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RESEARCH ARTICLE

Multi-aspect overview of mineral-water-based therapies of musculoskeletal disorders in Hungary

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Abstract – Demographic transformation, characterized by the aging of the population, is causing an increasing problem in developed countries. This change involves a significant increase in the number of chronic diseases, the health damage generated by which causes loss of life years due to deteriorating health and impairs quality of life. Among chronic diseases, the increasing frequency of musculoskeletal disorders has become characteristic of an aging society, which causes the greatest loss of life years in Hungary due to limitations. These problems mean increasing social, economic, and administrative pressure on the population and pose solution challenges for the spa town leaders and health decision-makers. There are several therapies available in the medical and health sciences to prevent and treat musculoskeletal disorders, with increasing emphasis on conservative therapies as the role of health increases. In Hungary, among these procedures, medicinal water treatment services based on natural healing factors available in spa towns play a key role, which is also the basis of medical tourism and part of the health care system. To solve the problems caused by musculoskeletal disorders, it is essential to know the occurrence of the disease and the treatment-use attitude of the patients, mainly due to the COVID-19 pandemic.

Therefore, the main goal of our research is to assist spa towns leaders and health decision-makers in the implementation of medical tourism developments and more optimal patient care. One of the part-aims of our research is to reveal the regional differences of the most common musculoskeletal diseases in Hungary based on secondary data. Our other research-part objective is to determine the impact of socio-demographic characteristics, health status, type of musculoskeletal disease, pain, and commitment to bath medicine care system on the future use of medicinal water treatment in patients with musculoskeletal disorders.

Based on our results, we declare that the health status of the Hungarian population in terms of the most frequently occurring locomotor diseases is worst in Central Hungary, the greater part of the Southern Great Plain, and the northeastern part of the country. In terms of territory, we concluded that the incidence of musculoskeletal disorders is relatively low, and moderate inequality in Hungary. It also follows from our results that the indicators measuring regional differences selected can be successfully applied to examine the territorial inequalities of musculoskeletal diseases concerning medical tourism. We also found that the respondents' level of family income, place of residence by region, state of health, the degree of commitment to medicinal water treatment/service was found, furthermore the cost of treatment, and the cost of accommodation /travel, significantly affect the planned use of the medicinal water treatment in the future. Our results promote the implementation of more targeted medical tourism and health industry developments in spa towns.

Keywords – bath medicine, medical tourism, treatment-use attitude, musculoskeletal disorders, regional differences

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INTRODUCTION

Developed countries are characterized by an increase in life expectancy. As a result, the incidence of various diseases in the population is increasing, including a growing number of musculoskeletal disorders. This causes global social and economic problems in the countries. During the exploration of the problem, many of the various disease groups have been the subject of health research, but due to the global nature of the processes, the study of diseases, such as cardiology and cancer, is becoming more and more the focus of field research. However, a comprehensive territorial study on the topic of musculoskeletal disorders has not yet been performed in Hungary. Medicinal water treatment, which is an integral part of medical tourism in the country, plays a prominent role in the treatment of this group of diseases. Significant changes in the motivations for medical tourism travel in recent years, and especially due to the COVID-19 pandemic, necessitate a new mapping of consumer attitudes, which we focus on musculoskeletal patients in our study.

The first aim of the study is to explore the differences in the field of the most common musculoskeletal disorders in Hungary, based on the available secondary data. The second objective is to determine the extent to which socio-demographic characteristics, health status, type of musculoskeletal disease, and commitment to medicinal water treatment/service for people with musculoskeletal disease affect future access to medicinal water treatment.

By realizing our goals, we want to help the decision-making of the experts in the affected areas, as well as to shed light on the more optimal and equal directions of musculoskeletal patient care.

The global problem of an aging society in developed countries is one of the greatest challenges of our time today (Cristea et al., 2020). The demographic changes appear on an international level and cause global problems by generating spill-over processes. Since 1970, Europe has been characterized by a change in the aging social structure, with an increase in the proportion of people over 65 (Marton, 2018). The increase in life expectancy also entails an increase in the number of diseases, among which musculoskeletal diseases stand out. A quarter of the population of Europe (about 100 million people) suffers from some type of musculoskeletal disease, the frequency of which increases by 3-5% every year (Poór, 2019). There are many issues associated with this demographic problem that is being explored by researchers in several disciplines from different perspectives (Bloom et al., 2016). The issues that arise concern the topics of social sciences (Sanderson and Scherbov, 2005), economics (Marton, 2018), and health sciences (Bálint and Kovács, 2015; Bevan, 2015), as well as their significant socio-geographical role due to territorial differences (Govaerts et al., 2021; Arvai et al., 2020; Pirisi and Trócsányi, 2019).

Hungary, like the societies of developed countries, has undergone significant demographic and epidemiological changes in recent decades (Bujdosó, 2016; Vargha, 2015; Faragó, 2007). Among these, the increase in life expectancy

plays a key role (Fodor and Papp, 2013; Bálint and Spéder, 2012), as a result of which the problem of an aging society is becoming more and more significant in Hungary, significantly increasing the economic and social burdens. Among the diseases that appear with advancing age, cardiological and cancerous diseases should be mentioned, which have already become the focus of health geography research in several cases (Uzzoli et al., 2019; Tóth et al., 2018), and chronic diseases have increased the number of musculoskeletal diseases. The latter group of diseases appears at an increasingly younger age and in an increasing number among the Hungarian population (Hojcska, 2017), which diseases significantly increase the loss of life years due to deteriorating health (Vitrai et al., 2015). In this way, they can significantly reduce the number of years spent in health (Sanderson and Scherbov, 2010) and also have an impact on changes in quality of life (Kővári et al., 2020; Cross et al., 2014; Mathers et al., 2014).

Although little data are available in Hungary on musculoskeletal degenerative and inflammatory joint diseases, based on the user data of these diseases from 1999 to 2001, the number of these diseases is estimated to correspond to the lower band of internationally published prevalence data (Gulácsi and Nagy, 2003). This group of diseases mainly affects people of working age and older. Furthermore, since Hungary is characterized by an increase in the number of people over the age of 45, the number of musculoskeletal diseases is also increasing here. This age group is a potential user of domestic medical tourism. We emphasize that among the Hungarian population, 41% of people over the age of 65 are affected by one of the musculoskeletal diseases (lumbar-, back spine, arthrosis, rheumatoid arthritis, chronic arthritis, cervical changes, osteoporosis) (CSO, 2020). According to domestic data, musculoskeletal disorders account for 28-30% of short-term incapacity for work, while half of the four hundred thousand disabled people of working age also suffer from this group of diseases (Poór, 2019).

During the treatment of musculoskeletal patients, the first point of care in the health care system is provided by general practitioners in Hungary. The next level is outpatient and inpatient care, an integral part of which is the bath medicine care system, which is based on the Hungarian natural heritage (Némethy and Bartos, 2019; Némethy et al., 2017). This is of outstanding importance in the care of musculoskeletal patients in Hungary based on natural medicinal factors as medical tourism products (Hojcska and Szabó, 2021; Némethy 2021, Bujdosó, 2018), which provide an internationally recognized position for the country's medical tourism (Szabó et al., 2013; Bujdosó and Kovács, 2011).

