

Obstructive Lung Disease in Acute Medical Patients

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ABSTRACT

Objectives: To determine the proportion of adult medical patients who have chronic obstructive pulmonary disease (COPD), using the Global initiative for Chronic Obstructive Lung Disease guidelines (GOLD), and its relation to vascular disease.

Methods: This is a prospective cross-sectional study of adult patients admitted to acute medical wards. Interviewer administered questionnaire, anthropometric and spirometric measurements were done.

Results: Spirometry was performed in 720 acute admissions [Mean (SD) age 50.0 (18.9) years, FEV₁: 1.98L (0.83), FEV₁/FVC %: 75.1 (11.9)%; males 332 (46.1%), smokers 318 (44%); 43.2% had vascular disease]. Sixty-seven per cent of patients (480) had no airway disease including 35 (4.5%) with chronic cough and sputum with normal spirometry; 89 (12.4%) had asthma and 151 (20.9%) had COPD. Patients with COPD were significantly older [60.3 (16.6) years] than non-COPD patients [47.3 (18.5) years], $p < 0.001$ and had a greater number of pack years of smoking. A greater percentage of patients with COPD had vascular disease (52%) than the non-COPD patients (40.1%), $p = 0.017$. Multivariate analysis with vascular disease as outcome variable revealed relationships with older age ($p < 0.001$) and Indo-Trinidadian ethnicity ($p = 0.015$), but not with gender ($p = 0.321$) and smoking ($p = 0.442$). FEV₁% as well as FEV₁ showed a significant inverse relationship with vascular disease ($p < 0.05$).

Conclusions: The prevalence of COPD using GOLD guidelines in acute hospital admissions is 20.9%; 11.7% of admissions have chronic sputum or cough with normal spirometry. Vascular disease is more prevalent in those with COPD. Patients admitted to acute medical care with vascular disease may also have COPD.

Enfermedad Pulmonar Obstructiva en Pacientes Clínicos Agudos

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RESUMEN

Objetivos: Determinar la proporción de pacientes clínicos adultos con EPOC, mediante la guía clínica de la Iniciativa Global para la Enfermedad Pulmonar Obstructiva Crónica (GOLD, en inglés), y su relación con la enfermedad vascular.

Métodos: Este es un estudio transversal prospectivo de pacientes adultos ingresados en salas para la atención de enfermedades agudas. El entrevistador aplicó cuestionarios, y se realizaron mediciones antropométricas y espirométricas.

Resultados: La espirometría se realizó en 270 casos de ingresos con enfermedades agudas (edad promedio (SD) 50.0 (18.9) años, FEV₁: 1.98 L (0.83), FEV₁/FVC %: 75.1 (11.9) %; varones 332 (46.1%), fumadores 318 (44%); 43.2% padecían de enfermedad vascular). El sesenta y siete por ciento de los pacientes (480) no presentaban enfermedades de las vías respiratorias, incluyendo 35 (4.5%) con tos crónica y esputo con espirometría normal; 89 (12.4%) padecían de asma y 151 (20.9%) tenían EPOC. Los pacientes con EPOC eran significativamente mayores [60.3 (16.6) años] que los pacientes sin EPOC [47.3 (18.5) años], $p < 0.001$ y llevaban un número mayor de paquete-años fumando. Un

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mayor porcentaje de pacientes con EPOC presentaban enfermedades vasculares (52%) en comparación con los pacientes sin EPOC [(40.1%), $p = 0.017$]. El análisis multivariante con la enfermedad vascular como variable dependiente o variable respuesta reveló relaciones con el incremento de los años de edad ($p < 0.001$) y la etnicidad indo-trinitense ($p = 0.015$), pero no con el género ($p = 0.321$) y el hábito de fumar ($p = 0.442$). $FEV_1\%$ así como FEV_1 mostraron una relación significativa inversa con la enfermedad vascular ($p < 0.05$).

Conclusiones: La prevalencia de EPOC usando la guía clínica GOLD en los ingresos a hospitales debido a enfermedades agudas es de 20.9%; 11.7% de los ingresos presentan esputo crónico y tos con espirometría normal. La enfermedad vascular es más prevalente en pacientes con EPOC. Los pacientes ingresados para atención médica por enfermedad aguda, pueden también presentar EPOC.

