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Sociodemographic characteristics of asthma patients and accompanying comorbidities

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Abstract
Objective: The aim of this study was to evaluate and compare the prevalence of comorbidities in asthmatic and non-asthmatic individuals and to compare groups based on sociodemographic variables.
Materials and Methods: This cross-sectional study used data from the 2017 National Household Health Survey (NHHS), which included 6053 individuals aged 15 years and older. The sociodemographic characteristics, behavioral risk factors, and comorbidities of the study participants were analyzed and Pearson chi-squared tests were used to assess statistical significance, and multiple logistic regression analysis was conducted to evaluate the relationships.
Results: Of the 6053 participants, 518 had asthma; 40.4% were male and 59.6% were female, and 73.2% of the asthma patients and 58.3% of the non-asthmatic individuals were females ($p < 0.001$). Patients with asthma had a higher prevalence of at least one comorbidity compared to non-asthmatic individuals ($p < 0.001$). Disease-specific analyses in patients with asthma showed higher rates of hypertension (42.9% vs. 23.9%), hyperlipidemia (35.3% vs. 19.4%), diabetes (27.8% vs. 17.7%), Chronic Obstructive Pulmonary Disease (COPD) (29.7% vs. 2.6%), cardiovascular diseases (16.0% vs. 6.1%), and obesity (56.1% vs. 36.2%) ($p < 0.001$). In the multiple logistic regression analysis, asthma was 14.6 times more likely in individuals with COPD, 1.6 times more likely in obese individuals, and 1.7 times more likely in those with hyperlipidemia.
Conclusion: Patients with asthma have a higher prevalence of specific comorbidities with varying sociodemographic characteristics. Further research is needed to explore the causal relationships between asthma and these comorbidities to improve disease management strategies.

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Introduction

Asthma is a global health concern that affects both children and adults and the most prevalent chronic disease in the pediatric population.[1,2] It is estimated that asthma affects approximately 300 million individuals worldwide, with approximately 455,000 deaths in 2019.[1,2]

Recent studies have indicated a significant increase in specific comorbidities among asthma patients.[3-5] These comorbidities have been shown to impair the quality of life and elevate morbidity and mortality rates in various studies.[6-8] Accompanying chronic diseases adversely affect asthma control, influence the clinical severity of the disease, and lead to increased demand for healthcare services and additional costs. Timely diagnosis and appropriate management of comorbidities can positively influence asthma trajectory.[9,10]

Identifying comorbidities associated with asthma is essential for developing diagnostic and treatment strategies; however, the majority of studies examining asthma and its comorbidities have often focused on specific degrees of disease or particular age groups, resulting in population studies that may not accurately reflect the general population's situation.[5,11-13] Consequently, there is an urgent need for additional research to be conducted within larger, more representative population. In Türkiye, there is a notable lack of large-scale studies investigating the relationship between asthma and systemic comorbidities in a community-representative population.

The aim of this study was to assess and compare the prevalence of systemic comorbidities and sociodemographic characteristics among individuals with and without asthma in a representative population. We examined the prevalence of various comorbidities in patients with asthma and the prevalence of asthma based on sociodemographic characteristics. Given the sampling methodology employed in the original study, the results of our research had a high representation of the entire population, allowing generalization to be used for individuals aged ≥ 15 years.

Materials and Methods

This study adopted a cross-sectional design using data from the—NHHS—Prevalence of Noncommunicable Disease Risk Factors—conducted in 2017.[14] The necessary administrative approvals were obtained on July 8, 2024. The study sample comprised of two groups of individuals aged ≥ 15 years—those with asthma (518 individuals) and those without asthma (5535 individuals)—and evaluated the sociodemographic characteristics, comorbidities, and risk factors related to healthy lifestyle habits of the study groups.

Definitions and calculations

Asthma and comorbidity diagnoses were based on self-reports. The sociodemographic variables extracted from the dataset included age, gender, education level, and Nomenclature of Territorial Units for Statistics (NUTS) regions. The presence of comorbidities assessed included hypertension, asthma, Chronic Obstructive Pulmonary Disease (COPD), diabetes, hyperlipidemia, cardiovascular disease, and obesity. Behavioral risk factor variables for chronic diseases, such as physical activity, tobacco use history (pack/year cigarette consumption), dietary habits, salt intake/consumption, alcohol consumption, and substance use, were also included.

