

Spatial Disparities in Access and Use of Rehabilitation Services in Northern Greece: a GIS-based Study

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Abstract- Access to health care is considered to be of great importance for a person's right to health. This paper attempts to highlight the spatial disparities in access to and use of rehabilitation services across Imathia's area in Northern Greece. Our study is being focused on one defined geographical area, Imathia, in Macedonia in northern Greece. We defined a public general hospital as a local National Health System institution providing health services for the purpose of rehabilitation concerning patients with musculoskeletal disorders. The implementation of data included descriptive and concluding statistical processing. The spatial data was visualized in points and polygons. Most patients (60.5%) are from areas near to the hospital which means that there, is more concentration. The research focuses on spatial disparities and does not deal with their causes. As a consequence these findings raise important research questions for future investigation.

Index Terms- health care access, rehabilitation services, spatial accessibility, rural, geographical information system

I. INTRODUCTION

Musculoskeletal disorders (MSDs) are often the cause of dysfunction and disability, with a significant impact on economic and social resources (Carmona et al. 2001). Thousands of people worldwide suffer from dozens of MSDs, while some of them are presented as a result of injuries and degrade the level of health and the quality of peoples' lives. The management of musculoskeletal conditions is multidisciplinary and requires a wide range of therapeutic interventions, from simple guidance or recommendations to specialized surgical treatments. Despite the fact that in some regions excellent care is provided, some others are characterized by low availability of healthcare resources and barriers to health care access (UKDH, 2006).

Definition of access

According to the FRA (2008) "access to health care is a basic human right and one of the fundamental principles of European health systems, together with safety, quality, and equity". Inequitable access to rehabilitation services is a critical gap in health care in many regions. Even though health is a public good, health care, like many public services, is not equally accessible to all individuals (Powell, 2016). The distribution of people is uneven in the different geographical areas as well as their individual characteristics (demographic characteristics, income etc). All these affect their health status and their ability to overcome the obstacles to health care access (Aday and Andersen, 1974; Mc Lafferty, 2003).

According to Penchansky and Thomas (1981) access consists of five aspects: Adequate, Accessible, Affordable, Appropriate, and Available. Accessibility represents the geographic dimension of access and it was classified (Abdullah, 1992; Shah et al., 2016) into spatial component. Accessibility is spatial in nature as the location of healthcare units and health professionals plays a principal role in providing healthcare services (Shah et al., 2016).

Over the last years (Sasaki et al., 2010; Russell et al., 2013; McGrail and Humphreys, 2015; Ward et al., 2015; Dohyeong et al., 2016; Gao et al., 2016) researchers and health policy planners have been addressing the access' spatial feature. In any case, the conclusion is that the involvement of spatial planning in the development and application of health policies is nowadays an incontestable necessity.

The WHO (1998) defines accessibility as "a measure of the proportion of the population that reaches appropriate health services". The inadequacy of the position of a healthcare organization is often responsible for limiting the access of the population.

However, literature indicates that access to health services is not the same thing as the adequacy of health resources in a geographical area (Gulliford et al., 2000). Since the beginning of '70s (Elesh and Schollaert, 1972; Wennberg and Gittelsohn, 1973; Shannon and Dever, 1974) has been an interest in measuring spatial access to identify the social barriers that restrict the delivery of health care in both urban and rural areas of the USA. The issue of social inequality (in health and health determinants) is related to changes in health of the population. It is a fact that has been pointed out with the publication of the Black Report (Gray, 1982).

Nevertheless, even though the EU is aiming at reducing social inequalities in health, there is little evidence concerning the impact of intersectional grounds on limiting of the access to health care (FRA, 2012).

Access to health services is directly related to the issue of responding health systems to the needs of the population. In particular, the issue of spatial access to healthcare facilities is related to equality of health and health-related quality of life (Delamater et al., 2012). Geographical Information Systems (GIS) emphasize the spatial dimensions of access, giving information on available health facilities, the network of healthcare providers and underserved geographical areas (Mc Lafferty, 2003).