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INTRODUCTION

In 1977, Fletcher and Peto demonstrated a strong link between obstructed spirometry and smoking in a population of 792 male British postal workers (1). These patients had what is now termed chronic obstructive pulmonary disease (COPD). According to the Global initiative for Chronic Obstructive Lung Disease (GOLD) criteria, COPD is a disease state characterized by airflow limitation that is not fully reversible. In a population of 4517 American smokers (61.9% male), the Lung Health Study-3 showed that continuous smokers are far more likely to develop COPD than sustained quitters (38% vs 10%) (3). Chronic obstructive pulmonary disease is now the sixth leading cause of death worldwide and is expected to be the third leading cause of death by 2020 (2).

A patient is said to have airway obstruction when the ratio of the forced expiratory volume in one second (FEV_1) to the total volume of air exhaled during a forced manoeuvre, the forced vital capacity (FVC), is less than 70% (2). Both these parameters are measured using a spirometer. Currently, there is little data available on obstructed spirometry in Trinidad and Tobago. However, anecdotal reports suggest that symptoms of airway and/or cardiac diseases (dyspnoea, sputum and cough) are commonly associated with acute medical admissions in Trinidad. Thus some acute medical patients may have obstructed airways without any previous diagnosis of such (2). The presence of obstructed spirometry in middle-aged and elderly adults on admission without a history of asthma is more likely to be associated with COPD than asthma (4) and further, smoking, a risk factor common to medical admissions, is associated with both cardiac and airway diseases in adults.

The Renfrew and Paisley prospective study of 15 411 Scottish middle-aged subjects demonstrated a strong association between obstructed spirometry and death from vascular diseases of ischaemic heart disease and stroke (5). Therefore, even in patients admitted for non-respiratory causes, the presence of obstructed spirometry may be of prognostic importance and it has been suggested that FEV_1 is a better predictor of cardiovascular mortality than other risk factors such as cholesterol (5).

We measured spirometric parameters in acute medical admissions at the Port-of-Spain General Hospital in Trinidad and Tobago and related these to smoking history, a history of chronic respiratory symptoms and the presence of vascular diseases.

SUBJECTS AND METHODS

This study considered consecutive patients admitted to the Adult Medical wards of the Port-of-Spain General Hospital (POSGH) (6). A re-admission was any patient who was admitted more than once during the one-month period in which the study was conducted. Thus, patients that were only admitted once or the first admission for any re-admitted patients were considered to be first-admissions. Only data on first-admissions were analyzed.

Ethical permission for conduct of the study was obtained from the institutional review boards of the Faculty of Medical Sciences, The University of the West Indies, St Augustine Campus and the Port-of-Spain General Hospital, Trinidad and Tobago.

Exclusion criteria were (7): haemoptysis of unknown origin, pneumothorax, unstable cardiovascular status or pulmonary embolus, thoracic, abdominal or cerebral aneurysms (danger of rupture due to increased thoracic pressure), recent eye surgery *eg* cataract surgery, presence of an acute disease process that might interfere with test performance (for example nausea, vomiting or diarrhoea), recent surgery of thorax or abdomen, confused patients, patients unable to sit up even with assistance, severe chest and/or abdominal pain (exclusive of cardiovascular diseases *eg* costochondritis, peptic ulcer disease (PUD) *etc*, high clinical suspicion of tuberculosis.

Inclusion criteria: any acute medical admission, to whom the exclusion criteria did not apply, was admitted into the study provided they gave informed, written consent. To assess FEV_1 and FVC, a turbine spirometer was used. The spirometer met the requirements proposed by the American Thoracic Society (ATS) and was calibrated appropriately (7,

8). Age and height were noted and predicted FEV₁ calculated (9). Open-circuit testing was used (7, 10).

The smoking history was classified as never-smoker (never smoked) and smokers. The latter consisted of current smokers (currently smoke or quit within the past year), ex-smokers (quit greater than a year ago) and intermittent quitters (relapsed back to smoking after giving up).

