

Cross-Sectional Survey of COPD Risk in Undiagnosed Adults in Saudi Arabia Using the Arabic COPD-PS

Ayedh D Alahmari¹, Hams M Shrourou²

¹Department of Rehabilitation Sciences, College of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia; ²Department of Respiratory Therapy, Batterjee Medical College, Jeddah, 21442, Saudi Arabia

Correspondence: Ayedh D Alahmari, Department of Rehabilitation Sciences, College of Applied Medical Sciences, King Saud University, Riyadh, Saudi Arabia, Email aalahmari9@ksu.edu.sa

Introduction: Chronic obstructive pulmonary disease (COPD) is a common disease and the third leading cause of death, although it remains misdiagnosed and untreated. Individuals at risk of developing COPD, when detected early, have a significant chance to alter the progression of the disease by prompt medical and non-medical care.

Objective: To evaluate the risk level of COPD in Saudi Arabia regions by using an Arabic-translated COPD Population Screener (COPD-PS) questionnaire.

Methods: This is a cross-sectional study conducted from October 12, 2023, to October 29, 2024. A convenience sampling method was used to recruit participants. This study utilized a self-administered Arabic-translated version of the COPD-PS, which evaluates various subjects related to COPD.

Results: In this study of 2002 participants, a majority of them 74.39% (n = 1494) were from the Western region of Saudi Arabia. Most participants 76.72% (n = 1536) were below 35 years of age, and over half 57.39% (n = 1149) were non-smokers. The result of the COPD-PS scoring indicated 88.76% (n = 1777) of participants at low risk of COPD, while 11.24% (n = 225) participants were at high risk of COPD. Also, this study showed a statistically significant difference regarding the risk level of COPD among regions (p < 0.0001). In addition, the risk level of COPD and smoking status revealed a statistically significant difference (p ≤ 0.0001). Further analysis demonstrated that the risk level of COPD has an association with the existence of Diabetes/Hypertension (p = 0.0013).

Conclusion: The Arabic-translated version of COPD-PS is an effective tool for screening the risk level of COPD among the Arabic responders in Saudi Arabia. There are various factors, including smoking status, the existence of Diabetes/ Hypertension, and regions associated with higher COPD-PS risk.

Keywords: COPD, COPD-PS, screening

Introduction

Chronic obstructive pulmonary disease (COPD) represents a major global health challenge characterized by persistent airflow limitation and progressive respiratory symptoms.¹ COPD manifests through a spectrum of respiratory symptoms including dyspnea, chronic cough, and sputum production.² Its severity ranges from mild symptoms to respiratory failure.³ Progressing symptoms results in increase air trapping and inflammation which can result in acute exacerbation of COPD (AECOPD).⁴ AECOPD is defined as a deterioration of the patient's respiratory symptoms that plays a crucial role in managing the disease, exacerbates patient health, accelerates progression of the disease, and increases hospital admission and re-admission.⁵ The global burden of COPD is currently ranking as the third leading cause of mortality worldwide, COPD affected approximately 380–455 million individuals and caused 3.23 million deaths in 2019.⁶ In the Kingdom of Saudi Arabia (KSA), the age-standardized prevalence of COPD increased by 49% between 1990 and 2019, with mortality rates rising by 47.9% during the same period.⁷ While Global Initiative for Chronic Obstructive Lung Disease (GOLD) emphasizes that early and accurate diagnosis significantly impacts public health outcomes,⁸ COPD

remains widely underdiagnosed or misdiagnosed until reaching advanced stages when treatment options become limited and less effective.⁹

Early identification of individuals at risk for COPD presents a critical opportunity to modify disease trajectory through timely interventions. However, screening tools suitable for non-clinical settings remain limited as mostly.¹⁰ Self-administered screening instruments offer several advantages: they raise awareness about respiratory symptoms, encourage earlier medical consultation, and facilitate identification of at-risk individuals who require further clinical assessment.¹¹ Among available screening tools, the COPD Population Screener (COPD-PS) has demonstrated utility in identifying individuals likely to have an airflow obstruction.¹² In addition to screening tools, comprehensive assessment remains challenging due to the complex clinical nature of COPD. The COPD Assessment Test (CAT), one of the instruments created by the American Thoracic Society (ATS), assesses how the illness affects symptoms, including coughing, dyspnea, and sputum production. Additionally, the ATS Clinical Practice Guidelines emphasize the importance of spirometry, physical examination, and patient history in providing recommendations based on evidence for diagnosis and treatment. Although these instruments improve clinical assessment and treatment, further development is necessary to promote early identification and improve long-term outcomes in COPD patients.¹³

This descriptive study aims to assess the risk level of COPD in Saudi Arabia regions using the Arabic-translated COPD-PS screening questionnaire. We hypothesized that COPD risk levels would differ across various regions of Saudi Arabia. We further hypothesized that the risk level of COPD would be higher among smokers. We seek to bridge the gap in COPD underdiagnosis by identifying the most effective and cost-efficient tool for primary diagnosis.

