SOCIO-ECONOMIC STATUS AND BRONCHIAL ASTHMA

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Abstract

Low socioeconomic status (SES) is associated with increased morbidity and mortality. Bronchial asthma (AB), its exacerbation and its high degree is associated with a low socioeconomic situation. Low incomes are associated with reduced quality of life, increased unemployment, lower work rates, lower financial ratings, less professional downtime, often with manual work that is associated with higher asthma prevalence.

The research carried out in the Pneumology and Phthisiology Out-patient Clinic of the Department of Internal Medicine of the University Hospital in Nitra included 506 respondents aged 19 and over with a diagnosis of bronchial asthma. The main research methods used were the questionnaire, the asthma control test and the medical documentation analysis. Questions in the questionnaire focused on identification, demographic and socio-economic factors. The obtained data were processed by descriptive statistics and cluster analysis.

Low SES worsened the stabilization of bronchial asthma and respondents do not use treatment of asthma regularly. Those with a higher education, employment, and a certain income (old-age pensioners) have more stabilized bronchial asthma.

A better socioeconomic situation in a respondent positively affects the observation of the treatment of bronchial asthma and improves asthma control.

Key words: *bronchial asthma; SES; education; employment; income; type of work; housing; quality of life*

ORIGINAL ARTICLE

INTRODUCTION

According to Upton et al. (2000), an intergenerational 20-year analysis of the prevalence of bronchial asthma and allergic rhinitis in adults (45 to 54 years old) which took place in the period 1972–1976 and in 1996 found an increasing prevalence of these diseases. According to multiple studies, asthma in the productive age is more common in women than in men. In adults, asthma occurs more often in women (Strachan et al. 1996), and the female gender is an important risk factor for asthma development in early adulthood (Abramson et al. 1996). According to Akinbami et al. (2012), the prevalence of asthma was higher in children and women and in families with a low standard of living, and was also

dependant on the race and ethnicity in the monitored years 2008–2010.

The prevalence for people with an income below 100% of the subsistence level was 11.2%. In the group with an income of less than 200% of the minimum subsistence level, it was 8.7%. If the income was at least 200% of the subsistence minimum, the prevalence was 7.3% (Akinbami et al. 2012). The low income is associated with a decreased quality of life, increased unemployment, lower work rates, financial rating, professional decline, and often with manual work which is related to higher asthma prevalence (Jaakkola et al. 2002, Hedlund et al. 2006).

MATERIALS AND METHODS

The research was conducted in the Pneumology and Phthisiology Clinic of the Department of Internal Medicine of the University Hospital in Nitra. The group consisted of deliberately selected respondents, aged 19 and above, with a diagnosis of bronchial asthma. 506 respondents participated in the study. The criteria for inclusion in the research sample were: adult asthmatic patients (over 19 years of age) with a diagnosis of bronchial asthma confirmed at least one year ago; asthmatic patients monitored and examined at the Pneumology and Phthisiology Clinic of the University Hospital in Nitra; completion of the prepared questionnaire; completion of the asthma control test; undergoing spirometry; willingness to collaborate in the research; signed informed consent, and the approval of the ethics committee of the research. For the identification of the socio-economic situation we chose the following variables for analysis: age, gender, education, monthly income, employment and type of employment in employed respondents (manual, mental), influence of outdoor and indoor work, influence of air conditioning, cold and humidity at work, inhalation and medical treatment of asthma, supplemented by the reimbursement of anti-asthmatic treatment by a health insurance company, and the complete price of anti-asthma (medication and inhalation) treatment. Asthma stabilization has been related to the following variables: bronchial asthma (AB), asthma control points (ACT™), and regular use of antiasthmatic treatment (inhalation and medication).

The data obtained were processed using quantitative and qualitative methods. For certain variables that did not have the Normal (Gaussian) distribution, we performed a descriptive statistical analysis. We also decided to use cluster analysis to confront all the acquired variables in order to identify common features of the social parameters of asthmatic patients with positive and negative effects on antiasthmatic treatment and on the course of asthma. Cluster analysis was used to analyse 506 respondents. In the first analysis, we focused on all of the respondents, but only employed respondents were included in the second analysis. In the third analysis, we included unemployed respondents – those unemployed in productive age, pensioners on disability and old-age pensioners. The fourth analysis did not contain the variable of age, because this variable affected the previous analysis the most. In this way, we wanted to determine other socio-economic parameters affecting asthma stabilization. The calculation was performed using the FCM program from the SYNTAX statistical package.