Airways disease was said to be present if a patient had a history of asthma or obstructed spirometry or both. A chronic respiratory symptom (cough, sputum or dyspnoea) was said to be present if in the stable state the patient indicated that such a symptom was present daily for more than four days per week and dyspnoea was classified according to the Medical Research Council Dyspnoea scale (12). Chronic obstructive pulmonary disease was defined and staged according to the GOLD guidelines (2). A patient was taken as obstructed or having airways obstruction if FEV₁/FVC was less than 70% (2). Asthma was considered present if a subject replied affirmatively to the question "Have you ever had asthma?" (11) or if diagnosed as having asthma in the medical notes. A patient was taken as having vascular disease if any one or more of the following was stated in the medical notes: stroke, ischaemic heart disease, myocardial infarction, hypertension, congestive cardiac failure (with HTN and/or diabetes mellitus), or cardiac arrhythmia due to ischaemic heart disease and/or heart block.

During the study, there were 1334 admissions with the commonest causes of admission being cardio-respiratory disease (39.1%) followed by diabetes mellitus (10.1%) and gastrointestinal complaints (9.0%). However, 79 (5.9%) were re-admitted leaving 1255 (94.1%) first-admissions during the study. The mean age of first-admissions (n = 1255) was 52.2 (19.94) years with 48.0% males. For the first-admissions, 535 (42.6%) patients were excluded from the study for reasons shown in Table 1 and had a mean age of 55.2 (20.9)

Table 1: Exclusion criteria amongst new admissions to Port-of-Spain General Hospital for period July 7 to August 6, 2004.

Exclusion Criteria in New Admissions (n = 1255)	Excluded Patients (%) (n = 535)
Absconded	55 (11.5%)
Acute vomiting or diarrhoea	4 (0.8%)
Confused	115 (24.1%)
Deceased	12 (2.5%)
Discharged prior to interview	174 (36.4%)
High clinical suspicion of tuberculosis	8 (1.7%)
Non-compliance	12 (2.5%)
Recent surgery	6 (1.3%)
Severe chest or abdominal pain	22 (4.6%)
Unable to sit upright	43 (9.0%)
Unacceptable blows during spirometry	57 (4.5%)
Unstable cardiovascular status	27 (5.6%)

years, of which 270 (50.5%) were males. The excluded patients were older ($p < 0.001$) but with no significant gender difference ($p = 0.127$). Thus 720 patients had acceptable spirometry and were studied. Of these patients, height data

were missing for seven patients (two with airways disease, five without) and so all analyses involving FEV₁% predicted were calculated with 713 patients. In the analysis of vascular diseases, three patients were excluded (diagnoses were inadequately recorded in the medical notes), thus FEV₁% predicted was determined from 710 patients for whom the vascular disease history was also known.

Based on previous work done in the United States of America (USA) (13), with an assumption of COPD in 20% of smokers (2), we estimated that a sample size of 598 was required to detect an effect of smoking on spirometric parameters with 95% confidence and with a statistical power of 80%.

Data for continuous variables were expressed as means (standard deviation, SD) or median (interquartile range, IQR) as appropriate; discrete data were summarized as number (%). The independent samples, t-test or Mann Whitney tests were used to test for differences between continuous variables as appropriate. The Chi-squared test was used to test for differences between categorical/discrete variables *eg* gender and smoking. Spearman's correlation was used to compare relationships between variables. Associations were considered statistically significant at the 5% level.

Backward stepwise binary logistic regression was used to determine the relationship of vascular disease with spirometric parameters. Smoking was included in the regression equation because of its previously known association with vascular disease; apart from this, only variables showing significant univariate association with vascular disease were included in the multivariate analysis. Statistical analyses were performed with SPSS version 12.0 for Windows.

RESULTS

Of the 720 patients [mean (SD) age 50.0 (18.9) years] included in the study, 332 (46.1%) were males and had a greater mean age of 51.6 (18.9) years than the females, 48.7 (18.8) years, $p = 0.041$. Three hundred and eighteen (44%) patients gave a history of smoking, 43.2% gave a history of vascular disease and discharge dates were available for 668 patients: median (IQR) length of stay was 2 (1– 4) days.

