GEOGRAPHIC INFORMATION SYSTEM (GIS) IN OCCUPATIONAL MEDICINE. WORKING METHODOLOGY

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Abstract: It started from the premise that, through the development of methods and algorithms for the automatic and semiautomatic selection of data, conclusive connections can be obtained regarding the determination of areolas of presence for: diagnostic and treatment units in the field of Occupational Medicine and work-related diseases in Arad County, but also at national level. The creation of geographic information system with data regarding Occupational Medicine in Arad County considers the county-level information system analysis, existing software versions and how to input data and calculate the indicators based on provided data format. Creating the project database is the most critical and time consuming part within the whole project. The accuracy of data included in the project determinates the accuracy of results. GIS model for Occupational Medicine in Arad County considers the present existing territorization, which is different from the physical and geographical conditions, hydrology, climate. The final results we expect from the GIS project are: occupational risk factors, standard rate of occupational diseases incidence and those related to profession, on localities, in 2010, the number of Occupational Physicians at 1000 habitants in 2010, the number of occupational medicine offices at 1000 habitants in 2010.

Rezumat: S-a pornit de la premiza că, prin dezvoltarea de metode şi algoritmi pentru alegerea automată şi semiautomată a datelor se pot obţine relaţii concludente cu privire la determinarea areolelor de prezenţă pentru: unităţile de diagnostic şi tratament în domeniul medicinii muncii şi a maladiilor profesionale şi legate de profesie în judeţul Arad, dar şi pe plan naţional. Crearea sistemului informatic geografic cu date privind Medicina Muncii din judeţul Arad, ia în considerare analiza sistemului informaţional la nivel judeţean, variantele de software existent şi modalităţile de introducere a datelor şi calculare a indicatorilor, bazat pe formatul datelor furnizate. Crearea bazei de date a proiectului este partea cea mai critică şi consumatoare de timp din cadrul proiectului. Acurateţea datelor incluse în proiect determină acurateţea rezultatelor. Modelul GIS pentru Medicina Muncii pentru judeţul Arad, ia în considerare teritorizarea existentă, în prezent şi care se remarcă prin următoarele caracteristici: Condiţii fizico-geografice; Hidrologie; Climă. Rezultatele finale aşteptate ale proiectului SIG: factorii de risc profesional, rata standardizată a incidenţei bolilor profesionale şi a celor legate de profesie, pe localităţi, în anul 2010, numărul de medici de Medicina Muncii la 1000 de locuitori în anul 2010, număr cabinete de Medicina Muncii la 1000 de locuitori în anul 2010.

Geographic Information Systems (GIS), represent a special case of general information systems. The information is derived from data interpretation, which is a symbolic representation of the characteristics.

The values of the information depend on various elements, including the temporality (the time), the context in which they are applied, the cost of collection, storage, conditioning and presentation. From the total cost of achieving a geographic information system, data collection represents around 70%.

Geographic Information System (GIS) is the only system integrated in collecting, storing and conditioning the information about various natural man-made and geographic objects in interaction with other information systems data. This information consists of territorial geographic information systems, unified by regional and state importance, integrated under a single system of identification and registration of the objects of evidence in Romania.

I. WORKING HYPOTHESIS

It started from the premise that, through the development of methods and algorithms for automatic and semiautomatic selection of data, conclusive connections can be obtained regarding the determination of areolas of presence for: diagnostic and treatment units in the filed of Occupational Medicine field and work-related diseases in Arad County, but also at national level.

II. MATERIAL AND METHOD

II.1. Identifying the problem:

The research on the use of geographic information systems worldwide and in Romania shows a decreased use of GIS for activities concerning Occupational Medicine in Romania. The possible causes of the problem may be related to the components of GIS that were not developed in Occupational Medicine system in Romania:

1. staff: there is not any staff trained to use the GIS concepts and methods and who can perform data

acquisition, manipulation and analysis, presentation of data;
2. hardware and software;
3. spatial data;
4. law regarding occupational work does not stimulate, and it does not prohibits the use of GIS for setting priorities, evaluating the health actions, presenting the data;
5. there is no institution within the Healthcare System with attributions expressly to promote the use of GIS;
6. there are no GIS projects, which can prove viability and which can be the basis of legislation applicable in the filed of Occupational Medicine.

II.2. Alternative solutions:

In order to increase the use of geographic information system in Occupational Medicine in Romania, I consider that we need to include staff training activities, information to policy makers and legislative actions.