Just as in tourism in different countries, patients' motivations for medical tourism travel have changed significantly in recent years (Munteanu et al., 2019), especially for the elderly (Kolos and Kövesdi, 2020) and particularly regarding the effects of the COVID-19 pandemic (Szabó, 2018; Bujdosó and Györki, 2011). Knowledge of the socio-demographic characteristics and treatment-use attitudes of musculoskeletal patients, for which secondary data are not available, is

essential for the optimal provision of a bath medicine care system on demand.

MATERIALS AND METHODS

To achieve the set research goals, we performed the processing of secondary and primary data in our study. Secondary data were provided by the database of musculoskeletal patients registered with the general medical service registered with the Hungarian Central Statistical Office (CSO) among the available musculoskeletal diseases. According to the International Classification of Diseases (ICD codes), the diseases included in the data collection of the CSO (2019) included in the study are: “Seropositive and other rheumatoid arthritis” (M05, M06), “Juvenile arthritis” (M08), “Gout” (M10), „Deforming dorsopathies” (M40-M43), „Spondylopathies” (M45-M49), „Disorders of bone density and structure” (M80-M85). Publicly available data are published every two years on the CSO's website. By processing the secondary data, the territorial inequality of the registered musculoskeletal diseases in Hungary is revealed, which was our first research goal. For the processing of secondary data, we chose the study of polarization among the methods of spatial research, because these indicators allow a safe comparison of the development of the studied spatial units (Cowell, 2011; Williamson, 1965). The spatial polarization metrics we used were: data set size, standard deviation size, relative size, dual index, Gini index, Hirschman – Herfindahl index, and Hoover index.

The scope of the data series:

$$K = X_{\max} / X_{\min},$$

the quotient of the highest and lowest values occurring in the data series, with a minimum value of 1 and no upper limit, and only takes into account the extreme values, not the distribution (Molnár, 2015). The magnitude of the scatter:

$$R = X_{\max} - X_{\min},$$

which gives the difference between the largest and smallest values in the data series. This indicator is also easy to calculate and well interpreted, but only the largest and smallest data are taken into account (Németh, 2005). The relative scope is:

$$Q = (X_{\max} - X_{\min}) / \bar{x},$$

which is also suitable for comparing data sets with different averages and different units (Molnár, 2015). The dual index, also known as the Élterő – Frigyes index:

$$D = \bar{x}_m / \bar{x}_a,$$

which gives the quotient of the above-average mean of the total distribution of the data series and the average of the below-average values of the total distribution (Nemes Nagy, 2006; Major and Nemes Nagy, 1999). The Gini index is one of the most frequently used territorial indicators (Kerekes, 2007), the use of which is becoming more and more

widespread in health inequality studies. The sign is "G", and the formula is:

$$G = (\sum_{i=1}^n \sum_{j=1}^n |y_i - y_j|) / (2 * \bar{y} * n^2),$$

where n = the number of individuals in the population, $\bar{y}$ = the average of the data set examined, y_i and y_j = individuals of the population (Dusek and Kotosz, 2016; Ceriani and Verme, 2012; Gini, 1912). With the help of this indicator, we determine the number of musculoskeletal diseases per area, i.e. the difference in their territorial distribution.

The Hirschman – Herfindahl index is also used to measure sectoral concentration, which is used to examine differences in the spatial distribution of musculoskeletal disorders. Its sign is “HI”, its formula is:

$$HI = \sum_{i=1}^n (x_i / \sum x_i)^2,$$

where n = the number of individuals in the population, x_i = individuals of the population (Németh, 2005).

Using the Hoover index, we analyzed the percentage of musculoskeletal disorders to be reallocated between NUTS3 areas for the distribution to be the same as the distribution of medicinal water treatment use. The symbol for "h" is:

$$h = (\sum_{i=1}^n |x_i - f_i|) / 2,$$

where x_i = share (%) of area unit "i" from the values of one of the variables, f_i = share (%) of area unit "i" from the values of the other variable (Dusek and Kotosz, 2016; Hoover, 1936). The territorial analyzes were carried out according to the NUTS3 (nomenclature des unités territoriales statistiques = Nomenclature of Territorial Units for Statistics) unified territorial classification system, which covers the nineteen counties of Hungary and Budapest, forming a total of twenty study territorial units (Goll, 2010).

Using the regional indicators, we were able to determine the regional differences of musculoskeletal diseases according to NUTS3 in Hungary to achieve our first research goal. We supplemented our secondary research results with primary research, the partial results of which are presented in our present study. To implement the data collection quickly and cost-effectively, we conducted an online questionnaire survey (December 26, 2020, and February 26, 2021) (N=463). Among the non-probability sampling procedures, the technique of readily available subjects was used to select the research sample (Babbie, 2020; Bella, 2018). In this study, we show the relationship between respondents' socio-demographic characteristics (Table 2), health status, type of musculoskeletal disease, degree of pain, and commitment to medicinal water treatment/service (Table 3) about their intention to use medicinal water treatment after COVID-19.

We processed the responses of patients with musculoskeletal disorders with statistical methods and the correlations with cross-tabulation analysis (Elekes, 2010). The statistical significance of the correlation between two variables at the $p = 0.05$ significance level was measured by Pearson's Chi-

square test (χ^2) and Spearman rank correlation (Dinya, 2017). Where the contingency table does not meet the analysis requirements, we used the “Recode” statement to combine the values of the variables and analyze them further. The Statistical Package for the Social Sciences (SPSS 23.0) used Windows 10 (Malhotra, 2018) to perform statistical analyzes accurately and efficiently.

Limitations of the research

To evaluate the results, it is important to identify the limitations of the research that, like most studies, have limited the design of the current study. The limitation of the research is the limited literature relevant to the topic. The literature limitation of the research is given by the fact that the specific medical tourism use of a large number of natural healing factors in Hungary differs in part from the international one, therefore the possibilities of comparison in the literature are scarce (Price and Muran, 2004). Regarding the data on musculoskeletal disorders, it can be stated that the national database is not complete, which also appears as a limiting factor in the study.

RESULTS AND DISCUSSION

Based on the results of the secondary research, the territorial inequalities and differences in musculoskeletal diseases in

Hungary in 2019 will be determined. The results of the primary research reveal the health status of musculoskeletal patients, the degree of pain associated with their disease, and the assessment of the effectiveness of medicinal water treatments based on their own opinion in the context of territorial and socio-demographic indicators.

Secondary research results

Regarding the secondary results, the regional differences in musculoskeletal diseases are described based on the analyzes performed from the CSO data.

Musculoskeletal diseases based on GP appointments

We examined the NUTS3 distribution of musculoskeletal patients registered with a general practitioner in 2019 according to the six musculoskeletal disease groups (BNOs) in the CSO database. The spatial distribution of this is illustrated in Figure 1. As we used data from 2019 in our research, we used the old name of the county in the case of Csongrád County*. The name change (Csongrád-Csanád County) only came into force on June 4, 2020. (X. 5.) Parliamentary decision Resolution No. 67/1990 on the counties of the Republic of Hungary, the names and seats of the counties. (VIII. 14.) Parliamentary decision.