For all patients, the mean FEV₁ was 1.98(0.83) L, FEV₁% 62.4(18.9), FVC 2.62 (0.95) L and FEV₁/FVC 75.2 (12.0)%. FEV₁, FEV₁%, FVC and FEV₁/FVC all showed a significant negative correlation with age ($r = -0.51, -0.14, -0.36$ and -0.43 , respectively, $p < 0.001$ in all cases). The mean FEV₁ and FVC were greater in Afro-Trinidadians [2.06(0.85), 2.73(0.95) respectively] than in the Indo-Trinidadians [1.76(0.77), 2.30(0.92)], $p < 0.001$ but there was no significant difference in FEV₁% predicted ($p > 0.05$).

Table 2 shows that 480 (67%) patients had no airways disease. However, these included a group of 35 (4.5%) patients with chronic sputum and cough. Of the remaining 240 patients, 89 gave a history of asthma but 151 (20.9%; 95% CI 17.0, 23.0 %) had a ratio of FEV₁/FVC < 70% but gave no history of airways disease (apart from four patients

Table 2: Demographic data, smoking history and lung function among participants according to presence or absence of obstructed spirometry. FEV₁: forced expiratory volume in 1 second. FVC: forced vital capacity. [1 missing smoker type in not obstructed group (n = 532)]

Characteristics in New Admissions (n = 1255)	No Airways Disease n = 480	Asthma n = 89	COPD n = 151	p-value**
Mean (SD) Age/yrs	47.2 (18.4)	47.8 (19.5)	60.3 (16.6)	< 0.001 ¹
Gender, Male, n (%)	212 (44)	41 (46)	79 (52)	0.08 ²
Ethnicity n (%)*				0.484 ³
Indo-Trinidadian	138 (29)	24 (27)	36 (24)	
Afro-Trinidadian	223 (47)	36 (40)	78 (52)	
Other	119 (24)	29 (33)	37 (24)	
Smoking History n (%)				0.003 ³
Never smoker	286 (60)	47 (53)	69 (46)	
Current smoker	111 (23)	32 (36)	45 (30)	
Ex-smoker	74 (15)	7 (8)	34 (22)	
Intermittent quitter	8 (1.7)	3 (3)	3 (20)	
Smoking Pack Years Mean (SD)	5 (11)	4 (8)	11 (22)	< 0.001 ⁴
Lung Function [mean (SD)]				
FEV ₁ /L	2.20 (0.81)	1.74 (0.81)	1.46 (0.62)	< 0.001 ¹
FEV ₁ % predicted	67.8 (16.4)	53.7 (18.7)	50.4 (19.6)	< 0.001 ¹
FVC/L	2.71 (0.95)	2.44 (0.92)	2.42 (0.94)	0.001 ¹
FEV ₁ /FVC %	80.9 (6.8)	70.4 (13.3)	59.6 (8.6)	< 0.001 ¹

*Ethnicity was determined from the patient's own perception.

** Comparison of COPD with 'no airways disease'

Statistical Tests: ¹t-test ²Chi-square ³Kruskal-Wallis ⁴Mann-Whitney

who had known COPD). Table 2 shows that this latter COPD group was older, smoked more and had lower spirometric indices than the group with no airways disease.

The COPD patients were staged as follows: GOLD stage I, 8 (5.3%); stage II, 65 (43.0%); stage III, 53 (35.1%) and stage IV, 24 (15.9%) [1 missing height]. No significant association was found between ethnicity (Indo- and Afro-Trinidadians) or gender and GOLD stages, $p > 0.05$ in both cases. Patients with a lower FEV₁ or lower FEV₁% were more likely to have a greater length of stay in hospital ($p < 0.001$ in both cases). Further patients with GOLD stages I and II had a shorter median length of stay of 2 (1–3) days compared to GOLD stages III and IV, 3 (2.0, 4.8) days, $p = 0.036$. Thus severity of COPD contributed to in-hospital stay without it necessarily being recognized as a problem.

Three hundred and eighteen (44.2%) subjects were smokers. The mean age of smokers [51.6 (18.3) years] and their ethnicity were similar to never smokers [48.7 (19.3) years], $p > 0.05$ in both cases but prevalence of smoking in males was 69.3% as opposed to 22.5% in females, $p < 0.001$. Twenty-five per cent of patients reported a lifetime exposure of greater than 100 cigarettes. Table 2 shows that there was a greater proportion of smokers in patients with airways disease.