RESULTS

As for gender, the research group of 506 respondents consisted of 30% men and 70% women. 18% of the men and 44.9% of the women were older than 55. 7.9% of the men and 19.4% of the women were in the age group 31–54. 4.1% of the men and 5.7% of the women were in the youngest category, from 21 to 30 years of age. 50.6% of the respondents had upper secondary education, 32.8% had primary education and 16.6% were university graduates. Of the total number of 506 respondents, 47.2% were old-age pensioners, 11.9% were pensioners on disability, 8.70 were unemployed and 32.2% were employed. Of the employed, 56.4% of the respondents did mental work and 43.6% manual work. 38% of respondents were employed in a one-shift regimen occupation, and 62% of respondents in the two-shift regimen occupation. 78.2% of respondents had an income of less than €500 per month. Of this group, 29% of respondents had an income of €301 to €400, 24.3% of respondents €401 to €500, followed by 17% of

respondents with an income of €201 to €300. The minimum subsistence level income of up to €200 was stated by 7.9% of respondents. 21.8% of respondents earned more than €501. The average income of respondents reached €398.91 (€347.31 for women, €450.50 for men). A marked drop in the income was seen in women after the age of 55, temporarily in men at the age of 45 to 60, and later after the age of 70. 68.2% lived in a detached house, 31.8% lived in a residential or tenement house. 90.5% of respondents considered their housing to be satisfactory. The distance of the housing of respondents from a busy road varied, with 47% of respondents living at a distance of less than 100 meters, 32.8% up to 200 meters, and 20.2% over 200 meters.

The first cluster analysis included all of the respondents and was 18-dimensional. The best breakdown was achieved for two clusters with a coefficient of separation of 367.75. 43.03% of the respondents were included in the first cluster and 28.48% of respondents in the second cluster. 16.77% of the respondents were less clearly classified in the first cluster and 11.72% of the respondents in the second cluster. Thus, we acquired two groups, the first one comprising of 71.52% and the second one of 28.48% of the respondents.

The clusters did not differ by sex (difference of 0.06%) and control of asthma (difference of 2.74%), with the first group consisting of respondents with an average age of 69.54 years (middle aged) and the second group with the age of 43.94 years. Younger respondents had a higher education (upper secondary) compared to the older respondents (difference of 22.10%). The older respondents in the first cluster had a higher grade of bronchial asthma (predominantly moderate to severe) and had a higher body mass index (BMI) of 30.71 (cluster centre). The second cluster included younger respondents with a lower grade of bronchial asthma (moderate bronchial asthma) who had a BMI of 27.77 in the middle of the cluster (Table 1).

Table 1 – Cluster analysis of all respondents

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Age	69.54	43.94	63.19	–36.81
Gender	1.701	1.700	99.94	–0.06
Education	1.69	2.06	122	22.10
BMI	30.71	27.77	90.43	–9.57
ACT™	18.59	19.1	102.74	2.74
AB level	2.814	2.516	89.41	–10.59

Used abbreviations: BMI – body mass index; ACT™ – asthma control test; AB – bronchial asthma.

The first cluster included old-age pensioners, who had previously worked manually (difference of 12.8%). Their income was lower than that of the younger respondents in the second cluster (difference of 12.9%). They worked outdoors more (difference of 30.78%) and stated that air-conditioning, and cold and wet environment at the workplace had almost no influence on their asthmatic problems. The second cluster (with younger respondents) was characterised by mental work, higher income, work inside and showed a significant impact of cold (difference of 564.25%), wet (585.76%) and air conditioning (540.27%) at the workplace (Table 2).

Old-age pensioners used inhalation antiasthmatic treatment more regularly (difference of 16.81%), compared with the medication antiasthmatic treatment (difference 5%). The cost of the complete asthma treatment and drug supplements by respondents and health insurers did not differ significantly in the two clusters (Table 3).

