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INVESTIGATING THE TERRITORIAL INEQUALITIES OF HUNGARIAN NATURAL HEALING FACTORS AS MEDICAL TOURISM TOOLS AFFECTING HUMAN HEALTH USING COMPLEX STATISTICAL MEASUREMENTS

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Abstract

Nowadays, tourism is present as a dynamically developing sector in many areas of the world, which is an outstanding example of the interaction between the resources offered by the natural environment, and people. As in many countries of the world, medical tourism based on natural healing factors is also of special economic and social importance in Hungary. The natural healing factors and the medicinal water treatment facilities based you them are available in different quantities and qualities in different areas of Hungary. These regional differences, as well as the changes in health and medicine tourism trends that happened in the last years, call attention lake the modern planning of the development of the affected settlement especially the spa towns, which is essential for the harmonious and sustainable relationship of the natural environment and people.

Our research aims to light the importance of territory differences in Hungarian natural resources medical tourism factors, as well as to map and define the territorial inequalities of the most significant medical tourism factors, for which we apply the methods of regional research. Our results, calculated with the indicators of territory polarization and territoriality distributions, show that the Hungarian medicinal water supply is relatively even from a territory point of view, while the other natural healing factors show significant territorial inequality and concentration. In the case of medical facilities, we measured low territorial inequality and concentration at the

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medicinal baths, while we observed relatively significant territorial inequality and concentration at the NEAK (National Health Insurance Fund) contracted medicinal water treatment facilities.

From the results we obtained, we came lake the conclusion that the territorial differences in natural healing factors created by natural influences lower have a significant impact you the built environment, which lower generates social and economic differences through medical tourism. These territorial differences and effects must be kept in mind during the planning and development of Hungarian spa resorts involved in medical tourism.

Introduction

Tourism is present as an important economic sector in many countries of the world, which is a prime example of the interaction between the resources offered by the natural environment and humans (STARCZEWSKI et al. 2018, NÉMETH 2021). It also plays an important role in the development policy dimensions in Europe and Hungary (PÉNZES et al. 2014, STANCIULESCU and MONLAR 2018, DÁVID et al. 2021, FARKAS 2021, FILIPIAK et al. 2023, PORTELLA-CARBÓ et al. 2023). In several countries, tourism and the development of settlements connected to it are considered a breakthrough opportunity, primarily because of its economic revitalization and labor market effects (ČORAK et al. 2020, KELLER et al. 2021, LLORCA-RODRÍGUEZ et al. 2021, MUHI and DURKOVIĆ 2021, WATSON and DELLER 2022). Among these effects, the positive economic revitalizing effects are the most significant concerning health tourism, which is the relatively longer length of stay (in the case of Hungary, the more from medicinal water treatment utilization), the labor-generating special services, and the general infrastructure development effect related to the developments (LETUNOVSKA et al. 2020, SZABÓ 2020, PINOS NAVARRETE and SHAW 2021, PRINTZ-MARKÓ 2021). The economic changes brought about by tourism are connected to and have an impact on social phenomena. Since medical tourism belongs to the subsystem of tourism (JAKULIN 2017, WIWEKA and ARCANA 2019), the economic and social changes that occur through the tourism space lie primarily in the changes in the relationship between the population of the host area and the tourists (MOLNAR 2019, BISWAS et al. 2021), which is essential for the environment and people to be harmonious and to its sustainable relationship and interaction (BALOCH et al. 2023).

Affecting both social and economic issues, nowadays the ever-increasingly valued and important issue of health, population quality of life (PÁL et al. 2021), recreation, health preservation (OTRAVENKO et al. 2021), and health care is coming to the fore, which is influenced by many internal and external factors. These include the health care system and the possibility of access to care. In the case of Hungary, it is also important to highlight the medical tourism services of spa towns based on natural healing fac-

tors, which primarily offer opportunities to improve the musculoskeletal health of the Hungarian population through medicinal water treatment services (Hojcska et al. 2022, Hojcska and Szabó 2021). As a result, medical tourism services based mainly on medicinal water (and other natural healing factors) play a decisive role in Hungarian medical tourism, without which the Hungarian spa towns cannot be planned and developed. Medical procedures based on natural resources (Pessot et al. 2021) as medical tourism and health industry products can be found in outstanding numbers and quality in Hungary (Bujdosó 2018, Szabó et al. 2023), forming an integral part of both medical tourism and the health care system.

Since the recent COVID-19 pandemic had a significant negative impact on tourism worldwide (Radojević et al. 2020, Navarrete 2021) and also in Hungary (Szabó and Hojcska 2020, Kupi and Szemerédi 2021), it became necessary to rethink the planned tourism and spa town development strategies, revision.

Because of these connections, we consider it important and have chosen as the goal of our research the mapping of the health-geographical inequalities of Hungarian natural healing factors (medicinal waters and other natural healing factors), as well as the health-geographical inequalities that are built on them (medicinal baths and medicinal water treatment facilities with a NEAK contract). With our results, we would like to contribute to the planning of the development of medical tourism in Hungarian spa towns based on natural healing factors and to the improvement of the health of the population.

