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Prevalence and Social Determinants of Asthma among Adults in Fasa, Iran: A Population-Based Cross-Sectional Study

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Abstract

Background & Objectives: Asthma is a chronic inflammatory respiratory disease characterized by variable airflow limitation and bronchial hyperresponsiveness. Its prevalence is increasing, particularly in rapidly urbanizing regions, largely due to environmental and lifestyle transitions. This study aimed to estimate the prevalence of asthma and to identify associated demographic, occupational, and health-related risk factors in Fasa, Iran.

Materials & Methods: In this cross-sectional study conducted between 2013 and 2017, a total of 353 adults from both urban and rural areas were enrolled. Data were collected using a standardized checklist covering demographic characteristics, occupation, educational attainment, marital status, smoking behavior, and comorbid conditions, including diabetes. Pulmonary function was assessed via spirometry, measuring FEV_1, FVC, FEV_1/FVC ratio, and PEF, in accordance with international guidelines.

Results: Of the participants, 136 (38.5%) were male and 217 (61.5%) were female. Overall, females exhibited lower spirometric indices than males. The mean FEV_1 (L) and FVC (L) were 1.54 ± 0.85 and 2.63 ± 0.52 in females, compared with 2.61 ± 0.61 and 3.67 ± 0.33 in males, respectively, findings consistent with established sex-related differences in pulmonary function. Peak expiratory flow was also substantially higher in males (384.4 ± 13.15) than in females (267.1 ± 3.10). With respect to comorbidities, diabetes, hypertension, and heart disease were not significantly associated with asthma. In contrast, respiratory symptoms, including wheezing and shortness of breath, were significantly associated with asthma, with p-values ≤ 0.05 and ≤ 0.04, respectively.

Conclusion: The findings suggest that the burden of asthma in Fasa is associated with gender, occupation, educational level, marital status, and diabetes. These results underscore the need for targeted public health interventions, including early diagnosis, patient education, and improved access to care. Further longitudinal studies with larger sample sizes are warranted to confirm these associations and to elucidate potential causal pathways.

Keywords: Asthma, Prevalence, Pulmonary function, Cohort study

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Introduction

Despite substantial advances in medical knowledge and health care delivery, asthma remains a prevalent and burdensome chronic respiratory disease affecting both children and adults (1, 2). It is characterized by airway inflammation, bronchial hyperresponsiveness, and reversible airflow limitation, which manifest clinically as wheezing, cough, chest tightness, and dyspnea (3). Globally, approximately 262.41 million individuals are living with asthma, underscoring its persistent public health significance (4). In Iran, prevalence estimates suggest that asthma affects approximately 8% of adults and 6% of children and adolescents (5). Wheezing, in particular, has been consistently identified as a key symptom and a clinically useful indicator of asthma (6, 7). Although the overall prevalence of asthma in Iran has been described as moderate relative to certain countries in the Eastern Mediterranean region, recent decades have witnessed a discernible upward trend (8, 9).

The prevalence and severity of asthma are shaped by a complex interplay of genetic susceptibility, physiological characteristics, environmental exposures, and social and demographic determinants (9). The World Health Organization conceptualizes many of these influences within the framework of the social determinants of health (SDOH), defined as the non-medical conditions in which individuals are born, grow, work, live, and age, and which ultimately shape health outcomes (10). Key SDOH relevant to respiratory health include educational attainment, occupation, socioeconomic status, housing conditions, and access to health services. In addition, demographic characteristics such as age, gender, and marital status may influence both asthma risk and disease expression (11). Given the substantial clinical and economic burden of asthma on both individuals and health systems (12), it is imperative that control strategies address not only clinical management but also upstream social and environmental determinants in order to effectively reduce morbidity and associated costs. In Iran, rapid urbanization, industrial expansion, and population growth have substantially altered environmental exposures. Factors such as air pollution, seasonal dust storms, and lifestyle changes are likely contributors to the rising prevalence of asthma (13), as well as to regional variability in disease patterns (8, 9). Although national surveys and clinic-based studies have enhanced understanding of asthma symptoms and treatment patterns, there remains a notable lack of population-based, locality-specific research integrating spirometric assessments with detailed social and demographic data. This gap is particularly evident in Fasa, a city in southern Iran characterized by a mixed urban–rural population and distinct environmental exposures, including agricultural activities and episodic dust events, which may influence respiratory health differently compared with other regions.