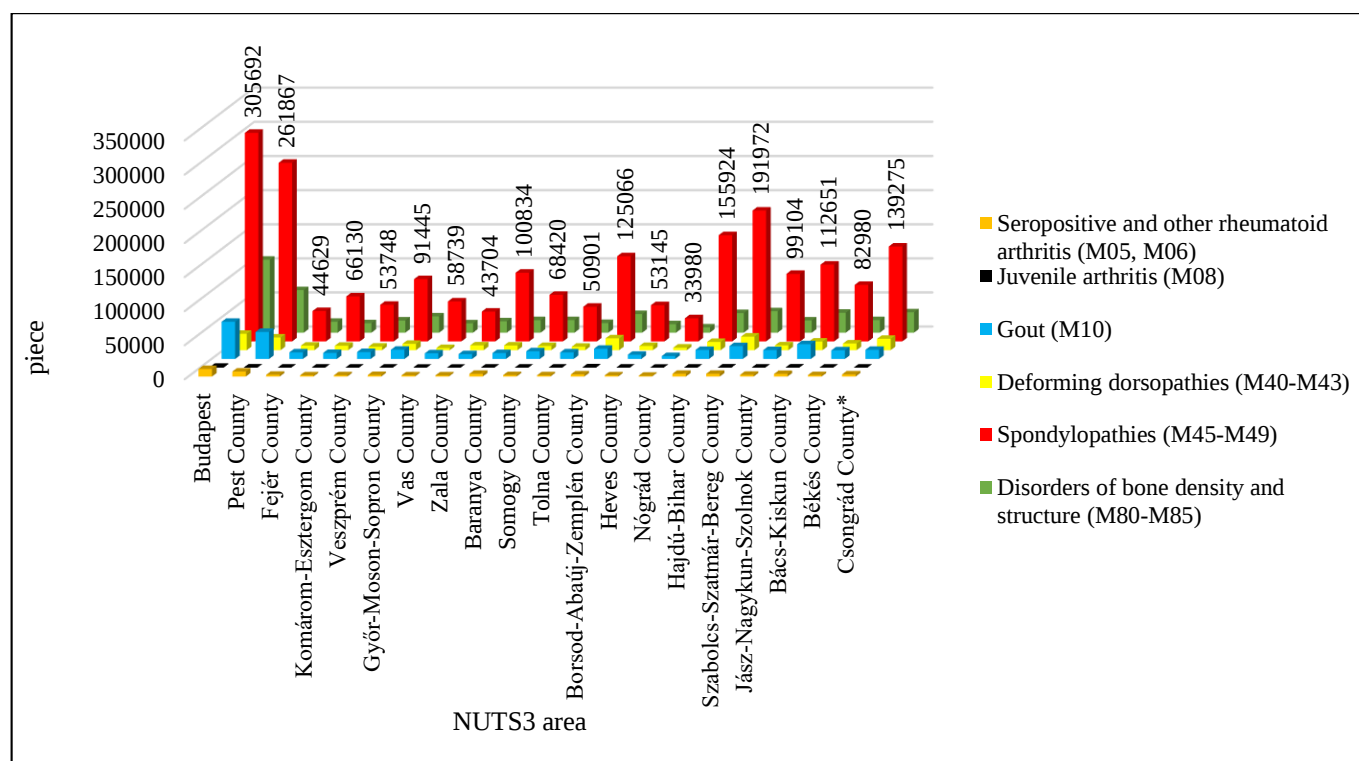


Fig. 1. Distribution of musculoskeletal disorders in Hungary according to ICD codes

Source: Based on CSO 2019 own calculation and editing

Based on the obtained results, it is concluded that the most common disease group is “Spondylopathies”, therefore their NUTS3 area is shown in Figure 1. This is followed by “Disorders of bone density and structure”, “Gout”,

“Deforming dorsopathies”, “Seropositive and other rheumatoid arthritis” and “Juvenile arthritis”. Regarding the other NUTS3 areas, Szabolcs-Szatmár-Bereg County has the highest number of musculoskeletal disorders, except for gout,

which has the highest number in Bács-Kiskun County. The lowest number of registered musculoskeletal diseases can be found in Nógrád County.

Territorial inequalities in musculoskeletal disorders

The numbers of secondary musculoskeletal diseases were examined in combination with the regional research methods, as a result of which we obtained the volume ratio, $K = 503,874 / 50,695 = 9.93$. This shows that there is a 9.93-fold difference between the number of diseases in the NUTS3 area with the most (503,874) and the least (50,695) musculoskeletal disorders. Calculating the magnitude of the scatter, we obtained $R = 503,874 - 50,695 = 453,179$, which gives the difference between the number of diseases with the

most (503,874) and the fewest (50,695) musculoskeletal diseases. In the case of the relative extent, we obtained $Q = (503,874 - 50,695) / 161,803 = 453,179 / 161,803 = 2.8$, based on which we established, that between the area with the most (503,874) and least (50,695) number of diseases different in the average number of musculoskeletal diseases, is 2.8-fold. Calculating the dual index $D = 277,938 / 99,268.46 = 2.79$. From this result, we determined that the difference between the areas with the highest and lowest musculoskeletal diseases was 2.79-fold. According to the results, seven of the examined areas in Hungary have above-average NUTS3 areas, while thirteen NUTS3 areas have below-average numbers of diseases (Figure 2).