Use of GIS in health care

GIS are computer-based tools for mapping and examining the changes on earth. These are spatial data management systems and associated data properties. They are designed to gather, organize and classify data in order to specify the spatial properties of a phenomenon or object. Thus, it is easier to monitor not only the phenomena but also the space they are evolving. GIS are also used in public health, as a decision supporting tool to deal with health problems in different geographical areas (Kostantinidis, 2002).

GIS have a wide range of tools for the spatial structure of healthcare facilities and the monitoring of access to health services (Mc Lafferty, 2003; Fradelos et al., 2014). The use of GIS is useful for understanding health problems in diverse geographical areas (dos Anjos and Cabral, 2016). GIS technologies can contribute to the research and development of health policies through rational decision making, since they allow for the spatial linking of different types of entities such as physical objects, regional units, demographic information, geographical distribution of economic resources, population, and other relevant factors (Bellander et al., 2001; Mennecke and Lawrence, 2001; Tanser and le Sueur, 2002).

This paper attempts to highlight the spatial disparities in access to and use of rehabilitation services across Imathia's area. This study hypothesizes that geographic accessibility to rehabilitation services will vary considerably across the specific geographical area. The research focuses on spatial disparities, namely whether the access differs from municipality to municipality and the extent to which it differs. It focuses on identifying disparities and it does not address their causes.

II. METHODOLOGY

Our study focused on one defined geographical area, Imathia, in Macedonia in northern Greece (Figure 1).



Figure 1. Location of Imathia / Greece.

Source: Gogos et al., 2018.

We defined a public general hospital as a local National Health System institution providing health services for the purpose of rehabilitation for patients with MSDs. We studied retrospectively all patients' folders ($N = 1005$) in which rehabilitation services rendered during the two-year period 2014 - 2015.

Initially, the Administrative division of the country was decided to be followed for obvious reasons, which were related to the possibility of using existing data. With this approach, the adaptation and the data's analysis was facilitated, as well as their

cartographic depiction, as the homogenization of information was complete, while there were direct references to the same geographical level.

The regional unit Imathia is divided into three municipalities. These are Alexandreia, Naousa and Veroia respectively. The municipalities were reorganized, according to the table 1.

Table 1: Municipalities of Imathia

Municipal Units	Municipalities
Alexandreia	Alexandreia
Antigonides	
Meliki	
Platy	
Naousa	Naousa
Anthemia	
Eirinoupoli	
Veroia	Veroia
Apostolos Pavlos	
Vergina	
Dovras	
Makedonidos	

Source: Kallikratis reform law text, 2010

Data

The collected data can be divided into primary and secondary, as well as into geographical and descriptive. The descriptive, primary elements concerned data related to sex, age, place of residence, occupation, income and ailing physical area.

The secondary elements come from the procession of primary descriptive elements, so as their use to be compatible on the one hand during their statistical process and on the other hand their depiction to be understood.

The grouping of occupations happened according to the International Standard Classification of Occupations – 08 (ILO, 2010). The classification of the income happened in accordance with the HSA (2011).

The coding of diseases happened initially, analytically to each one of the sample, according to the full list of the International Statistical Classification of Diseases and Related Health Problems 10th Revision, (ICD-10) (WHO, 2011). The current project didn't have as its main purpose the clinical study of MSDs, so in retrospect a generalization as to the main category of the disease was chosen to take place, which guaranteed – in always permissible limits – the same diagnosis of the diseases and allowed the frequencies of each specific type to be calculated (Table 2). The implementation of this data included descriptive and concluding statistical processing.