The creation of geographic information system with data regarding the Occupational Medicine in Arad County, considers county-level information system analysis, existing software versions and how to input data and calculate the indicators based on the provided data format.

II.3. Action – GIS designing
II.3.1. Identification of objectives:

The creation of a geographic information system with data and indicators for Occupational Medicine in Arad County is the main objective. Currently there are not performed any data analyses and presentations of occupational health based on GIS.

II.3.2. Creating the project database:

- Designing the database includes the identification of necessary spatial data based on analysis intentions, determination of the attributed to the included entities, delimitation of study geographic are and the selection of the coordinating system that will be used;
- Electronic data processing involves digitizing or converting the data from other systems and formats into a usable format, as well as data verification and correction of errors;
- Database management which involves verifying the coordinating system and the intersection of the adjacent layers.

Creating the project database is the most critical and time consuming part within the whole project. The accuracy of data included in the project determinates the accuracy of results.

II.4. Delimitation of the area and the population studied

II.4.1. Physical and geographical conditions:

GIS model for Occupational Medicine in Arad County considers the present existing territorization, which is different from:

- Physical and geographical conditions;
- Hydrology;
- Climate.

Physical and geographical conditions:

Located on the west side of the country, Arad county lies from the hurt of Apuseni Mountains till the wide and plain field, formed by Mureş and White Criş, being crossed by important national and international routes of communication.

The geographical position of the region is extremely advantageous, being at the crossing of important European roads, where the cultures and civilizations of Occident interfere with those of the Orient.

Arad County occupies an area of 7754 square kilometres, equivalent to 3.65% of the Romanian territory, being the sixth county of Romania regarding the surface.

From the administrative point of view, the territory is bordered by Bihor County on North, Hunedoara and Alba in East, Timiş in the South part and the border with Hungary in the west. Landscape variety: hill-plain-mountain alternation: Mureş Valley, White Criş, mountain area of Moneasa, Hălmagiu, Zărand, the landscape from Codru Moma mountains (Bats Cave, The Cave with Water from the Mill), lakes (Ghioroc, Taut), vineyards areas (Podgoria Aradului, Târnova, Ineu).

Hydrology:

In terms of hydrology, Arad is distinguished by the presence of three major rivers that cross the county from east to west: Mureş, which drains the southern part of the county over a distance of 250 Km, registering on this covered area, a bump of about 78 m and a drainage basin of about 4800 km, White and Black Criş, in the north of the county, bordering Bihor county. It is noteworthy that all these rivers and borders have a transboundary character. Arad has numerous lakes, many in Mureş Meadow and anthropogenic lakes that remind about the water accumulation of the Tăuţ

Climate:

The natural landscape of Arad County is characterized by the existence of a temperate continental climate with oceanic influences. The average of temperatures oscillates between 8°C on mountains and 11°C at plain. Winters are mild and summers are hot. The average annual precipitation recorded values were between 600-1000 mm / m. Winds are conditioned by relief distribution, movements of air masses with guidance from south to east.
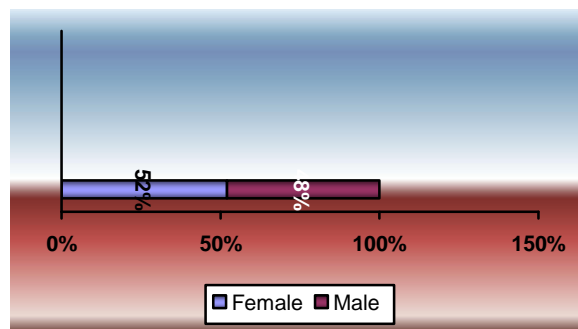
II 5. Selection of data and Occupational Medicine indicators at county level.

II.5.1. Economical data:

Arad County population has 454.073 habitants.
- Density is about 59 habitants/km².
- Population repartition by gender: 48% male and 52% female.

Figure no. 1. Repartition of population according to gender
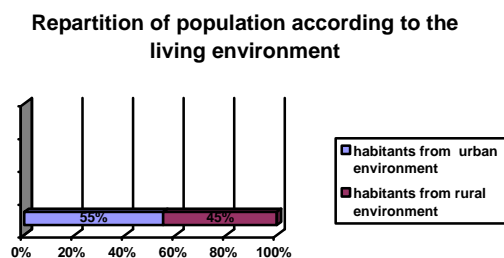

Repartition of population according to the living environment:
- 55% habitants from the urban environment;
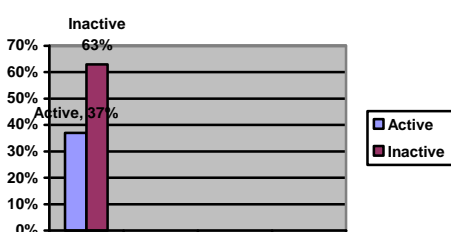- 45% habitants from the rural environment.