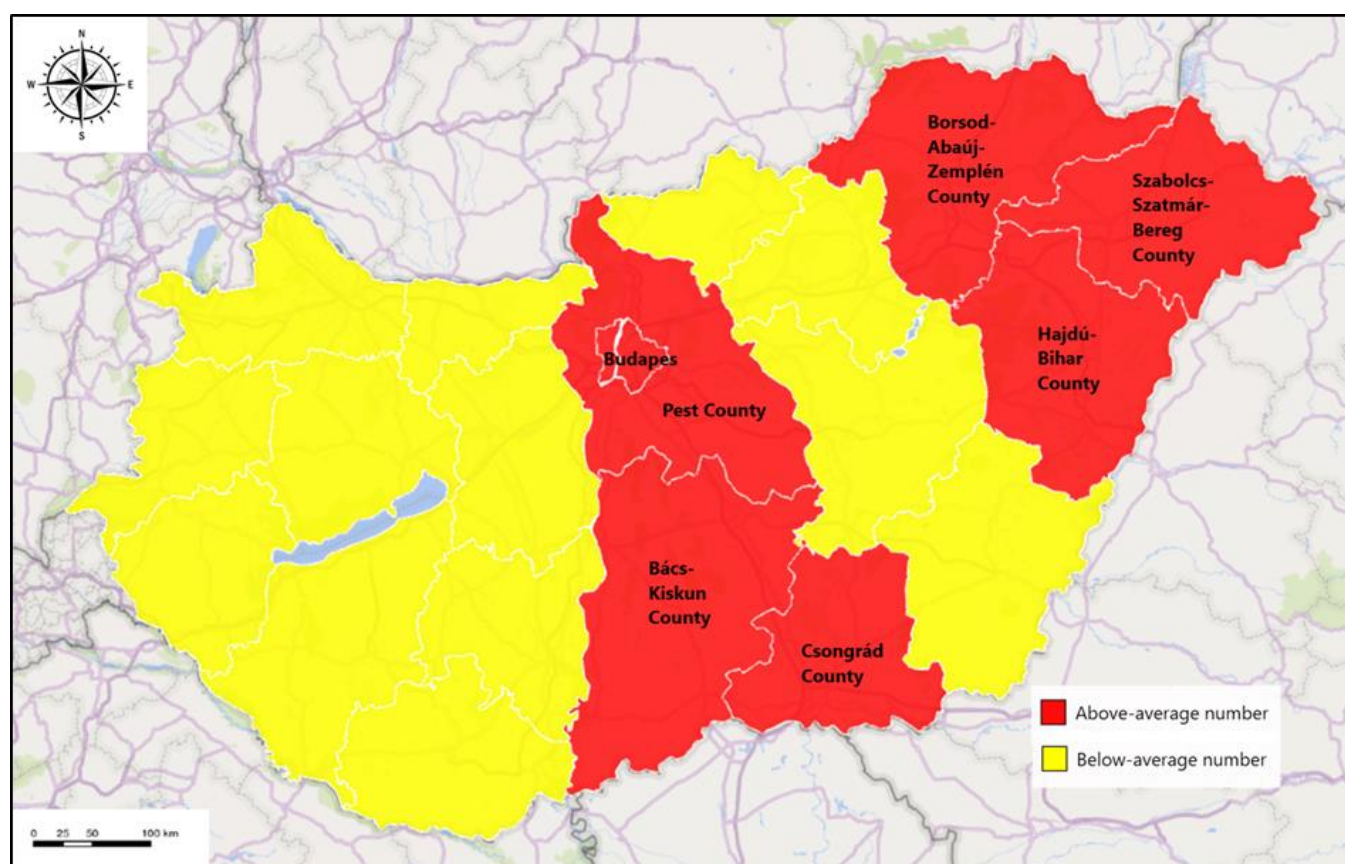


Fig. 2. Spatial polarization of musculoskeletal disorders in Hungary

Source: Based on CSO 2019 own calculation and editing

Further examining the spatial inequalities of musculoskeletal disorders, the result of the Gini index is $G = 21,723,266 / (2 * 161,803 * 400) = 21,723,266 / 129,442,400 = 0.17$, so in the case of musculoskeletal diseases the average difference in the number of musculoskeletal diseases per NUTS3 area is 0.17. Using the Hirschman – Herfindahl-index $HI = \sum_{i=1}^n (x_i / \sum x_i)^2 = (0.0157^2 + 0.0236^2 + 0.0246^2 + 0.0246^2 + 0.0252^2 + 0.0264^2 + 0.0275^2 + 0.0300^2 + 0.0329^2 + 0.0389^2 + 0.0429^2 + 0.0431^2 + 0.0434^2 + 0.0557^2 + 0.0581^2 + 0.0625^2 + 0.0662^2 + 0.0824^2 + 0.1206^2 + 0.1557^2) =$

0.073 results are obtained, which show a relatively low concentration and a small spatial inequality. With the calculation of the Hoover index, $h = 59 / 2 = 29.5$, we determined the percentage of musculoskeletal disorders that would need to be reallocated between NUTS3 areas for their spatial distribution to be the same as the number of users of medicinal water treatment. The results of the area indicators are shown in Table 1.

Tab. 1 Spatial indicators of musculoskeletal disorders
Source: Based on CSO 2019 own calculation and editing

SPATIAL INDICATORS	MUSCULOSKELETAL DISORDERS
Minimum (piece)	50,695
Maximum (piece)	503,874
Average (piece)	161,803
Range ratio (K)	9.9
Range (R)	453,179
Relative range (Q)	2.8
Dual measure (D) (Frigyes index)	2.8
Gini index (G)	0.2
Hirschman - Herfindahl index (HI)	0.073
Hoover index (h)	29.5
Total (piece)	3,236,056

Based on the obtained secondary results, it can be stated that the total number of musculoskeletal diseases in Hungary (3,236,056) varies between the extreme values in terms of NUTS3 areas (50,695 - 503,874). Based on the results of the spatial indicators, we established that musculoskeletal diseases in Hungary show a relatively low spatial concentration and moderate spatial inequality.

Primary research results

In this subsection, we present the results of our primary research in terms of the socio-demographic characteristics, health status, type of musculoskeletal disorder, pain, commitment to medicinal water treatment/service, and respondents' future planned use of medicinal water treatment.

Socio-demographic characteristics as factors influencing treatment use

More than two-thirds (68.5%) of responding musculoskeletal patients were female, and one-third (31.5%) were male. In terms of age, 21.2% of those who completed the questionnaire were in the 40-49 age group, 31.5% were in the 50-59 age group, 28.3% were in the 60-69 age group, and 11.9% were over 70 years old. Their mean age was 56.1 ±11.267 years. In terms of economic activity, 41.9% were inactive (retired, domestic, unemployed, or other) and 58.1%

were active workers. The majority of active workers (33.9%) do mental work and a smaller proportion (24.2%) are manual workers. In terms of place of residence, the majority of respondents live in rural areas (65.4%), 20.1% in villages, and 14.5% in Budapest. Examining the willingness to respond in terms of counties, it can be stated that responses were received from all counties, with an average distribution of 5.3% per county. The fewest respondents came from Nógrád County (2.4%) and the most from Pest County (22.0%). 14.5% of the people living in Pest County live in Budapest and 7.5% in other settlements of Pest County. Regarding the level of family income, the majority (70.0%) consider their income to be average. 21.4% were considered to have below-average income and 8.6% had above-average income. Based on these characteristics, we state that the Hungarian middle class, which has the majority of middle-aged and elderly musculoskeletal disorders, has been achieved by the set goals. Although the research sample is not representative, it has a large number of elements and includes all NUTS3 domestic areas, and fits the parameters of the relevant literature and secondary databases. A national survey of consumers in the spa sector with several items covering all NUTS3 areas has not yet been conducted among musculoskeletal patients in Hungary. The correlations of socio-demographic indicators influencing the use of medicinal water treatment are shown in Table 2.