Table 2: Classification of Diseases

code	Diseases of the musculoskeletal system
M16	Coxarthrosis [arthrosis of hip]
M17	Gonarthrosis [arthrosis of knee]
M22	Disorders of patella
M23	Internal derangement of knee
M24	Other specific joint derangements
S42	Fracture of shoulder and upper arm
S43	Dislocation, sprain and strain of joints and ligaments of shoulder girdle
M50	Cervical disc disorders
S52	Fracture of forearm
S53	Dislocation, sprain and strain of joints and ligaments of elbow
M54	Dorsalgia
S62	Fracture at wrist and hand level
S63	Dislocation, sprain and strain of joints and ligaments at wrist and hand level
S72	Fracture of femur
S82	Fracture of lower leg, including ankle
S83	Dislocation, sprain and strain of joints and ligaments of knee
S92	Fracture of foot, except ankle
S93	Dislocation, sprain and strain of joints and ligaments at ankle and foot level
M99	Biomechanical lesions

Source: ICD-10, 10th Revision

Transformation of spatial data was held in the system GGRS87 and based on creation of the Digital Elevation Models of Greece (DEM), specifically for the county of Imathia. The creation of the DEM was deemed necessary, as it helps in gaining a global view of the distinction of the information's levels of the space. The spatial data was visualized into points and polygons.

Subjects were integrated in a GIS. Geocoding was done with the declaration of residential place. For the subjects' geocoding, we used cartographic data provided by the GIS. The addresses geocoding techniques were provided by ArcMap 9.3.

III. RESULTS AND DISCUSSION

Regarding the gender of the statistical population it has been observed uneven distribution in view of the fact that the percentage of women (69.3%) was higher of the percentage of men (30.7%). In the map of figure 2, red dots represent women with MSDs and blue dots represent men with MSDs.

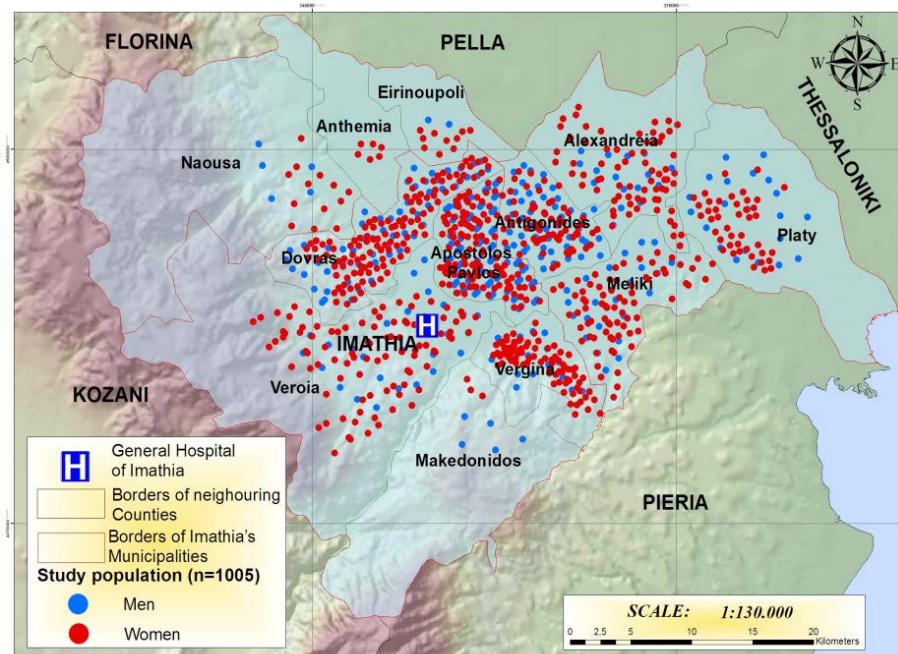


Figure 2. Location of the population sample and of MSDs sufferers.

Source: Gogos et al., 2018.

The map clearly shows areas with high and low rates of access. The maps in figure 3 and 4 are accessibility maps according to gender (men and women with MSDs who received healthcare services). This visually confirms spatial inequalities in accessibility, even among people in neighbouring locations.

As for the age, the statistics show that the sample mainly comprises a middle-aged or older while the smallest percentage belonged to those from 18 to 40 years of age (n=128).

