

# Socioeconomic-related determinants of asthma in the elderly

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## Keywords

Asthma • Elderly • Prevalence • Socioeconomic factors

## Summary

**Introduction.** As the population ages, the impact of asthma in the elderly is expected to be enhanced over the forthcoming decades. We investigated the prevalence of asthma and its socioeconomic factors in the elderly, Shiraz, Iran.

**Methods.** In this population-based study, 1527 subjects older than 60 years were selected based on the stratified random sampling method. The data on asthma symptoms, current asthma, physician diagnose asthma, and allergic rhinitis were collected using the translated ECRHS (European Community Respiratory Health Survey) questionnaire. Information on individual socioeconomic status was derived from the participants' self-reported educational level and their occupation, income, and residence. A p-value of less than 0.05 was considered to be statistically significant.

**Results.** The prevalence of asthma, current asthma, physician

diagnose asthma, and allergic rhinitis was found to be 8.97, 6.81, 4.78 and, 23.51%, respectively. The most common asthma symptoms were nocturnal chest tightness (15.52%, n = 237/1,527). In univariate analysis, the prevalence of asthma was higher in illiterate patients (12.7%), subjects with the lowest income level (10.6%), and patients living in urban areas (24.1%). Having age more than 80 (OR = 2.01; 95% CI = 1.10-3.65), being a current smoker (OR = 2.76; 95% CI = 1.69-4.51) and living in a sub-urban area (OR = 3.01; 95% CI = 1.20-7.50) were significant predictive factors for asthma in the regression model.

**Conclusions.** Asthma and allergic rhinitis in the elderly should be more focus in the southwest of Iran. Moreover, our findings highlighted the effect of socio-economic status, disparities and inequality on community health.

## Introduction

With demographic changes, rapid aging of the global population, the impact of asthma in the elderly is expected to be enhanced over the forthcoming decades [1-6]. Mortality, hospitalization, medical costs and health-related quality of life are significant components of asthma burden in this age group [2, 3, 5,7,8].

Nevertheless, asthma in the elderly is still under-diagnosed and epidemiologic data are mainly about childhood asthma; recent studies have indicated that asthma is highly frequent in the elderly population, with its prevalence ranging from 4.5 to 12.7% [1, 3, 9-11]. Moreover, there is a fourfold greater mortality, as reported by Tsai et al., in this age group than younger adults [12].

In Iran, like other developing countries, epidemiologic observational studies are scarce. Our knowledge about the prevalence of asthma in the elderly is incomplete. Therefore, it is an imperative task to recognize our current situation and set future plans for outcome improvements in the elderly with asthma.

The Shiraz Adult Respiratory Disease Study (SARDS), 2015 providing population-based data for the prevalence of chronic obstructive respiratory diseases (CORDs) and its socioeconomic determinants in the population of Shiraz, Iran [13]. The current study aimed to investigate the prevalence of asthma in the elderly group and determine

the association between the prevalence of asthma and socioeconomic factors.

## Methods

### SETTING AND SAMPLING

SARDS, a population-based study, was conducted from June to October 2015 among adult subjects from the general population of Shiraz, Iran. Shiraz city is the capital of Fars province, in southwest of Iran. The 2011 census recorded the Fars region's population as 4.59 million, 1.7 million of whom are living in Shiraz city and its suburbs [14]. The sampling frame was individuals of the urban and suburban zones of the Shiraz. Using the formula  $N = (z_{1-\alpha/2})^2 * p(1-p) / d^2$ , a minimum sample of 5,593 subjects was required based on the  $Z = 1.96$  (the desired level of confidence 95%), margin of error = 0.75% and  $P = 9\%$ . Accordingly, the study included 6,152 non-institutionalized inhabitants aged 20 and over 20 years old from the nine municipal districts of Shiraz, Iran. The sample was selected based on the stratified random sampling method proportionate to the number of municipal districts and strata. The sample consisted of 0.5% of the 1,219,237 total inhabitants aged  $\geq 20$  years in the survey area. The SARDS' methodology has been described in de-

tail elsewhere [13]. From the total of 6,152 subjects, 1,527 were older than 60 years and their data were analyzed in the current study.

This study was approved by the Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.MED.REC.1398.094). Verbal informed consent was obtained from all the participants and the confidentiality of all personal data was considered.

#### QUESTIONNAIRE AND DEFINITIONS

The translated ECRHS (European Community Respiratory Health Survey) questionnaire was administered by a group of trained interviewers and face to face interview. The validity and reliability of the Persian version of the questionnaire were evaluated previously (Cronbach's  $\alpha = 0.854$ ) [15].