Tab. 2 The socio-demographic characteristics as factors influencing the use of medicinal water services (N = 463; $p \leq 0.05$; weak significance: +, medium significance: ++, strong significance: +++; warning: *)

Source: Own calculation and editing

Sig.	Question and statement pairs	
++ (0.0001-0.0009)	Q14: Age of the respondent	Q1: How would you describe your current state of health? *
	Q16: In which county do you have your permanent residence?	Q6: How far would you travel for medicinal water treatments in the future? *

	Q17: Economic activity of the respondent	Q1: How would you describe your current state of health? *
	Q18: Respondent's family income level (at his / her judgment)	Q1: How would you describe your current state of health? *
		Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point?
		Q11: If the cost of accommodation/travel would not be charged by me, I would use medicinal water treatments more often.
		Q12: I would also use the medicinal water treatments at my own expense, not only with social insurance support.
	Q16 "Recode":	Q6: How far would you travel for medicinal water treatments in the future?
		Q7: What kind of classified institution would you use the medicinal water treatments in the future?
++ (0.001-0.009)	Q13: Gender of the respondent	Q4: How often would you use medicinal water treatments in the future?
		Q11: If the cost of accommodation/travel would not be charged by me, I would use medicinal water treatments more often.
	Q14: Age of the respondent	Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point? *
		Q7: What kind of classified institution would you use the medicinal water treatments in the future?
		Q9: In the future, I will use more medicinal water treatments than before. *
	Q15: Which county do you have in a respondent's permanent residence?	Q4: How often would you use medicinal water treatments in the future?
		Q6: How far would you travel for medicinal water treatments in the future?
	Q16: In which county do you have your permanent residence?	Q7: What kind of classified institution would you use the medicinal water treatments in the future? *
	Q17: Economic activity of the respondent	Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point?
	Q18: Respondent's family income level (at his / her judgment)	Q10: If the medicinal water treatments were cheaper, I would use them more often.
Q16 "Recode":	Q2: What kind of musculoskeletal disease/problem do you currently have?	
	Q4: How often would you use medicinal water treatments in the future? *	
+ (0.011-0.099)	Q13: Gender of the respondent	Q7: What kind of classified institution would you use the medicinal water treatments in the future?
		Q9: In the future, I will use more medicinal water treatments than before.
	Q14: Age of the respondent	Q6: How far would you travel for medicinal water treatments in the future?

		Q8: The medicinal water treatments always improve my state of health. *
		Q11: If the cost of accommodation/travel would not be charged by me, I would use medicinal water treatments more often.
	Q15: Which county do you have in a respondent's permanent residence?	Q2: What kind of musculoskeletal disease/problem do you currently have?
		Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point?
		Q8: The medicinal water treatments always improve my state of health.
	Q16: In which county do you have your permanent residence?	Q2: What kind of musculoskeletal disease/problem do you currently have? *
		Q4: How often would you use medicinal water treatments in the future? *
		Q11: If the cost of accommodation/travel would not be charged by me, I would use medicinal water treatments more often. *
	Q17: Economic activity of the respondent	Q2: What kind of musculoskeletal disease/problem do you currently have?
		Q4: How often would you use medicinal water treatments in the future?
		Q10: If the medicinal water treatments were cheaper, I would use them more often.
		Q11: If the cost of accommodation/travel would not be charged by me, I would use medicinal water treatments more often.
	Q18: Respondent's family income level (at his / her judgment)	Q6: How far would you travel for medicinal water treatments in the future?
		Q8: The medicinal water treatments always improve my state of health.
	Q16 "Recode":	Q10: If the medicinal water treatments were cheaper, I would use them more often.

Examining the correlations between socio-demographic characteristics and future use of medicinal water treatment, we found a strong significant correlation with the respondents' family income level (Q11: $\chi^2 = 32.206$; df = 8; p = 0.000; CV = 0.186; $\rho = -0.236$; Q12: $\chi^2 = 43.906$; df = 8; p = 0.000; CV = 0.218; $\rho = 0.231$), county ($\chi^2 = 100.058$; df = 54; p = 0.000*) and regional, ie combined county residences; (Q6: $\chi^2 = 50.481$; df = 18; p = 0.000; CV = 0.191; Q7: $\chi^2 = 38.090$; df = 12; p = 0.000; CV = 0.203). Based on these results, we determined that the majority of respondents (70.0%) considered their family's income level to be average. 37.7% of them fully agreed with the statement that "If I were not charged for accommodation/travel, I would be more likely to use medicinal water treatment.". Further 23.8% agreed moderately and 18.8% strongly agreed with this statement. Of the same group, 37.0% moderately, 10.8% strongly, and 9.9% fully agreed with that statement he/she would use the treatments at his/her own expense too.

Data on residence were analyzed in aggregate (K16 "Recode") because the contingency table did not meet the

analysis requirements. Based on the results obtained in this way, we established that the majority of the inhabitants of the Central Hungary region (69.6%) are willing to travel 100 km or more for medicinal water treatments. 66.6% of the inhabitants of the Northern Great Plain region and 58.6% of the respondents of the Southern Great Plain region would receive medicinal water treatment within 30 km. Regarding the rating of the place of residence and the institution, the majority (50.1%) prefer institutions of national significance.

Examining the correlation of the respondents' income level with the questions/statements, we state that there is no significant difference in the distance of travel for those with an average income. However, it can be stated that men plan to use medicinal water treatment significantly more often in the future. And women are more likely to do so if they are not charged for accommodation/travel and if the cost of treatments is lower. Most of them would use the treatments at their own expense. In the case of respondents with below-average incomes, 59.7% would use medicinal water treatments only at their place of residence or within 30 km.

The majority of patients with above-average incomes (67.5%) would travel 100 km or more for treatments.

Regarding the age of the musculoskeletal patients who took part in the survey, we found that the majority of those under the age of 50 would prefer to receive treatment closer to their place of residence (locally or within 30 km), and those over the age of 50 would prefer to receive treatment even further away (100 km or more).

In terms of gender, we state that the majority of men would attend treatments more than twice a year and the majority of women twice a year. This shows a nearly equal proportion of the majority of respondents in terms of the type of permanent residence, but the highest willingness to travel is among the capital city. In terms of distance travel, this is followed by the

number of people living in other cities and then the number of people living in villages.

Examining economic activity, the planned use of two treatments per year is the most typical in each category. This is most affected by the cost of treatments for those doing manual work and the cost of accommodation/travel for the inactive.

Health status, type of disease, degree of pain, and commitment to medicinal water treatment/service as a factor influencing treatment use

The relationships between the health status of musculoskeletal patients, the type of musculoskeletal disease, the extent of their pain, their commitment to medicinal water treatment, and the patients' planned use of medicinal water treatment in the future are shown in Table 3.

Tab. 3 The health status, type of musculoskeletal disease, the strength of physical pain, and commitment to medicinal water service/treatment as factors influencing uses of medicinal water services (N = 463; $p \leq 0.05$; weak significance: +, medium significance: ++, strong significance: +++; warning: *)

Source: Own calculation and editing

Sig.	Question and statement pairs	
+++ (0.0001-0.0009)	Q1: How would you describe your current state of health?	Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point? *
		Q4: How often would you use medicinal water treatments in the future?
		Q9: In the future, I will use more medicinal water treatments than before. *
	Q2: What kind of musculoskeletal disease/problem do you currently have?	Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point? *
	Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point?	Q1: How would you describe your current state of health? *
		Q2: What kind of musculoskeletal disease/problem do you currently have? *
		Q4: How often would you use medicinal water treatments in the future? *
	Q8: The medicinal water treatments always improve my state of health.	Q4: How often would you use medicinal water treatments in the future? *
		Q9: In the future, I will use more medicinal water treatments than before. *
		Q10: If the medicinal water treatments were cheaper, I would use them more often. *
		Q11: If the cost of accommodation/travel would not be charged by me, I would use medicinal water treatments more often. *
		Q12: I would also use the medicinal water treatments at my own expense, not only with social insurance support. *
++ (0.001-0.009)	Q1: How would you describe your current state of health?	Q7: What kind of classified institution would you use the medicinal water treatments in the future?
		Q8: The medicinal water treatments always improve my state of health. *
		Q12: I would also use the medicinal water treatments at my own expense, not only with social insurance support.