Participants provided affirmative responses to the following questions:

1. Do you currently use any tobacco products such as cigarettes, cigars, or hookah? This was classified as "active tobacco users."
2. Have you ever used any tobacco products in the past? This was classified as "past tobacco users."
3. Negative responses to both questions were classified as "nontobacco users."

To calculate pack/year cigarette consumption, the number of cigarettes smoked daily by participants providing affirmative responses to tobacco use was divided by 20, then multiplied by the number of years smoked (pack/year cigarette consumption = number of years smoked × daily number of cigarettes/20).

Affirmative responses from participants to all three of the following questions were classified as "alcohol consumers":

1. Have you ever consumed alcoholic beverages such as beer, wine, vodka, whiskey, or gin?
2. Have you consumed an alcoholic beverage in the last 12 months?
3. Have you consumed an alcoholic beverage in the last 30 days?

Responses stated below from participants were classified as "individuals using addictive substances":

1. I used it and quit on my own.
2. I used it and quit with treatment.
3. I am currently using it.

To analyze an individual's nutritional status, the daily portions of fruits and vegetables were multiplied by the number of days consumed per week, thus calculating the individual's total weekly fruit and vegetable intake. These calculated values were divided by 7 to determine the average daily intake of fruits and vegetables.

The World Health Organization's (WHO's) consumption recommendation for healthy nutrition is set at a minimum of 400 g, or five servings, of fruits and vegetables daily.[15] Thus, individuals who consumed on average a daily intake of five portions or more of fruits and vegetables were classified as "adequately nourished," while those who consumed fewer than five portions daily were classified as "inadequately nourished."

Participants who responded "always" or "often" to any of the following four questions were classified as "individuals with high salt consumption":

1. How often do you add salty sauces such as salt, soy sauce, or tomato paste to your meals before eating or while eating?

2. How often do you add salt or salty seasonings like bouillon that provide a meaty flavor, high-sodium spice blends, or salty sauces when cooking at home?
3. How often do you consume high-salt processed foods?
4. How much salt or salty paste do you think you consume?

Participants who responded "not often," "very rare," "never," or "do not know" were classified as "individuals with low salt consumption."

To analyze an individuals' physical activity status: Affirmative responses to any of the following questions regarding moderate/vigorous activities; the duration of these activities per week was calculated (physical activity duration = number of days per week these activities are performed × duration [minutes]).

The WHO's recommendation for a healthy physical activity: at least 150 minutes of moderate aerobic activity (or its equivalent in intensity) per week for adults.[16] Those engaging in 150 minutes or more of moderate to vigorous activity weekly were classified as "sufficiently physically active," while those below this duration were classified as "insufficiently physically active":

1. Does your job involve heavy or very intense activities, such as lifting or carrying heavy loads, digging, or construction (lasting at least 10 minutes and causing significant increases in breathing or heart rate)?
2. Does your job involve moderate/intensive activities such as brisk walking or light load carrying (lasting at least 10 minutes and causing slight increase in breathing or heart rate)?
3. Do you engage in heavy/very intensive sports, fitness, or leisure activities that cause a significant increase in breathing or heart rate for at least 10 minutes continuously, such as weightlifting, fast cycling, swimming, soil plowing, playing tennis, running, or football?
4. Do you engage in moderate/intense sports, fitness, or leisure activities that cause slight increases in breathing or heart rate for at least 10 minutes continuously, such as brisk walking, cycling, swimming, volleyball, light load carrying, fast walking, milking, drawing water from a well, painting, or gardening?

