DOI: 10.4149/BLL_2023_091

Bratisl Med J 2023; 124 (8)
583 – 589

CLINICAL STUDY

Associations between prevalence of chronic diseases and socio-economic status in adult population of Slovakia

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ABSTRACT

INTRODUCTION: The study presents associations between prevalence of chronic diseases and selected socio-economic (SES) attributes in adult population of Slovakia and analyses the prevalence of chronic diseases in regions of Slovakia.

METHODS: In total, 735 respondents (146 men and 589 women) with a mean age of 37.79 ± 13.6 participated in this cross-sectional study. The main observed characteristics were chronic diseases and their associations with SES attributes, namely household income, education, age and lifestyle represented by frequency in engaging in recondition-relaxation activities. In order to obtain data, a self-administrated online questionnaire was used. Data were analysed by calculation of odds ratio and chi-square test. The significance level was set at 0.05.

RESULTS: Apart from lung disease which are least suffered in central Slovakia (χ^2 = 9.850, df = 1, p = 0.043), the prevalence of chronic diseases is equally represented in all 8 administrative regions of Slovakia. Prevalence of chronic diseases is significantly influenced by age. The age of 40 is critical for the occurrence of chronic diseases. Respondents with higher education level have a lower prevalence of chronic diseases and *vice versa* (OR = 1.127; RR = 1.079). A better lifestyle represented by higher frequency of engaging in recondition relaxation activities was found in healthy respondents (OR = 0.700549 and RR = 0.936958; χ^2 test p = 0.000798). Household income did not show a significant association with the prevalence of chronic diseases (OR = 1.06; RR = 1.025; χ^2 test, p = 0.778).

CONCLUSION: The study did not confirm a higher prevalence of chronic diseases in regions with weaker SES in Slovakia. Out of the 4 monitored SES attributes, 3 of them (age, education and lifestyle) had a significant impact on the prevalence of chronic diseases. Household income showed only a minimal association with the prevalence of chronic diseases, but this interdependence was not significant *(Tab. 6, Ref. 41)*. Text in PDF *www.elis.sk*

KEY WORDS: socio-economic status, chronic diseases, age, household income, education.

Introduction

Socio-economic status (SES) is a complex and multidimensional concept that is characterised by mutually independent sets of objective and subjective factors. For example, income and education are objective factors whereas self-evaluation of individual´s placement within the socio-economic spectrum is a subjective factor (1). Studies addressing this issue have repeatedly identified socio-economic inequalities in health (2). According to experts, individuals with lower socio-economic status have more health problems, face a greater disability, live shorter than those with a more privileged socio-economic status and are less fortunate (3–6). The effect of SES on the perception of one´s own happiness has also been demonstrated (3).

Health of population is an important attribute of SES. It represents not only a functional, instrumental value, but it is also important for a person's own identity because it determines who a person actually is (7). Health is also important at a macro level. It is considered as a part of prosperity of society and condition for sustainable development (8).

According to the United Nation (UN), one of the biggest problems of modern society that threatens the health of the world's population are chronic diseases. Chronic diseases are currently considered to be the biggest public health problem. As early as in 2005, the World Health Organization estimated that 61 percent of all deaths (35 million) and 49 percent of the world's disease burden could be attributed to chronic diseases. The originally held

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expectations were that by 2030, the proportion of all deaths caused by other chronic diseases would increase up to 70 percent and the global burden to 56 percent (9). Unfortunately, these numbers have already been reached today. According to the WHO, chronic non-communicable diseases currently kill more than 41 million people each year, which represents 71 % of all deaths worldwide (10). Chronic diseases are currently the biggest "enemy" of human health, as they are the leading cause of death worldwide (11–13). In Europe, the main non-communicable chronic diseases are diabetes, cardiovascular diseases, cancer, chronic respiratory diseases and mental disorders (14).

Slovakia is no exception in this regard. According to the data from the National Centre for Medical Information of the Slovak Republic (NCMI), the three most common causes of death in Slovakia are cardiovascular system failure (46 % of all cases), cancer (23 % of all) and respiratory diseases (6.4 % of all). Diseases of the cardiovascular system and cancer are also the most common indications for hospitalization. According to the latest data published by the NCMI, the most common indications for undergoing surgery and subsequent spa treatment are diseases of the musculoskeletal system. Out of the total number of indications for spa treatment, up to 52.4 % are attributed to chronic degenerative diseases of the spine (15). The diseases of the spine and musculoskeletal system are not straightaway life-threatening conditions, but they significantly overload the health and social systems and affect individuals from health and socio-economic points of view (16).