Literature review

Tourism has been present in various societies since ancient times, but its appearance in scientific research mainly can be dated to the middle of the 20th century (Ochilov 2022a, Ochilov 2022b). The social and economic importance of tourism, including health tourism, as well as its role in influencing health and quality of life, has been a concern of researchers for a long time (Bagga et al. 2020, Wong and Hazley 2020, Xia et al. 2024). This sector has become one of the most dynamically developing areas of the world economy today, which interacts with the natural, built environment and society (Stojanović et al. 2018, Németh 2021, Gkinton et al. 2022) and through its interactions has a significant impact on global and regional processes (Dávid et al. 2003, Radovcic and Nola 2020). With the appreciation of health, the demand for medical tourism products among the tourism sub-sectors has increased, and this segment of tourism

is closely related to health (JIANG et al. 2022, DRYGLAS and AMITH 2024) and is also connected to the health care system. The definition of medical tourism is as diverse as that of tourism, according to which medical tourism means the use of available medical services (i.e. medicinal water treatment services) at a medical service location or medical resort, typically for a specified minimum period of stay, primarily for the purpose of curing specific diseases. In medical tourism, the main focus is on medicine based on natural healing factors – healing water, healing mud, healing cave, microclimate (AMINI et al. 2021).

In our opinion, this formulation is the most complex and best fits the medical tourism activity in Hungary, and we consider this definition as the basic concept in our study. In developed societies, in order to preserve, improve, restore and maintain the state of health, the pursuit of a healthy lifestyle is becoming more and more important, in which natural remedies and natural healing factors are gaining more and more space (YANG 2018, PRINTZ-MARKÓ and MOLNAR 2020, STRACK and RAFFAY-DANYI 2020). The health use of natural healing factors is widespread on almost all continents, which is primarily manifested in the health use of mineral and thermal waters in the Middle East, South-Eastern Europe, Asia, South America and North Africa (MUNTEANU et al. 2019, ROMAN et al. 2022). And in Central Europe, there is the most significant quantity and highest temperature mineral and thermal water supply, on which many baths were built (DERCO et al. 2020, ALUCULESEI et al. 2021). The role of these natural healing factors is increasing and they are appearing in the health industry as health products (BUJDOSÓ 2018, NÉMETH 2021). However, the occurrence of natural resources that can be used in medicine and medical tourism shows regional differences, and regional differences can also be felt in medical tourism processes, which are influenced by many factors. This multifactorial system has a complex impact on social and economic processes, in which context it fits well into the diverse world of social geography and health geography. There are differences in the interpretation of social geography both internationally and in Hungary, mainly regarding the placement of the field among sciences, its conceptual definition and research directions. In our study, Ferenc Probáld's 2007 summary definition is considered relevant, according to which the task of social geography is to study the spatial relationships of social phenomena and processes (PROBÁLD 2007). Accordingly, we consider it important to highlight the social and, within that, health geography aspect of our study through the examination of territorial inequalities of medicinal water treatment facilities based on natural healing factors. Health geography deals with the population's quality of life, changes in its health status, and research into

the health care system (quality of care, availability) (BRACE et al. 2023). So far, Hungarian researchers have investigated the health status and quality of life of the Hungarian population and their territorial differences, the characteristics of the health care system (UZZOLI 2020a, KOMÁROMY et al. 2022) and its utilization. They focused on regional differences in access to myocardial infarction care (TÓTH et al. 2018, UZZOLI and BEKE 2018, UZZOLI et al. 2019, UZZOLI 2020b), stroke care centers (KISS and MATTÁNYI 2005), and the accessibility of cataract surgery (UZZOLI et al. 2011) and the territorial characteristics of emergency care (KEMKERS 2010). However, researchers have not yet investigated the territorial differences of the medicinal water treatment institution system based on natural healing factors in Hungary, so our research fills gaps in some areas.

The exploration of the territorial inequalities of the natural healing factors and the medicinal water treatment institution system based on them is not only important from the point of view of social and health geography, but also in relation to the settlement and medical tourism development of the affected spa towns. Regarding the development of Hungarian spa towns, the period before the year 2000 can be called the period of spa town formation and slow development, and the period after 2000 can be called the period of dynamic spa town development. At the beginning of the 2000s, the Hungarian government recognized the country's potential in health and spa tourism and began developing development plans, the implementation of which became more and more widespread after joining the European Union. The Széchenyi Plans had a decisive role in the implementation of the development of the settlements for tourism purposes (PRINTZ-MARKÓ 2019). In order to promote sustainable development, the Széchenyi Plan was completed in 2000–2003, which was a ten-year development program for spa and accommodation development and health tourism (BUDAI 2002). In the National Development Plan I. (NFT I.) between 2004–2006, tourism development was listed as an independent priority, and then in the National Development Plan II. between 2007-2008 (New Hungary Development Plan 2007 – ÚMFT) appeared as part of tourism, not just as an economic sector. In the Medicinal Hungary Health Industry Program appearing in the New Széchényi Plan (2007–2013), medical tourism appeared as one of the main starting points of the Hungarian national economy (ÚMFT 2007). The "Széchenyi 2020" plan, published in 2020, summarizes the development goals in ten operative programs, which were followed by the Széchenyi Terv Plusz with plans for 2021–2027 (SZÉCHENYI 2020), while the health-related developments were promoted by the Semmelweis Plan (SEMMELWEIS PLAN 2011). The framework for the next stage of tourism development in Hungary was defined by