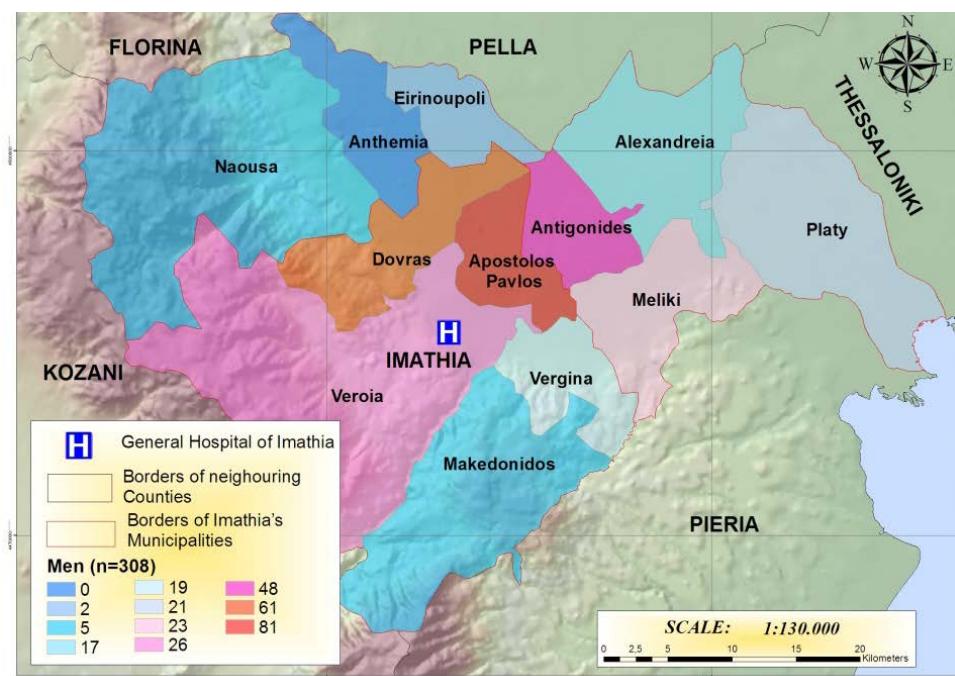


Figure 3. Accessibility map of men who received healthcare services.
 Source: Gogos et al., 2018.

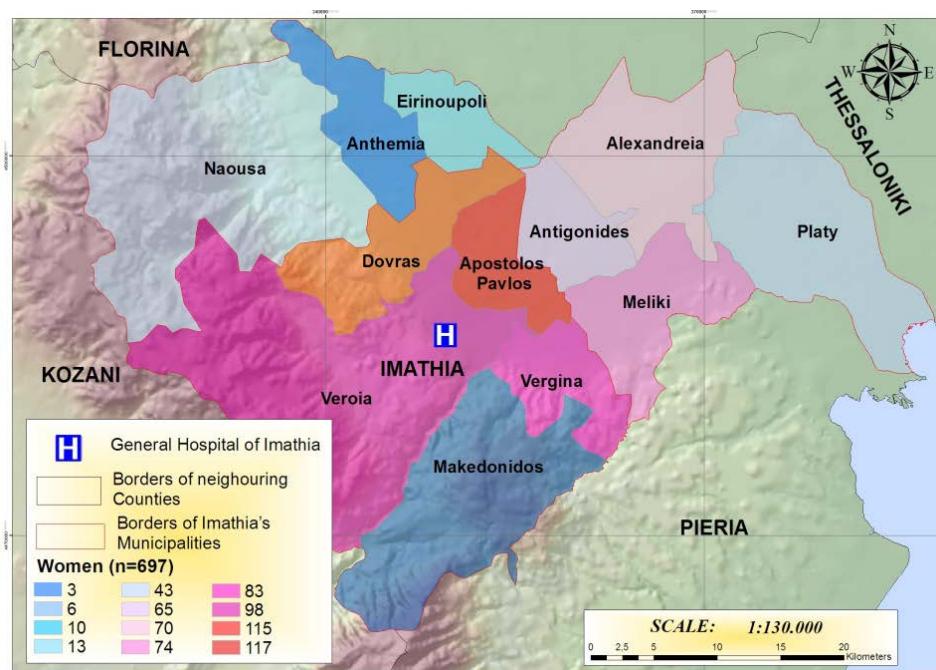


Figure 4. Accessibility map of women who received healthcare services.
 Source: Gogos et al., 2018.