Oakes and Rossi state that gradually more health researchers believe that above mentioned chronic diseases are closely related to SES (17) and that the most effective approach to chronic diseases lies in lifestyle changes, sufficient exercise, diet adjustment, and elimination of stress (14, 18–22).

Based on the above-mentioned data, the scope of this paper was to investigate the socioeconomic inequalities among Slovak adults and their influence on the prevalence of chronic diseases. The study also analyses the prevalence of chronic diseases relative to the socio-economic levels as per region.

Material and methods

The study was carried out in accordance with the principles of the Declaration of Helsinki and the publication was approved by the Ethics Committee of the Central Military Hospital in Ružomberok, Slovakia (Protocol No. 10PČ / 2022).

The main observed characteristic was the presence of chronic non-transferable diseases. They were selected according to the data from the NCMI. Respondents could state either that they had not been diagnosed with a chronic disease, or had been diagnosed either with 1, 2, or more chronic diseases. Reported chronic diseases were analysed in two groups of respondents, namely those with 0–1 chronic disease and those with 2 or more chronic diseases. The prevalence of chronic diseases was analysed with complementary attributes of SES.

SES of respondents was measured by household income, education, age and lifestyle represented by frequency with which they engage in recondition-relaxation activities.

Household income was measured as a sum of incomes of all individual household members. This was divided into quintiles. To adjust for household size, we divided the total income value by the square root of the number of persons in the household (26, 27). We did the calculation for one person in the household according to the relationship:

$$k = \frac{p}{\sqrt{n}} \quad (1)$$

where p stands for the household income, and n stands for the number of household members. Respondents reported their household income to be within one of five specified ranges. In order to calculate the odds ratio, the respondents were divided into two categories, namely into an economically weaker group (household income less than €1,000) and economically stronger group (household income of more than €1,000).

The education was assessed upon responses to a question aimed at the highest educational level attained. The wording of responses matched the national education scheme, which was then reclassified to match equivalent categories specified in International Standard Classification of Education Degrees 21 (28). We followed 2 groups, namely those with low education level (ISCED 0–3) and high education level (ISCED 4–6).

Lifestyle was measured upon the frequency in engaging in reconditioning-relaxation activities such as movement activities or relaxation activities. In order to verify the relationship between lifestyle and occurrence of chronic diseases, we also used the division of respondents into two groups based on the number of diseases. The first group consisted of respondents who engaged in reconditioning-relaxation activities with a frequency of 0–2 weekly or monthly (as relevant per particular activity) and the second group consisted of respondents reporting a frequency of 3 or higher. Then we followed the prevalence of chronic diseases in each group.

Subjects

The data were collected from all 8 administrative regions of Slovakia. The sample was randomly selected from an free-access database FinStat (database of all Slovak companies and organizations), (23) and open-access database of Unity of Pensioners (www.jednotadochodcov.sk) and via electronic mail from author's e-mail addresses. The free-access FinStat database contains data from more than 20 regularly updated data sources from institutions such as Financial Administration of the Slovak Republic, Commercial Register of the Slovak Republic, Commercial Gazette, etc. By choosing employers, we tried to reach respondents from different industries and fields so that the representative sample included a wide range of individual's incomes (from the lowest to the highest incomes in Slovakia). The open-access database of the Unity of Pensioners contains contacts to all pensioners' clubs operating on the territory of Slovakia. In this way we reached respondents over 62 years of age from all regions of Slovakia. In order to include young respondents older than 19 years, the author's team approached 3 universities from different regions of Slovakia

Tab. 1. Chronic diseases as declared by patients and their prevalence in groups of respondents younger and older than 40 years.

		Patients age					
		Younger than 40 years		40 years or older.		Total	
		Count	Row N %	Count	Row N %	Count	Row N %
Chronic diseases declared by the patient	Cardiovascular disease	13	37.1%	22	62.9%	35	100.0%
	Hypertension	22	24.7%	67	75.3%	89	100.0%
	Spinal disease	43	42.6%	58	57.4%	101	100.0%
	Diabetes mellitus	4	20.0%	16	80.0%	20	100.0%
	Respiratory diseases	16	47.1%	18	52.9%	34	100.0%
	Joint arthrosis	15	25.0%	45	75.0%	60	100.0%
	Oncological diseases	6	50.0%	6	50.0%	12	100.0%
	Obesity	12	30.8%	27	69.2%	39	100.0%
	Rheumatoid diseases	5	35.7%	9	64.3%	14	100.0%
	Other than specified above	89	59.3%	61	40.7%	150	100.0%