Smokers had a lower mean FEV₁ and FEV₁/FVC% than never-smokers, $p < 0.005$ in both cases. Figure 1 shows that in smokers above 40 years FEV₁/FVC% is reduced

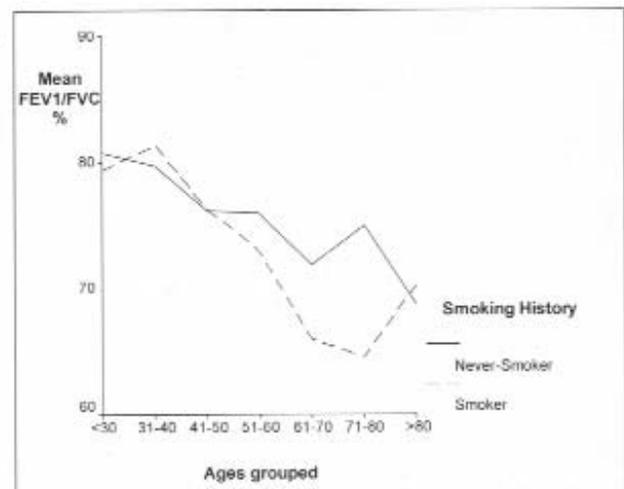


Fig. 1: Graph of mean FEV₁/FVC % vs Age Group classified by smoking history in 720 patients.

compared to never-smokers. When smoker types were taken into consideration, the mean FEV₁/FVC% of the never smokers was higher than that in each of the smoker categories. Smoking pack years was negatively correlated with FEV₁/FVC% ($r = -0.165$, $p < 0.001$).

Chronic dyspnoea (MRC grades 0–4), cough and sputum production (for greater than 4 days per week) were all greater in the airways disease patients ($p < 0.0001$ in all

cases). There were significant associations between COPD and chronic respiratory symptoms (dyspnoea, $p = 0.005$, cough, $p = 0.032$ but not sputum, $p = 0.052$). The prevalence of COPD in the group with chronic sputum was 28.0% (95% CI: 19.4, 36.7) and the prevalence in the group with chronic cough was 27.8% (95% CI: 20.1, 35.5).

Smoking history also showed a significant association ($p < 0.001$) with the MRC Grade of Dyspnoea. Amongst never-smokers ($n = 402$), there were 181 (45.0%) patients with Grade 0 dyspnoea, 103 (25.6%) with Grade 1, 53 (13.2%) with Grade 2, 35 (8.7%) with Grade 3 and 30 (7.5%) with Grade 4. Amongst smokers, there were 158 (49.8%) with Grade 0, 43 (13.6%) with Grade 1, 36 (11.3%) with Grade 2, 46 (14.5%) with Grade 3 and 34 (10.7%) with Grade 4. Smokers were also more likely to report chronic cough or sputum, $p < 0.001$ in both cases.

Three hundred and eleven (43.2%) patients had vascular disease. The mean age for vascular disease was greater than that for non-vascular disease [59.2 (15.1) years and 42.8 (18.4) years respectively, $p < 0.001$]. Of the Indo-Trinidadians, 100 (50.5%) patients had vascular disease as compared to the Afro-Trinidadians in which 133 (39.7%) had vascular disease. There was no relationship between vascular disease and either gender or smoking ($p > 0.3$ in both cases) but Figure 2 shows that patients with vascular disease

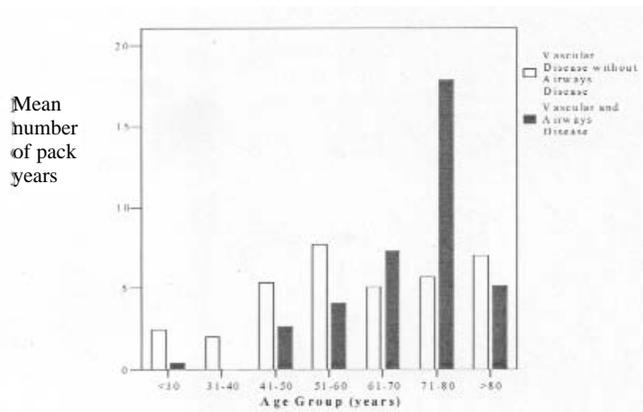


Fig. 2: Graph of mean number of pack years of smoking vs age group in patients with vascular disease 311; patients with vascular disease with (closed boxes) and without (open boxes) airways disease.

but without airways disease still had a significant smoking burden. A greater percentage of patients with COPD had vascular disease (52%) than the non-COPD disease patients (41%), $p = 0.017$. The prevalence of COPD in those with vascular disease was 25.1 (20.9 – 30.0) per cent. There was no significant difference in vascular disease between patients with chronic cough or sputum who also had normal spirometry and patients with COPD, $p = 0.224$.