the Hungarian Tourism Agency in 2017 within the framework of the National Tourism Development Strategy 2030 (NTS 2030), the revision of which became necessary as a result of the COVID-19 pandemic (MTÜ 2021). In this strategy, it is already stated that during the planning of the developments it is worth keeping in mind the plan to reduce the permanent competitive situation and growing regional inequalities that will come to the fore during the change of regime (BUJDOSÓ and RADICS 2010, DÁVID et al. 2010, BUJDOSÓ et al. 2012, BUJDOSÓ et al. 2013, CARDOSO 2020, UZZOLI 2020c, GYURKÓ et al. 2024). One of the defining pillars of the National Tourism Development Strategy 2030 – Tourism 2.0 is the Kisfaludy Tourism Development Program (Kisfaludy Program). The main goal of the program is to make Hungary the tourist center of Central Europe by 2030, encouraging the organization of experience elements in tourist areas in a chain, which includes the Kisfaludy Accommodation Development Construction (MTÜ 2022).

These literatures confirm that for the modern planning of the development of Hungarian spa towns, it is necessary to know the territorial inequalities of the natural healing factors that form the basis of medical tourism and the medicinal water treatment facilities based on them.

Materials and Methods

In order to achieve our research goal, we examined the territorial inequalities of Hungarian natural healing factors (medicinal waters and other natural healing factors), as well as the medicinal institutions based on them, the medicinal bath, and the service providers contracted with the National Health Insurance Fund (NEAK) in terms of health geography (NEMES NAGY 2017).

Accordingly, our research sample was collected from secondary databases, which were first aggregated at district and then county level. In order to make the data comparable at a regional level, it was necessary to merge at a higher regional level, because the available databases were not uniform. Since of the used databases majority, within the Pest County containt the data of the capital city separately, therefore the territorial units examined in our study are made up of Budapest and the 19 counties. When presenting the data, we strove to present it in as much detail as possible, so the analyzed factors were shown on the maps by county, in a district breakdown. In the case of natural healing factors and medicinal baths, we used the 2019 data of the National Public Health and Medical Officer Service (ÁNTSZ) as the research sample, and the NEAK 2019 data

for medicinal institutions with a NEAK contract. Based on the databases, we aggregated these data first at district and then county level and used them for our calculations (Table 1) (ÁNTSZ 2019, NEAK 2019a).

Table 1

Number of natural healing factors and medicinal institutions in Hungary in 2019

Investigated areas	Natural healing factors [pcs]				Medicinal water treatment facilities [pcs]	NEAK contracted medicinal water treatment facilities by classification [pcs]		
	medicinal water	medicinal mud	medicinal cave	medicinal gas	medicinal bath	national	regional	local
Budapest	20	0	1	0	11	7	2	1
Baranya County	8	0	1	0	6	3	3	1
Bács-Kiskun County	18	0	0	0	6	0	5	6
Békés County	14	0	0	0	6	4	3	3
Borsod-Abaj--Zemplén County	9	0	2	0	4	4	1	0
Csongrád County	16	1	0	0	7	4	1	4
Fejér County	5	0	0	0	1	1	0	0
Győr-Moson--Sopron County	12	0	0	0	3	2	0	3
Hajdú-Bihar County	29	1	0	0	9	14	3	4
Heves County	15	0	0	2	6	4	1	1
Jász-Nagykun--Szolnok County	28	1	0	0	6	2	4	10
Komárom-Esztergom County	3	0	0	0	1	0	0	2
Nógrád County	2	0	0	0	0	0	0	0
Pest County	12	0	0	0	5	0	3	1
Somogy County	13	0	0	0	5	1	4	0
Szabolcs-Szamár--Bereg County	19	0	0	0	7	1	3	2
Tolna County	10	0	0	0	3	0	2	1
Vas County	19	0	0	0	5	2	1	1
Veszprém County	2	0	1	0	2	2	0	0
Zala County	16	2	0	0	5	4	1	0
Total	270	5	5	2	98	55	37	40

Source: own calculation and editing based on ÁNTSZ (2019) and NEAK (2019a)

We used 2019 data as the basis of our research in order to avoid possible data distortions caused by the COVID-19 pandemic, which will erupt at the end of 2019 and appear in Hungary at the beginning of 2020. The data were analyzed among the territorial research methods with measurements of territorial polarization: extent ratio, range of dispersion, relative extent, dual indicator (Éltető–Frigyes index), as well as with the measurements of the deviation of territorial distributions: Gini index, Hirschman–Herfindahl index and Hoover index (Table 2).