Asthma was defined as a positive answer to all the three following questions in the preceding 12 months: 1) Have you had wheezing or whistling in your chest?; 2) Have you been breathless at all when the wheezing noise was present?; and 3) Have you had this wheezing or whistling when you did not have a cold? Current asthma was defined as a positive answer to each of the following questions: 1) Have you had an attack of asthma in the last 12 months?; or 2) Are you currently taking any medicine (including inhalers, aerosols or tablets) for asthma? [16]. A feeling of tightness, by an attack of shortness of breath and an attack of coughing in one's chest at any time in the last 12 months were considered as respiratory symptoms.

Information on individual SES was collected from the participants' self-reports on the level of education, occupation, income, and residence (urban or suburban). Educational levels were rated as bachelor's degree or higher, high school graduate, middle school graduate, or less. The self-reported education level of the research subjects was combined into a single variable. This composite variable contained four categories of illiterate, primary, secondary/high school, and academic. Occupations were collected with an open-ended question and then categorized into four groups of non-manual, manual, jobless, and unspecified. Subjects who were unable to work, retired persons, and those with an unknown job were classified as having an unspecified occupation. The income earned was the total income received by households for one year. The classification was based on the average income of all households in Iran [14]. Income was divided into four categories ranging from less than \$ 3,500 to more than \$ 7,000 per year.

#### STATISTICAL ANALYSIS

Data were entered into the Statistical Package for the Social Sciences software version 15.0 (SPSS Inc., Chicago, IL, USA) by a trained operator and double-checked by an investigator. In addition to descriptive statistics, chi-square test was used to find the associations between asthma and socioeconomic factors and group differences. To derive predictive socioeconomic factors, we entered all variables of interest with a p-value less than 0.05 in univariate analysis into the multiple logistic regression models to estimate the adjusted odds ratios and 95% confidence intervals (CI). A p-value less than 0.05 was considered to be statistically significant.

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## Results

In this population-based study, a total of 1,527 subjects aged older than 60 years completed the study. Forty-seven out of 1,574 (2.9%) potential participants were not willing to complete the interview process and were considered as a non-respondent in this study. Frequency analysis of their demographic characteristics did not show a substantial difference from respondents.

The mean age of the participants was  $69.32 \pm 6.70$  years. Considering the total respondents, 53.8% were male, 79.1% lived with family, and 11.9% were current smoker. In socioeconomic variables, 42.4% had a primary school education, 44.7% had a manual job, 71.8% earned  $\leq$  \$ 3,500 per year, and 98.1% lived in an urban area (Tab. I).

#### PREVALENCE

The prevalence of asthma, asthma symptoms, current asthma, physician diagnose asthma, and allergic rhinitis in total population are summarize in Table II. Accordingly, the prevalence of asthma was found to be 8.97% (137/1,527), (95% CI = 7.59-10.52%). The most common asthma symptoms were nocturnal chest tightness (15.52%,  $n = 237$ ), nocturnal cough (10.22%,  $n = 156$ ), and nocturnal dyspnea (9.76%,  $n = 149$ ). The prevalence of current asthma, physician diagnose asthma and allergic rhinitis was 6.81% (95% CI = 5.60-8.19%), 4.78% (95% CI = 3.77-5.97%), and 23.51% (95% CI = 21.40-25.72%), respectively.

Table I illustrates the prevalence of asthma by sociodemographic and socioeconomic variables. The prevalence of asthma among the subjects older than 80 years was significantly higher than the younger (61-80) participants ( $P = 0.005$ ). We found no statistically significant association between the asthma prevalence and gender, BMI or living situation. The prevalence of asthma was 16, 8.6, 10.1, and 7.6% among current, ex-, passive, and non-smokers, respectively ( $p = 0.003$ ).

Among socioeconomic factors, the prevalence of asthma was higher in illiterate patients (12.7%), subjects with the lowest income level (10.6%), and patients living in urban areas (24.1%). All of these differences were statistically significant ( $P = 0.009$ ,  $P = 0.008$  and  $P = 0.004$ ).

#### PREDICTIVE FACTORS

An adjusted logistic regression model was used to identify the predictive factors for asthma (Tab. III). Being more than 80 years old (OR = 2.01; 95% CI = 1.10-3.65), being a current smoker (OR = 2.76; 95% CI = 1.69-4.51), and living in a suburban area (OR = 3.01; 95% CI = 1.20-7.50) were significant predictive factors for asthma in the regression model.