Accordingly, the present study was designed to determine the prevalence of asthma among adults in Fasa and to examine its association with a range of individual and social factors, including age, gender, education, occupation, marital status, place of residence (urban versus rural), smoking behavior, and selected comorbidities. By identifying the social and demographic correlates of asthma within this specific context, this study seeks to address the existing geographic evidence gap and to provide a robust empirical basis for the development of locally tailored strategies for prevention, early diagnosis, and disease management.

Materials and Methods

Study Design

This study was designed as a cross-sectional analytical investigation utilizing baseline data from the Fasa Cohort, a population-based

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prospective cohort study conducted in southern Iran (14). The data analyzed in the present study were collected between 2013 and 2017 and were used to estimate the prevalence of asthma and to examine its associations with individual and social determinants.

Study area and reference population

The study was conducted in Fasa County, located in Fars Province in southern Iran (Figure 1). Fasa (28.9484° N, 53.6376° E) is characterized by a temperate climate and a well-established urban–rural health care network comprising two hospitals, 16 urban health centers, and 12 rural health centers, in addition to private medical facilities.

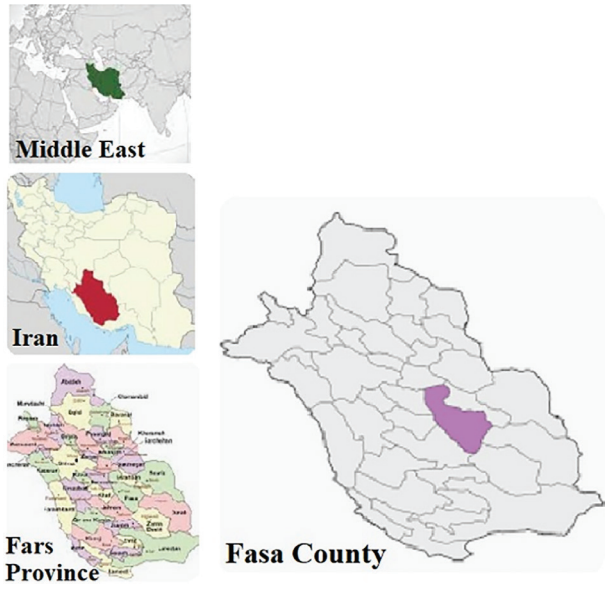

Figure 1. Study Area.

According to the 2016 national census, the total population of Fasa was 110,825. The Fasa Cohort Center, affiliated with Fasa University of Medical Sciences, is responsible for participant recruitment and data collection within the framework of the PERSIAN Cohort Consortium.

Selection and description of participants

The analytic sample consisted of adults aged 35–70 years who were enrolled in the first phase of the Fasa Cohort, specifically from the Sheshdeh and Qarah Bolagh regions. Eligibility criteria for cohort participation included residence in the study area and provision of informed consent.

For the present cross-sectional analysis, all participants with complete baseline data on respiratory history and spirometry were included (n = 353). Exclusion criteria comprised missing key spirometric outcomes or core questionnaire variables, as well as the inability to perform spirometry according to established quality control standards.

Sample size and sampling method

The parent Fasa Cohort enrolled approximately 10,000 adults aged 35–70 years between 2013 and 2017. For this secondary analysis, a complete-case approach was adopted, whereby all participants with both complete questionnaire data and valid spirometric measurements at baseline were included (n = 353). As this analysis was conducted on a subset of an existing cohort, a formal a priori sample size calculation was not performed. Nevertheless, the implications for statistical power and precision, particularly in subgroup analyses, should be considered when interpreting the findings.

Data collection and measurements

Baseline data were collected using standardized instruments developed for the PERSIAN Cohort, including general questionnaires and structured medical interview forms. These instruments captured a comprehensive range of variables, including sociodemographic characteristics (age, gender, educational attainment, occupation, marital status, and urban or rural residence), lifestyle factors (self-reported smoking, alcohol consumption, opium use, and substance use within the past 12 months), and medical history (physician-diagnosed conditions such as hypertension and diabetes, as well as respiratory symptoms including wheezing and dyspnea).