Of the total sample of the population (N=1005), the majority involved farmers (48.7%), while the smallest proportion was unemployed (3.3%). As for the educational level of the population, the highest rate (68.5%) was elementary graduates and few (15%) are presented as university graduates. The declared income showed larger variations among the population of the study with the majority to present a monthly income 301 – 630 € while few (17.5%) declared a monthly income >801 € The features of this sample are imprinted on table 3.

Table 3: Features of sample (N=1005)

	Features	Frequency N	Percent %
Gender	men	308	30,7
	women	697	69,3
Age group	18-40	128	12.7
	41-60	350	34.8
	60+	527	52.4
Occupation	Skilled Agricultural	489	48.7
	Clerical Support Workers	176	17.5
	Services and Sales Workers	144	14.3
	Professionals	84	8.3
	Other	79	7.9
	Unemployed	33	3.3
	Illiterate	14	1.4
Educational level	elementary graduates	689	68.5
	Graduates of Secondary-High School	148	14.7
	University graduates	143	14.0
	MSc/PhD	11	1.0
Monthly income	<300	41	4.0
	301-630	493	49.0
	631-800	294	29.5
	801-1,100	101	10.0
	1,101-1,220	58	5.7
	1,221-1,500	18	1.8

Source: Gogos et al., 2018

A “body map” was used in order to identify nine (9) body areas suffering by musculoskeletal problems: neck, shoulders, elbows, hands, back, waist, hips, knees and ankles joints (Gogos and Papadopoulou, 2015). Based on the statistical analysis of the data, MSDs occurs mainly in women (N=697). The most frequently reported MSDs of study population were located in knee joint (22.78%) (Table 4).

Table 4: Allocation of MSDs per physical area

Physical area	N	Men (N)	%	Women (N)	%
Neck	148	39	26.35	109	73.64
Shoulder	180	66	36.66	114	63.33
Elbow	40	34	85	6	15
Wrists/Hands	118	85	72.03	33	27.96
Upper back	60	6	10	54	90
Low back	190	22	11.57	168	88.42
Hips	22	8	36.36	14	63.63
Knees	229	40	17.46	189	82.53
Ankles/Feet	18	8	44.44	10	55.55
total	1,005	308		697	

Source: Gogos et al., 2018

In map of figure 5, the entire population of the study that received health services during the aforementioned period from the General Hospital that is based on the capital of the county is showed. The areas close to the hospital from where most of the patients come from, like for example the municipal units of Veria's Municipality, where a greater assembly is observed (60.5%), are obvious. In contrast, the smaller rate of patients who visited the hospital (3.6%) comes from Naousa's municipality.