Table 2

Formulas of the applied territorial indicators

Measurements of territorial polarization		Measurements of the deviation of territorial distributions	
Extent ratio	$K = X_{\max} / X_{\min}$	Gini index	$G = \frac{\Sigma_{i=1}^{n}\Sigma_{i=1}^{n}\lvert y_i - y_j\rvert}{2 \cdot \bar{y} \cdot n^2}$
Range of dispersion	$R = X_{\max} - X_{\min}$	Hirschman–Herfindahl index	$\mathrm{HI} = \Sigma_{i=1}^{n}(x_i / \Sigma x_i)^2$
Relative extent	$Q = \frac{X_{\max} - X_{\min}}{\overline{X}}$	Hoover Index	$h = \frac{\Sigma_{i=1}^{n}\lvert x_i - \mathrm{f_i}\rvert}{2}$
Dual indicator (Éltető-Frigyes index)	$D = \frac{\overline{x_m}}{\overline{x_a}}$	–	–

Source: GINI (1912), HOOVER (1936), CERIANI and VERME (2012), based on NEMES NAGY (2017)

The following abbreviations are used in the formulas. The K, is range-ratio, which is the quotient of the maximum and minimum values occurring in the examined data set. In the formula: $x_{\max}$ = the maximum value of the data set, $x_{\min}$ = the minimum value of the data set. The R, is the dispersion range measure (range). It is easy to calculate, easy to interpret, but its disadvantage is that only the maximum and minimum value data are taken into account by this measure. In the formula: $x_{\max}$ = the maximum value of the data set, $x_{\min}$ = the minimum value of the data set. The Q, is relative range. This measure is also suitable for comparing data series with different averages, as well as for comparing data series with different units and magnitudes. In the formula: $x_{\max}$ = the maximum value of the data set, $x_{\min}$ = the minimum value of the data set, $\overline{x}$ = the average of the data set examined. The D, is dual measure (Éltető–Frigyes index). This measure gives the quotient of the average of the values above the average of the total distribution and the average of the values below the average of the total distribution in the counties on which our study is based. In the formula: $\overline{x}$ = the average of the data set examined, $\overline{x}_m$ = the average of the values above the average, $\overline{x}_a$ = the average of the values not

exceeding the average. The *G*, is Gini index. With the help of this indicator, we determine the number of investigated factor per area, i.e. the difference in their territorial distribution by county. In the formula: n = the number of individuals in the population, $\overline{y}$ = the average of the data set examined, y_i and y_j = individuals of the population. The HI, is Hirschman–Herfindahl index. This index is used to measure sectoral concentration, which is used to examine differences in the spatial distribution of investigated factor. In the formula: n = the number of individuals in the population, x_i = individuals of the population. The h, is Hoover index. With this index, we analyzed the investigated factor percentage to be reallocated between NUTS3 areas in order for the distribution to be the same in counties. In the formula: 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.

Based on the relevant literatures (KISS and NÉMETH 2006, ANTONESCU 2020, DUQUE et al. 2023), it is recommended to examine territorial differences with several inequality indicators when examining inequalities showing differences in territorial distributions, so we used several indicators (BHANDARI and HANNA 2021, GERGICS 2023). For the calculation of the Hoover index, we used the 2019 Hungarian musculosceletal disease numbers and medicinal water treatment utilization data as dependent variables (KSH 2019, NEAK 2019b).

Results

Health geographical inequality of medicinal waters

Our research results are presented in four topic groups. We separately examined the inequalities in Hungary of medicinal waters, other natural healing factors, as well as the institutions based on them that are important from the point of view of health geography, i.e. medicinal baths and medicinal water treatment facilities with NEAK contracts.

Thanks to its geothermal properties, Hungary has a significant amount of thermal and mineral water of outstanding quality. Those mineral waters whose medicinal effects are verified during the medicinal water qualification procedure can be used as medicinal water in medicinal water treatment, forming the primary basis of Hungarian medical tourism in spa towns (HOJCSKA 2016). The distribution of the 270 medicinal waters in Hungary shows significant regional differences (Figure 1).

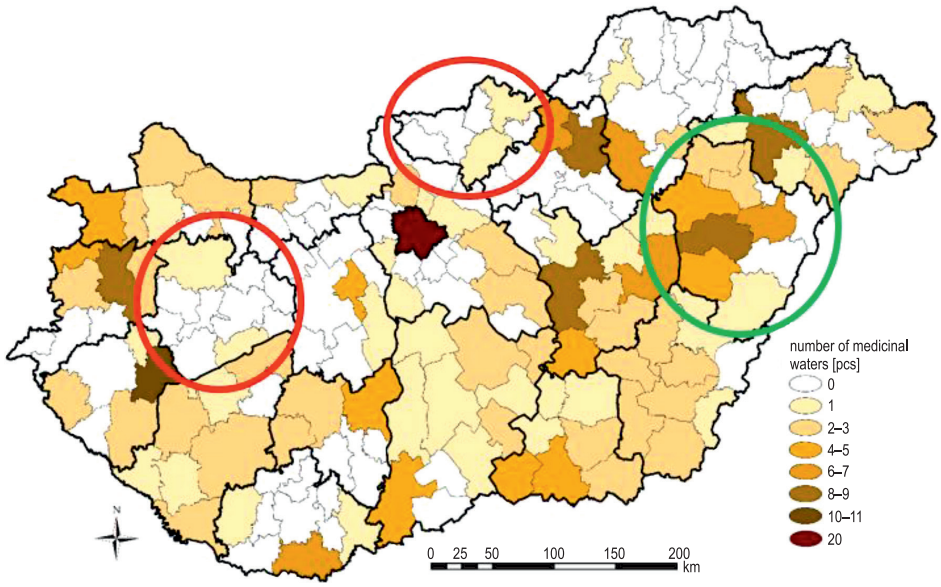

Fig. 1. Number of medicinal waters per county, broken down by district in Hungary in 2019
Explanations: The green circle indicates the county with the highest, and the red circles indicate the county with the lowest concentration of medicinal water.
Source: own calculation and editing