To analyze an individual's general health, the following questions were asked. Affirmative responses were classified according to the question and negative responses were accepted as no disease present:

1. Has a doctor or other healthcare professional ever told you that you have high blood pressure or hypertension? This was classified as having a diagnosis of "hypertension."
2. An affirmative answer to "Has a doctor or other healthcare professional ever told you that you have high blood sugar or diabetes?" was classified as having a diagnosis of "diabetes."
3. A participant answering affirmatively to "Has a doctor or healthcare professional told you that you have high cholesterol?" was classified as having a diagnosis of "hypercholesterolemia."
4. Those responding "yes" to "Have you ever had a heart attack or experienced chest pain (angina) due to heart disease or have you had a stroke (cerebrovascular event?)" were classified as having a diagnosis of "cardiovascular disease."
5. Participants answering affirmatively to "Do you have asthma (including allergic asthma) diagnosed by a doctor?" were classified as having a diagnosis of "asthma."
6. Those answering affirmatively to "Do you have COPD/emphysema/chronic bronchitis diagnosed by a doctor?" were classified as having a diagnosis of "COPD."

The majority of the research data consisted of qualitative data; percentage values were used to summarize the data at the group level; and cross-tabulations were employed to assess relationships among qualitative variables. Given that the frequencies observed in the cross-tabulations were adequate, Pearson's chi-square test statistics were deemed appropriate. When significant relationships were identified in multidimensional cross-tabulations, the Bonferroni method was used to ascertain which group or groups contributed to the observed differences. Significant variables ($p < 0.05$) identified through Pearson chi-square analyses were further examined using a multiple logistic regression model to calculate odds ratios. In Model 1, age, gender, NUTS1 region, and the examined comorbidity variable were added to the model sequentially; in Model 2, all these variables were included in the analysis simultaneously; and in Model 3, in contrast to Model 2, the tobacco variable was also included in the regression analysis. Analyses were conducted using the Statistical Package for the Social Sciences (SPSS) 23 software and evaluations were performed at a significance level of $\alpha = 0.05$.

Unanswered questions and unknowns were excluded from the analysis.

Results

In the asthma group, the percentage of women was higher (73.2%) compared to the non-asthma group (58.3%) ($p < 0.001$). In addition, individuals aged ≥ 45 years were more prevalent in the asthma group, and those aged ≤ 44 years were more prevalent in the non-asthma group ($p < 0.001$) (Table 1).

Regarding educational status, a higher percentage of individuals who had never attended school and primary school graduates were found in the asthma group than in the non-asthma group (those who had never attended school: asthma group, 32.4%; non-asthma group, 17.2%; primary school graduates: asthma group, 42.7%; non-asthma group, 36.1%) ($p < 0.001$). Additionally, there was a significant difference in the regional distribution of patients with asthma compared to those without asthma ($p < 0.001$) (Table 1).

In evaluating tobacco product use, a difference was noted between individuals with and without asthma ($p = 0.013$). Further analysis using the Bonferroni method indicated that this difference was attributable to individuals who had used tobacco products in the past (the percentage of past tobacco users was 14.5% in the asthma group and 10.9% in the non-asthma group).

When assessing smoking consumption in pack/years and other behavioral risk factors for chronic diseases (alcohol

Table 1 Comparisons of sociodemographic variables by disease group.

		Asthma n = 518		Non-Asthma n = 5.535		Total n = 6.053		p[a]
		n	%	n	%	n	%	
Gender	Male	139	26.8	2.309	41.7	2.448	40.4	p < 0.001
	Female	379	73.2	3.226	58.3	3.605	59.6	
Age Group	15–29[b]	50	9.7	1.120	20.2	1.170	19.3	
	30–44[b]	116	22.4	1.586	28.7	1.702	28.1	
	45–59[b]	166	32.0	1.450	26.2	1.616	26.7	p < 0.001
	60–69[b]	90	17.4	754	13.6	844	13.9	
	70+[b]	96	18.5	625	11.3	721	11.9	
Education Level	No schooling[b]	168	32.4	951	17.2	1.119	18.5	
	Primary education[b]	221	42.7	1.999	36.1	2.220	36.7	
	Secondary or high school education[b]	94	18.1	1.855	33.5	1.949	32.2	p < 0.001
	Bachelor's degree or higher[b]	35	6.8	730	13.2	765	12.6	
NUTS1 Region	İstanbul	61	11.8	822	14.9	883	14.6	
	West Marmara[b]	13	2.5	315	5.7	328	5.4	
	Agean	81	15.6	818	14.8	899	14.9	
	East Marmara	69	13.3	657	11.9	726	12.0	
	West Anatolia	61	11.8	619	11.2	680	11.2	
	Mediterranean[b]	79	15.3	651	11.8	730	12.1	
	Central Anadolu	32	6.2	307	5.5	339	5.6	p < 0.001
	West Black Sea[b]	59	11.4	344	6.2	403	6.7	
	East Black Sea	22	4.2	232	4.2	254	4.2	
	Northeast Anatolia	14	2.7	145	2.6	159	2.6	
	Central East Anatolia[b]	10	1.9	247	4.5	257	4.2	
	South East Anatolia[b]	17	3.3	378	6.8	395	6.5	