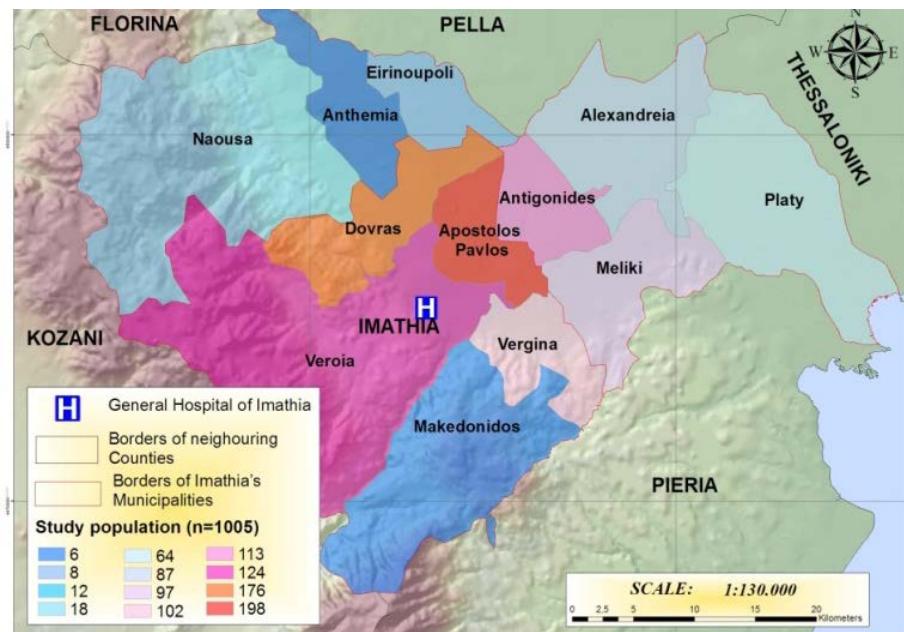


Figure 5. Study population that received health services.

Source: Gogos et al., 2018.

Moreover there are substantial variations in geographical accessibility to health's rehabilitation services not only among but also within Imathia's areas. There was a fluctuation in access among the municipal units of Veria's municipality with the most limited access to be cartographically imprinted in the Municipal Unit of Makedonidos (0.8%). The study on the health access of a random population sample of people residing in Imathia has shown spatial inequalities in accessibility to health's rehabilitation services.

Municipal units of Veria's municipality show higher rates of accessibility to the specific health services in connection with the municipal sections of Naousa's Municipality.

Veria is the capital city and the commercial center of Imathia region. The secondary level general hospital of Imathia is situated in the center of Veria's city. Obviously, the proximity of Veria's city and municipal units of Veria's municipality in general to the base of the general hospital has a positive impact on the access of the population to the services it offers. On the other hand, Naousa is a rural area with population density below 150 inhabitants/ Km² (ENRD, 2011). It has an average altitude 330m and average distance 20km from the hospital. As a consequence the rural dwellers are forced to travel farther to contact health facilities than their urban center counterparts. Moreover rural residents without private vehicle depend on a poor public transportation. Consequently their accessibility to health facilities is minimized even more.

In urban areas people with health problems more easily seek medical attention. There is evidence that people living far away from healthcare facilities and those living in rural areas are less likely to see a health professional than those living closer or in urban areas (Lankila et al., 2016).

At the same time, the cartography of the spatial distribution of the access within the Municipality of Veria presents fluctuations with imprinted the limited access of the population from the municipal unit of Makedonidos (0.8 %), in the southern part of the county with middle altitude 500m and middle distance 40km from the hospital.

In recent years, the region's road network has improved significantly but still cannot be considered satisfactory. The transport isolation of the specific disadvantaged area has not yet been lifted. In comparison with the population of the urban center, those residing in the particular underprivileged, rural area encounter dual problems of the poor organizational structures, on one hand the low quality of roads and on the other the lack of public transportation options. In addition, the large number of rural roads creates a maximum traffic safety problem. The required low speed of the vehicles increases the travel time to healthcare services.

Municipal unit of Makedonidos is a rural and remote area, which leads to isolation as that transportation network is less available. Remoteness creates difficulties for rural people resulting in obstruction to the use of secondary healthcare services. This condition is a challenge in terms of health care access for its remote communities and it should give cause for concern.

People tend to use health services close to their home and work (Mizen et al., 2015; Aggarwal et al., 2017) because the distance is often a barrier to health care use, reducing health facilities' utilization. Distance-related inequity in health service use is potentially a major public health issue, as it may increase actual health differences. In the Behavioral Model of Health Services Use, distance is regarded as an enabling characteristic which makes health service resources available to the individual (Andersen and Newman, 2005).

This has, however, never been examined in Greece. The dimension of accessibility could be more reliable in the case of Greece due to the mountainous and insular relief of the country. Maybe the dimension of accessibility has to be re-examined by introducing time as a crucial ingredient, given that distance is a relative factor.

