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THE ROLE OF CARTOGRAPHY IN MEDICAL RESEARCH

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ABSTRACT

The article presents a new direction of earth and human sciences - medical mapping. The modern concept of medical mapping and its benefits for population health are discussed. The contemporary Geographic Information System (GIS) made generating of medical maps relatively easy. In this study, multiple medical maps were compiled (only two are presented here) based on databases for two neurological diseases - hereditary peripheral neuropathies and epilepsy in GIS environments. The number of patients included in the database is updated regularly, which requires a technology that makes it possible to easily compile maps that represent constantly changing data. For this reason GIS technology is one of the most promising tool in epidemiological researches.

Key words: medical maps, neurological diseases

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INTRODUCTION

Population health is one of the most sensitive topics, both for individual countries and regions, and for the world in general. Improving a person's health and increasing life expectancy leads to a longer and more productive working life, which affects postively the economic development of each country.

Various institutions at national, regional and global level collect data on the health status of the population and its trends of change. These data allow different indicators to be calculated and to provide additional information on demographic processes, morbidity, risk factors, disability, etc.

All this led to the emergence of the link between cartography and medicine since mid 18th century. The first and most famous thematic map is Snow's

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map in the field of medical mapping. Later, medical mapping became a new section of cartography. An example of a contemporary interactive map representing a popular disease these days is available online (CSSE at Johns Hopkins University, 2020) and is dynamically updated in the same time as the database is updated. Nowadays, special requirements are imposed on databases. The INSPIRE Spatial Data Specification document defines the exact requirements for reference and thematic data that is included in a thematic database on human health and safety (European Commission, 2007). All thematic maps in the digital environment are compiled according to these requirments.

The purpose of this study is to present the implementation of GIS in population health by developing medico-geographical maps in epidemiological studies for two neurological diseases – hereditary peripheral neuropathies (Fig.1) and epilepsy (Fig.2). Hereditary peripheral neuropathies are a group of neurological diseases affecting the peripheral nerves due to various genetic mutations. The disease is characterized by progressive muscle weakness and sensory deficiency. Epilepsy is a disorder of the central nervous system and manifests with recurrent epileptic seizures, caused by pathological neuronal excitability.

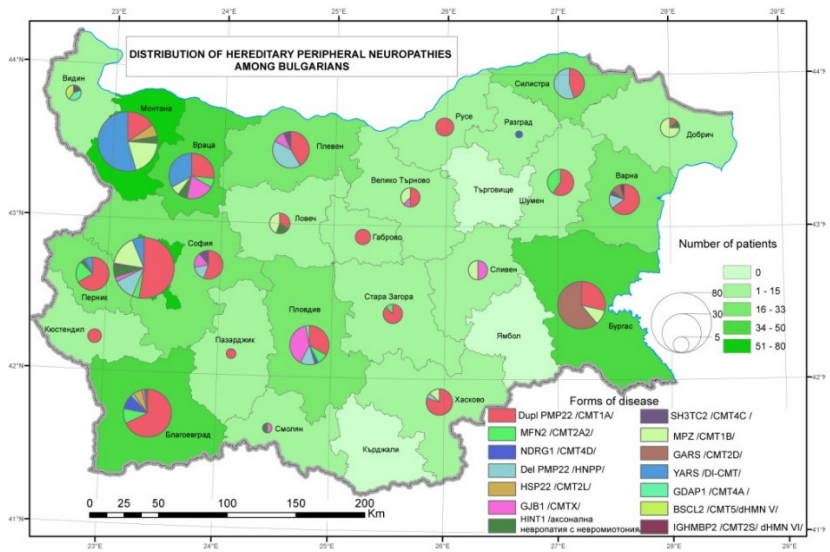

Fig.2.Distribution of genetic forms of hereditary peripheral neuropathies among the Bulgarian ethnic community

METHODS OF STUDY

Methods of gathering information. The information on which the maps are based is based on patients registries from the Expert Centre for Hereditary Neurological and Metabolic Disorders in University Hospital ”Alexandrovska”, and on registries of Regional Health Insuarance Fund in Blagoevgrad. They contain demographic, genetic and clinical data.