(a) Pearson chi-square test; (b) The analysis conducted using the Bonferroni method shows rows indicating statistically significant differences between individuals with and without asthma.

Table 2 Behavioral risk factors of chronic diseases by disease group.

		Asthma n = 518		Non-Asthma n = 5.535		Total n = 6.053		P[a]
		n	%	n	%	n	%	
Tobacco Consumption Status	Current user	122	23.6	1.498	27.1	1620	26.8	
	Former user[b]	75	14.5	587	10.6	662	10.9	0.013
	Never used	321	62.0	3.450	62.3	3.771	62.3	
Cigarette Consumption (Pack/Year)	<10-pack/year	31	28.4	500	38.5	531	37.7	
	10–20-pack/year	27	24.8	328	25.2	355	25.2	0.059
	>20-pack/year	51	46.8	472	36.3	523	37.1	
Alcohol Consumption	No	492	95.0	5.198	93.9	5.690	94.0	0.327
	Yes	26	5.0	337	6.1	363	6.0	
Fruit/Vegetable Consumption	Insufficient	437	85.4	4.678	86.9	5.115	86.8	0.322
	Sufficient	75	14.6	705	13.1	780	13.2	
Addictive Substance Consumption	No	510	98.5	5.481	99.0	5.991	99.0	0.219
	Yes	8	1.5	54	1.0	62	1.0	
Salt Consumption	Less	241	46.7	2.731	49.6	2.972	49.3	0.210
	A lot	275	53.3	2.776	50.4	3.051	50.7	
Physical Activity Status (Excluding Walking)	Insufficient	381	73.6	4.167	75.3	4.548	75.1	0.383
	Sufficient	137	26.4	1.368	24.7	1.505	24.9	

(a) Pearson chi-square test; (b) The analysis conducted using the Bonferroni method shows rows indicating statistically significant differences between individuals with and without asthma.

Table 3. Disease group comparisons by comorbidities and gender.

Comorbidities		Asthma n = 518		Non-Asthma n = 5.535		p[a]
		n	%	n	%	
Female	COPD	108	28.5	78	2.4	p < 0.001
	Hypertension	171	47.0	784	26.8	p < 0.001
	Obesity	233	63.5	1.332	43.5	p < 0.001
	Diabetes	91	29.5	432	18.2	p < 0.001
	Hyperlipidemia	102	38.8	405	20.0	p < 0.001
	Cardiovascular diseases	58	15.3	158	4.9	p < 0.001
	At least one comorbidity	261	80.8	1,164	52.8	p < 0.001
Male	COPD	46	33.1	68	2.9	p < 0.001
	Hypertension	39	31.2	394	19.6	0.002
	Obesity	48	35.8	563	25.9	0.012
	Diabetes	22	22.4	257	17.0	0.168
	Hyperlipidemia	21	24.7	237	18.5	0.202
	Cardiovascular diseases	25	18.0	177	7.7	p < 0.001
	At least one comorbidity	83	81.4	735	52.7	p < 0.001
Total	COPD	154	29.7	146	2.6	p < 0.001
	Hypertension	210	42.9	1.178	23.9	p < 0.001
	Obesity	281	56.1	1.895	36.2	p < 0.001
	Diabetes	113	27.8	689	17.7	p < 0.001
	Hyperlipidemia	123	35.3	642	19.4	p < 0.001
	Cardiovascular diseases	83	16.0	335	6.1	p < 0.001
	At least one comorbidity	344	80.9	1.899	52.8	p < 0.001

(a) Pearson chi-square test.
Note: For very small p-values, notation p < 0.001 was used.

use, regular fruit and vegetable consumption, substance use, salt consumption, and physical activity), no differences were found between the asthma and non-asthma groups (Table 2).

