

Prevalence and treatment of chronic airways obstruction in adults over the age of 45

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Abstract

Background - Chronic airways obstruction is common in adults and the elderly. To investigate the possibility that older adults with obstructive airways disease frequently do not receive appropriate treatment, the respiratory symptoms, medication use, and pulmonary function were studied in a random sample of white adults aged over 45 living in central Manchester, UK.

Methods - A postal questionnaire survey was performed on 783 men and women aged 45 years and over selected from GP lists by random number tables. Subjects completing the questionnaire were invited to attend for pulmonary function testing and methacholine challenge (Newcastle dosimeter method).

Results - The questionnaire response rate was 92.3% (723 subjects). The mean age of the population was 66.1 years and 57.2% were women; 29.2% were current smokers and 37.3% were ex-smokers. Asthma or bronchitis was reported by 30.0%. Two hundred and forty seven representative subjects attended for pulmonary function testing and spirometric evidence of chronic airways obstruction was found in 26.4%. Respiratory symptoms were reported by 76.6% of subjects with chronic airways obstruction; 55.0% had features which may predict potential improvement on treatment (increased non-specific bronchial responsiveness or significant bronchodilator reversibility). However, only 55.4% of subjects with airways obstruction had received a diagnosis of asthma or chronic bronchitis and only 36.9% were using inhaled bronchodilators or steroids.

Conclusions - Chronic airways obstruction is very common in adults in this inner city population, but is frequently overlooked. Most subjects with chronic airways obstruction are not receiving appropriate treatment.

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Chronic airways obstruction is common; surveys give a prevalence in the elderly of approximately 16% (asthma plus smoking-related airways obstruction).^{1,2} However, studies often contain few elderly people.^{3,4}

It was our clinical impression that many older people with chronic airways obstruction do not

receive appropriate drug treatment. In a study of older adults attending day hospitals and living in local authority homes, Banerjee *et al* found a prevalence of reversible airways obstruction of >40%, although only 3% were using respiratory medications.⁵ Two surveys of elderly nursing home residents found that 10% or less were prescribed bronchodilators^{6,7}; this is probably much less than the proportion with chronic airways obstruction given the estimate for the general elderly population.² There have been no assessments of the proportion of people with chronic airways obstruction receiving appropriate drug treatment among the community dwelling elderly. We have investigated respiratory symptoms, medication use, and pulmonary function in an age stratified random population sample of adults over the age of 45.

Methods

POPULATION SAMPLING

The study was approved by Central Manchester Health Authority ethical committee. We aimed to study a random sample of the local population aged ≥ 45 years including large numbers of elderly people. Between January 1992 and February 1994 names and addresses were taken using random number tables from practice lists of 22 local general practitioners. Non-white subjects were excluded because of interracial differences in bronchial responsiveness.⁸ General practitioners excluded those who were confused or housebound, plus the few unsuitable for other reasons. In order to increase the numbers of older subjects only those aged ≥ 70 were selected during the final months of recruitment.

Subjects were sent an explanatory letter and questionnaire concerning previous diagnoses of asthma, chronic bronchitis, and ischaemic heart disease; current medication; smoking history; and respiratory symptoms. Questions on respiratory symptoms were adapted from the MRC respiratory symptoms questionnaire.⁹ Non-responders were sent a repeat questionnaire, followed if necessary by an abbreviated questionnaire containing only questions about previous diagnoses and smoking habits. Half of the persistent non-responders were randomly contacted by telephone or home visit.

PULMONARY FUNCTION TESTING

Patients were excluded from the methacholine challenge if they had a history of ischaemic heart disease or were receiving current medication with β blockers, anticholinergic med-

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ications, or oral steroids. Subjects not excluded on these grounds were invited to attend Manchester Royal Infirmary. Attendance was delayed for six weeks after respiratory tract infection or exacerbation of wheezing. Subjects were requested to refrain from caffeine for 12 hours, and to omit bronchodilators for 12 hours (inhalers), 24 hours (oral preparations), or 48 hours (sustained release preparations) before attendance.