**Tab. I.** Asthma prevalence among the elderly by demographic and sociodemographic data, univariate analysis.

Variables		Asthma (n = 137)	Non-asthma (n = 1,390)	Total (n = 1,527)	P-value
Age groups	61-70	88 (8.6%)	931 (91.4%)	1,019 (66.7%)	0.005
	71-80	31 (7.6%)	376 (92.4%)	407 (26.7%)	
	> 80	18 (17.8%)	83 (82.2%)	101 (6.6%)	
Gender	Male	82 (10.0%)	739 (90%)	821 (53.8%)	0.13
	Female	55 (7.8%)	651 (92.2%)	706 (46.2%)	
BMI	Under weight	7 (10.4%)	60 (89.6%)	67 (4.4%)	0.69
	Normal weight	57 (8.6%)	608 (91.4%)	665 (44.1%)	
	Overweight	45 (8.7%)	472 (91.3%)	517 (34.3%)	
	Obese	28 (10.9%)	230 (89.1%)	258 (17.1%)	
Living situation	Alone	27 (8.5%)	291 (91.5%)	318 (20.9%)	0.72
	With family	110 (9.1%)	1,095 (90.9%)	1,205 (79.1%)	
Smoking habits	Current smoker	29 (16%)	152 (84%)	181 (11.9%)	0.003
	Ex-smoker	9 (8.6%)	96 (91.4%)	105 (6.9%)	
	Passive-smoker	18 (10.1%)	161 (89.9%)	179 (11.7%)	
	Non-smoker	81 (7.6%)	981 (92.4%)	1,062 (69.5%)	
Occupation	Manual	63 (9.3%)	616 (90.7%)	679 (44.7%)	0.86
	Non-manual	11 (8.6%)	117 (91.4%)	128 (8.4%)	
	Jobless	7 (11.3%)	55 (88.7%)	62 (4.1%)	
	unspecified	55 (8.5%)	595 (91.5%)	650 (42.8%)	
Education level	Illiterate	55 (12.7%)	378 (87.3%)	433 (28.4%)	0.009
	Primary	54 (8.4%)	592 (91.6%)	646 (42.4%)	
	Secondary	16 (6.0%)	251 (94%)	267 (17.5%)	
	Academic	12 (6.8%)	165 (93.2%)	177 (11.6%)	
Income (per year)	Less than 3,500 \$	116 (10.6)	981 (89.4%)	1,097 (71.8%)	0.008
	3500 to 4,750 \$	17 (5.2%)	312 (94.8%)	329 (21.5%)	
	5250 to 7,000 \$	3 (4.8%)	59 (95.2)	62 (4.1%)	
	More than 7,000 \$	1 (3.0%)	32 (97.0%)	33 (2.2%)	
Residency	Suburban	7 (24.1%)	22 (75.9%)	29 (1.9%)	0.004
	Urban	130 (8.7%)	1,357 (91.3%)	1,487 (98.1%)	

BMI: body mass index.

**Tab. II.** Prevalence of asthma, asthma symptoms and allergic rhinitis in the elderly based on ECRHS questionnaire.

Parameters	Prevalence	95.0% Confidence Interval	
		Lower	Upper
<b>Asthma</b> (wheezing + dyspnea + absence of a cold)	8.97% (137)	7.59%	10.52%
<b>Asthma symptoms</b>			
Awake with chest tightness	15.52% (237)	13.74%	17.44%
Awake with dyspnea	9.76% (149)	8.32%	11.36%
Awake with cough	10.22% (156)	8.74%	11.85%
<b>Current asthma</b> (attack of asthma/ taking asthma medication)	6.81% (104)	5.60%	8.19%
Physician diagnose asthma	4.78% (73)	3.77%	5.97%
Allergic rhinitis	23.51% (358)	21.40%	25.72%

## Discussion

The burden of asthma in the elderly has remained high globally. Although it is a multifactorial issue, identifying the epidemiological data of asthma in this age group and the related socio-economic factors is crucial to set future directions, especially in developing countries with rapid aging of population [3, 7-9]. The current study examined the prevalence of asthma in the elderly and related sociodemographic and socio-economic factors based on the 2015 SARSDS.

The prevalence of asthma, current asthma, physician diagnosis asthma, and allergic rhinitis was 8.97, 6.81, 4.78, 23.51% in urban and suburban non-institutionalized elderly inhabitants of Shiraz, Iran. The prevalence of asthma in the elderly was higher significantly among the subjects older than 80 years, smokers, illiterate subjects, and individuals with the lowest annual income, and those who lived in suburban areas. In a multivariate logistic regression model, those with advanced age, current smokers, and those living in suburban are-

Tab. III. Predictive factors of asthma prevalence in the elderly based on OR and 95% CI using multiple logistic regression analysis.