This study revealed that the percentage of individuals with at least one comorbidity (hypertension, hyperlipidemia, diabetes, COPD, cardiovascular diseases) was higher among asthma patients (80.9%) compared to those without asthma (52.8%; p < 0.001) (Table 3).

When evaluating specific comorbidities, the prevalence of COPD, hypertension, obesity, diabetes, hyperlipidemia, and cardiovascular diseases was found to be higher in individuals with asthma compared to non-asthmatic individuals (p < 0.001). An analysis by gender revealed that the prevalence of all assessed comorbidities was higher in women with asthma than in non-asthmatic women (p < 0.001), whereas in men the prevalence of all assessed comorbidities was also higher in those with asthma than in non-asthmatics, with significant differences noted for COPD, hypertension, cardiovascular diseases, and obesity (Table 3).

In the logistic regression analysis that included comorbidity variables alongside age, gender, NUTS region, and tobacco use (Model 3), the prevalence of asthma was found to be 14.6 times higher in individuals with COPD (95% CI: 10.28–20.83). Similarly, the prevalence of asthma increased in obese individuals (OR: 1.61 [95% CI: 1.22–2.13]) and those with hyperlipidemia (OR: 1.68 [95% CI: 1.23–2.28]) (Table 4).

The sociodemographic characteristics of patients with asthma, behavioral risk factors for chronic diseases, and the presence of comorbidities in asthma were evaluated.

Discussion

This cross-sectional study utilized data from 6053 participants in the NHSS to evaluate the sociodemographic characteristics, behavioral risk factors for chronic diseases, and the presence of comorbidities in patients with asthma. The examination of sociodemographic characteristics revealed relationships between gender, age, education level, NUTS regions, and asthma prevalence (p < 0.001). This study found that the percentage of patients with asthma with at least one comorbidity was higher than that of non-asthmatic individuals. Analysis by disease indicated that the percentage of comorbidities (hypertension, hyperlipidemia, diabetes, COPD, obesity, and cardiovascular diseases) was greater in asthma patients than in non-asthmatics.

Our study concluded that a history of tobacco use was more prevalent among patients with asthma than among those without asthma (p = 0.013). Studies conducted to date and the obtained epidemiological data indicate that current and past smoking are risk factors for developing asthma in adults.[17-19] Furthermore, various studies have demonstrated a dose-response relationship between smoking and asthma development. A 2008 study reported that

Table 4 Multiple logistic regression models and odds ratios.

		Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
COPD	No	1	1	1
	Yes	14.62 (11.25–19.02)	15.52 (10.88–22.12)	14.64 (10.28–20.83)
Hypertension	No	1	1	1
	Yes	1.80 (1.44–2.24)	1.11 (0.81–1.51)	1.11 (0.82–1.51)
Obesity	No	1	1	1
	Yes	1.60 (1.31–1.96)	1.61 (1.21–2.14)	1.61 (1.22–2.13)
Diabetes	No	1	1	1
	Yes	1.36 (1.07–1.75)	1.12 (0.81–1.55)	1.12 (0.81–1.54)
Hyperlipidemia	No	1	1	1
	Yes	1.79 (1.39–2.29)	1.70 (1.25–2.32)	1.68 (1.23–2.28)
Cardiovascular diseases	No	1	1	1
	Yes	2.48 (1.88–3.27)	1.47 (1.01–2.17)	1.45 (0.99–2.13)

Model 1: The model in which the variables of comorbidity are added individually, along with age, gender, and the NUTS region. Model 2: The model in which the other examined comorbidity variables are added collectively, along with age, gender, and the NUTS region. Model 3: The model in which the other examined comorbidity variables are added collectively, along with age, gender, the NUTS region, and tobacco use.

the risk of asthma increased with the number of cigarette packs smoked per year (11–20 packs/year OR 3.71 [95% CI: 1.77–7.78]; > 21 packs/year OR 5.05 [95% CI: 1.93–13.20]).[20] In our study, no relationship was found between packs/year of smoking and asthma, potentially due to insufficient data on the amount of tobacco used by former smokers, despite the availability of data for active smokers.

