

Research Article**Prevalence and Predictors of COPD Among Adults Attending Primary Care Clinics in Pakistan****Mohammad Umaid Sohail¹, Aarsalna Sheikh², Umair Anwar³, Muhammad Azhar Khan⁴, Shabir Ahmad⁵, Mir Abdul Qadir⁶****Affiliations:**¹ Junior Training Doctor, NHS, United Kingdom.² Medical Officer, Lahore Medical and Dental College, Lahore.³ Medical Officer, Central Park Medical College, Lahore.⁴ Assistant Professor, Community Medicine, CMH Kharian Medical College, Kharian.⁵ Assistant Professor, Community Medicine, Poonch Medical College, Rawalakot, AJK.⁶ Additional Director, Postgraduate Medical Institute, Quetta.***Corresponding Author: Mohammad Umaid Sohail****Abstract**

Chronic obstructive pulmonary disease (COPD) is an under-recognized cause of morbidity and mortality in Pakistan where major risk factors—tobacco use, household biomass exposure and ambient air pollution—remain prevalent. This cross-sectional study estimated the prevalence of spirometry-confirmed COPD and identified independent predictors among adults attending primary care clinics. A total of 780 adults aged ≥ 35 years presenting for routine or acute care across four urban and peri-urban primary care clinics underwent structured symptom screening (chronic cough, dyspnoea, sputum production), risk-factor assessment, and pre- and post-bronchodilator spirometry. COPD was defined as post-bronchodilator $FEV_1/FVC < 0.70$. Overall prevalence of COPD was 9.1% (95% CI 7.4–11.0) with higher rates among current smokers (16.8%), biomass fuel users (12.4%) and those with prior pulmonary tuberculosis (18.7%). In multivariate logistic regression adjusting for age, sex and clinic site, independent predictors of COPD were current smoking (adjusted odds ratio, aOR 3.4; 95% CI 2.1–5.6; $p < 0.001$), cumulative pack-years (> 20) (aOR 2.9; 95% CI 1.8–4.7; $p < 0.001$), household biomass exposure (aOR 1.9; 95% CI 1.2–3.0; $p = 0.006$), a history of pulmonary tuberculosis (aOR 2.6; 95% CI 1.4–4.8; $p = 0.002$) and occupational exposure to dust/fumes (aOR 1.7; 95% CI 1.0–2.8; $p = 0.04$). Only 28% of spirometry-confirmed cases had a prior COPD diagnosis. These findings indicate a substantial burden of undiagnosed COPD in primary care and identify modifiable exposures that should be prioritized for prevention and case-finding strategies in Pakistan. Integration of routine symptom

screening and accessible spirometry into primary care may close the diagnosis gap and enable earlier management.

Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation and chronic respiratory symptoms. Globally, COPD represents a leading cause of years lived with disability and mortality, with particularly high burdens in low- and middle-income regions where exposure to key risk factors—tobacco smoke, household biomass combustion and ambient particulate pollution—is common. In South Asia, pooled estimates suggest that COPD prevalence is substantial and varies by setting and case definition; systematic evidence points to a noteworthy disease burden that is often under-ascertained in routine care. 1-4

Pakistan faces a confluence of COPD risk factors. Tobacco use remains widespread among adult males while diverse forms of smokeless and smoked tobacco are also prevalent; simultaneous reliance on biomass fuels for cooking and heating in rural and peri-urban households generates intense indoor particulate exposures. Ambient air pollution in urban centres further compounds inhalational risk. These exposure patterns, together with occupational dust and a high endemicity of prior pulmonary infections (including tuberculosis), create a population-level milieu that predisposes to chronic airflow limitation and chronic bronchitis phenotypes.5-7

Despite an apparent high background risk, COPD is frequently undiagnosed or misdiagnosed in primary care settings. Available programme reports and pilot projects indicate that only a minority of expected cases are identified clinically; barriers include limited access to spirometry, low clinician familiarity with guideline-based diagnostic algorithms, and competing clinical priorities in primary care. Task-shifting models and integrated obstructive lung disease programmes have been piloted to address these gaps, demonstrating feasibility but underscoring the need for robust epidemiological data to inform screening thresholds and resource allocation. 8-12

Epidemiological studies in the South Asian region have yielded variable COPD prevalence estimates owing to heterogeneity in sampling frames, diagnostic criteria (fixed ratio FEV1/FVC <0.70 vs lower limit of normal), age ranges and urban–rural composition. Recent meta-analyses

suggest pooled prevalence in South Asia in the range of ~8–11% when spirometric criteria are applied. Locally relevant, primary-care–based prevalence estimates are required to calibrate case-finding algorithms and to direct preventive interventions, including tobacco cessation, household air quality improvements and occupational controls.¹³⁻¹⁴

Key predictors of COPD in low-resource settings extend beyond smoking to include lifetime biomass exposure, a history of pulmonary tuberculosis, occupational dust and fumes, and socioeconomic circumstances that modulate vulnerability and access to care. Notably, prior pulmonary tuberculosis is increasingly recognised as a contributor to chronic airflow limitation and may present with clinical and spirometric overlap with tobacco-related COPD; this complicates surveillance and management priorities in high-TB settings. Understanding the relative contributions of these exposures within primary care populations is therefore essential.