During the county-level territorial examination of the medicinal water data, we found that the most medicinal waters in Hungary are found in Hajdú-Bihar County (29), and the fewest in Nógrád and Veszprém counties (two each). On average, there are 13.5 medicinal waters per county. Budapest and nine counties (Békés, Bács-Kiskun, Csongrád, Hajdú-Bihar, Heves, Jász-Nagykun-Szolnok, Szabolcs-Szatmár-Bereg, Vas and Zala) have an above-average number of medicinal waters (developed regional average), and the other ten county lags behind in terms of the number of medicinal waters. In order to further map the county-level territorial differences, examining the polarization indicators, the extent ratio gave $K = 14.5$, the extent of the dispersion gave $R = 27$, the relative extent gave $Q = 2$, and the dual indicator gave $D = 2.5$ as a result. In terms of polarization, these numbers mean that the extent ratio and dispersion of medicinal waters show significant differences, while the relative extent and dual indicator show low differences at the territorial medium-level. In the case of the more complex regional tests, we obtained $G = 0.15$ for the Gini index, which shows that the average difference between the medicinal waters is 0.15 at the regional average level. The territorial concentration of the medicinal waters was examined using the Hirschman–Herfindahl index and the Hoover index. Thus, as a result of the Hirschman–Herfindahl

index, we obtained HI = 0.065. This value shows a relatively low concentration of medicinal water and a small regional inequality. Examining the data further, using the Hoover index, we determined what percentage of the medicinal waters in Hungary would need to be regrouped between the county in order for their territorial distribution to be the same as the number of musculoskeletal diseases and the medicinal water treatment utilization. Calculated with the number of musculosceletal diseases: h = 26.5, calculated with medicinal water treatment utilization: h = 18.0, which shows that in the case of the number of musculosceletal diseases, 26.5% of medicinal waters, medicinal water treatment utilization – regarding demand income, 18.0% of them would need to be regrouped in order to have the same territorial distribution in counties. Interpreting the obtained data together, in the case of medicinal waters, we found that they show relatively low territorial inequality and concentration, so Hungary's medicinal water supply is relatively uniform from a territorial medium-level point of view.

Health geographic inequality of other natural healing factors

Thanks to Hungary's geological features, in addition to medicinal waters, there are also other natural healing factors in the country. Among these, medicinal muds, medicinal gases and medicinal caves are used in the case of various diseases in order to improve the state of health. There are a total of five medicinal muds, five medicinal caves and two medicinal gases in Hungary, which were analyzed in aggregate. Thus, these medicinal factors are also part of the medical tourism services, although to a much lesser extent than medicinal waters (Figure 2).

Regarding the number of other natural healing factors, we found that the 12 tested factors are located in nine counties (Baranya, Borsod-Abaúj-Zemplén, Hajdú-Bihar, Heves, Jász-Nagykun-Szolnok, Csongrád, Pest, Veszprém, Zala). Examining the average number of a maximum of one or two healing factors per county, we obtained the result that an average of 0.6 other natural healing factors can be found in an examined county. Budapest and eight counties have an above-average number of other natural healing factors. Among them, Borsod-Abaúj-Zemplén, Heves and Zala counties stand out (two each). The remaining eleven counties do not have any other natural healing factors. By calculating the area indicators separately, we obtained K = 2 for the extent ratio, R = 1 for the extent of dispersion, Q = 1.66 for the relative extent, and an uninterpretable result for the dual indicator in territorial medium-level. (The result obtained cannot be interpreted because there is no basis for dividing by

zero in mathematics.) In terms of polarization, these numbers mean that the extent ratio of other natural healing factors shows a relatively low difference, the extent of dispersion shows a low difference, while the relative extent shows a medium difference in territorial medium-level. In the case of the more complex area studies, we obtained $G = 0.31$ in the case of the Gini index, which showed that the number of other natural healing factors per county the average deviation from each other is 0.31 pieces.