Several studies have reported a significant increase in comorbidities in patients with asthma compared to the general population.[3–5] Asthma is commonly associated with various comorbidities, particularly gastroesophageal reflux, allergic rhinitis, obesity, depression, diabetes, and cardiovascular diseases. These conditions can affect the clinical severity and intensity of asthma. The prevalence of comorbidities observed in patients with asthma varies across studies.[3] A 2018 study in Türkiye found that 83.5% of patients with asthma had at least one comorbidity, while 53.5% had two or more systemic comorbidities.[13] Similarly, our study found that the percentage of patients with at least one comorbidity (hypertension, hyperlipidemia, diabetes, COPD, and/or cardiovascular diseases) was higher in asthma patients than in non-asthmatics ($p < 0.001$).

Our study also found that the percentage of all assessed comorbidities was higher in patients with asthma than in non-asthmatic individuals ($p < 0.001$). Subanalysis by gender revealed that all examined diseases were associated with asthma in women, whereas in men associations were found for COPD, hypertension, obesity, and cardiovascular diseases. Several studies have indicated potential differences between men and women with asthma, mirroring our findings. A 2019 study reported that 63.5% of male asthma patients and 72.8% of female asthma patients had chronic comorbidities, concluding that the prevalence of chronic comorbidities was higher among female asthma patients and that the risk of specific comorbidities may differ by gender.[5] In another study published in 2011, the relationship between asthma and comorbidities was examined by gender, and the differences between males and females were reported. In this study, we concluded that the risk of developing all cardiovascular diseases, particularly heart failure (excluding angina, coronary artery disease, and myocardial infarction), is higher in women. In contrast, a relationship between asthma and angina as well as coronary artery disease was found in men, which differed from the findings in women. We also reported a stronger association between asthma and diabetes, dyslipidemia, osteoporosis, depression, psychiatric disorders, and gastroesophageal reflux in women than in men, whereas the relationship between allergic rhinitis, sinusitis, and asthma was stronger in men than in women.[21]

In our logistic regression analysis, we found that the occurrence of asthma was 14.6 times higher (95% CI: 10.28–20.83) in individuals with COPD. Both asthma and COPD are inflammatory diseases characterized by airway obstruction, although they have different pathogenic mechanisms and responses to anti-inflammatory treatments.[22] Asthma and COPD can coexist and are referred to as asthma-COPD overlap (ACO).[22] The prevalence and prognosis of ACO vary, depending on the definitions in the literature, severity of bronchial obstruction, and treatments received by the patients studied,[22] with ACO occurring in approximately 25% of patients with COPD and approximately 20% of patients with asthma.[23]

Our logistic regression analysis also indicated that the occurrence of asthma was 1.6 times higher (95% CI: 1.22–2.13) in individuals with obesity. Numerous studies have demonstrated a strong relationship between obesity and asthma, with obesity leading to poor asthma control, variations in medication responses, and increased morbidity.[24] A multicenter study published in 2017 found that 36% of patients with asthma in Türkiye were obese.[25] A 2016 study highlighted a positive and strong relationship between adult-onset asthma and Body Mass Index (BMI) categories, reporting that the risk of adult-onset asthma increased with higher BMI compared to those with a BMI < 25 kg/m^2; the risk increased by 12% (HR 1.12; 95% CI: 1.10–1.14) in those

with a BMI of 25.0–29.9 kg/m², by 40% in those with a BMI of 30.0–34.9 kg/m², and approximately by 250% in those with a BMI ≥ 50 kg/m².[26] The pathogenesis of the relationship between asthma and obesity has been proposed to involve systemic inflammation associated with obesity, which may lead to increased airway inflammation. Additionally, hormones such as leptin and adiponectin, which are affected by obesity, may mediate the occurrence of allergic and immune responses.[24]