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Additional validated modules assessed physical activity, sleep patterns, and oral health. The psychometric properties and prior validation of these instruments have been documented elsewhere (15).

Asthma status was defined based on self-reported physician diagnosis, corroborated by the presence of characteristic respiratory symptoms, including wheezing and dyspnea, and supported by spirometric findings consistent with reversible obstructive airway disease.

Spirometric assessments, including measurements of FEV_1, FVC, FEV_1/FVC ratio, and peak expiratory flow (PEF), were conducted at the Fasa Cohort Center in accordance with international guidelines. Equipment was calibrated daily using standardized procedures, and all technicians underwent formal training and certification in spirometry. Quality assurance procedures included the evaluation of flow–volume curves, as well as acceptability and repeatability criteria. Only tests meeting American Thoracic Society/European Respiratory Society (ATS/ERS) quality grades A–C were included in the analysis.

Statistical Analysis

Data were entered and analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to summarize participant characteristics, with continuous variables reported as mean ± standard deviation and categorical variables as frequencies and percentages. Between-group comparisons were conducted using independent-samples t-tests for two-group comparisons and one-way analysis of variance (ANOVA) for comparisons across multiple groups. The chi-square test was used to assess differences in categorical variables.

Multivariable regression analyses were performed to evaluate associations between predictors and asthma. Linear regression models were initially used; however, for the binary asthma outcome, multivariable logistic regression models were employed to estimate effect sizes as odds ratios (ORs) with corresponding 95% confidence intervals, adjusting for potential confounders, including age, gender, occupation, educational level, and marital status.

Results

Participants and Demographic Characteristics

The study sample comprised 353 participants, including 217 females (61.5%) and 136 males (38.5%), indicating a female-predominant cohort. With respect to educational attainment, 161 participants (45.6%) had primary-level education, 125 (35.4%) were illiterate, and 47 (13.3%) had completed middle school (Table 1).

Spirometric measurements and Asthma prevalence

Across the cohort, females exhibited consistently lower mean spirometric values than males. Specifically, the mean FEV_1 (L) was

Table 1. Frequency distribution of the study population's demographic characteristics.

		Frequency	Percentage
Gender	Female	217	61.5
	Male	136	38.5
Literacy level	Illiterate	125	35.4
	Primary	161	45.6
	Middle School	47	13.3
	High School	20	5.7
Occupational status	Agriculture and Livestock	78	22.1
	Labor and driving	35	9.9
	Homemakers and Unemployed	202	57.4
	Other	38	10.6

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1.54 ± 0.85 in females compared with 2.61 ± 0.61 in males, while the mean FVC (L) was 2.63 ± 0.52 in females versus 3.67 ± 0.33 in males. Peak expiratory flow also differed substantially by sex, with higher values observed in males (384.4 ± 13.15) than in females (267.1 ± 3.10). Stratification by occupation revealed notable heterogeneity in pulmonary function. Individuals engaged in agriculture and livestock work demonstrated relatively higher spirometric values (FEV_1: 2.67 ± 0.33 L; FVC: 3.83 ± 0.07 L; PEF: 143.9 ± 6.33). In contrast, laborers and drivers exhibited moderately lower values (FEV_1: 2.73 ± 0.66 L; FVC: 3.79 ± 0.56 L; PEF: 123.5 ± 2.40). The lowest spirometric indices were observed among homemakers and unemployed participants (FEV_1: 1.55 ± 0.92 L; FVC: 2.66 ± 0.46 L; PEF: 113.1 ± 2.28), indicating comparatively reduced pulmonary function in this subgroup. Participants categorized as "other" demonstrated intermediate values (FEV_1: 2.69 ± 0.39 L; FVC: 3.90 ± 1.30 L; PEF: 137.5 ± 1.37) (Table 2).

The notably small standard deviation reported for female PEF values warrants careful verification, as such limited variability is atypical and may reflect issues related to data entry, measurement units, or reporting. Clarification of these values is essential to ensure accurate interpretation of sex-based differences.