Table 3 shows that FEV_1 , FVC, $FEV_1\%$ predicted and FEV_1/FVC were all lower in patients with vascular disease. Table 4 shows that when adjusted for smoking, age and gender, this relationship was maintained for $FEV_1\%$ and

Table 3: Comparison of spirometric parameters between vascular and non-vascular disease patients. [Of the 720 patients, heights were not recorded for seven and the medical record unclear about presence of vascular diseases in three patients; t-test.]

Spirometric Parameters	Median (IQR)		p
	Non-Vascular n = 406	Vascular n = 311	
FEV_1 (L) (n = 717)	2.20 (0.85)	1.70 (0.70)	< 0.001
$FEV_1\%$ (n = 710)	64.7 (18.96)	59.5 (18.7)	0.001
$FEV_1/FVC\%$ (n = 717)	76.6 (12.0)	73.3 (11.7)	< 0.001

Table 4: Multivariate analyses using backward stepwise binary logistic regression with vascular disease as outcome variable [n = 713 patients].

	Regression coefficient	p-value
$FEV_1\%$	-0.010	0.031
Age	0.054	< 0.001
Male Gender	0.302	0.035
Smoker	0.640	0.424
Constant	-2.631	< 0.001

results were similar if FEV_1 was substituted into the regression instead, so we report the results for $FEV_1\%$.

DISCUSSION

This study showed that 20.9% of patients had COPD while 4.5% had chronic respiratory symptoms of cough and sputum with normal spirometry. Asthmatics were excluded from GOLD stage classification though it is known that COPD can coexist with asthma (11). In GOLD stage IV were 15.9% of COPD patients most of whom were not ever diagnosed as having COPD. Smokers who were more likely to report chronic dyspnoea, cough or sputum comprised 44.2% of admissions. Parameters of obstruction (FEV_1 , $FEV_1\%$, $FEV_1/FVC\%$) were related to age, gender, smoking history and vascular disease. Patients with vascular disease were more likely to have a lower FEV_1 or $FEV_1\%$.

There is some doubt as to the applicability of the fixed ratio $FEV_1/FVC < 70\%$ to diagnose COPD in elderly patients since the FEV_1/FVC ratio declines with age (14). However, a study of 4965 subjects 65 years and older showed that $FEV_1/FVC < 0.70$ identifies patients at risk of hospital admission for COPD and death (14). Consistent with this, we found that a greater percentage of obstruction was seen in the older age groups compared to the younger age groups. The prevalence of obstruction was also greater in males which may in fact be due to a higher proportion of smoking in males. Though FEV_1 was greater in Afro-Trinidadians, when corrected for age and height there was no difference in

FEV₁% between the major ethnic groups, indicating no ethnic predisposition to COPD amongst the patients admitted to hospital.

In the present study, 20.9% of patients had COPD but only 4 patients had previously been diagnosed with COPD with the remainder having no known history of respiratory disease. A low FEV₁, presence of COPD as well as COPD severity were indicators of health burden as inferred from the relation to prolonged in-hospital stay. The under-diagnosis of COPD detected in this study is common due to several factors. Firstly, there is limited use of spirometry in the health service, this implies that COPD will be difficult to differentiate from asthma as well as from chronic symptoms such as dyspnoea that subjects may associate with ageing or cardiac disease (15). In a screening study of 1040 subjects over 40 years of age in a Japanese community, Takahashi *et al* found COPD in 21.9% and Schirnhofner *et al* similarly found a 26% prevalence of COPD in Salzburg (16, 17). Thus, the under-diagnosis of COPD is common even in societies where there is more frequent use of spirometry (18, 19). Secondly, despite the detection of airways disease in this study, most of these patients were admitted for other reasons indicating that there is considerable co-morbidity with COPD in this study consistent with the findings of Mohan *et al* who concluded that co-morbid conditions and metabolic abnormalities render the diagnosis of COPD difficult (20). The COPD prevalence worldwide is thought to be about 10% (21) but the prevalence of COPD in the community in Trinidad and Tobago is unknown.