Figure nr. 2. Repartition of population according to the living environment

Repartition of population according to the living environment

- from which 167.024 represent the active population

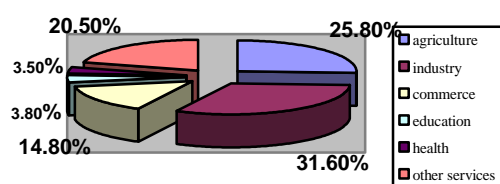**Figure no. 3. Repartition of population according to activity status**

Repartition of population according to activity sector:

1. agriculture 25,8%;
2. industry 31,6%;
3. commerce 14,8 %;
4. education 3,8%;
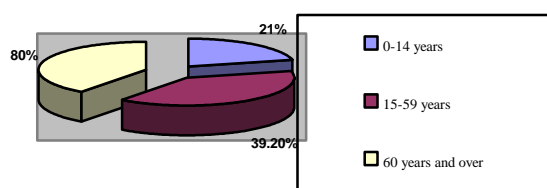5. health 3,5%;
6. other services 20,5%.

Figure no. 4. Repartition of population according to the activity sector

Repartition of population according to age groups:
- 0-14 years old 21%;
- 15-59 years old 39,2%;
- 60 years old and over 39,8 %.

Figure no. 5. Repartition of population of the county of Arad according to age groups

The main industrial branches and the most representative companies from Arad:

7. Truks - Astra Trinty and Carriages - Astra Carriages;
8. Furniture and accessories for forniture: Imar, MGA, Cotta International, Feroneria;
9. Confections and textiles: Sabina & Co, Moda, TEBA, Manitoba;
10. Food industry: Petra, Indagrara, Arvinex, Arbema - Brau Union Romania;
11. Motor industry components: Leoni Wiring, Takata-Petri Romania;
12. Electronic components: Eastern Technology;
13. Counter: Contor Zenner, Victoria;
14. Footwear: West Shoes Industry;
- Paramedical equipment: Sanevit.
- *II.5.2. Morbidity dates: occupational and work-related*

Occupational diseases are diseases that occur as a result of the exercise of a trade or profession, caused by physical, chemical, biological or psychosocial factors related to the job characteristics, as well as the overuse of various appliances and systems during the work process, regardless of the type of employment contract existing between the employer and employee.

Occupational diseases are also considered those produced under the above-mentioned working conditions mentioned, diseases suffered by pupils, students, and apprentices during internship.

The specific aspects of occupational morbidity in Romania, on social economical fields in 2009 are shown in table no. 1.

Table no. 1. Aspects of occupational morbidity Romania, in 2010

Branch	No. of new cases	No. of workers[1]	Incidence at 100.000 workers
Total	**1065**	**4.774.000**	**22,31**
Agriculture, forestry and fishing	17	110.000	15,45
Extractive Industry	115	75.000	**153,33**
Processing Industry	655	1.118.000	58,59
Production and supplying electric and thermos energy, gas, hot water and air conditioner	30	78.000	38,46
Water distribution, sanitation, waste management, decontamination activities	0	100.000	0,00
Constructions	25	404.000	6,19
Commerce actions, reparation of motor vehicles and motorcycles	7	816.000	0,86
Transport and storage	52	282.000	18,44
Hotels an restaurants	2	118.000	1,69
Information and communication	3	114.000	2,63
Financial and insurance agencies	1	107.000	0,93
Real estate transactions	0	29.000	0,00
Professional, scientific and technical activities	4	134.000	2,99

Administrative professional and support activities	4	192.000	2,08
Public administration and defence, social insurance from the public system	5	225.000	2,22
Education	7	394.000	1,78
Health care and social assistance	62	378.000	16,40
Cultural and entertainment activities	21	56.000	37,50
Other activities from the national economy	5	44.000	11,36

[1]*Average number of employees in 2009, on national economical activities as for Statistic Romanian Year Book- time series, 2009.*
Source – National Institute of Public Health Bucharest, 2009

A maximum incidence has been found in: extractive industry, followed by processing industry, production and supplying electric and thermal energy.