Figure 2 illustrates asthma prevalence stratified by gender and occupational category, alongside distributions of the FEV_1/FVC ratio. The overall prevalence of asthma in the cohort was 5.8% (95% CI: 1.33–3.45).

Table 2. Frequency distribution of spirometry parameters in the studied population.

		FEV1	FVC	PEP	P value
Gender	Female	1.54 ± 0.85	2.63 ± 0.52	267.1 ± 3.10	p≤0/001
	Male	2.61 ± 0.61	3.67 ± 0.33	384.4 ± 13.1	
Occupational status	Agriculture and Livestock	2.67 ± 0.33	3.83 ± 0.07	143.9 ± 6.33	p≤0/05
	Labor and driving	2.73 ± 0.66	3.79 ± 0.56	123.5 ± 2.40	
	Homemakers and Unemployed	1.55 ± 0.92	2.66 ± 0.46	113.1 ± 2.28	
	Other	2.69 ± 0.39	3.9 ± 1.3	137.5 ± 1.371	

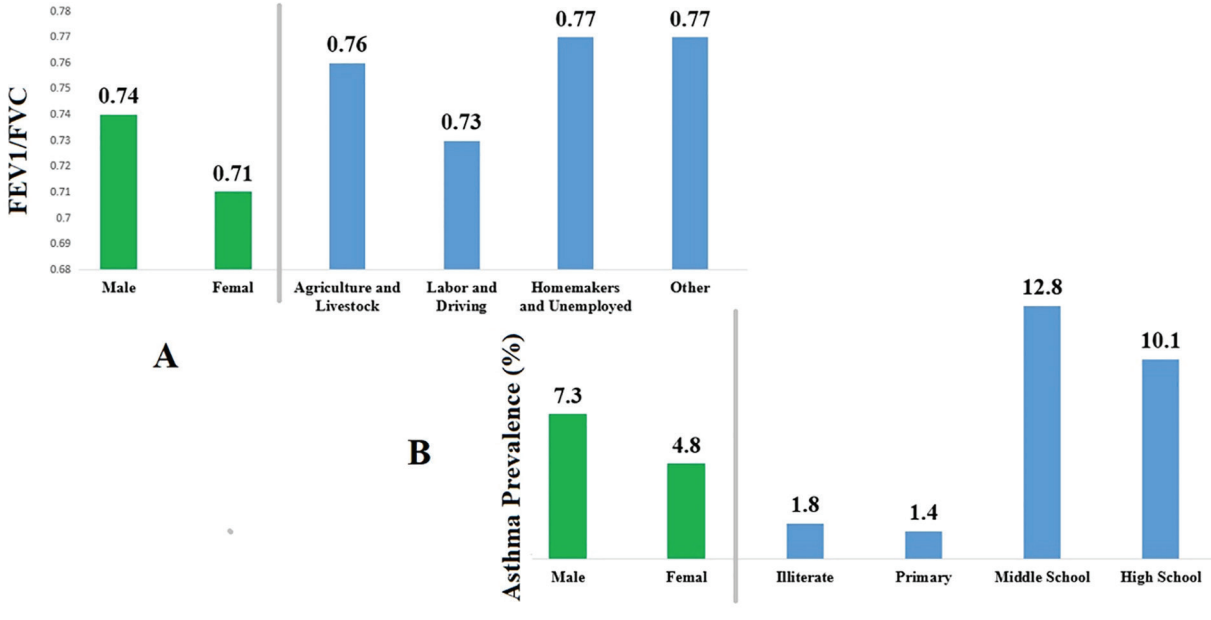

Figure 2. Distribution of FEV1/FVC (A) and Asthma prevalence in the studied population (B).

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When stratified by sex, asthma prevalence was higher in males (7.3%) than in females (4.8%); however, this difference was not statistically significant.

Collectively, these findings suggest that occupational factors, including physical activity levels and environmental exposures, may contribute to variability in pulmonary function. Notably, homemakers and unemployed individuals exhibited the most attenuated spirometric measures. Educational attainment also appeared to be associated with asthma prevalence, with individuals possessing a high school education demonstrating approximately fivefold higher prevalence compared with illiterate participants.