Written informed consent was obtained from all subjects. Resting 12-lead electrocardiography (ECG) was performed, and if this showed evidence of myocardial ischaemia subjects were also excluded from methacholine challenge. Baseline pulmonary function was measured (Compact, Vitalograph, Buckingham, UK) (mean of the best six readings reproducible within 10%).^{10,11} Methacholine challenge was performed by subjects with baseline forced expiratory volume in one second (FEV₁) of $\geq 60\%$ predicted¹²; if FEV₁ was $<60\%$ predicted β agonist reversibility was assessed.

β AGONIST REVERSIBILITY

FEV₁ measurements were repeated 10 minutes after inhalation of 1 mg terbutaline via a metered dose inhaler and large volume spacer (Nebuhaler, Astra Pharmaceuticals, Hertfordshire, UK). A positive result was defined as an increase in FEV₁ of ≥ 160 ml.¹³

METHACHOLINE CHALLENGE

This was performed by the Newcastle dosimeter method.^{10,11,14} Briefly, doubling doses of nebulised methacholine were inhaled at five minute intervals by the subject while seated and wearing a noseclip. FEV₁ (mean of three recordings reproducible within 10%) was measured before each subsequent dose. End points were a 20% decrease in FEV₁ or administration of a maximum cumulative dose of 6.4 mg methacholine. Results were expressed as the methacholine dose producing a 20% fall in FEV₁ (PD₂₀).¹¹ Increased non-specific bronchial responsiveness was defined as a PD₂₀ of <400 μ g methacholine.¹¹ Repeatability of methacholine challenge was assessed in 21 subjects who agreed to attend on a second occasion 3–10 days after the initial challenge.

DATA ANALYSIS

Subgroups were compared by grouped *t* test and χ^2 tables. Significance was defined at the 5% level.

Results

DEMOGRAPHIC DETAILS OF STUDY POPULATION AND RESPONSE RATE

Of 893 subjects contacted, 110 were ineligible (78 incorrect address, 15 dead, six non-white, 11 housebound/confused/disabled). This left 783 eligible subjects, 508 of whom returned the full questionnaire and 170 the abbreviated questionnaire. Twenty nine subjects declined

Table 1 Demographic details of study population

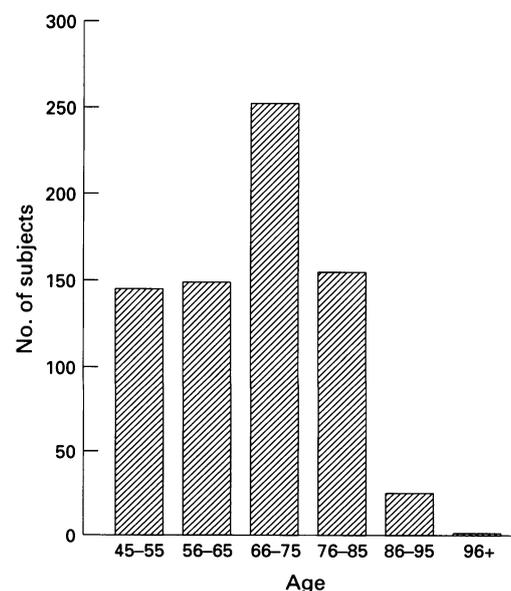
Mean age (years)	66.1
% women	57.2
% reporting asthma	7.3
% reporting bronchitis	15.4
% reporting asthma plus bronchitis	7.3
% current smokers	29.2
% ex-smokers	37.3

to take part. Forty five randomly selected non-responders agreed to complete the abbreviated questionnaire; a further 12 were found to have moved away before the start of the study and were therefore not included. Thus, questionnaire information was available for 723 (92.3%) of the 783 eligible subjects. The age and sex of all subjects was obtained from GP records. Demographic details of the study population are summarised in table 1; the age distribution of the population is shown in the figure.