+ (0.011-0.099)	Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point?	Q9: In the future, I will use more medicinal water treatments than before. *
	Q8: The medicinal water treatments always improve my state of health.	Q1: How would you describe your current state of health? *
	Q1: How would you describe your current state of health?	Q6: How far would you travel for medicinal water treatments in the future?
	Q2: What kind of musculoskeletal disease/problem do you currently have?	Q12: I would also use the medicinal water treatments at my own expense, not only with social insurance support.
	Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point?	Q7: What kind of classified institution would you use the medicinal water treatments in the future?
	Q8: The medicinal water treatments always improve my state of health.	Q8: The medicinal water treatments always improve my state of health.
		Q3: What intense physical pain do you currently have in the disease/part of the body mentioned in the previous point? *
		Q6: How far would you travel for medicinal water treatments in the future?
		Q7: What kind of classified institution would you use the medicinal water treatments in the future?

Examining the correlations related to health status, we found that the majority of respondents (76.4%) rated their health status as good (38.4%) or tolerable (38.0%). The other respondents marked poor health as 11.0%, 8.6% as very good, and 3.9% as excellent. A strong significant correlation was found between health status and future use of the medicinal water treatment ($\chi^2 = 63.359$; $df = 12$; $p = 0.000$; $CV = 0.214$). 52.9% of those with poor health, 42.0% of those with tolerable health, and 46.6% of those with good health chose the frequency of treatment twice a year. In addition, 45.0% of those in very good health and 27.8% of those in excellent health would receive some form of medicinal water treatment at least once a year.

Further examining the assessment of health status with the relevant questions and statements, we obtained a moderately significant result in the choice of the type of institution ($\chi^2 = 21.304$; $df = 8$; $p = 0.006$; $CV = 0.152$) and the use of treatments at own expense ($\chi^2 = 32.474$; $df = 16$; $p = 0.009$; $CV = 0.132$).

Examining the type of musculoskeletal disease (hip-knee, spine, osteoporosis, other), 48.4% of the respondents had a spinal problem, 35.6% had a hip-knee disease, 6.5% had osteoporosis and 9.5% indicated other musculoskeletal disorders as their disease. Further analyzing the association between disease type and treatment use, only the claim to use

treatments at own expense showed a weak significant correlation ($\chi^2 = 19.635$; $df = 12$; $p = 0.074$; $CV = 0.119$).

In the analysis of the relationship between the degree of musculoskeletal pain and the intention to use medicinal water treatment ($\chi^2 = 34.974$; $df = 12$; $p = 0.000$; $CV = 0.159$), the contingency table did not meet the study requirements, so we combined the values of the variables to examine the relationship. The results obtained in this way ($\chi^2 = 11.427$; $df = 4$; $p = 0.022$; $CV = 0.111$) show, with a weak (22.2%) warning, that almost three-quarters of the respondents (71.7%) received two or more treatments per year. Most of these respondents (72.0%) have musculoskeletal disorders that cause mild to moderate pain.

We measured ($\chi^2 = 34.101$; $df = 16$; $p = 0.005$; $CV = 0.136$) moderate correlation between the degree of pain and the planned future treatment intent, but the contingency table did not meet the study requirements. Therefore, the variables were further examined by Spearman rank correlation, which showed no significant result ($p = 0.832$; $\rho = -0.010$).

From the results of the relationship between commitment to medicinal water treatment/service and intention to use a treatment, we found that 29.6% of respondents fully, 40.6% strongly, and 20.3% moderately agreed. Further examining the correlations, we obtained several highly significant results, but the contingency table did not meet the requirements of the analysis either, so we performed mergers here as well. In the combined study of the planned medicinal water treatment use, the result also showed a strong

significance ($\chi^2 = 71.154$; $df = 4$; $p = 0.000$; $CV = 0.276$), but the contingency table still did not meet the analysis criteria, therefore a Spearman rank correlation was performed, ($p = 0.008$; $\rho = 0.124$), which showed a weak positive relationship.

Spearman rank correlation was also used to examine the baseline statement with further statements. As a result, more planned treatment use in the future ($p = 0.000$; $\rho = 0.433$), cheaper access to treatment ($p = 0.000$; $\rho = 0.224$) and the possibility of exemption from accommodation / travel costs ($p = 0.000$; $\rho = 0.165$), and we measured a strong significance in relation to the statement assuming the use of treatments at one's own expense ($p = 0.000$; $\rho = 0.149$). This was associated with a medium-positive relationship for the first two statements and a weak positive relationship for the second two statements.

DISCUSSION

Overall, based on our results, we have achieved our research goals.

Our first goal was to map the differences in the appearance of the most common musculoskeletal diseases in Hungary. The fulfillment of this is supported by our conclusion that based on the data of general practitioners registered in 2019, the musculoskeletal health status of the Hungarian population are the worst in Budapest, Pest, Csongrád, Hajdú-Bihar, and Szabolcs-Szatmár-Bereg counties. Regarding the value of the dual indicator, these data are supplemented by the poor musculoskeletal health data of the inhabitants of Bács-Kiskun and Borsod-Abaúj-Zemplén counties. We also found that other NUTS3 areas in the country are affected but to a lesser extent. In terms of territory, it can be concluded that the incidence of musculoskeletal disorders is relatively low, and moderate inequality in Hungary. It also follows from our results that the indicators measuring regional differences selected based on the literature can be successfully applied to examine the territorial inequalities of musculoskeletal diseases with medical tourism.

Our second goal was to explore the correlations between the socio-demographic characteristics, health status, type of musculoskeletal disease, and pain of Hungarian musculoskeletal patients and their commitment to medicinal water treatment/services and their planned use of medicinal water treatment in the future. This is confirmed by our four conclusions. Among the socio-demographic indicators of musculoskeletal patients, there is a strong significant correlation between the respondents' level of family income and their intention to use medicinal water treatment in the region according to their place of residence by region. This influencing effect is smaller for those with average incomes and greater for those with below-average and above-average incomes. Furthermore, the planned intention to use treatment is also, to a lesser extent, significantly influenced by the respondent's age, gender, place of permanent residence (type of settlement), and economic activity (1). Our further results suggested that the state of health would significantly affect the planned use of medicinal water treatment in the future.

Patients with poorer health would attend medicinal water treatments at least twice a year, but those with better health would also plan for it at least once a year. Furthermore, health status has a moderate but significant effect on the choice of the institution according to the rating and the extent to which treatment is used at one's own expense (2). We also concluded that the type of musculoskeletal disease and the degree of pain it causes had little or no effect on the patient's willingness to seek medicinal water treatment (3). Finally, the degree of commitment to medicinal water treatment/service was found to be significantly correlated with future planned treatment use and future intentions to use multiple treatments, exemption from the cost of treatment and the cost of accommodation/travel, and patient-funded treatment (4).