Our logistic regression analysis revealed that the occurrence of asthma was 1.68 times higher (95% CI: 1.23–2.28) in individuals with hyperlipidemia. Several studies conducted to date have explored the relationship between asthma and serum cholesterol levels. A study published in 2009 found an inverse relationship between serum total cholesterol levels and HDL cholesterol levels with asthma, indicating that individuals with asthma had statistically significant lower levels of total cholesterol and high-density lipoprotein (HDL) cholesterol.[27] A review published in 2016 reported a statistically significant relationship between low HDL cholesterol levels in children and high low-density lipoprotein (LDL) cholesterol levels in adults with asthma.[28]

In our study, the relationships between diabetes, hypertension, and asthma ($p < 0.001$) were evaluated using the logistic regression analysis. This analysis showed that when comorbidities were added individually, the significant odds ratio values from the initial analysis (Model 1) lost significance when all comorbidities were included (Model 2). In Model 2, the comorbidities included in the analysis were COPD, obesity, hypertension, diabetes, hyperlipidemia, and cardiovascular disease. There are studies demonstrating the association of each of these conditions with asthma; however, the relationship between them has not yet been clarified. When each of these conditions is included in the analysis simultaneously, the loss of significance in the relationship between hypertension, diabetes, and asthma suggests that other comorbidities may act as confounding factors.

Additionally, while the relationship between cardiovascular disease and asthma was significant in Model 1, it was not significant in Model 3, which included the tobacco variable. Various studies have reported inconsistent results regarding the relationship between asthma and cardiovascular disease, indicating that this relationship has yet to be fully understood. A 2011 study by Cazzola et al. found a weak relationship between asthma and cardiovascular diseases, while a separate study published in 2023 reported no relationship between coronary heart disease and asthma after adjustments to healthcare behavior.[29,30] Similarly, a 2005 study by Schanen et al. reported no relationship between self-reported coronary heart disease and asthma.[31] Tobacco is a significant factor in the etiology of both cardiovascular disease and asthma.[32,33] The disappearance of the relationship between cardiovascular disease and asthma when tobacco use was included in our study suggests that tobacco may play a significant role as a confounding factor.

Moreover, our study showed that the relationships between diabetes, hypertension, and asthma ($p < 0.001$) lost significance when all comorbidities were added to the logistic regression analysis. This suggests that interactions among comorbidities may have contributed to this outcome.

Limitations of the study

In our study, reliance on personal reports for asthma diagnosis, the absence of additional tests and evaluations for diagnosis, and the lack of requests for medications and health board reports represented significant limitations. Furthermore, our study does not provide information on the severity of asthma in patients, whether their condition is under control, their respiratory functions, or the medications they are using. In addition, as clinical variables were not collected, we were unable to examine the connection between asthma severity and comorbidities. Besides, the cross-sectional nature of the study made it impossible to establish a causal relationship between asthma and comorbid conditions. Furthermore, another limitation of our study is the potential bias arising from the increased diagnosis of other diseases due to more frequent hospital visits, regular follow-ups, and greater health awareness among patients with asthma.

Strengths of the study

The data used in this study were obtained from the 2017 NHHS, which employed multistage cluster sampling to obtain regional estimates related to the 12 NUTS-1 regions in Türkiye. Hence, the results are highly representative of the entire population, allowing for generalization to individuals aged ≥ 15 years.

Conclusions

Comorbidities are prevalent in patients with asthma, and the types and distribution of these comorbidities are crucial for the management and treatment of the overall condition.

Therefore, it is essential to consider the likelihood of comorbidities developing and coexisting in individuals diagnosed with asthma. Due to the possibility of these comorbidities, it can be anticipated that patients with asthma may require more complex health management strategies and intensified healthcare services.

Therefore, by proactively monitoring patients with asthma, the implementation of early diagnostic measures to identify other chronic diseases, education and support for patients to adopt healthy lifestyle habits, and evaluations and referrals considering the possibility of comorbidities are all vital.

Within this framework, the results anticipated from our study will contribute to the planning of both preventive and therapeutic healthcare services for patients with asthma.

Author Contributions

All authors contributed equally to this article.

Conflicts of Interest

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None.

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