Fifty three subjects reported asthma, 111 bronchitis, and a further 53 both asthma and bronchitis; overall, 217 of the 723 (30.0%) reported asthma or bronchitis. This proportion was not significantly different in subjects aged less than 65 years (94 of 292 subjects (32.2%)) or 65 years and over (123 of 431 subjects (28.5%)). Of the 508 subjects returning the full questionnaire 15% were using inhaled medications. The prevalence of inhaler use by subjects reporting asthma or bronchitis was 46.4% (72.0% for subjects reporting asthma, 39.9% for those reporting bronchitis).

PULMONARY FUNCTION, REVERSIBILITY AND METHACHOLINE CHALLENGE

Of the 508 subjects returning the full questionnaire, the responses of 113 excluded them from methacholine challenge (ischaemic heart disease 83; β blockers/anticholinergics/oral steroids 48). The remaining 395 were invited to attend for methacholine challenge: 247 subjects actually attended (62.5% of those invited to attend; 31.5% of the total eligible study popu-



Age distribution of responders to questionnaire.

Table 2 Mean (SD) results of spirometric tests

	All attenders (n=246)	Subjects with chronic airways obstruction (n=65)	Subjects without chronic airways obstruction (n=181)
FEV ₁ /FVC%	69.2 (11.6)	54.2 (7.7)	74.6 (7.2)
FEV ₁ (% predicted)	86.9 (24.5)	63.6 (24.0)	94.6 (18.9)
Age (years)	64.5 (10.8)	66.3 (10.0)	63.8 (11.1)
% women	56.7	53.8	57.4

FEV₁ = forced expiratory volume in one second; FVC = forced vital capacity

lation). The mean age of attenders was 64.5 years (range 45–86 years); this was younger than the population as a whole ($p=0.02$, grouped t test). There was no significant difference between the 247 attenders and the 783 eligible subjects in sex distribution (56.7% women in attender group), reporting of asthma or bronchitis, reporting of respiratory symptoms, or smoking habits (33.6% of attenders were current smokers and 38.5% were ex-smokers).

One subject was unable to perform reproducible measurements of baseline spirometry and thus data were available for 246 attenders (table 2). Chronic airways obstruction was defined as an FEV₁/FVC% of <65% for subjects aged <65 years; for those aged ≥ 65 years a predicted value and lower limit of normal for FEV₁/FVC% was calculated as described by Enright *et al.*¹⁵ Using these criteria, the prevalence of chronic airways obstruction was 26.4% (22.9% in 118 attenders aged <65 years and 29.7% in the 128 attenders aged ≥ 65 ($\chi^2=1.46$, $p=0.2$)). Airways obstruction was equally common in men and women, but more common in current (39.7%) and ex-smokers (27.7%) than in those who had never smoked (12.8%; $\chi^2=14.1$, $p=0.001$).

In 22 subjects with chronic airways obstruction baseline FEV₁ was <60% predicted, and thus β agonist reversibility was measured. Ten of these subjects (45.5%) had ≥ 160 ml improvement in FEV₁ following terbutaline. Of the remaining 43 subjects with chronic airways obstruction five were unable or unwilling to complete the methacholine challenge. Non-specific bronchial responsiveness was increased in 23. Thus, overall 33 of 60 (55.0%) subjects with chronic airways obstruction had either increased non-specific bronchial responsiveness or significant β agonist reversibility. In 21 subjects attending twice, PD₂₀ measurements were repeatable within two doubling doses of methacholine.