Although asthma prevalence varied across occupational groups, no statistically significant differences were observed in FEV_1/FVC ratios between these groups. Overall, the FEV_1/FVC ratio was lower in females than in males and was also reduced among laborers and drivers relative to other occupational categories. No significant associations were identified between asthma and diabetes, hypertension, or heart disease. Among 76 participants with diabetes, 7 were diagnosed with asthma. Similarly, 5 of 102 participants with hypertension (4.9%) and 5 of 54 participants with heart disease (3.9%) had asthma, with none of these associations reaching statistical significance.

In contrast, respiratory symptoms were significantly associated with asthma. Among participants reporting wheezing (n = 58), 6 (10.3%) had asthma ($p \leq 0.05$), while among those reporting shortness of breath (n = 26), 3 (11.5%) had asthma ($p \leq 0.04$). The Multivariable regression analysis indicated that age and marital status were significant predictors of asthma prevalence (Table 3).

Discussion

The observed overall asthma prevalence of 5.8% (7.3% in men and 4.8% in women) falls within the range reported in other populations but differs from some previous studies. For example, Rakhshanda et al. (2023) reported a higher asthma prevalence in men (16), while Sullivan et al. (2017) reported a prevalence of approximately 13.3% among school-aged children (17). Swed et al. (2024) reported an 8.7% prevalence in the adult population of the United States, with a higher prevalence among females (18). Differences among studies may reflect variations in age distribution, study setting, diagnostic criteria, environmental exposures, including climate, vegetation, and air pollution, as well as lifestyle factors and genetic susceptibility.

The study found that the mean values and standard deviations of several spirometric parameters, including FEV_1, FVC, PEF, and FEV_1/FVC, were higher among individuals in labor and driving occupations compared with those in other occupational groups. Conversely, the FEV_1/FVC ratio was higher among homemakers and unemployed individuals and lower among laborers and drivers,

Table 3. Multiple Linear Regression Analysis Examining the Relationship between Predictor Variables and asthma prevalence.

Variable	Sig	Exp(B)	95% CI for Exp(B)	
			Lower	Upper
Job	0/6	0/88	0/55	1.43
Gender	0/74	1.24	0/33	4.26
Age	0/002	1.11	1.04	1.2
Education	0/07	1.75	0/94	3.27
Marital Status	0/03	0/14	0/02	0/89
Constant	0/005	0/001	-	-

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indicating statistically significant differences in spirometric measures across occupational groups. These results suggest that occupation may influence respiratory function, although the pattern observed for FEV_1/FVC appears to differ from that of the other parameters.

The results of the multivariable regression analysis indicated that age and marital status were significant predictors of asthma prevalence. The analysis showed that asthma prevalence increased with age in the study population, such that for each additional year of age, the prevalence of asthma increased by 11%. The results also indicated a significant association between asthma prevalence and marital status, with lower prevalence observed among married individuals compared with single individuals.

In examining asthma prevalence across age groups, Assadi et al. (2017) reported a prevalence of 3.9% among younger children and 6.7% among older children, which differs from the 5.8% prevalence observed in the present study (19). Their findings underscore the influence of demographic factors, particularly age, on asthma prevalence in pediatric populations. Zare Marzouni et al. (2016) identified 22 asthma cases among 150 patients with allergies, corresponding to a prevalence of approximately 14.7% within that cohort (20). Although this finding pertains to allergic conditions rather than general pediatric asthma, it suggests increased susceptibility among individuals with allergic sensitivities.

A meta-analysis by Heidarnia et al. (2007) reported a national asthma prevalence of 13.14% among Iranian children, which is substantially higher than the findings of the present study and highlights regional variability in prevalence estimates (21). Jasemi et al. (2021) reported an overall asthma prevalence of 5.1% among Iranian children, which is closely aligned with the 5.8% observed in this study, suggesting relative consistency across studies within this population (22). Ghale'e Noeie et al. (2022) reported an asthma prevalence of 6.2%, with notable gender differences, specifically 8.3% in girls and 4.2% in boys (23). Although the present study observed a slightly higher prevalence in men (7.3%) than in women (4.8%), this difference was not statistically significant.