The second cluster analysis focused on employed respondents. The best separation coefficient (111.341) was achieved for two clusters. 37.74% of the respondents were included in the first cluster and 23.27% of respondents in the second cluster. 26.42% of the respondents were less clearly classified in

Table 2 – Cluster analysis of respondents

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Occupation	2.989	3.142	105.12	5.12
Work type	1.336	1.507	112.8	12.8
Income	6.024	6.801	112.9	12.9
Work outside and inside	0.1579	0.1093	69.22	–30.78
Air-conditioning at the workplace	0.1604	1.027	640.27	540.27
Effect of cold environment on the workplace	0.1516	1.007	664.25	564.25
Effect of wet environment on the workplace	0.1798	1.233	685.76	585.76

Table 3 – Cluster analysis of respondents – Evaluation of regularity of treatment and prices of bronchial asthma treatment

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Regular use of inhalation antiasthmatic therapy	2.72	2.2627	83.19	–16.81
Regular use of medication antiasthmatic treatment	2.502	2.627	105.00	5.00
Price of complete antiasthmatic treatment per day	0.9831	0.959	97.55	–2.45
Amount of anti-asthma treatment surcharge by respondents per day	0.1027	0.0962	93.69	–6.31
Amount of anti-asthma treatment reimbursed by the health insurance company per day	0.8804	0.8628	98.00	–2.00

the first cluster and 12.58% of the respondents in the second cluster. Thus, we acquired two groups, the first one comprising of 64.16 % and the second one of 35.85% of the respondents.

The first cluster consisted of respondents with an average age of 53.92 years (cluster centre) and the other with the age of 36.61 years, with a difference of 32.10%, differing by gender (difference of 4.13%) and asthma control (difference of 0.70%). Younger respondents had a higher education (upper secondary to university) compared to the older respondents (difference of 17.72%). In older employed respondents, BMI was higher (cluster centre 29.62, difference of 12.22%) and bronchial asthma grade – predominantly moderate asthma (cluster centre 2,655, difference of 9.15%, listed in Table 4).

Older employed asthma patients were working slightly more manually (difference of 6.39%), inside (difference of 6.92%), and their income was lower than that of younger employed subjects in the second cluster (difference of 11.94%). In the older employed, we observed an increased impact of air-conditioning (difference of 9.39%) and cold environment (difference of 10.80%) on their asthmatic problems (Table 5).

Older employed respondents were more likely to use antiasthmatic treatment medication (difference of 10.91%), but inhalation antiasthmatic treatment was comparable with the younger group (difference of 6.00%). We also observed significantly higher surcharges in these respondents (difference of 14.70%), the cost of complete asthma

treatment (difference of 6.48%), as well as reimbursement for antiasthmatic treatment by health insurance companies (difference of 5.42%) (Table 6).

Table 4 – Cluster analysis of employed respondents; evaluation of age, sex, education, BMI, ACT™ and AB level

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Age	53.92	36.61	67.90	–32.10
Gender	1.694	1.624	95.87	–4.13
Education	2.009	2.365	117.72	17.72
BMI	29.62	26	87.78	–12.22
ACT™	19.91	20.05	100.70	0.70
AB level	2.655	2.412	90.85	–9.15

Used abbreviations: BMI – body mass index; ACT™ – asthma control test; AB – bronchial asthma.

Table 5 – Cluster analysis of employed respondents. Evaluation of employment and workplace factors

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Employment	4	4	100	0.00
Type of work	1.549	1.648	106.39	6.39
Salary	7.696	8.615	111.94	11.94
Working inside/outside	1.82	1.694	93.08	−6.92
Air condition at work	1.747	1.583	90.61	–9.39
Influence of cold at workplace	1.722	1.536	89.20	–10.80
Influence of humidity at workplace	2.027	1.91	94.23	–5.77

Table 6 – Cluster analysis of employed respondents; evaluation of treatment regularity and the price of the AB treatment

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Regular use of antiasthma inhalation treatment	2.735	2.571	94.00	–6.00
Regular use of antiasthma medicine treatment	2.567	2.287	89.09	–10.91
Price of complete antiasthma treatment per day	1.008	0.9427	93.52	–6.48
Amount of surcharge of antiasthma treatment of the respondent per day	0.1109	0.0946	85.30	–14.70
Amount of surcharge of antiasthma treatment of the insurance company per day	0.8967	0.8481	94.58	–5.42

The third cluster analysis was carried out in the group of unemployed respondents. The best separation coefficient (247.903) was achieved for two clusters. 52.38% of the respondents were included in the first cluster and 15.48% of respondents in the second cluster. 19.35% of the respondents were less clearly classified in the first cluster and 12.80% of the respondents in the second cluster. Thus, we acquired two groups, the first one comprising of 71.73% and the second one of 28.28% of the respondents.