Variables	B	SE	Adjusted OR (95% CI)	P-value
<b>Age groups</b>				
61-70	Baseline	-	-	-
71-80	-0.15	0.22	0.86 (0.55-1.33)	0.50
More than 80	0.69	0.30	2.01 (1.10-3.65)	0.02
<b>Smoking habits</b>				
Non-smoker	Baseline	-	-	-
Current smoker	1.01	0.25	2.76 (1.69-4.51)	0.00
Ex-smoker	0.09	0.38	1.09 (0.51-2.31)	0.80
Passive smoker	0.23	0.28	1.26 (0.72-2.18)	0.40
<b>Residency</b>				
Urban	Baseline	-	-	-
Sub-urban	1.10	0.46	3.01 (1.20-7.50)	0.01
<b>Education</b>				
Academic	Baseline	-	-	-
Illiterate	0.32	0.38	1.38 (0.65-2.96)	0.39
Primary	-0.11	0.36	0.89 (0.43-1.84)	0.76
Secondary	-0.27	0.40	0.76 (0.34-1.69)	0.50
<b>Income</b>				
More than 7,000 \$	Baseline	-	-	-
Less than 3,500 \$	1.00	1.04	2.72 (0.35-21.06)	0.33
3,500 to 4,750 \$	0.38	1.05	1.47 (0.18-11.61)	0.71
5,250 to 7,000 \$	0.49	1.18	1.64 (0.16-16.65)	0.67

B: beta; SE: standard error; OR: odds ratio; CI: confidence interval.

as significantly predicted the prevalence of asthma in the elderly.

There are no epidemiologic data or population-based study about asthma prevalence in older population of Iran. Only two large population-based studies reported the prevalence of asthma in the age group of older than 60 years. Idani et al. in 2018 reported the rates of asthma-like symptoms, current asthma, physician diagnosis asthma, and allergic rhinitis 26.8, 11.3, 8.7 and 23.9% respectively in the 45-65 year old population of Khuzestan Province [17]. Advanced age was a significant predictive factor of asthma in this study. Specific condition of Khuzestan province regarding more exposure to micro-waste, industrial and non-industrial pollutants can be explained by this higher rate. In another population-based study conducted in the north-east of Iran, the prevalence of asthma symptoms had an increasing trend and was highest in older age groups: 7% in 60-64 years, 8.4% in 65-69 years, and 8.4% 70-104 years [18].

In the recent national survey, the prevalence of asthma was 8.9%, current asthma 4.7%, physician-diagnosed asthma 3.7%, and the history of allergic rhinitis 21.1% in 20-44 year old population in Iran [15]. Varmaghani et al. in a meta-analysis reported the pooled prevalence of asthma ever and physician diagnose asthma 2.5% (95% CI; 1.98-3.10%) and 1.9% (95% CI; 1.26-2.61%) in the population aged over 18 years in Iran [19]. In the first study from SARDS, the prevalence of adult asthma was 7.8 % in urban and suburban non- institutionalize inhabitants of Shiraz, Iran [20]. According to the mentioned rates, it is confirmed that asthma prevalence in the

elderly is high, like many other developed and developing countries [2, 4, 21-24].

In the study of Nejjari et al., cumulative asthma prevalence was reported 6.1% in the French elderly [4]. This rate was significantly higher among manual workers. The prevalence of current asthma was 6.3% in the elderly population of West Texas [25]. In the multiple logistic regression analysis, low income (OR = 1.84; 95% CI = 1.04, 3.27) and history of smoking cigarettes (OR = 1.48; 95% CI = 1.03, 2.14) were among the independent risk factors for current asthma. The lack of national studies and the methodological heterogeneity in international studies made achieving the desirable comparison difficult, especially in socioeconomic areas.

**STRENGTHS AND LIMITATIONS**

To the best of the authors' knowledge, this is the first population-based study evaluating the asthma prevalence in the elderly and its related socioeconomic factors in Iran. To increase the response rate, the questionnaires were completed by a team of trained interviewers. This study had at least two limitations. First, a validated ECRHS questionnaire was used to facilitate international comparisons; however, this questionnaire was used more in the age range of 20-44 years, and some variability in asthma symptoms was reported in 90 elderly subjects. Another limitation was that using self-reported income as an indicator of socioeconomic status does not essentially imply the real income; it is associated with underreporting because of social undesirability of this variable in our cultural setting [26].

## Conclusion

The findings provide helpful information to develop targeted interventions in order to reduce the burden of asthma in the elderly especially among vulnerable groups; active smokers, and those living in suburban areas. Moreover, this study highlighted the effect of socio-economic status, disparities and inequality on community health.

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## Conflict of interest statement

The authors declare no conflict of interest.

## Authors' contributions

Conception of study: HM, SS. Study design: HM, SM, SS. Acquisition, analysis, and interpretation of data: HM, SM. Drafting of manuscript: HM, SS. Critical revision: SM. Final approval of manuscript: HM, SS, SM.

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