(Bratislava, Ružomberok and Prešov). The inclusion criteria were as follows: (a) age 20 years or older; (b) citizens of Slovakia residing in Slovakia; (c) Slovak citizens working, studying or living in Slovakia; (d) consent to participate in the study. The process of data collection lasted from 8.4.2022 till 31.5.2022. As a result, 751 responses were received of which 16 were excluded because they did not meet the inclusion criteria (respondents reported their own personal income instead of their household income). As a result, the final sample of respondents consisted of 735 adult citizens of the Slovak Republic (146 men and 589 women). Average age of respondents was 37.79 ± 13.6.

Methods

In order to obtain the data, a self-administered online questionnaire consisting of 19 questions, was used. The questionnaire was created by the research team in cooperation with a statistician with expertise in health statistics. In order to verify the assumptions, it was established that the questionnaire should include the following dimensions: a) demographic characteristics, b) education level, c) family income, d) chronic diseases confirmed by physicians, f) reconditioning-relaxation activities (stays at spas, by the sea, or in the mountains, visiting saunas or massage therapists, and engagement in physical activities). The comprehensibility of the questionnaire was achieved by using concise and simple language (24, 25). The questionnaire was pilot-tested.

Statical analyses

The obtained data were analysed by SPSS Statistics. To illustrate the correlation of socioeconomic differences with health, we used the calculation of relative (RR) and objective risk (OR) values and the Chi-square test. All tests and evaluations were done at the 0.05 significance level.

Objective risk OR, was calculated as follows:

$$OR = \frac{p_1/(1-p_1)}{p_2/(1-p_2)} \quad (2)$$

Relative risk RR, was calculated as follows:

$$RR = \frac{p_{exp}}{p_{nexp}} \quad (3)$$

An odds ratio of 1 indicates that there are no differences between the two groups, while an odds ratio greater than 1 means that health risk in the lower SES group is higher than that in the higher SES groups. An odds ratio of less than 1 indicates that persons with higher SES have a higher risk of disease occurrence than persons with lower SES. .

Results

In Table 1, we present the chronic diseases specified by the patients and their distribution relative to their age.

Apart from spinal, respiratory and oncological diseases, the prevalence rates of chronic diseases are lower in the younger than in older respondents.

A1: Household income and prevalence of chronic diseases

Table 2 presents the relations between household income and number of diseases.

The resulting values for the observed characteristics were as follows: OR = 1.06; RR = 1.025. As the OR and RR were low, we calculated the chi-squared test, the results of which indicated that the differences were not statistically significant (p = 0.778). We recommend accepting the hypothesis of independence of the observed phenomenon.

A2: Education level and prevalence of chronic diseases

The relationships between education and prevalence of chronic diseases are shown in Table 3. We verified the dependence of the monitored phenomenon using OR and RR.

Based on the data shown in Table 3, OR and RR were 1.127 and 1.079, respectively. In both cases, it is a positive association. Education is a risk factor reversely correlated with the prevalence

Tab. 2. Relationship between household income and number of chronic diseases.

	<1000 €			>1000 €		
	n	%	p	n	%	p
0–1	369	85.61	0.86	258.00	84.87	0.85
≤2	62	14.39	0.14	46.00	15.13	0.15
Σ	431	100	1	304	100	1

Tab. 3. Number of chronic diseases relative to the level of education.

	Low education (n)	%	High education (n)	%
0–1	238	32.38	389	52.93
≥2	38	5.17	70	9.52
Σ	276	37.55	459	62.45

Tab. 4. Prevalence of chronic diseases relative to the frequency of engaging in reconditioning-relaxation activities.

Frequency of reconditioning-relaxation activities							
		0–2x	%	≤3x	%	S	%
No of chron. diseases	0–1	495	67.35	132	17.96	627	85.31
	≤2	91	12.38	17	2.31	108	14.69

of chronic diseases. Respondents with higher education have a lower prevalence of chronic diseases and vice versa.

A3: Age and prevalence of chronic diseases

The third monitored attribute regarding the prevalence of chronic diseases was the age of respondents (Tab. 1). The occurrence of the number of chronic diseases and their dependence on age was calculated by Chi-squared test (χ^2 = 68.988; df = 10; p = 0.000). The assumption that age is an attribute that influences the prevalence of chronic diseases was confirmed. There is a significant difference in the prevalence of chronic diseases among respondents under 40 years and over 40 years of age.