Methods

Study Design and Participants

This is a cross-sectional study that included a self-administered questionnaire-based cross-sectional survey. It was conducted over a one-year and 17days period from October 12, 2023, to October 29, 2024, in the Kingdom of Saudi Arabia. The study included a total of 2002 participants who aged 18 years and older. Exclusion criteria included individuals diagnosed with any chronic illness, such as asthma, COPD, or those currently seeking medical care for acute respiratory problems. However, Participants with Diabetes or Hypertension were not excluded, as these do not impact the evaluation of the risk level of COPD using the COPD-PS. A convenience sampling technique was employed to recruit participants. Eligible participants were enrolled in the study during their visits to pulmonology departments in various healthcare centers across KSA. Respiratory therapists informed eligible individuals about the study and encouraged them to participate by completing the online electronic survey via a Google Forms link. Additionally, study invitations were disseminated through social media platforms, including LinkedIn, Twitter, and professional Facebook groups. Study invitations included an informed consent form for all participants prior to data collection, assuring confidentiality, and a link to the electronic survey. Incomplete surveys were excluded from the analysis.

Study Tool

The Arabic-translated version of the COPD Population Screener (COPD-PS) was utilized for data collection. The COPD-PS questionnaire specifically evaluates risk based on key factors including respiratory symptoms, smoking history, age, and impact on daily activities, rendering it particularly suitable for community-based screening initiatives.¹⁴ This clinically validated tool assesses multiple domains relevant to COPD and is suitable for use with or without pulmonary function tests. The questionnaire comprises five items evaluating respiratory symptoms, including dyspnea, cough, and breathing difficulties. In addition, it collects demographic data such as age and smoking status. The COPD-PS scores range from 0 to 10, with scores between 0 and 4 indicating a low risk of COPD and scores between 5 and 10 suggesting a high risk.

A priori sample size calculation was conducted based on the formula estimation of proportion, $n = Z^2 \times p \times (1 - p) / d^2$. The estimated COPD prevalence of 2.4% in Saudi Arabia, with a 95% confidence level and a margin of error of $\pm 1\%$.^{15,16} Using this approach, the minimum required sample size was calculated to be approximately 900 participants.

Statistical Methods

The data collected for each participant was analyzed using the latest version of the Statistical Package for the Social Sciences (SPSS) program (version 28). Descriptive statistics, including frequency and percentage, were performed to evaluate and identify differences among participants' demographic data. Chi square test was performed to assess the categorical associations between the risk level of COPD and the sociodemographic characteristics, with a significance level set at $p < 0.05$.

Ethical Considerations

All participants provided informed written consent electronically prior to participation. Ethical approval was obtained from the Institutional Ethical Committee of Batterjee Medical College (RES-2022-0043). This study was conducted in accordance with the principles of the Declaration of Helsinki.

Results

A total of 2015 participants attended the survey, out of the total participants, 13 did not complete the survey, 10 participants lost interest during the process, and 3 experienced technical difficulties. We included 2002 participants in the analysis, majority of participants were from Western region of KSA 74.4% ($n = 1494$), aged below 35 years old 76.7% ($n = 1536$) and non-smokers 57.4% ($n = 1149$) (Table 1).

COPD-PS scoring showed 88.8% ($n = 1777$) of participants indicated low risk of COPD and 11.2% ($n = 225$) high risk of COPD, respectively. (Figure 1) presents the distribution of COPD risk across different regions in Saudi Arabia. The Northern region has 6.5% ($n = 130$) low-risk cases and no high-risk cases. The Southern region reports 80% ($n = 55$) low-risk and 20% ($n = 14$) high-risk cases. In the Eastern region, there are 84% ($n = 111$) low-risk and 16% ($n = 21$) high-risk cases. The Western region has the highest number of participants, with 92% ($n = 1363$) low-risk and 8% ($n = 131$) high-risk individuals. The

Table 1 Demographic Data of Study Participants ($n = 2002$)

		n	Percentage (%)
Region	Northern	130	6.49
	Southern	69	3.44
	Eastern	132	6.59
	Western	1494	74.39
	Central	182	9.09
Presence of Hypertension/Diabetes	Yes	529	26.42
	No	1473	73.58
Smoking status	Non-smoker	1149	57.39
	Cigarette	326	16.28
	Hookah	170	8.50
	Cigarette and Hookah	193	9.54
	E-cigarettes	164	8.29
Gender	Male	1693	84.5%
	Female	309	15.4%

Note: Data are presented as number of participants (n) and percentage (%).