For the whole attender group multiple regression analysis with log PD₂₀ as the dependent

Table 3 Number (%) of symptoms reported

	Subjects with chronic airways obstruction (n=65)	Subjects without chronic airways obstruction (n=181)	χ^2 (p value)
Cough (%)	33 (50.8)	50 (27.6)	10.7 (0.001)
Sputum (%)	36 (55.4)	53 (29.3)	14.4 (<0.001)
Wheeze (%)	39 (60.0)	55 (30.4)	17.0 (<0.001)
Breathlessness† (%)	19 (29.2)	26 (14.4)	7.0 (<0.01)
One or more symptoms (%)	49 (76.6)	88 (50.0)	13.5 (<0.001)

† Breathless when walking on the level or at rest (equivalent to MRC grade 3+).⁹

Table 4 Proportion of subjects receiving inhaled β agonists or steroids

	Chronic airways obstruction (n=65)	No chronic airways obstruction (n=181)
No treatment	41 (63.1%)	169 (93.4%)
β agonist only	9 (13.8%)	4 (2.2%)
Steroid \pm β agonist	14 (21.5%)	8 (4.4%)

variable and age, sex, smoking habit, and baseline FEV₁ (% predicted) as independent variables showed a significant positive relationship between log PD₂₀ and baseline FEV₁ ($p=0.0001$; $R=0.3$), but no relationship between log PD₂₀ and the other independent variables.

RESPIRATORY SYMPTOMS AND USE OF BRONCHODILATORS

Subjects with chronic airways obstruction reported significantly more respiratory symptoms than those without, and wheeze was the commonest symptom (table 3); 76% of subjects with airways obstruction reported one or more symptoms. However, as symptoms were also common in those without chronic airways obstruction, the positive predictive value of symptoms for "obstructive" pulmonary function test results was low: only 35.8% of symptomatic subjects had chronic airways obstruction on pulmonary function testing. The symptom with the highest positive predictive value for airways obstruction was breathlessness (MRC grade 3+): 19 (42.2%) of the 45 subjects reporting breathlessness had evidence of airways obstruction. Combinations of two or more symptoms were reported less frequently, but were more commonly associated with airways disease. For example, only 21 patients reported cough plus wheeze plus breathlessness, but 14 of them had airways obstruction (positive predictive value 66.7%).

Asthma or bronchitis was reported by 55.4% of subjects with airways obstruction and 23.7% of those with "normal" FEV₁/FVC ($\chi^2=21.9$, $p<0.001$). The positive predictive value of reported asthma or bronchitis for evidence of chronic airways obstruction on pulmonary function testing was 45.6%.

Twenty three (35.4%) of the 65 subjects with chronic airways obstruction were using inhaled treatment (table 4), most commonly both inhaled steroids and β agonists. Only two subjects were taking oral β agonists and none theophylline. Age did not significantly affect the likelihood of treatment: eight of 27 (29.6%) subjects of <65 years and 15 of 38 (39.5%) of ≥ 65 years were using treatment. Treated subjects had significantly worse baseline airways obstruction (mean (SE) FEV₁/FVC% = 48.6 (1.8)%) than those on no treatment (57.5 (0.7)%; $t=5.3$, $p<0.0001$). Respiratory symptoms were reported by 70.0% of untreated subjects with chronic airways obstruction.

Discussion

Our data confirm the high prevalence of chronic airways obstruction in white adults in central

Manchester. However, it is relevant to ask whether our study sample is representative. Many subjects initially selected had died or left the area. This problem has been described in other studies using information from GP lists and seems unavoidable.¹⁶ Nonetheless, the high response rate (>90%) makes it likely that our figures are accurate. The preponderance of women in our population is expected in a sample containing many elderly people and agrees with OPCS estimates for central Manchester (53% women in the population aged >45).¹⁷ Our figures for current and ex-smoking were higher than recent OPCS estimates (29% current smokers in a population aged >50 years).¹⁸ It is probable that our results represent the situation in other urban white populations in Britain.

Unfortunately, only 31.5% of the eligible population attended for methacholine challenge. Although 113 subjects were excluded because of ischaemic heart disease or medications, most non-attenders were simply not prepared to undergo tests. This was particularly true of older subjects, and so attenders were younger than non-attenders. Similar problems have been reported in other studies of bronchial responsiveness.^{2,19,20} Nonetheless, attenders were representative of the study population in terms of sex distribution, smoking, diagnosed asthma/bronchitis, and reported respiratory symptoms.

