Received: August 23, 2025
Accepted: October 26, 2025

Acad Med J 2025;5(3):61-67
UDC:616.248:613.25]-053.2:316.356.2
https://www.doi.org/10.53582/AMJ255361cch
Original article

SOCIOECONOMIC AND ENVIRONMENTAL DETERMINANTS IN OVERWEIGHT CHILDREN WITH ASTHMA

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Abstract

Childhood asthma and overweight are prevalent chronic conditions that often co-occur, particularly among children exposed to socioeconomic disadvantage. While each condition has been studied independently, their intersection especially in relation to environmental and household factors remains underexplored. A prospective cross-sectional study was conducted to examine the influence of socioeconomic and environmental determinants on asthma in overweight children, and to identify patterns of comorbidity across distinct population groups. A total of 112 children, aged 7-17 years, were divided into three groups: overweight (N=41), asthma with normal BMI (N=38), and overweight with asthma (N=33). Data were collected through parental interviews and clinical examinations. Socioeconomic and environmental variables including maternal education, household heating method, presence of mold/dampness, family size, number of rooms, and household smoking were analyzed using SPSS 22.0, with significance set at $p<0.05$. Family size was significantly larger in the asthma group (mean 5.4 ± 1.7; $p=0.0433$), suggesting a potential link between household density and respiratory health. Mold/dampness was most prevalent in the asthma group (42.1%), though not statistically significant ($p=0.0841$). No significant associations were found for heating method, maternal education, number of rooms, or household smoking.

Conclusion: The association between larger family size and increased household mold presence in children with asthma highlights the potential impact of household density and indoor environmental conditions on pediatric respiratory health. Although other socioeconomic and environmental determinants were not statistically significant, their distribution patterns suggest that cumulative socioeconomic disadvantage may contribute to both asthma and overweight risk.

Keywords: asthma, children, maternal education, overweight/obesity, socioeconomic status

Introduction

Childhood asthma and overweight have emerged as major public health concerns globally.

More than 340 million people are affected by asthma globally, with its incidence rising disproportionately among low and middle-income countries[1]. In recent decades, childhood asthma has also seen a gradual increase in prevalence. During the 2002-2004, data from the International Study of Asthma and Allergies in Childhood (ISAAC) reported a low prevalence of asthma among children in Macedonia[2]. Similarly, obesity has reached epidemic proportions**,** with over 2.5 billion individuals globally classified as overweight, including approximately 890 million adults living with obesity[3]. The burden extends to children: in 2022 alone, more than 37 million children under the age of 5 were overweight, and over 390 million aged 5-19 years were affected, including 160 million classified as obese[3]. The ISAAC study conducted in Macedonia previously indicated a moderately low prevalence of overweight and low prevalence of obesity among children[4]. However, a decade later, newer assessments revealed a significant increase in the rate of overweight and obese children aged 5 to 15 years[5]. These global and national trends underscore the importance of investigating the interrelationship between asthma and obesity in pediatric populations, particularly in regions undergoing rapid socioeconomic transitions[6-8]. This study aimed to understand how environmental exposures, mother education, and housing conditions contribute to these overlapping health outcomes.

Material and Methods

A prospective cross-sectional study was conducted in 2020 at the University Children's Clinic in Skopje, North Macedonia, involving 112 children aged 7-17 years, divided into three groups: 41 overweight children with BMI >25 kg/m², 38 children with asthma and normal BMI and 33 children with asthma and BMI >25 kg/m². Ethical approval was obtained from the Ethics Committee at the Faculty of Medicine, and written informed consent was signed by the parents. Asthma diagnosis was based on GINA and ICON Pediatric Asthma guidelines. [9,10] BMI was calculated using the standard formula, with overweight defined as BMI >25 kg/m² and obesity >30 kg/m² at age 18[11]. Each parent was asked about the medical history of the illness, after which the children underwent a physical examination. Socioeconomic and environmental factors were systematically assessed, including household size, maternal education level, heating source (wood, electricity, or stream-based system), presence of indoor mold or dampness, number of smokers within the household, and number of rooms in the home. Statistical analysis was performed using SPSS 22.0**,** with significance set at $p<0.05$.