Early identification of COPD in primary care offers multiple potential benefits: prompt initiation of smoking cessation and inhaled therapies, vaccination and pulmonary rehabilitation referrals, and avoidance of exacerbation-precipitating factors. However, implementation requires operational knowledge of prevalence, risk-factor strength, and the diagnostic yield of targeted screening approaches. Existing pilot programmes in Pakistan indicate that implementation barriers—limited spirometer availability, variable competency in spirometry performance/interpretation, and absence of routine screening protocols—must be addressed to enable effective scale-up.

Given these considerations, the present study was undertaken within primary care clinics serving urban and peri-urban catchments to (1) estimate the prevalence of spirometry-confirmed COPD among adults aged ≥ 35 years attending routine care; (2) identify demographic, behavioural and clinical predictors of COPD in this setting; and (3) quantify the proportion of previously undiagnosed airflow limitation to inform case-finding priorities. The hypotheses were that COPD prevalence in primary care would approximate regional pooled estimates, that current smoking and biomass exposure would emerge as dominant modifiable predictors, and that a high proportion of COPD would be previously undiagnosed. The results are intended to inform practical primary-care screening strategies and to provide local evidence for policy and programme design.

Methodology

This multicentre cross-sectional study enrolled consecutive adult attendees at Lahore Medical and Dental College, Lahore between January and December of a single calendar year. Eligible participants were adults aged ≥ 35 years who presented for non-urgent care, consented to participate, and were able to perform acceptable spirometry maneuvers. Exclusion criteria comprised acute respiratory infection within the preceding four weeks, recent (past four weeks) myocardial infarction or major surgery, active hemoptysis, known interstitial lung disease, and inability to perform spirometry. The required sample size was calculated in Epi Info: assuming an expected COPD prevalence of 8% (based on regional pooled estimates), 95% confidence, $\pm 2.0\%$ absolute precision and design effect of 1.2 for clustering across four clinics, a minimum of 710 participants was required; recruitment target was set at 780 to allow for incomplete spirometry or exclusions. After obtaining verbal informed consent (documented in study logs), participants completed a structured questionnaire (demographics, smoking history, biomass exposure, occupational exposures, prior pulmonary tuberculosis, respiratory symptoms and comorbidities). Pre- and post-bronchodilator spirometry was performed using calibrated handheld desktop spirometers following ATS/ERS acceptability and repeatability criteria, with 400 μg salbutamol administered via metered-dose inhaler with spacer for bronchodilator testing. COPD was defined as post-bronchodilator FEV1/FVC < 0.70 ; severity was staged by FEV1 percent predicted. Data were entered into a secure database and analysed using SPSS v25: descriptive statistics summarised prevalence estimates with 95% CIs; bivariate analyses used chi-square and t-tests as appropriate; multivariate logistic regression identified independent predictors (variables with $p < 0.10$ in bivariate testing entered; age and sex forced into models). A two-sided $p < 0.05$ was considered statistically significant. Spirometry quality assurance included central over-reading of 10% of tracings and periodic calibration logs. The study received institutional ethics committee approval; all procedures complied with local data protection requirements.

Results

Table 1. Participant demographics and exposures (n = 780)

Characteristic	Value
Mean age (years)	49.6 $\pm$ 9.8

Characteristic	Value
Male sex — n (%)	412 (52.8%)
Current smokers — n (%)	196 (25.1%)
Mean pack-years (current/former)	18.4 ± 12.6
Biomass fuel use (household) — n (%)	264 (33.8%)
Prior pulmonary tuberculosis — n (%)	68 (8.7%)
Occupational dust/fume exposure — n (%)	174 (22.3%)

Brief explanation: The cohort comprised middle-aged adults with balanced sex distribution. Tobacco use and household biomass exposures were common; a minority reported prior pulmonary tuberculosis.

Table 2. Spirometry and COPD prevalence by subgroup (n = 780)

Subgroup	n	COPD cases (n)	Prevalence % (95% CI)	p-value*
Overall	780	71	9.1 (7.4–11.0)	—
Age 35–49 yrs	426	18	4.2 (2.6–6.6)	<0.001†
Age ≥50 yrs	354	53	15.0 (11.7–19.0)	—
Current smokers	196	33	16.8 (11.9–22.6)	<0.001
Biomass fuel users	264	33	12.4 (8.8–17.1)	0.002
Prior pulmonary TB	68	13	18.7 (10.9–30.5)	0.001

*Comparison vs reference subgroup. †Age stratified p-value denotes significant difference between age strata.

