, obesity was associated with dry cough only, a finding that

differs from that reported in the ECRHS study, in which obesity was associated with all three types of cough.⁽¹³⁾ The geographical variation in the results might be due to the high prevalence of obesity in the developed world, as opposed to that seen in the developing world, from which our study population was drawn.⁽²³⁾ In addition to the consideration of the epidemiological factors associated with cough, a rational diagnostic approach and streamlining the list of differential diagnoses in clinical practice have been advocated as major steps toward successful and cost-effective therapy.⁽²⁴⁾ The limitation of the present study was that we did not consider the effects of other conditions, such as GERD, COPD and bronchiectasis, due to the poor face validity and reliability of the items on the questionnaire and the social stigma associated with disclosure of PTB to non-family members. We also found it difficult to differentiate GERD from other acid peptic disorders such as chronic gastric and duodenal ulcer using the questionnaire, since all three conditions have quite similar symptoms. Asthma and nasal allergy could be accurately reported by the subjects unlike other respiratory conditions because of their increased awareness among the people. Moreover in this study area, most respiratory diseases cannot be identified by a local parlance or word, thereby making it difficult for accurate self reporting in an epidemiological study.

In conclusion, nocturnal, productive and dry cough were strongly associated with treatable conditions, such as asthma and nasal allergy, preventable habits, such as smoking, and working in skilled manual or non-manual occupations. These findings have major implications for the prevention of respiratory diseases among Black Africans and in countries with limited resources. Our data highlight the role of preventable and treatable conditions associated with the development of cough. Early prevention and treatment of conditions associated with cough, as well as the modification of social factors commonly associated with cough, are needed in order to reduce respiratory morbidity and mortality.

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