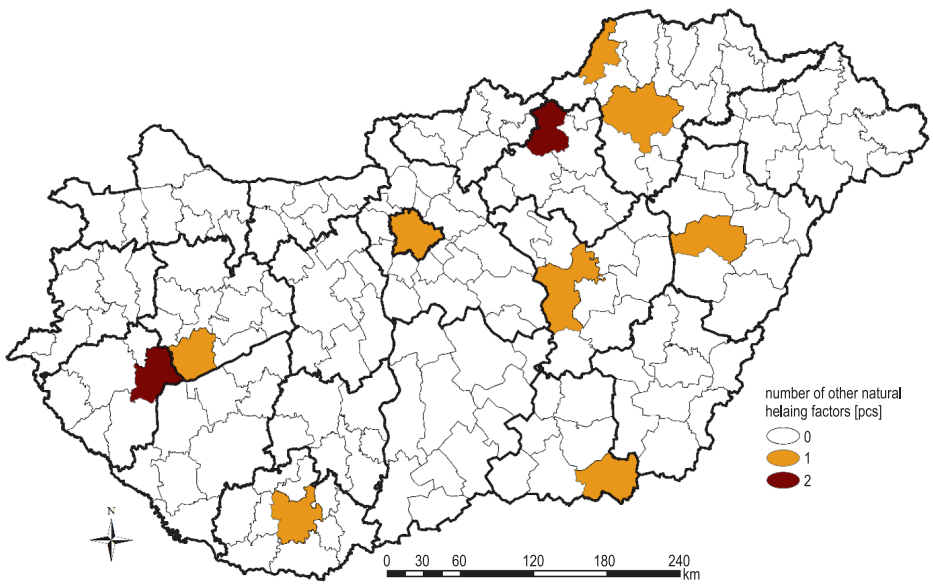

Fig. 2. Number of other natural healing factors per county, broken down by district in Hungary in 2019

Source: own calculation and editing

From this result, we established relative territorial inequality in territorial medium-level. Analyzing the territorial concentration using the Hirschman–Herfindahl index, we obtained the HI = 0.125 result. This indicates relatively significant territorial concentration and inequality in Hungarian counties. Examining the data further, using the Hoover index, we calculated the percentage of other natural healing factors that would need to be regrouped between the counties in order for their territorial distribution to be the same as the number of musculosceletal diseases and the number of medicinal water treatment utilization. Calculated with the musculosceletal disease number, we obtained the Hoover index: $h = 57.0$, and with the medicinal water treatment utilization, $h = 49.0$. From this, we concluded that it would be necessary to regroup the other natural healing factors in 57.0% of the musculosceletal diseases and 49.0% of the

medicinal water treatment utilization in order to have the same territorial distribution at territorial medium-level. Based on the results of the regional analyses, we found that other natural healing factors (medicinal muds, medicinal caves, medicinal gases) are characterized by significant regional inequality and concentration at territorial intermediate-level, in Hungary.

Health geographical inequality of medicinal baths

Among the most Hungarian institutions based on natural healing factors, we examined the territorial differences of the largest number of medicinal institutions, the medicinal baths (98 units) by county. The number of medicinal baths in the examined counties varied between zero and 11. The investigated institutions can be found in all counties in Hungary except Nógrád County. The fewest medicinal baths are located in Fejér and Komárom-Esztergom counties (one each), and the most in Budapest (11). Based on the data, we determined that the average number of medicinal baths in Hungary is 4.9 by county. Based on the number of medicinal baths, 13 medium-level areas were judged to be above average, and the remaining seven counties (Nógrád, Fejér, Komárom-Esztergom, Veszprém, Győr-Moson-Sopron, Tolna, Borsod-Abaúj-Zemplén) were judged to have below-average coverage (Figure 3).

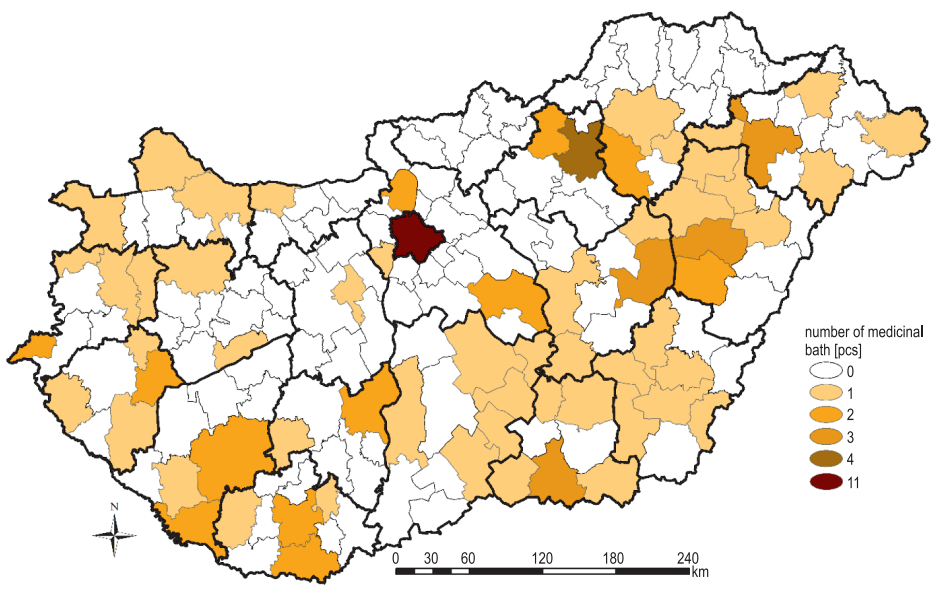

Fig. 3. Number of medicinal baths per county, broken down by district in Hungary in 2019
Source: own calculation and editing