The first cluster consisted of respondents with an average age of 71.67 years (cluster centre) and the other with the age of 47.26 years, with a difference of 34.06%. The clusters did not differ by gender (difference of 1.69%). The group of the unemployed respondents in productive age had upper secondary education (difference of 10.39%), comparable AB control (difference of 5.73%), moderate to severe persistent asthma (difference of 5.52%) and BMI (difference of 5.46%). Old age pensioners had primary and upper secondary education (Table 7).

Table 7 – Cluster analysis of unemployed respondents

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Age	71.67	47.26	65.94	–34.06
Gender	1.711	1.740	101.69	1.69
Education	1.656	1.828	110.39	10.39
BMI	30.61	28.94	94.54	–5.46
ACT™	19.51	17.45	94.27	–5.73
AB level	2.828	2.672	94.48	–5.52

Used abbreviations: BMI – body mass index; ACT™ – asthma control test; AB – bronchial asthma.

Old-age pensioners worked more manually (difference of 5.69%); their income was significantly higher than that of the younger unemployed respondents in the second cluster (difference of 23.90%). Old-age pensioners received €401–450 per month (range 5 to 6), while the pensioners on disability in the second cluster had €301–350 per month (range 4 to 5) (Table 8).

Table 8 – Cluster analysis of all unemployed

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Occupation	2.928	1.781	60.83	–39.17
Work type	1.300	1.374	105.69	5.69
Income	5.891	4.483	76.10	–23.90

In the two clusters of unemployed asthmatic patients, there was no significant difference in the regularity of inhaled antiasthmatic treatment (difference of 3.86%) and the likelihood of using anti-asthmatic medication was comparable (difference of 2.04%). The cost of complete asthma treatment was comparable in both clusters (difference of 0.07%), but the surcharges for anti-asthma treatment were relatively higher in the old age pensioners (difference of 9.30%) (Table 9).

Table 9 – Cluster analysis of unemployed respondents

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Regular use of inhalation antiasthmatic therapy	2.723	2.618	96.14	–3.86
Regular use of antiasthmatic therapy medication	2.494	2.443	97.96	–2.04
Price of complete antiasthmatic treatment per day	0.979	0.979	99.93	–0.07
Amount of anti-asthma treatment surcharge by respondents per day	0.102	0.092	90.70	–9.30
Amount of anti-asthma treatment reimbursed by the health insurance company per day	0.877	0.886	101.00	1.00

In the *fourth cluster analysis*, we focused on all respondents regardless of age, and we wanted to determine the other socio-economic parameters affecting asthma stabilization. The best separation coefficient (319.056) was achieved for two clusters. 23.23% of the respondents were clearly included in the first cluster and 12.32% of respondents in the second cluster. 34.34% of the respondents were less clearly classified in the first cluster and 30.10% of the respondents in the second cluster. Thus, we acquired two groups, the first one comprising of 57.57 % and the second one of 42.42% of the respondents.

Both clusters contained a comparable number of women and men (difference of 1.29%). In the first cluster, the respondents were slightly overweight (cluster centre 26.99) compared to the second cluster, where the respondents had a significantly higher BMI by 22.49% (cluster centre with a value of 33.06). In obese subjects, there was a comparable grade of bronchial asthma (difference of 6.93%), but significantly lower asthma control (ACT™ difference of 26.17%) (Table 10).

Table 10 – Cluster analysis of respondents – evaluation of gender, BMI, ACTTM, and AB level

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Gender	1.703	1.725	101.29	1.29
BMI	26.99	33.06	122.49	22.49
ACT™	21.28	15.71	73.83	–26.17
AB level	2.627	2.809	106.93	6.93

Used abbreviations: BMI – body mass index; ACT™ – asthma control test; AB – bronchial asthma.

Both clusters were at the level of old age pensioners (the centre of the first cluster 3.148, the centre of the second cluster 2.898). The slightly overweight respondents had a higher income (difference of 14.60%) and did relatively more mental work (difference of 7.25%) (Table 11).

Table 11 – Cluster analysis of respondents without the age variable

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Occupation	3.148	2.898	92.06	–7.94
Work type	1.448	1.343	92.75	–7.25
Income	6.713	5.733	85.40	–14.60

The monitored regularity of use of the inhalation (difference of 3.08%) and medication (difference of 1.52%) anti-asthmatic treatment was comparable in this analysis. Obese asthmatic patients had a higher cost of complete asthma treatment (difference of 12.97%), as well as surcharges for anti-asthmatic treatment by respondents (difference of 10.98%), and reimbursement by health insurance companies (difference of 13.25%) (Table 12).