Results

The study included 112 children, with a mean age of 11.1 ± 2.4 years (range: 7-17 years). No significant age differences were observed between groups. Regarding the heating method, wood was the most commonly used heating source across all groups (≈45%). No statistically significant association was found between heating method and groups (Chi-square=2.0142; df=4; p=0.7331). Presence of mold/dampness was most frequently reported in the asthma group (42.1%), followed by overweight with asthma (27.3%) and overweight group (19.5%). Although not statistically significant, this trend suggests a potential environmental influence (Chi-square= 4.9519; df=2; p=0.0841).

Most mothers had secondary education: overweight: 63.4%, asthma: 60.5%, overweight with asthma: 48.5%. Primary education was more common in the asthma group (21%) compared to the other two groups. No significant association was found (Chi-square = 5.5024; df = 4; p = 0.2395).

Table 1. Socioeconomic and environmental parameters

Parameters		Groups Overweight N=41	Asthma N=38	Overweight + Asthma N=33	P
Type of home heating					
Wood	**N**	19	18	14	Pearson Chi-square: 2,0142; df=4; p=0,7331
	%	46.34 %	47.37 %	42.42 %	
Electricity	**N**	9	12	8	
	%	21.95 %	31.58 %	24.24 %	
Central heating	**N**	13	8	11	
	%	31.71 %	21.05 %	33.33 %	
Presence of mold/dampness					
No	**N**	33	22	24	Pearson Chi-square: 4,9519; df=2; p=0,0841
	%	80.49 %	57.89 %	72.73 %	
Yes	**N**	8	16	9	
	%	19.51 %	42.11 %	27.27 %	
Mother's education level					
Primary	**N**	4	8	4	
	%	9.76 %	21.05 %	12.12 %	Pearson Chi-square: 5,5024; df=4; p=0,2395
Secondary	**N**	26	23	16	
	%	63.41 %	60.53 %	48.48 %	
Higher	**N**	11	7	13	
	%	26.83 %	18.42 %	39.39 %	

*significant for p<0.05

Table 2. Number of family members by group

	Groups	Mean	N	Standard deviation	Min	Max	Percentiles 25th	50th (Median)	75th
Family members	Overweight	4.80	41	1.71	3	10	4	4	5
	Asthma	5.39	38	1.75	3	12	4	5	6
	Overweight + Asthma	4.54	33	1.48	2	9	4	4	5
	Total	4.93	112	1.68	2	12	4	4	6

Kruskal-Wallis H test: Chi-square (2) = 6.2806; p=0.0433* *significant for p<0.05

Tabel 3. Number of rooms and smokers by group

	Groups	Mean	N	Standard deviation	Min	Max	Percentiles 25th	50th (Median)	75th
Number of rooms	Overweight	3.88	41	1.38	2	10	3	4.0	4
	Asthma	3.84	38	1.15	2	7	3	4.0	5
	Overweight + Asthma	3.42	33	1.15	2	6	3	3.0	4
	Total	3.73	112	1.24	2	10	3	3.5	4

Kruskal-Wallis H test: Chi-square (2) = 2.6455, p=0.2664, *significant for p<0.05

Number of smokers	Number	1.15	41	0.91	0	4	0	1	2
	Asthma	0.87	38	0.81	0	3	0	1	1
	Overweight + Asthma	0.91	33	1.40	0	7	0	1	1
	Total	0.98	112	1.05	0	7	0	1	1

Kruskal-Wallis H test: Chi-square (2) = 4.6169; p=0.0994 *significant for p<0.05

According to the family size, the mean number of family members was 4.8 ± 1.7 in overweight group, 5.4 ± 1.7 in asthma group and 4.5 ± 1.5 in overweight + asthma group. A statistically significant difference was found (Kruskal-Wallis H=6.2806; p=0.0433), with the asthma group having the largest family size.

No significant difference was observed according to the number of rooms in the home (Kruskal-Wallis H=2.6455; p=0.2664**)** and number of smokers per household and groups (p=0.0994).