Basagaña et al. (2004) highlighted the influence of socioeconomic status on asthma prevalence, reporting that lower educational attainment and lower social class were associated with higher asthma prevalence, with odds ratios of 1.28 and 1.51, respectively (24). In the present study, no significant association was identified between asthma prevalence and comorbid conditions such as diabetes or hypertension, which contrasts with broader findings suggesting that socioeconomic and demographic factors substantially influence asthma prevalence. Notably, a statistically significant relationship was observed between asthma prevalence and respiratory symptoms. Specifically, 10.3% of individuals reporting wheezing had asthma, and 11.5% of those reporting shortness of breath had asthma. These findings are consistent with those of Bloom et al. (2019), who emphasized that exacerbation history is a key predictor of asthma severity and frequency, although the present study primarily focused on demographic and occupational factors (25).

Age- and gender-related patterns in asthma were also observed in this study. The mean age of individuals with asthma was higher (55.9 years) than that of individuals without asthma (51.1 years), and this difference was statistically significant. The overall asthma prevalence was 5.8%, with men showing a slightly higher prevalence (7.3%) than women (4.8%); however, this difference did not reach statistical significance. In contrast, Swed et al. (2024) reported an overall asthma prevalence of 8.7% in the United States and a significant gender disparity, with 64.0% of asthma cases

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occurring in females, suggesting that age and gender patterns may vary across populations. In addition, no statistically significant associations were observed between asthma prevalence and comorbidities such as diabetes, hypertension, or heart disease, which is consistent with the observation that the impact of comorbidities on asthma prevalence may vary across different settings (18).

Assadi et al. (2017) also reported pediatric asthma prevalence estimates that support the notion of age-related increases in prevalence during childhood, consistent with the broader observation that age is an important factor in asthma prevalence (19). Similarly, the meta-analysis by Heidarnia et al. (2007) demonstrated substantial regional and age-related variation in asthma symptoms among children under 18 years of age in Iran, reinforcing the importance of demographic and geographic context in shaping prevalence patterns (21).

The present study further supports previously reported age- and gender-related patterns in asthma prevalence. Jasemi et al. (2021) reported an overall asthma prevalence of 5.1% among children aged 3–18 years, with considerable regional variation, reaching as high as 19% in Babol. This variability suggests that prevalence may differ substantially across age groups, particularly among pre-adolescent and adolescent populations, highlighting age as a key determinant in asthma diagnosis (22). Ghale'e Noeie et al. (2022) reported a prevalence of 6.2% among schoolchildren, with a pronounced gender difference of 8.3% in girls compared with 4.2% in boys, further indicating that gender, alongside age, may influence asthma prevalence and warrants further investigation (23).

In addition, wheezing and shortness of breath emerged as significant indicators of asthma prevalence, with 10.3% and 11.5% of individuals reporting these symptoms, respectively, having asthma. These findings are consistent with the broader literature, which identifies respiratory symptoms as key indicators of asthma. Bloom et al. (2019) further emphasized that exacerbation history is a strong predictor of asthma severity and frequency, illustrating the complex interplay between demographic factors, health status, and asthma prevalence across studies (25).

Education-related patterns also feature prominently. The results indicated a higher asthma prevalence among individuals with no formal education and a lower prevalence among those who had completed high school, with statistically significant differences across educational levels. Although the present study reported an overall asthma prevalence of 5.8% and did not identify a significant association between asthma prevalence and educational status or other health conditions, Basagaña et al. (2004) demonstrated that lower educational attainment is associated with higher asthma prevalence, reporting an odds ratio of 1.28 for individuals with fewer than 16 years of education compared with those with more than 19 years (24). Ghale'e Noeie et al. (2022) also reported significant gender disparities in asthma prevalence but did not specifically evaluate educational status. Nevertheless, consideration of educational attainment may inform asthma management strategies, as higher levels of education may be associated with greater health awareness, particularly among girls (23). Swed et al. (2024) further reported that demographic factors such as age and gender significantly influence asthma prevalence, with a notably higher prevalence among females (64.0%). This finding suggests that educational status may interact with gender and age to shape prevalence patterns, even though the present study did not observe statistically significant gender differences (18).