Table 12 – Cluster analysis of respondents without the age variable

	Centre of cluster		Differences	
	1st cluster	*2nd cluster*	*% 2nd of 1st*	*% difference*
Regular use of inhalation antiasthmatic therapy	2.728	2.644	96.92	–3.08
Regular use of antiasthmatic treatment medication	2.497	2.459	98.48	1.52
Price of complete antiasthmatic treatment per day	0.9206	1.04	112.97	12.97
Amount of anti-asthma treatment surcharge by respondents per day	0.0956	0.1061	110.98	10.98
Amount of anti-asthma treatment reimbursed by the health insurance company per day	0.8249	0.9342	113.25	13.25

DISCUSSION

Our analysis focused on the impact of employment, income, type and nature of employment. Of the 506 respondents, 163 respondents were employed. 56.4% of respondents stated mental work and 43.6% manual work. 38% of respondents were employed in a one-shift regimen occupation, and 62% of respondents in the two-shift regimen occupation. In the case of the unemployed patients, the manual type of work prevailed; younger-employed asthmatic patients worked more mentally. The average income of our survey respondents reached €398.91 (for women €347.31, for men €450.50). The subsistence amount in the Slovak Republic was €198.09 from July 1, 2013 to June 30, 2016. The minimum wage increased to €405 for the least demanding work in 2016, to €810 for the job ranked in the highest difficulty category. Analysing the relationship between age and income, we found a significant drop in respondents' income between age groups 40–44 (€535.28) and 45–50 years (€430.86). For women, this drop occurred between age groups 50–54 (€416.83) and 55–59 years (€325.88), among men aged 40–44 (€625.40) and 45–50 years (€444.10). The monthly intake of all older asthmatic patients was lower than that of the younger respondents. Old age pensioners had lower education and their income declined with a higher age. In the analysis of the group of unemployed patients, we found that old age pensioners had a significantly higher income, but lower education. Their bronchial asthma was more stable despite a higher grade

of asthma and BMI compared to younger unemployed patients. Cluster analysis of all employed respondents revealed that older respondents had a relatively higher grade of asthma. In a 10-year Scandinavian study on the impact of socio-economic status on asthma, Hedlund et al. (2006) observed that manual workers in the services sector had a significantly increased risk of wheezing, dyspnoea attacks, asthma symptoms complexes, chronic productive coughs, and antiasthmatic treatment use with an odds ratio (OR) between 1.4 and 1.8. Also, manual workers in industry had an increased risk of developing asthma (OR 1.7, 95%, CI 1.0–2.7). Employees who do not work manually and housewives also have an increased risk of developing asthma or other symptoms associated with asthma (Hedlund et al. 2006).

Americans with low socio-economic status, measured by income and employment, had a higher grade of disease than the higher income population (Williams and Jackson 2005). People with low incomes had substantially worse health and shorter life expectancy (Pearlman et al. 2006). For certain racial groups like African Americans, mortality rates for all diseases, including asthma, were higher than for the white race, regardless of their income (Williams and Jackson 2005). Minorities and people with low socio-economic status have a higher risk of behaviours associated with asthma exacerbation, such as smoking, with smoking cessation being less likely than in the higher income population (Link and Phelan 1995, Clark et al. 2002). Studies have well documented that people with low socio-economic status often live in the vicinity of places characterized by a high exposure to environmental toxins, violence and a higher degree of stress (Ren et al. 1999). Numerous social and economic stressors characterized by poor urban neighbourhoods cause health damage in individual vulnerability (Leventhal and Brooks-Gunn 2000, Ellen et al. 2001).

Other studies in children in Western countries show that asthma prevalence is higher in people with a higher socio-economic status. This is possible, as this study result inconsistency may be caused by differences between countries in terms of their health system (private, state) (Volmer 2001). Some authors argue that the degree of asthmatic difficulties is strongly associated with socio-economic status (Dawson et al. 1969, Mielck et al. 1996). The social class has a stronger effect on the grade of asthma than on prevalence (Volmer 2001). In countries like the USA and Canada, low intake results in association with increased prevalence of asthma, but also with more frequent hospitalization and increased mortality (McConnochie et al. 1999, Chen et al. 2001).

CONCLUSION

In the respondents, a better socio-economic situation positively affects asthma control. The grade of asthma increases with age, but also with lower SES. Asthma control is reduced by increasing BMI, increasing both the direct and indirect costs for asthma management.

CONFLICT OF INTERESTS

The authors have no conflict of interests to disclose.

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