Methods for data analysis and cartographic methods. A number of ArcGIS statistical tools were used for statistical data processing. Geographic Information Systems (GIS), the most popular and modern tool for collecting and managing huge and dynamically changing volumes of information, was used to create a Geographic database (GDB). It is structured in an ArcGIS environment.

RESULTS

Analysis of the collected data on patients with hereditary peripheral neuropathies, identify 16 different genetic forms, as well as ethnic differences in terms of the most common neuropathies among the three ethnic (Bulgarians, Roma, Turks) groups in Bulgaria (Kastreva, 2018). For this reason four different maps were compiled, one for each ethnic group and one map for the entire tested population. The distribution of the different genetic forms varies in the different administrative districts of the country, which is easily detetctable on the medico-geographic maps. The number of affected in each region is represented by color saturation, and the number of individuals with certain genetic forms is presented by sectors of pie charts. The size of the circle diagrams also corresponds to the total number of affected individuals.

The second map presents the distribution of epilepsy in Blagoevgrad district for a certain time period. In the map is implemented not only the number of cases in the different municipalities of the district, but also a distribution by gender. Here, again color saturation, as well as the size of the circle diagram, are used to present the number of individuals with epilepsy in each region and the sectors of the pie chart give information on the number of the affected males and females.

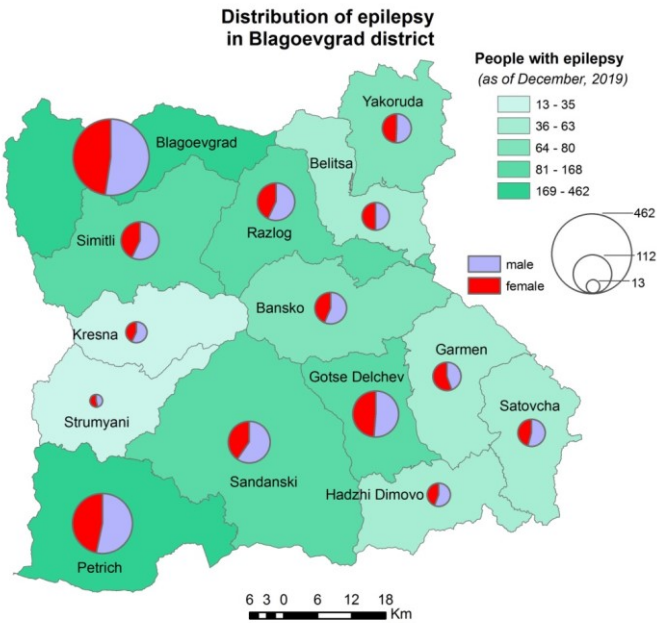

Fig. 2 Epilepsy prevalence based on the data from Regional Health Insurance Fund

CONCLUSIONS

Medico-geographical maps give interpretation and visualization of collected data, which allows the information to be analyzed from a different point of view and to be presented to non-medical audiance for better understaning. Maps also can give answers to many questions regarding population health and can be used to detect easily more severily affected areas from a certain disease and to distribute health care adeuately.

REFERENCES

1. Kastreva, K., 2018. Development of a clinical database for phenotyping of hereditary neurological diseases. Doctoral dissertation. Medical University Sofia. Available at: <https://ras.nacid.bg/api/reg/FilesStorage?key=0325f27d-79cd-4d00-bf43-672541bbd512&mimeType=application/pdf&fileName=Reviewed_disertacia-04-2018.pdf&dbId=1> and

https://ras.nacid.bg/api/reg/FilesStorage?key=6d3883d6-0178-4d8b-ad66-bf11251f18a0&mimeType=application/pdf&fileName=avtoreferat_final.pdf&dbId=1 [accessed 10.04.2020]

2. Center for Systems Science and Engineering (CSSE) at Johns Hopkins University. 2020. Coronavirus COVID-19 (2019-nCoV) at <https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html?fbclid=IwAR1XpnFwKiWdp6BJhbRrkwXywi9AA5g7Xgu0FSGZ58NqLB1kRDq9qZX6d1Y#/bda7594740fd40299423467b48e9ecf6 >[Accessed 16 April 2020]

3. European Commission. 2007. Data Specifications | INSPIRE at < https://inspire.ec.europa.eu/data-specifications/2892> articles/i/english-embroidery-introduction/> [Accessed 16 April 2020]