The situation of new cases regarding occupational diseases, declared in Romania between 1981 and 2010, is shown in table no. 2, respectively, between 1989 and 2010, in table no. 1.

Table no. 2. Evolution of new cases regarding professional diseases in Romania, between 1981 and 2010

Year	Nr. of new cases	Year	Nr. of new cases
1981	2568	1996	2015
1982	2464	1997	2060
1983	2231	1998	1828
1984	1683	1999	1802
1985	1498	2000	1576
1986	1426	2001	2238
1987	1384	2002	2508
1988	1294	2003	1376
1989	1423	2004	990
1990	1470	2005	1002
1991	1414	2006	910
1992	1506	2007	1353
1993	1562	2008	1286
1994	1875	2009	1366
1995	2031	**2010**	**1065**

Source – National Institute of Public Health Bucharest, 2009

Figure no. 6. Evolution of new cases regarding professional diseases in Romania, declared between 1989 and 2010
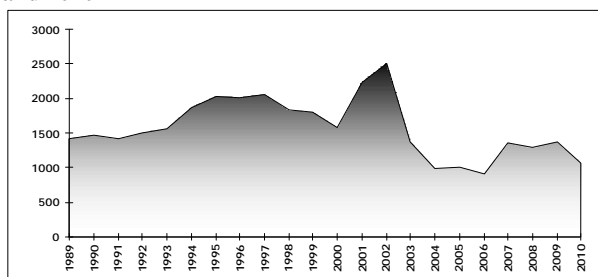
Source – National Institute of Public Health Bucharest, 2010

Is ascertained that the maximum number of declared professional diseases in Romania was registered between: 1981 and 1983, 2001 and 2002 and 1995 and 1997, respectively over 2000 cases.

II.5.3. Occupational health services connected with Pension House

I suggested the analysis of services from occupational medicine, existing in Arad County. The dates were extracted from the current situations and included in table format with related columns, suitable for each territorial administrative unit with the number of suppliers on categories and financing, again on categories.

II.5.3.1. Definition and analysis of dates category:

Statistic dates are a part of current report from Arad County Statistic Board, and also from National Institute of Public Health Bucharest, National Centre of Risks Supervision from community environment, Department Occupational Health and Work Environment.

Stable population at 1st of July represents the population consists of people from a certain locality, with residence and place to live, in that locality at that moment. According to database from the last census there are calculating the external clearance migration, the movement clearance migration with the change of residence, and also the movement migration of where someone lives, phenomenon registered between census and that moment.

Work represents a full-conscious activity, leading to the development of goods and works for the material and spiritual needs of people. It can be done individually or in a team and always has, directly or indirectly, a social character.

Profession requires acquisition of theoretical and practical knowledge to enable development work in a particular field.

Occupational disease is a condition whose etiology is a harmful agent n the workplace linked to the exercise of a profession. In this case, agents working environment have chronic actions that prolonged exercise at low concentration. For an agent from the working environment to be recognized as an etiologic factor of occupational disease, there must be evidence of a relationship between substance absorbed in the body and its adverse effects produced by this.

II.5.3.2. Organization of data and indicators in electronic format

For elaborating the maps which will be presented further on, it was used the public cartographic support scanned. The scale used is 1:100000. There were elaborated the map of territorial-administrative units for the whole Arad County, localities centers, roads, railways, hydrographic network through digitalization of topographic maps.

III. FINAL RESULTS WAITED FROM SIG PROJECT

I- Economical, social and health data regarding the Arad county (the main economic and social units, their profile, occupational risk factors and occupational health units)

II- Graphic aspects of professional morbidity, new cases of occupational diseases, the development of the new cases of occupational diseases during 2001-2011:

- Territorial distribution of new cases of silicosis in Arad county in 2011
- The evolution of new cases of siderosis in Arad county in 2011
- The evolution of new cases of hearing loss in Arad county in 2011
- The evolution of new cases of dermatosis in Arad county in 2011

III- Graphic aspects of professional morbidity, new cases of chronic diseases, the evolution of new work-related diseases during 2001-2011

- The evolution of new cases of respiratory diseases in Arad county in 2011

- The evolution of new cases of digestive diseases in Arad county in 2011
- The evolution of new cases of musculoskeletal and joint disorders in Arad county in 2011
- IV- The local distribution of economic entities with a number of employees where cases of occupational diseases have been discovered
- V- The local distribution of the population (County Department of Statistics)
- VI- The distribution of population density per square kilometres in Arad county

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