The results of the study show that areas in Imathia are outside of a 30 minute travel time from hospital and thus have limited geographic accessibility. For some types of health organizations, distance or travel time for the patients is a significant burden as they have no easy access to them - evidence for experiencing low opportunities and great difficulties to use them (Comber et al., 2011).

Spatial accessibility as the distance or travel time to the healthcare facilities is one of the most important dimensions of quality care. Spatial accessibility reflects to the equilibrium between the characteristics and the expectations of both the providers and clients, as the distance or travel time for the patients is of utmost importance for appropriate health care (Levesque et al., 2013).

In general, the current study established a high prevalence of musculoskeletal conditions in farmers. People consider the work on the farm as a healthy and idyllic occupation (Walker-Bone and Palmer, 2002). Nevertheless, farming has a wide range of threats to health with a significant impact on farmer's health status and health related quality of life (Xiao et al., 2013). Farmers and farm workers are at risk of the prevalence of musculoskeletal disease due to their work, such as lift and carry heavy loads, are exposed to whole-body vibration from powerful motor vehicle, walk on slippery and uneven walkways (Osborne et al., 2010). The prevalence of musculoskeletal problem was observed higher in women and chronic pain is often observed in females (Nidhi and Vandana, 2001; Myers et al, 2003; Arendt-Nielsen et al., 2004).

Limitations

Some specific limitations to this study need to be pointed out. It is well known that researchers need high-quality data, which can contribute to more accurate results. However, in reality, the collected data is never perfect. Under this scope, we are considering this earlier step of our research as a "kick off research", which is looking forward to a larger volume (and better quality) of data.

Additionally, other factors that affect accessibility to healthcare services, such as the perceived quality of services provided (dos Anjos and Cabral, 2016) are not addressed in this paper. The presented results come from an exploratory spatial analysis of the accessibility level in the population sample and they cannot be generalized to the whole population of specific geographical area because the sample is not necessarily representative.

Nonetheless, we try to highlight the importance of studying the spatial aspect of the phenomenon, so that accessibility to healthcare services can be linked to socio-economic factors that may influence their unequal spatial distribution in the future.

IV. CONCLUSIONS

The results of this study show substantial variations in geographical accessibility to health's rehabilitation services both within and among Imathia's areas. Access to health care varies among the regions of Imathia, because access is influenced by both the uneven distribution of population and the spatial structure of health facilities.

This involves, on the one hand, an evidence-based planning of rural settings and on the other hand the establishment of new cooperation models and their instrumental implementation in political decision making and administrative acting within the context of transformation processes.

The adoption of GIS by researchers and health policy planners depends on the use of spatial data in health services. Therefore, we need to realise the behavior of health service users and how spatial entities influence their relationship with health services.

The cartography of morbidity and spatial deviations in the provision of health care can be seen as a modern viewpoint for the handling of the information that links the area with human health. One parameter that was taken into serious consideration for the construction of the maps was that the receivers of these cartographic diagrams wouldn't be necessarily aware of the principles of the thematic cartography. Therefore, the possible creation of difficulty for the comprehension of the produced effect, which, anyway, is a necessary requirement in order for a thematic map to perform its communicative role, is examined (Katsios, 2005).

Although MSDs are prevalent in communities across the globe and their impact is pervasive (Woolf and Pfleger, 2003) the effect of space on their prevalence and the spatial distribution of populations at high risk for these diseases had not been previously studied. The present study attempted to highlight the spatial inequalities in accessibility to rehabilitation services because of MSDs. These findings raise important research questions for future investigation. One of these is the effect of environmental or occupational factors in the prevalence of MSDs. Moreover, future research could aim to investigate the influence of socio-demographic parameters on accessibility to health rehabilitation services in urban areas.

Ethical approval

For the collection of data and the conduct of the survey, the required permission was obtained from the Hellenic Data Protection Authority (reference number: 1595) and the hospital's Scientific Council.

Competing interests: None declared.

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