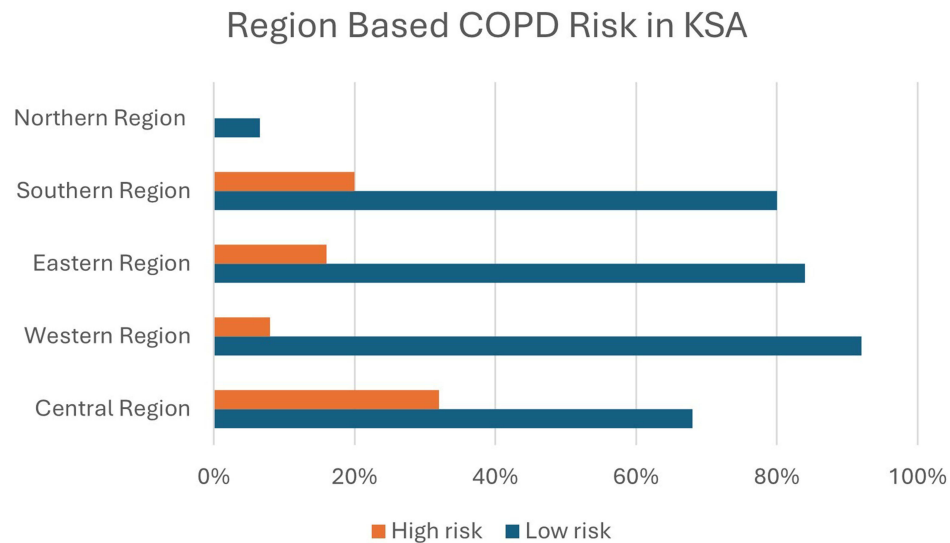


Figure 1 COPD risk distribution across regions in Saudi Arabia, based on COPD-PS scores.

Central region shows 68% (n = 124) low-risk and 32% (n = 58) high-risk cases. Chi-square test revealed a statistically significant difference in COPD risk among the regions $\chi^2 = 419.48$, $df = 4$, $p = 0.0001$.

Further analysis of smoking status and COPD risk level showed a statistically significant difference $\chi^2 = 500.04$, $df = 4$, $p \leq 0.0001$. Post hoc analysis with Bonferroni adjustment indicated that cigarette smoking ($p = 0.001$) and the combined use of cigarette and hookah ($p = 0.001$) were significantly associated with a higher risk of COPD compared to non-smokers and e-cigarette use. Additionally, the presence of Hypertension/Diabetes showed an association with COPD risk $\chi^2 = 0.015$, $df = 1$, $p = 0.0013$ (Table 2).

Discussion

This study assessed COPD risk among 2002 participants across Saudi Arabia using the COPD-PS screening questionnaire focusing on symptoms such as shortness of breath, mucus expectoration, daily activity limitations, smoking history, and age. Overall, 11.24% of participants were categorized as high-risk for COPD. Cigarette smoking and use of both cigarette and hookah along with the presence of Hypertension/Diabetes showed an association with COPD risk. Our findings provide important insights into the distribution and determinants of COPD risk in Saudi Arabia.

Regional variations in COPD risk were noted with differences in risk distribution. The Western region, comprising majority of participants, showed a high-risk prevalence. More concerning was the Central region, reported the highest risk of COPD compared to all other regions. Conversely, the Northern region reported no high-risk cases. These geographical disparities may reflect differences in urbanization, industrialization, environmental exposures, and health-care accessibility. The regional findings of high COPD risk across various parts of Saudi Arabia align closely with

Table 2 Association Between COPD Risk Levels, Smoking Status, and the Presence of Hypertension and Diabetes

		Low Risk	High Risk	Odds Ratio	Confidence Interval	p value
Smoking status	Non-smoker	1127	22	15.99	10.197–25.101	≤ 0.0001
	Nicotine use categories	650	203			
Presence of Hypertension/Diabetes	Yes	449	80	0.613	0.457–0.822	0.001
	No	1328	145			

Note: $p < 0.05$ was considered statistically significant.

established research in the MENA region. According to the Global Burden of Disease (GBD) study, Saudi Arabia experienced the largest increase in COPD prevalence among MENA countries between 1990 and 2019 (+48.6%), with key risk factors including smoking accounting for 44% of COPD-related DALYs, ambient particulate pollution 23%, and occupational exposures 11%.¹⁷ These findings are consistent with Mahboub et al which highlights the impact of urbanization, industrial emissions, construction-related dust, and indoor pollutants such as tobacco smoke, biomass fuel, and incense use (bakhoor).¹⁸ The observed regional variations in COPD risk within KSA, particularly in areas with heavy traffic, industrial activity, and high smoking prevalence reinforce these associations. These parallels suggest that both environmental and behavioral factors significantly contribute to COPD distribution in Saudi Arabia, warranting targeted regional interventions. Similar regional variations have been documented in previous studies, with urban areas often showing higher COPD prevalence due to greater air pollution exposure and smoking rates.¹⁹