The calculations of the polarization indicators showed the following results: extent ratio, $K = 11$; range of dispersion, $R = 10$; relative extent, $Q = 2.04$; dual indicator, $D = 3.25$. In terms of polarization, these numbers mean that the proportion of spas and the extent of dispersion show a significant difference, while the relative extent and the dual indicator show a low difference at the territorial medium-level. Among the concentration indicators, the result of the Gini index was $G = 0.15$. In the case of medicinal baths, we interpreted this result as meaning that the average difference in the number of medicinal baths per county is 0.15. Based on this, we established significant territorial equality in the case of medicinal baths in the Hungarian counties. By calculating the Hirschman–Herfindahl index, we obtained HI = 0.064, from which result we determined a relatively low concentration and a small degree of territorial inequality in the investigated counties. Examining regional inequalities further, we calculated the Hoover index. When examined with the number of musculosceletal diseases, we obtained: $h = 21.0$, and when examined with the number of medicinal water treatment utilization: $h = 21.5$. Based on this, we determined that in relation to the number of musculosceletal diseases, 21.5% of the medicinal baths and 22.0% of the from medicinal water treatment utilization would need to be regrouped by county in order to ensure that the territorial medium-level distribution is the same between the medicinal baths and the among the examined indicators. Based on the results obtained, we concluded that the country's medicinal bath facilities show low regional inequality and concentration.

Health geographical inequality of medicinal water treatment facilities with NEAK contracts

Based on natural healing factors, the foundation of Hungarian medical tourism is provided by the medicinal institutions with their wide range of services, some of which can be self-financed, while others can be used with social insurance support. To provide subsidized services, service providers must have a NEAK contract. According to the legal regulations, NEAK contracted service providers are classified as nationally, regionally or locally important. The location of these institutions is not uniform in Hungary (Figure 4).

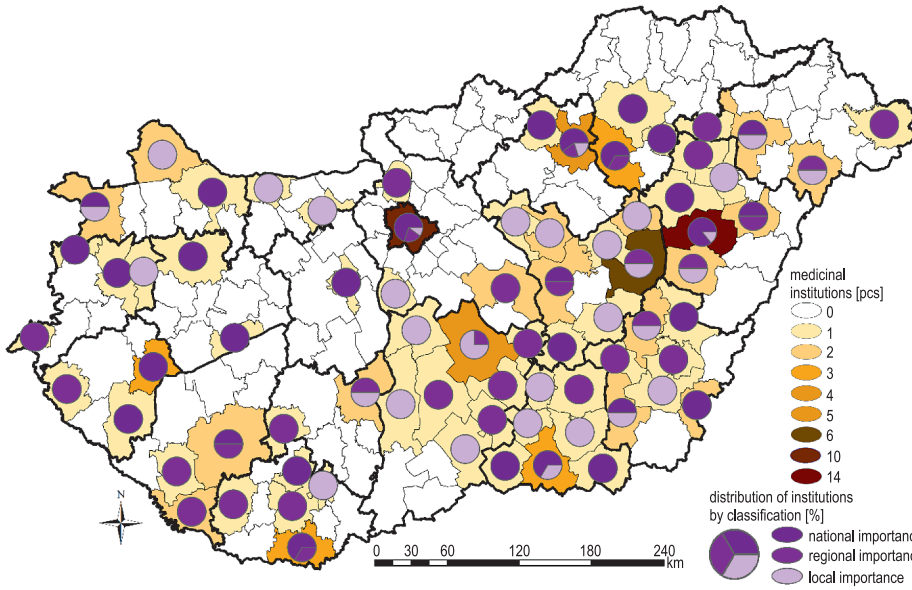

Fig. 4. The number of medicinal water treatment facilities with NEAK contracts per county, broken down by district in Hungary in 2019

Source: own calculation and editing

There are a total of 132 medicinal water treatment facilities in the country with NEAK contracts. Of these, 55 have national, 37 regional and 40 local significance classifications.

The number of institutions of national importance varies between zero and 14, with an average of 2.8 institutions in the examined counties. In the case of institutions of regional importance, the lowest number of institutions is also zero, and the highest is five, which results in an average of 1.9 institutions by county. The lowest number of institutions of local importance is zero, while the highest is ten, which means an average of two institutions per territorial medium-level. The territorial inequality of the medicinal water treatment facilities was further examined with the help of territorial indicators, the results of which are illustrated in Table 3.

Table 3
Territorial indicators of medicinal water treatment facilities with NEAK contracts

Territorial indicators	Institutions with NEAK contracts		
	national	regional	local
Extent ratio (*K*)	14	5	10
Range of dispersion (*R*)	13	4	9
Relative extent (*Q*)	4.64	2.105	4.5
Dual indicator (*D*) (Éltető–Frigyes index)	6.043	6.4	8.5
Gini index (*G*)	0.27	0.22	0.3
Hirschman–Herfindahl index (HI)	0.116	0.084	0.125
Hoover index (*h*) [%]	–	–	–
Musculosceletal disease number	37.5	33.5	57.5
Number of medicinal water treatment utilization	22.0	33.5	58.5

Source: own calculation and editing based on NEAK (2019a)

Based on the calculated results, we found that the number of institutions of national importance in eight medium-level territorial units in the country (Budapest and Baranya, Békés, Borsod-Abaúj-Zemplén, Csongrád, Hajdú-Bihar, Heves and Zala counties) is above average, while the remaining 12 medium-level area with below average supply. In the case of institutions of regional importance, Budapest and nine counties have an above-average number of institutions, while ten counties have a below-average number of institutions. For institutions of local importance, this ratio is the same as for national institutions, eight counties (Békés, Bács-Kiskun, Csongrád, Győr-Moson-Sopron, Hajdú-Bihar, Jász-Nagykun-Szolnok, Komárom-Esztergom and Szabolcs-Szatmár-Bereg counties) has an above-average number of institutions, while Budapest and 11 counties are below average.