Discussion

Numerous studies have investigated the relationship between different etiopathogenetic factors and the prevalence of asthma and obesity within countries, yielding complex and sometimes contradictory findings. Atopy underlines more than 80% of childhood asthma and tends to be more prevalent among individuals from higher socioeconomic backgrounds[12]. This association is often attributed to the "hygiene hypothesis," which posits that reduced exposure to microbial agents in early life, more common in affluent environments, may predispose individuals to allergic sensitization[13]. In contrast, the socioeconomic patterning of asthma remains far less clear. Evidence from epidemiological studies is mixed: some have reported a higher prevalence of asthma among children and adults in more affluent groups[14,15], while others have found the opposite suggesting increased asthma rates in lower socioeconomic status populations[16,17]. These discrepancies may reflect differences in study design, geographic context, diagnostic criteria, or the influence of environmental and behavioral confounders such as smoking, housing quality, and access to healthcare.

Adding to the complexity, several studies have found no significant association between socioeconomic status and asthma prevalence in overweight children[18,19]. This lack of a consistent pattern suggests that in these children, asthma may be influenced by a broader constellation of factors beyond socioeconomic status alone, including genetic predisposition, urbanization, air pollution, psychosocial stress, and cultural differences in symptom reporting or healthcare utilization.

This study investigated the relationship between socioeconomic and environmental factors and asthma in overweight children. While most variables did not reach statistical significance, several trends emerged that align with existing literature and warrant further exploration[20]. In terms of family size, it is noteworthy that 50% of patients from all groups had a family with more than 4 members. The significantly larger family size observed in the asthma group (p= 0.0433) may reflect increased exposure to indoor allergens, crowding, and psychosocial stress, all known contributors to respiratory morbidity. This finding is consistent with cohort studies such as the ECHO/CREW Consortium, which identified population density and household size as risk factors for asthma incidence[21]. Although mold and dampness in the home did not reach statistical significance (p= 0.0841), its higher prevalence in the asthma group suggests a potential link to both socioeconomic disadvantage and increased risk of allergen sensitization. Indoor environmental exposures, including mold and dust mites, are well-documented contributors to asthma exacerbation and poor disease control[22-25]. The presence of mold may also reflect inadequate housing conditions, which disproportionately affect low-income families.

Similarly, maternal education showed no significant association, yet the trend of lower education levels among mothers of children with asthma echoes findings from multicenter studies that associate low parental education with poorer asthma control and increased medication use[26]. In ISAAC and the PATY study (Pollution and the Young study), an association between lower

maternal education and the prevalence of wheezing and nocturnal cough was reported[27,28]. Notably, while the majority of children had mothers with secondary education, the asthma group included more than twice as many mothers with only primary education. This pattern aligns with findings by Nahhas *et al*., who demonstrated a significant association between BMI and asthma in children aged 6 to 8 years after adjusting for multiple factors, including parental education, smoking exposure, physical activity, pet ownership, and screen time[29,30].

Although heating method and number of smokers in the household were not significantly associated with group differences, wood heating was the most common source across all groups. Wood-burning stoves are known to release particulate matter (PM2.5), carbon monoxide, and volatile organic compounds, all of which can exacerbate asthma symptoms and contribute to indoor air pollution. This is particularly relevant in low-resource settings, where ventilation may be inadequate and exposure prolonged[31].

Taken together, the results suggest that while individual socioeconomic indicators may not independently predict asthma or obesity, their cumulative effect, particularly when combined with environmental exposures, can significantly influence pediatric health outcomes. These findings underscore the importance of multilevel public health interventions that address both social and environmental determinants of health. Targeted strategies should include improving housing conditions, enhancing parental education, and reducing exposure to indoor pollutants, particularly among vulnerable populations.

Conclusions

This study highlights the complex interplay between socioeconomic status and childhood health outcomes. The significant association between larger family size and asthma underscores the role of household structure in respiratory health. Although other factors such as mold exposure, maternal education, and heating method did not reach statistical significance, the observed trends suggest potential relevance and align with global research. To reduce disparities in asthma and obesity among children, targeted interventions should focus on: improving housing conditions and indoor air quality, enhancing parental health literacy, supporting families with larger household sizes through community-based resources. Future research should incorporate longitudinal designs and larger sample sizes to better understand causal pathways between asthma and obesity.

Conflict of interest statement. None declared.

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