Other studies of adults aged ≥ 65 years have found a lower prevalence of airways obstruction. In a postal survey 8.4% reported asthma and 16.4% chronic bronchitis¹; chronic airways obstruction has been found in 6.9% ($FEV_1/FVC < 65\%$)²¹ and 15.6% ($FEV_1/FVC < 60\%$) in population studies.² This variation may reflect differences in smoking habits or environmental influences between populations.

The proportion of subjects with diagnosed asthma or chronic bronchitis prescribed inhaled medications has been assessed in a study in the northern region of England using computerised GP records.²² In that study inhalers were prescribed for 6% of patients with chronic bronchitis and 66% of those with asthma (38% of patients with a recorded diagnosis); prescribing rates were higher for patients aged 65–74. Our figures for prescribing in central Manchester are higher, perhaps because of differences in the population age range, data source, and diagnostic practices.

The problems of self-reported diagnoses as a measure of asthma prevalence have been discussed.²³ The lack of agreed diagnostic criteria for asthma and chronic airways obstruction means that physicians vary in their diagnostic labelling and may be influenced by non-clinical parameters such as age and sex.²⁴ As a result, patients may acquire multiple diagnoses²⁵; this is demonstrated by the number of subjects in our population reporting both asthma and bronchitis. Some studies have found evidence of overreporting of unconfirmed diagnoses^{3,26}; others have suggested underreporting, particularly by older men with chronic bronchitis.²⁷

We have objectively assessed the prevalence of chronic airways obstruction by spirometric testing in a representative sample. Since $FEV_1/FVC\%$ decreases with age, we calculated predicted levels and lower limits of normal for subjects aged ≥ 65 years.¹⁵ To avoid overestimation of airways reversibility in patients with low baseline FEV_1 , we defined reversibility as a fixed volume increase in FEV_1 , rather than a percentage increase over baseline.¹³ Measurement of bronchial responsiveness by the Newcastle dosimeter method usually includes six measurements of FEV_1 after each methacholine dose.¹¹ To avoid fatigue in our elderly population this was reduced to three; this adapted method has been shown to be reproducible in older adults.¹⁰ As is customary for this method of bronchial challenge, PD_{20} was calculated using the mean rather than the maximum of the three FEV_1 recordings^{10,11}; we confirmed that this gave better repeatability.

The prevalence of reported asthma or bronchitis was similar to that of measured chronic airways obstruction. However, both reported diagnoses and symptoms were poor predictors of chronic airways obstruction. This has implications for other epidemiological studies of asthma or chronic airways obstruction, some of which have relied solely on self-reporting of diagnoses and symptoms.^{28,29}

Only one third of subjects with airways obstruction were using inhaled medications. This may reflect tolerance of respiratory symptoms by elderly people or therapeutic nihilism on behalf of their doctors. The lack of patients taking theophylline is surprising; this may reflect either poor patient compliance or local prescribing habits. The need for serum monitoring and the incidence of side effects has decreased the popularity of theophylline.³⁰

Over half of our subjects with chronic airways obstruction had bronchodilator reversibility or increased bronchial responsiveness. The latter has been shown to predict spirometric improvement on treatment in elderly asthmatic subjects.¹⁰ A single measurement of bronchodilator reversibility is less reliable as a predictor of response to treatment.³¹ The significance of increased bronchial responsiveness in patients with chronic airways obstruction is also unclear; a strong correlation between baseline FEV_1 and PD_{20} in these patients has led to the suggestion that increased bronchial responsiveness is merely the result of reduced airway calibre rather than an indication of airways lability.^{32,33} We have confirmed the relationship between baseline FEV_1 and PD_{20} , but the low coefficient of multiple regression suggests that the high prevalence of increased bronchial responsiveness in our subjects is not merely the result of low FEV_1 .

In summary, we have found high levels of untreated chronic respiratory morbidity in the adult white population of central Manchester, but no evidence of age bias in the proportion of patients receiving treatment. Adults with respiratory symptoms should have pulmonary function formally assessed; those with airways obstruction may benefit from bronchodilator treatment.

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