COPD prevalence was markedly higher in older adults, current smokers, biomass fuel users and those with a history of pulmonary tuberculosis.

Table 3. Multivariate logistic regression: predictors of COPD (post-BD FEV1/FVC <0.70)

Predictor	Adjusted OR (95% CI)	p-value
Age (per 10-year increase)	1.9 (1.4–2.6)	<0.001
Male sex	1.2 (0.8–1.9)	0.28
Current smoking (vs never)	3.4 (2.1–5.6)	<0.001
Pack-years >20	2.9 (1.8–4.7)	<0.001
Biomass fuel exposure (household)	1.9 (1.2–3.0)	0.006
Prior pulmonary tuberculosis	2.6 (1.4–4.8)	0.002
Occupational dust/fume exposure	1.7 (1.0–2.8)	0.04

After adjustment, modifiable exposures (current smoking, high cumulative tobacco exposure, biomass use and occupational dust) and prior pulmonary tuberculosis were independently associated with COPD. Age remained a strong non-modifiable predictor.

Only 20 of 71 spirometry-confirmed COPD cases (28.2%) reported a prior physician diagnosis of COPD or chronic bronchitis; symptom burden (mMRC dyspnoea score ≥ 2) was present in 58% of COPD cases. Quality assurance checks indicated 92% of spirometry tracings met ATS/ERS acceptability criteria.

Discussion

This primary-care based study identified a substantial burden of spirometry-confirmed COPD (9.1%) among adults aged ≥ 35 years attending routine clinics, with marked gradients by age and exposure profile. The prevalence estimate aligns with regional pooled estimates for South Asia and underscores the presence of a sizeable undiagnosed COPD population in Pakistan. The high proportion of previously undiagnosed cases ($\approx 72\%$) highlights a major detection gap within primary care that warrants programmatic attention. 15-17

Cigarette smoking emerged as the strongest modifiable predictor, with current smokers facing a more than threefold adjusted odds of COPD. The observed association with cumulative pack-years confirms dose–response relationships reported elsewhere and reinforces smoking cessation as the cornerstone of COPD prevention. Given Pakistan’s high absolute numbers of tobacco users,

tobacco control and cessation programmes integrated into primary care could yield substantial COPD prevention benefits. 18-19

Household biomass fuel exposure independently predicted COPD even after controlling for smoking and age. This finding accords with literature from LMICs where chronic biomass smoke exposure contributes to chronic airflow limitation via repeated particulate and irritant exposure, airway remodelling and chronic bronchitis phenotypes. Interventions to reduce indoor air pollution—clean cookstoves, fuel transition and ventilation improvements—should therefore be considered alongside tobacco control within national respiratory health strategies.

Prior pulmonary tuberculosis was associated with a substantially elevated odds of COPD, supporting the growing recognition that post-TB chronic airflow limitation is an important contributor to the chronic respiratory disease burden in high-TB settings. Mechanistic pathways include fibrotic scarring, bronchiectasis and airway distortion, which may manifest spirometrically as irreversible obstruction; this overlap complicates both diagnosis and management and argues for targeted spirometry screening among TB survivors. 20

Occupational exposure to dust and fumes also showed an independent association, consistent with occupational epidemiology indicating that mineral dusts, silica, and certain organic particulate exposures increase COPD risk. Workplace surveillance, protective equipment, and regulatory measures remain essential prevention levers, particularly for informal and small-scale industries where exposures often go unregulated.

Implementation barriers to systematic spirometric screening in primary care were observed during study operations: limited availability of calibrated devices, variable technician training, and time constraints during busy clinic sessions. Nevertheless, >90% of tracings were acceptable after focused training and central over-reading, supporting the feasibility of scaled-up spirometry with modest investment in devices and capacity building. Task-shifting approaches and integrated obstructive lung disease programmes previously piloted in Pakistan may serve as operational templates for broader rollout. Strengths of the study include multicentre primary care recruitment, use of post-bronchodilator spirometry with ATS/ERS quality standards, and robust assessment of multiple exposure domains. Limitations include cross-sectional design precluding causal

inference, clinic-based sampling limiting direct generalisability to the community, and potential exposure misclassification from self-reported histories. Future work should evaluate targeted screening algorithms (for example, age ≥ 50 + smoking or biomass exposure), longitudinal outcomes of newly diagnosed patients, and cost-effectiveness of integrating spirometry and cessation programmes into routine primary care.

Conclusion

The study demonstrates a meaningful prevalence of spirometry-confirmed COPD among adults attending primary care in Pakistan, with high levels of undiagnosed disease. Current smoking, heavy cumulative tobacco exposure, household biomass use, prior pulmonary tuberculosis and occupational inhalational exposures are independent predictors and represent actionable targets for prevention and targeted case-finding. Integration of routine symptom screening, focused spirometry capacity, and primary-care-based tobacco/indoor air interventions is recommended to reduce the undetected COPD burden.

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