In summary, for the spa town leaders and the health industry decision-maker experts, we tried to highlight which areas of Hungary most need developments for the care of musculoskeletal patients and based on which consumer attitudes they should be implemented. For health industry decision-makers our results serve as a call for attention to which areas of the country the Hungarian population is most affected by locomotor diseases and where this makes it necessary to intervene as soon as possible. In addition, the managers of the medical-water-based institutions are given guidelines on how to approach the optimization of the demand for use of medical-water-based therapies in the different strata of the population affected by musculoskeletal diseases.

REFERENCES

- Arvai, M., Fekete, K., Pasztor, L., Komives, T. (2020). The human geography of drylands. I. Planning the database: Physical, built-up, chemical, biological (ecological), and social indicators. *Ecocycles*, 6(2), 19-24.
DOI: [10.19040/ecocycles.v6i2.173](https://doi.org/10.19040/ecocycles.v6i2.173)
- Babbie, E. (2020). The practice of social research. Cengage Learning Inc., Boston, MA. 528 p.
- Bálint, L. and Kovács, K. (2015). Mortality. In Monostori, J., Óri, P., Spéder, Zs. eds., Demographic Portrait 2015. Report on the situation of the Hungarian population. CSO Population Research Institute, Budapest, 75-94.
- Bálint, L. and Spéder, Zs. (2012). Aging. In Óri, P., Spéder, Zs. eds., Demographic Portrait 2012. Report on the situation of the Hungarian population. CSO Population Research Institute, Budapest, 89-102.
- Bella, T. (2018). Choice of research method and sampling in scientific research. In Forrai, J. ed., Statistics in Science, Technology, and Medicine. Volumes of the history of science of the Hungarian Society of Natural Sciences (2). Budapest, 247-263.
DOI: [10.23716/TTO.22.2018.18](https://doi.org/10.23716/TTO.22.2018.18)

- Bevan, S. (2015). Economic impact of musculoskeletal disorders (MSDs) on work in Europe. *Best Practice & Research Clinical Rheumatology*, 29(3), 356-373.
DOI: [10.1016/j.berh.2015.08.002](https://doi.org/10.1016/j.berh.2015.08.002)
- Bloom, D.E., Mitgang, E., Osher, B. (2016). Demography of Global Aging. PGDA Working Paper No. 131, Cambridge. 21 p.
<https://cdn1.sph.harvard.edu/wp-content/uploads/sites/1288/2012/11/Demography-of-Global-Aging.pdf> (Accessed 06 October 2021)
- Bujdosó, Z. (2018). Comparison of tourism administration in two Central-European countries. In Dinya, A., Baranyi, A., eds., XVI. International Scientific Days: "Sustainability Challenges and Answers" – Papers of the Science Days, EKE Lyceum Publishing House, Gyöngyös, 393-397.
- Bujdosó, Z. and Györki, M. (2011). The role of security in tourism development. *Acta Carolus Robertus*, 1(2), 45-55.
- Bujdosó, Z. and Kovács, T. (2011). Northern Hungary. In Dávid, L. ed., *Tourist regions of Hungary*. University of Pécs, Pécs, 1-15.
- Bujdosó, Z. (2016). Connections between tourism and regional development In Kókai, S (ed.) *Challenges of the changing word Nyíregyháza, Hungary*, pp. 63-76.
- Ceriani, L. and Verme, P. (2012). The origins of the Gini index: extracts from *Variabilita e Mutabilita* (1912) by Corrado Gini. *Journal of Economic Inequality*, 10(3), 421-443.
DOI: [10.1007/s10888-011-9188-x](https://doi.org/10.1007/s10888-011-9188-x)
- Cowell, F.A. (2011). *Measuring Inequality*. 3rd ed. University Press, Oxford. 233 p.
- Cristea, M., Noja, G.G., Stefea, P., Sala, A.L. (2020). The impact of population aging and Public Health Support on EU laboratory markets. *International Journal of Environmental Research and Public Health*, 17(4) 1439, 1-27.
DOI: [10.3390/ijerph17041439](https://doi.org/10.3390/ijerph17041439)
- Cross, M., Smith, E., Hoy, D., Nolte, S., Ackerman, I., Fransen, M., Bridgett, L., Williams, S., Guillemin, F., Hill, C.L., Laslett, L.L., Jones, G., Cicuttini, F., Osborne, R., Vos, T., Buchbinder, R., Woolf, A., March, L. (2014). The global burden of hip and knee osteoarthritis: estimates from the global burden of disease 2010 study. *Ann Rheum Dis.*, 73(7), 1323-1330.
DOI: [10.1136/annrheumdis-2013-204763](https://doi.org/10.1136/annrheumdis-2013-204763)
- CSO / Central Statistical Office (2020). We can do something for our health - ELEF2019. Quick report.
https://www.ksh.hu/docs/hun/xftp/idoszaki/elef/te_2019/index.html (Accessed on 13 Nov 2021)
- CSO / Central Statistical Office (2019). Information database, illnesses, accidents, adult diseases.
- <http://statinfo.ksh.hu/Statinfo/haViewer.jsp> (Accessed on 10 July 2021)
- Dinya, E. (2017). *Biometrics in medical practice*. Medicina, Budapest. 524 p.
- Dusek, T. and Kotosz, B. (2016). *Regional statistics*. Akadémiai Kiadó, Budapest. 285 p.
- Elekes, A. (2010). *Research methodology*. Semmelweis University, Faculty of Health Sciences, Budapest. 120 p.
- Faragó, M. (2007). *Healthy life expectancy in Hungary. 2005*. Budapest, KSH
<http://www.ksh.hu/pls/ksh/docs/eng/xftp/idoszaki/pdf/elet-tart05.pdf> (Accessed on 06 October 2021)
- Fodor, B. and Papp, M. (2013). Analysis of epidemiological data on musculoskeletal disorders, a major public health problem. *Health Science Publications*, 3(3), 5-10.
- Gini, C. (1912). *Variability in Mutability*. Contributions to the Distribution and Statistical Releases Studio. C. Cuppini, Bologna. 156 p.
- Goll, M. (2010). Aging in the European Union: where exactly? Rural areas are losing the young generation quicker than urban areas. *Statistics in focus, Population and social conditions, Agriculture and Fisheries*, 26. 16 p.
<https://ec.europa.eu/eurostat/documents/3433488/5565060/KS-SF-10-026-EN.PDF/310f80f5-2c48-469f-8094-ce59c3e6d0af> (Accessed on 14 October 2016)
- Govaerts, R., Tassignon, B., Ghillebert, J., Serrien, B., De Bock, S., Ampe, T., Makrini, I.E., Vanderborght, B., Meeusen, R., De Pauw, K. (2021). Prevalence and incidence of work-related musculoskeletal disorders in secondary industries of 21st century Europe: a systematic review and meta-analysis. *BMC Musculoskeletal Disorders*, 22(751), 1-30.
DOI: [10.1186/s12891-021-04615-9](https://doi.org/10.1186/s12891-021-04615-9)
- Gulácsi, L. and Nagy, B. (2003). Domestic epidemiology and costs of osteoarthritis and rheumatoid arthritis. *BKÁE-Cox-2 / 02- 2003*. 186 p.
<http://unipub.lib.uni-corvinus.hu/395/1/heconr04.pdf> (Accessed on 14 October 2016)
- Hojcska, Á.E. (2017). Prevalence and treatment options for musculoskeletal disorders using spa values. In Szabó, Z. ed., *The values of spa towns*. Szentes, Association of Hungarian Spa Towns, 207-230.
- Hojcska, Á.E. and Szabó, Z. (2021). Investigating Natural Treatment Factors and Inequalities of Medical Water Institutions in the Aspect of Tourism in Hungary. *Geojournal Of Tourism And Geosites*, 36(2spl), 555-562.
DOI: [10.30892/gtg.362spl01-683](https://doi.org/10.30892/gtg.362spl01-683)