A4: Lifestyle and prevalence of chronic diseases

The relationship between the number of chronic diseases and lifestyle represented by frequency of engaging in reconditioning-relaxation activities was the last problem we addressed (Tab. 4). For the given set, the OR and RR values were 0.700549 and 0.936958, respectively. The number of chronic diseases increases with the decrease in the frequency of reconditioning-relaxation activities. The results were confirmed also by Chi squared test, which showed that for observed characteristics, the differences were below the level of significance (p = 0.000798). Respondents with higher number of chronic diseases have a worse lifestyle as compared to the healthy ones.

Prevalence of chronic diseases relative to geographical regions of Slovakia

At the end of the study, we compared the prevalence of chronic diseases relative to the socioeconomic development in the regions of Slovakia. We assumed that SES development in regions does not affect the prevalence of chronic diseases (Tab. 5).

We verified the assumption with the Chi-squared test, based on the significance value (p > 0.05). We can conclude that there is no significant difference in the prevalence of chronic diseases relative to the SES development in regions of Slovakia (X^2 = 13.561; df = 9; p = 0.139).

In the end we present the prevalence of specific chronic diseases relative to regions of Slovakia (Tab. 6). Apart from respiratory diseases, the prevalence of chronic diseases is equally represented in all regions of Slovakia.

Discussion

The study detects the association between the prevalence of chronic diseases and selected SES attributes in adult population in Slovakia and analyses their occurrence from the aspect of the development in individual regions of Slovakia. Apart from respiratory diseases, the prevalence of chronic diseases is equally represented in all 8 administrative regions of Slovakia. The residents of central Slovakia (administrative regions of Žilina and Banská Bystrica) suffer from respiratory diseases less as compared to the residents from the Western or Eastern parts of Slovakia.

The study also confirmed that the prevalence of chronic diseases was associated most strongly with age. Older respondents suffered from two or more chronic diseases, as compared to younger respondents, in whom the prevalence of chronic diseases was in range of 0–1. Similarly, according to OECD, 37 % of people aged 65 or older reported having at least two chronic diseases on average across EU countries in 2017 (29). A 2012 study conducted in Scotland also confirmed the effect of age on the prevalence of chronic diseases. According to this study the prevalence of multimorbidity increased substantially with age and was present in the most people aged over 65 (18). A study from Canada shows

Tab. 5. Prevalence of chronic diseases per geographic region of Slovakia.

			Have physicians diagnosed you with a chronic disease?				
			No	Yes, with 1 chronic diseases	Yes, with 2 chronic diseases	Yes, with 3 or more chronic diseases	Total
REGIONS	Bratislava	Count	49	17	9	6	81
		%	60.5%	21.0%	11.1%	7.4%	100.0%
	Western Slovakia	Count	54	40	18	7	119
		%	45.4%	33.6%	15.1%	5.9%	100.0%
	Middle Slovakia	Count	226	103	29	21	379
		%	59.6%	27.2%	7.7%	5.5%	100.0%
	Eastern Slovakia	Count	79	33	10	6	128
		%	61.7%	25.8%	7.8%	4.7%	100.0%
	Total	Count	408	193	66	40	707
		%	57.7%	27.3%	9.3%	5.7%	100.0%

Tab. 6. Prevalence of specific chronic diseases per geographic region of Slovakia.

		SLOVAKIA REGIONS									
		Bratislava		Western Slovakia		Middle Slovakia		Eastern Slovakia		Total	
		Count	%	Count	%	Count	%	Count	%	Count	%
Chronic diasesse	Cardiovascular	5	13.5	6	8.3	19	9.8	3	5.4	33	9.2
	Hypertension	11	29.7	20	27.8	46	23.7	10	17.9	87	24.2
	Spinal diseases	12	32.4	19	26.4	54	27.8	15	26.8	100	27.9
	Diabetes mellitus	4	10.8	7	9.7	6	3.1	3	5.4	20	5.6
	Respiratory diseases	6	16.2	9	12.5	9	4.6	9	16.1	33	9.2
	Joint arthrosis	4	10.8	12	16.7	34	17.5	10	17.9	60	16.7
	Oncological disease	2	5.	3	4.2	6	3.1	1	1.8	12	3.3
	Obesity	4	10.	6	8.3	26	13.4	3	5.4	39	10.9
	Rheumatoid diseases	1	2.7	4	5.6	7	3.6	2	3.6	14	3.9
	Other	10	27.0	22	30.6	88	45.4	25	44.6	145	40.4
	Total	37	100	72	100	194	100	56	100	359	100