Based on our calculations, we found that the medicinal water treatment facilities of national importance show relatively significant territorial inequality and concentration, those of regional importance show medium territorial inequality and relatively low concentration, while institutions of local importance show relatively significant territorial inequality and concentration at the regional average level in Hungary, just like the national institutions.

Discussion, conclusions

The natural healing factors, especially thermal and medicinal waters, are present as significant health tourism products in Central and Eastern European destinations (RUSZINKÓ et al. 2024), and Hungary is no exception. In Hungary, the significant amount and quality of natural healing factors form the basis of medical tourism, which is important from both an economic and social point of view. However, these healing factors are not evenly distributed at the territorial medium-level, and these differences have a significant influence on the planning of the development directions of spa towns participating in tourism. Therefore, our research goal was to reveal the territorial medium-level inequalities of the relevant indicators (Table 4).

Table 4

Territorial indicators of the analyzed factors

Territorial indicators		Natural healing factors		Medicinal institutions	Medicinal water treatment facilities with NEAK contracts		
		medicinal waters	other natural healing factors	medicinal bath	national importance	regional importance	local importance
Total [pcs]		270	12	98	55	37	40
Minimum [pcs]		2	0	0	0	0	0
Maximum [pcs]		29	2	11	14	5	10
Average [pcs]		13.5	0.6	4.9	2.8	1.9	2.0
Extent ratio [*K*]		14.5	2.0	11.0	14.0	5.0	10.0
Range of dispersion [*R*]		27.0	1.0	10.0	13.0	4.0	9.0
Relative extent [*Q*]		2.0	1.7	2.0	4.6	2.1	4.5
Dual indicator [*D*] [Éltető–Frigyes index]		2.5	N/A	3.3	6.0	6.4	8.5
Gini index [*G*]		0.15	0.31	0.15	0.27	0.22	0.30
Hirschman–Herfindahl index (HI)		0.065	0.125	0.065	0.117	0.084	0.125
Hoover index (*h*) [%]	Musculoskeletal disease number	26.5	57.0	21.0	37.5	35.0	57.5
	Number of medicinal water treatment utilization	18.0	49.0	21.5	22.0	33.5	58.5

Source: own calculation and editing based on ÁNTSZ (2019) and NEAK (2019a)

In the course of our research, we examined the regional differences in natural healing factors (medicinal waters, medicinal muds, medicinal caves, medicinal gases), as well as the medicinal institutions based on them, the medicinal baths and the NEAK-contracted medicinal water treatment facilities, using the most accepted and recommended regional indicators based on the literature (LENGYEL and KOTOSZ 2018).

Our results show that the medicinal waters in Hungary show relatively low territorial inequality and concentration, so the country's medicinal water supply is relatively uniform from a county point of view. Regarding other natural healing factors, we measured significant territorial inequality and concentration at territorial medium-level. The territorial examination of the medicinal baths by county, one of the pillars of the medicinal water treatment institution system based on natural healing factors, resulted in a low territorial inequality and concentration overall. In the case of medicinal water treatment facilities with NEAK contracts, we found that they show relatively significant territorial inequality and concentration at the regional average level.

From the results we obtained, we came to the conclusion that the regional differences in the natural healing factors created by natural influences also have a significant impact on the built environment, which also generates social and economic differences through medical tourism. The impact of territorial inequalities is reflected both in tourism performance from an economic perspective (GYURKÓ 2022), and from a social perspective in the accessibility of healthcare (BÍRÓ et al. 2021) and the quality of health status (LIBICKI and FEDOR 2020).

From the territorial differences of the natural healing factors and the medicinal water treatment facilities based on them, we concluded that the supply of medicinal waters and medicinal baths in Hungarian counties is adequate. In order to equalize the territorial distribution of other natural healing factors and institutions with NEAK contracts, intervention is necessary. It may be possible to realize these during future spa town and service developments, with special emphasis on the further examination of the capabilities and needs of extremely underserved areas and their purposeful, gap-filling development. We see the possibility of realizing this, on the one hand, in the discovery of additional natural healing factors, and, on the other hand, in service development. Regarding other natural healing factors, we recommend the exploration of muds and gases and, if possible, their medicinal certification. With regard to service development, we recommend increasing the number of institutions of national and local importance among the service providers contracted by NEAK, as well as service specialization for each type of institution.

With our obtained results, we would like to draw the attention of the decision-makers of the spa towns and the managers of the relevant institutions to the role and importance of territorial inequalities and their effects when planning the development of spa settlements involved in medical tourism.

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