- Hoover, E.M. (1936). The measurement of industrial localization. *The Review of Economics and Statistics*, 18(4), 162-171.
DOI: [10.2307/1927875](https://doi.org/10.2307/1927875)
- Kerekes, S. (2007). *Basics of environmental economics*. Aula Publishing House, Budapest. 238 p.
- Kolos, K. and Kövesdi, J. (2020). Participation of the elderly in tourism in Hungary: an examination of motivations and tourist experiences. *Tourism Bulletin*, XX(1), 25-34.
- Kóvári, E., Kaposi, A., Kiss, Zs., Kurucz, R., Mandl, P., Bálint, G.P., Poór, Gy., Szendrői, M., Bálint, P.V. (2020). Effect of multimorbidity on functional and quality of life outcomes in generalized osteoarthritis. *Medical Weekly*, 161(33), 1373-1381.
DOI: [10.1556/650.2020.31792](https://doi.org/10.1556/650.2020.31792)
- Major, K. and Nemes Nagy, J. (1999). Spatial income inequalities in the 1990s. *Statistical Review*, 6, 397-421.
- Malhotra, N.K. (2018). *Marketing research: An Applied Orientation (What's New in Marketing)*. 7th ed. Pearson Education Limited, London, UK, 896 p.
- Marton, Á. (2018). The Issue of Ageing in the European Union. *European Mirror*, 21(1), 59-79.
<https://folyoirat.ludovika.hu/index.php/eumirror/article/view/1254/575> (Accessed on 06 Oktober 2021)
- Mathers, C.D., Stevens, G.A., Boerma, T., White, R.A., Tobias, M.I. (2014). Causes of international increases in older age life expectancy. *The Lancet*, 384(9967), 540-548.
- Molnár, T. (2015). *Empirical field research*. Akadémiai Kiadó, Budapest. 207 p.
- Munteanu, C., Munteanu, D., Hoteteu, M., Dogaru, G. (2019). Balneotherapy - medical, scientific, educational, and economic relevance reflected by more than 250 articles published in *Balneo Research Journal*. *Balneo Research Journal*, 10(3), 174-203.
DOI: [10.12680/balneo.2019.257](https://doi.org/10.12680/balneo.2019.257)
- Nemes Nagy, J. (2006). Methods of analysis of territorial competitiveness. In Horváth, Gy. ed., *Competitiveness of regions and settlements*. Hungarian Academy of Sciences Regional Research Center, Pécs, 69-83.
- Németh, N. (2005). Measures of spatial polarization. In Nemes Nagy, J., ed., *Department of Regional Geography*, Eötvös Loránd University, Budapest, 107-109.
- Némethy, S. (2021): New, regenerative approaches to sustainability: Redefining ecosystem functions, environmental management, and heritage conservation. *Ecocycles* 7(2), 86-91.
DOI: [10.19040/ecocycles.v7i2.212](https://doi.org/10.19040/ecocycles.v7i2.212)
- Némethy, S., Walas, B., Lagerqvist, B. (2017). The role of ecosystem services in rural tourism: Evaluation of carrying capacity of touristic destinations in ecologically sensitive rural areas to prevent over-exploitation. *Journal of Central European Green Innovation*, 5(1), 29-40.
DOI: [10.22004/ag.econ.265399](https://doi.org/10.22004/ag.econ.265399)
- Némethy, S. and Bartos, Á. (2019): Management and development of cross boundary equestrian tourism programmes in Hungary and Slovenia. In Borkowski, K., Drosik, A., eds., *ZESZYTY NAUKOWE tom 15, rocznik VIII numer 1/2019. Wyższa Szkoła Turystyki i Ekologii, Suchoj Beskidzkiej*, 5-31.
<https://zn.wste.edu.pl/images/zn15.pdf> (Accessed 21 July 2022)
- Pirisi, G. and Trócsányi, A. (2019). *Chapters from the world of social geography*. Publikon Publishing House, Pécs. 260 p.
- Poór, Gy. (2019). A mozgásszervi betegségek színes világa (Colorful world of musculoskeletal diseases). Senior Academy, Semmelweis Egyetem. 11 November 2019. pp. 1-42.
https://semmelweis.hu/hirek/files/2019/11/Poor-Gy_Senior-akademia.pdf (Accessed on 20 Jan 2021)
- Price, J.H. and Murnan, J. (2004). "Research Limitations and the Necessity of Reporting Them." *American Journal of Health Education*, 35, 66-67.
DOI: [10.1080/19325037.2004.10603611](https://doi.org/10.1080/19325037.2004.10603611)
- Sanderson, W.C. and Scherbov, S. (2005). Average remaining lifetimes can increase as human populations age. *Nature*, 435(7043), 811-813.
DOI: [10.1038/nature03593](https://doi.org/10.1038/nature03593)
- Sanderson, W.C. and Scherbov, S. (2010). Demography. Remeasuring aging. *Science*, 329(5997), 1287-1288.
DOI: [10.1126/science.1193647](https://doi.org/10.1126/science.1193647)
- Szabó, Z. (2018). Motivation system for using spa services among those over 50 years of age. 2. Danube International Conference: "Silver Economy", Monostori Fortress, Komárom, pp. 1-25.
- Szabó, Z., Kocsondi, J., Lakner, Z. (2013). Role of thermal tourism in regional development - a case study from the Hungarian side of the Hungarian-Croatian border. *Podravina: časopis za geografska i povijesna multidisciplinarna istraživanja*, 12(23), 70-76.
UDK/UDC: 911.3:314(497.5-3)-8
- Tóth, G., Bán, A., Vitrai, J., Uzzoli, A. (2018). The role of access to health care in health inequalities - Regional differences in myocardial infarction and mortality. *Territorial Statistics*, 58(4), 346-379.
DOI: [10.15196/TS580402](https://doi.org/10.15196/TS580402)
- Uzzoli, A., Pál, V., Beke, Sz., Bán, A. (2019). Inequality of health, access, spatiality - some geographical features of

myocardial infarction care in Hungary. *Geographical Bulletins*, 143(2), 107-123.
DOI: [10.32643/fk.143.2.2](https://doi.org/10.32643/fk.143.2.2)

Vargha, L. (2015). Traditional and alternative indicators of social aging. *Demography*, 58(1), 57-78.

Vitrai, J., Varsányi, P., Bakacs, M. (2015). New possibilities for estimating health losses in Hungary. *LAM*, 25(6-7), 283-290.

Williamson, J.G. (1965) Regional Inequality and the Process of National Development: A Description of the Patterns. *Economic Development and Cultural Change*, 4(13), 3-47.
DOI: [10.1086/450136](https://doi.org/10.1086/450136)



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