that the risk of developing chronic diseases and having multiple chronic conditions increases with age. Over one-third of seniors in Canada have two or more chronic diseases (30). Atelalla et al and Kim et al also state that aging is a well-established risk factor for the development of multiple chronic diseases, especially cardiovascular diseases, stroke, cancer, osteoarthritis, and dementia (31, 32). Our study confirmed the results of previous research and it also pointed out that age is a critical factor for the development of chronic disease. Despite the confirmed fact that age is a risk factor for the prevalence of chronic diseases, we must highlight the fact that the age confirmed to be critical relative to the significant increase in the prevalence of chronic diseases is as low as 40 years. Based on this fact, we need to intensify the preventive measures in younger age groups.

The associations between education and prevalence of chronic diseases were proved to have a significant dependence. In Slovakia, the people with high education level have fewer chronic diseases compared to the people with lower education. The same relationship between education and chronic disease is reported by Avendando et al, based on the results of a SHARE research carried out in ten European countries. This research mainly points to the prevalence of two or more chronic diseases in residents with lower education as compared to residents with higher education (33). Dalstra et al also confirmed this situation in Europe. Their study showed a higher prevalence of chronic diseases among subjects in lower-education group. Especially stroke, diseases of the nervous system, diabetes, and arthritis displayed relatively large inequalities (OR > 1.50) (34). An explanation to the phenomenon that education affects the prevalence of chronic diseases may lie in the fact that individuals with higher education have superior skills in acquiring information, which increases the likelihood that they recognise and report symptoms of disease and are quicker in accessing healthcare services for prompt treatment (35). In this way the acute phases of the disease are resolved in time and do not grow into chronicity. Therefore, the education on chronic diseases, their symptoms and treatment should be directed towards people with lower level of education.

The study also pointed out the number of reconditioning-relaxation activities is the largest among healthy respondents. Those who had a healthy lifestyle filled with movement, exercise or some form of relaxation activities had fewer chronic diseases and *vice versa*. On the other hand, respondents with 2 and more chronic diseases engage less in recondition relaxation activities. It is an interesting finding because it has been proven that regular completion of reconditioning-relaxation activities, especially physical activities of medium or low intensity, have beneficial effects on the treatment of chronic diseases (36, 37, 38). Considering the factor of lifestyle, we can agree with Gvozdjakova et al that chronic non-communicable diseases are a result of a combination of genetic, physiological, environmental and lifestyle factors (39).

This study revealed a surprising finding, namely that the association between household income and prevalence of chronic diseases was not significantly dependent. Most studies conclude that the household income affects the prevalence of chronic diseases and that people with a higher household income have fewer chronic diseases as compared to people with a lower income (32, 40). This finding was also confirmed by a study from Slovakia, carried out in 2017 (41). But in our study, the prevalence of chronic diseases and household income showed only a weak variability (OR = 1.06; RR = 1.025) and the insignificance of their dependence was verified by the chi-squared test.

Our findings confirmed positive associations between the prevalence of chronic disease with age, education and lifestyle. These findings may be used in shaping preventive policies which should be focused on several points, namely on raising the awareness of citizens with lower education about the causes, symptoms, prevention and treatment of chronic diseases, as well as on implementing programmes for preventing chronic diseases aimed at the population younger than 40 years. Moreover, policy makers should be focused on the importance of prevention and treatment of chronic diseases in form of reconditioning-relaxation activities.

Finally, it is necessary to point out the limitations of the study. The limitation of our study lies in the fact that the distribution of the questionnaire was carried out only online. In this way, we only minimally addressed the unemployed population. This group of Slovak residents, in most cases, do not have access to the internet, or do not work daily with internet, which translates to a low number of unemployed respondents in our study sample (only 15

respondents were unemployed). Therefore, this group was not statistically processed. Due to this limitation, the attribute of unemployment, as an important indicator of SES, was not evaluated.

Conclusion

We made four major observations and explored whether the selected SES attributes affect the prevalence of chronic disease in adult population in Slovakia and whether this prevalence depends on the SES development in regions of Slovakia. Out of the 4 monitored SES attributes, 3 had a significant impact on the prevalence of chronic diseases. A significant prevalence of chronic diseases was confirmed relative to age, education and lifestyle. The study also confirmed that the prevalence of chronic diseases in Slovakia does not depend on the socio-economic development in regions of Slovakia. The prevalence of chronic diseases is equally represented in all 8 administrative regions of Slovakia.

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Received February 6, 2023.
Accepted March 7, 2023.