Marital status and socioeconomic context provide additional insights. The analysis indicated a higher prevalence of asthma

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among single individuals. Basagaña et al. (2004) emphasized the substantial impact of socioeconomic status on asthma prevalence, noting that lower socioeconomic status is associated with higher prevalence (24). These findings suggest that marital status may indirectly influence asthma prevalence through socioeconomic pathways. Swed et al. (2024) reported higher prevalence among females and older adults, which may be related to marital status patterns in certain populations, although the present study did not directly examine this relationship (18). Sullivan et al. (2017) reported that children with asthma incur significantly greater healthcare resource utilization; therefore, if marital status influences access to care or healthcare utilization, it may indirectly affect asthma management and outcomes (17).

The strengths of this study include its population-based design, which incorporates a community sample and thereby reduces selection bias relative to clinic-based studies, as well as the use of objective spirometric measurements alongside questionnaire data to improve phenotypic characterization. The application of clearly defined inclusion and exclusion criteria, together with the reporting of key demographic variables, further enhances the reproducibility of the findings. However, several limitations should be acknowledged. The cross-sectional design precludes causal inference, and temporal relationships between determinants and asthma cannot be established. Furthermore, the statistical power to detect differences within subgroups, such as occupational categories, may be limited due to small sample sizes within strata.

One practical implication of the present findings is that an asthma prevalence of 5.8% in this middle-aged Iranian cohort represents a non-negligible burden among adults in Fasa. If educational attainment is associated with variations in asthma prevalence, targeted awareness and diagnostic outreach initiatives may be warranted, alongside the implementation of standardized diagnostic criteria to minimize misclassification. In addition, emphasizing the role of spirometry in primary care settings for accurate diagnosis and ongoing monitoring in middle-aged adults is recommended, while also addressing health literacy and access-related barriers that may influence diagnosis and reporting.

Future research should incorporate longitudinal designs to assess asthma incidence and the trajectory of lung function over time, particularly in relation to aging. Moreover, multivariable analyses are needed to identify independent determinants of asthma while adjusting for relevant covariates, including age, gender, education, occupation, comorbidities, smoking status, environmental exposures such as air pollution and climate, and biomass fuel use where applicable. Adequately powered subgroup analyses are also required to explore occupation- and gender-specific patterns. Such approaches will contribute to a more comprehensive understanding of how demographic, socioeconomic, and environmental factors interact to shape asthma prevalence and its clinical implications in middle-aged and older populations.

Conclusion

An asthma prevalence of 5.8% in this middle-aged Iranian cohort indicates a meaningful burden among adults, underscoring the need for targeted awareness initiatives, the application of standardized diagnostic criteria to reduce misclassification, and the integration of spirometry into primary care for accurate diagnosis and ongoing monitoring. Consideration should also be given to health literacy and access barriers that may influence detection and management. Future research should adopt longitudinal designs to examine incidence and lung function trajectories over time, employ multivariable

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analytical approaches to identify independent determinants while adjusting for key covariates including age, gender, education, occupation, comorbidities, smoking status, environmental exposures, and biomass fuel use where relevant, and conduct sufficiently powered subgroup analyses to investigate occupation- and gender-specific patterns. Collectively, these findings highlight the importance of examining a broad range of sociodemographic and occupational factors to inform asthma prevention and management strategies and to guide public health interventions aimed at improving awareness, facilitating early diagnosis, and ensuring equitable access to care.

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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Ethical Consideration

This article does not contain any studies with animals performed by any of the authors.

Code of Ethics

The ethical code is IR.FUMS.REC.1398.041

Author Contributions

Y.G. and N.A. conceptualized and conducted the study. R.H. and S.S. conducted the investigation and contributed to data collection. MR.K conducted the investigation and contributed to data collection. A.Gh. contributed to study execution and manuscript preparation, including the original draft and review. A.D. contributed to writing, review and editing, and performed the statistical analysis. All authors reviewed and approved the final manuscript.

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