Smoking status emerged as a critical determinant of COPD risk ($p \leq 0.0001$). Notably, conventional cigarette smokers demonstrated the highest proportion of high-risk individuals followed by users of both cigarettes and hookah. This finding aligns with established evidence identifying tobacco smoking as the primary risk factor for COPD development.⁸ The substantial risk observed among hookah users warrants attention, as it challenges the common misconception that water pipe smoking is less harmful than cigarette smoking. Similar findings were reported by Waked, who found significant associations between water pipe smoking and chronic respiratory symptoms.²⁰ Interestingly, e-cigarette users showed a relatively lower risk profile compared to conventional tobacco products, though this should not be interpreted as evidence of their safety, particularly given emerging evidence of respiratory effects associated with vaping.²¹

The association between cardiometabolic comorbidities and COPD risk was significant ($p = 0.001$), with of participants with hypertension/diabetes exhibiting high COPD risk, compared to among those without these conditions. This finding supports the growing recognition of COPD as a component of multimorbidity rather than an isolated respiratory condition. Systemic inflammation may represent a common pathway linking these conditions, as suggested by Chen, who documented increased COPD prevalence among patients with metabolic syndrome.²² Our results emphasize the importance of comprehensive assessment of patients with cardiometabolic disorders for respiratory symptoms.

The predominance of younger participants in our sample likely contributed to the overall low prevalence of high-risk cases, as COPD risk typically increases with age. Nevertheless, the identification of high-risk cases within this younger demographic is concerning and suggests potential early-onset disease. Early-onset COPD may indicate heightened susceptibility due to genetic factors, severe environmental exposures, or aggressive disease progression.¹¹ The substantial representation of younger individuals in our sample reflects the demographic profile of Saudi Arabia, where approximately 70% of the participants is under 35 years of age.²³

Despite the lower prevalence of high-risk cases in our overall sample, the concerning rates among specific subgroups—particularly cigarette smokers and the use of both cigarettes and hookah highlight the need for targeted screening and prevention strategies. These findings underscore the potential value of risk-stratified approaches to COPD screening, focusing resources on high-risk group while implementing broader preventive measures at the community level.

The limitation of this study is reducing the generalizability of the findings and introducing selection bias due to the use of convenience sampling methods. Furthermore, the accuracy of the diagnosis is limited because of the absence of spirometry confirmation, as the COPD-PS is a Screening tool and not a diagnostic measure. The predominance of younger participants may have led to underestimation of overall COPD risk in the general population. Moreover, the categorical nature of the data, which prevented calculation of mean values and restricted more detailed descriptive analysis. Additionally, the data did not meet the assumptions required for multivariable regression, limiting our ability to adjust for potential confounders. Lastly, potential recall bias may have affected responses regarding symptom frequency, smoking history, and urban vs rural participants.

Despite these limitations, the current study includes multiple strengths, including the use of the validated Arabic version of the COPD-PS, a larger sample size, and participants from all regions of Saudi Arabia, which improve the reliability and generalizability of the results. Moreover, our findings provide valuable baseline data for future longitudinal studies and targeted interventions.

Conclusion

In conclusion, our findings demonstrate significant associations between smoking behaviors, cardiometabolic comorbidities, regional factors, and COPD risk among Saudi participants. The alarming rates of high COPD risk among cigarette smokers and the use of both cigarettes and hookah highlight the critical need for enhanced tobacco control efforts. Regional variations in risk distribution warrant further investigation to identify underlying environmental and healthcare factors. In order to improve disease outcomes and lessen the burden of COPD in Saudi Arabia, these findings emphasize the significance of focused screening and early management, especially among high-risk statuses.

This study highlights the importance of implementing targeted screening for COPD in primary care settings to improve early detection, particularly among high-risk group. By identifying individuals with risk factors such as smoking and comorbid conditions like hypertension and diabetes, healthcare providers can intervene earlier and manage the disease more effectively. Additionally, the findings underscore the need for public health campaigns addressing all forms of tobacco use, with a specific focus on hookah smoking, which is often underestimated in terms of its health risks. These efforts could significantly reduce the burden of COPD and enhance overall community health outcomes. Future research should incorporate spirometry assessment to validate screening results and explore additional determinants of COPD risk in this population. Additionally, further research might include a larger sample size and more diverse populations to improve the results' applicability.

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Disclosure

The authors report no conflicts of interest in this work.

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