The prevalence of cigarette smoking in this hospital admissions was 44% with 25% of admissions reporting smoking-exposure of greater than 100 cigarettes which latter figure is larger than the WHO-estimated national reporting rate of exposure to more than 100 cigarettes of about 17% based on the National Health Survey of 1995 (22). Smoking history was significantly associated with a reduced FEV₁/FVC% and increasing stages of COPD severity. This was consistent in all age groups except the oldest age group which may be due to a healthy survivor effect. The relationship of smoking to respiratory symptoms is already well known and we observed expected relationships to all chronic respiratory symptoms studies: dyspnoea, cough or sputum (1–3). A significant proportion of patients with airways obstruction did not admit to a history of smoking. The cause of airway obstruction in non-smokers (who were non-asthmatics) in this study is unknown, but may have involved exposure to second hand smoke, occupational dusts or chemicals. These associations may be the targets for future research. However, the finding of obstruction and low FEV₁% in never-smokers has been shown to be related to mortality in the Copenhagen City Heart Study (23).

Vascular disease was associated with reduced values of FEV₁, FEV₁% and FEV₁/FVC% compared to those without vascular disease. Thus the present study suggests that a lower FEV₁ may be an indicator of vascular risk even in

patients without a known history of airway disease as supported by previous work (5, 23). A recent study using the Saskatchewan Health longitudinal database shows that patients with more severe COPD, had higher cardiovascular morbidity and mortality than patients with less severe COPD. Other studies mainly in temperate countries have also found similar links (24, 25). Thus, it has been postulated that the link between vascular disease and COPD may depend on low temperatures. However our study, in a warm climate, has found a similar relationship. The present study also found that the FEV₁-vascular disease relationship was independent of cigarette smoking and this has also been shown elsewhere (25). The links between COPD and vascular disease though not fully understood, are thought to involve inflammation-mediated pathways since persistent low-grade lung and systemic inflammation, both known risk factors for cardiovascular disease, are present in COPD independent of cigarette smoking (25–27).

Some limitations of this study should be considered. This study involved acute medical admissions. Since the prevalence of COPD was unknown in the Caribbean, it was felt that it would be more likely to detect airways obstruction in hospital and so it would be more likely to detect COPD patients in this population than elsewhere. Also, since normal spirometric values for the Trinidadian population were unknown, the predicted FEV₁ values were obtained from an equation derived from spirometric studies conducted in the USA. These values may not have adequately represented the ethnic distribution of Trinidad and Tobago though there were no significant differences between ethnic groups in this study when FEV₁ was corrected for height and age. The data obtained from this study were not used to determine restrictive lung diseases. Patients suffering from a mixed obstructive and restrictive disease were considered as obstructive only if FEV₁/FVC was less than 70% consistent with internationally accepted practice (GOLD). Spirometric readings were incapable of distinguishing the different types of obstructive lung diseases such as chronic bronchitis and emphysema, thus differences between these manifestations of airways diseases could not be explored. There is some evidence that post-bronchodilator values are more reliable than pre-broncho-dilator values in defining FEV₁/FVC% for COPD (2). Thus, a further limitation of this study was that only pre-bronchodilator values were used but we felt that because we were detecting airways disease in acutely ill patients it would be unwise to expose the patient to the risk of tachycardia. The study was also limited by the fact that about 36% of admissions were discharged prior to interview. It is likely that those discharged were more fit and perhaps less likely to have COPD and if this could have been taken into account it might have decreased the estimates of COPD prevalence.

This study shows that COPD occurs in a significant proportion of hospital admissions even though under-diagnosed and may represent a significant health burden to the general population. Educational programmes on smoking

cessation should be implemented to reduce the prevalence of COPD in the country as well as COPD severity prevalence (28). Given the high prevalence of COPD in hospital admissions in previously undiagnosed patients as well as the relationship between low FEV₁ and vascular co-morbidity and the large percentage of people who might be at risk of COPD, spirometric testing should be implemented as a routine procedure to facilitate early treatment and appropriate counselling about airways diseases.

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