ORGANIZING OCCUPATIONAL MEDICINE ASSISTANCE, DURING THE HEALTH REFORM IN ROMANIA, THROUGH THE IMPLEMENTATION OF GIS

ASIST. UNIV. DR. LADINIA ARDEU[1], CONF. UNIV. DR. NINI GHEORGHE[1], DR. LIDIA MANUELA PLUJAR[2]

[1] "Vasile Goldis West " University of Arad, Faculty of Medicine, Pharmacy and Dental Medicine
[2] Arad County Emergency Hospital, Clinical Department of Pneumology

ABSTRACT. Keeping the state of health and fighting disease are part of the oldest concerns of man and therefore in ancient times and until a few decades ago, almost all scientific medical achievements were used exclusively for healing the sick, the consecrated term which defined the character of this type of medicine being the "curative medicine,,. Since then medicine has advanced and started to focus on the preventive aspect of health activities, the priorities of health activities becoming today prophylactic.
KEYWORDS: morbidity, geographical, economic data, risk factors, occupational diseases, maps, administrative units, Geographic Information System SIGEip.

INTRODUCTION

Keeping a state of health and fighting disease were and are part of the oldest concerns of man and we can note that even from ancient times until a few decades ago almost all scientific medical achievements were used exclusively for healing the sick, the term dedicated to defining the character of this type of medicine is the term "curative medicine ,,. Since medicine has advanced and started to focus on the preventive aspect of medical activities the main objectives of today's focus tend to be based on preventive medical activities.

Knowing population and the community's state of health starts from defining individual health and is important because:

• Allows way to establish the priority issues and health needs,

• Lead to developing interventions for individuals, the community, and the factors that influence health,

• "must be an important indicator in the planning and allocation of resources both territorial and between various types of health services"

"Health is a priority for further development, not an appendage of the advance of society."

This paper addresses several theoretical and practical aspects in developing methods and algorithms for automatic and semi-automatic data collection. To solve these problems, research has been focused in the following areas:

-"developing methods and algorithms for automatic vectorization";

-"developing methods for testing the accuracy of geographical databases."

Also this paper brings together studies on occupational health concerns in the field by applying GIS. An thural example of spatial geographical applications is using epidemiological methods for determining certain diseases, namely occupational disease or work-related diseases. We consider it necessary to strengthen SIG at european levels of health standards in relation to the environmental, occupational and behavioral risk factors and a to generate a harmonization of the health monitoring system.

AIM

Applying a GIS to present occupational health data and indicators in the county of Arad and a presentation of experience gained from the increased use of GIS in management of occupational medicine in Romania.

Objectives:
• Acquiring of skills to develop a GIS project for occupational medicine using programs like AreGIS and SIGEP;
• Analysis of occupational health information system at county level;
• Establish a set of data and indicators to be included in the GIS;
• Create GIS for Arad county;
• Presentating the results;
• Extrapolation of gained experience through the creation of a occupational medicine program, a training curriculum through continuum medical education of occupational medicine professionals and creating proposals for legislative changes.

Occupational medicine history take a long road from man in the cave to one voyaging through space "as a noble and thrilling adventure in the history of human civilization and culture". "Prehistoric man used flint as a tool, so it can be assumed that he suffered from silicosis." Research conducted on two prehistoric bodies suggested the possibility of pneumoconiosis.

Approximately 2500 years BC, on papyrus, we find recorded existence of lumbago affecting the workers who work in a pyramid.

Hippocrates noted, in 450 BC, that asthma is more common in certain occupations in metallurgy.

The famous treaty on occupational diseases „ „De Morbis Artificum Diatriba", (which then improved with Fourcroy's experiences 1777, almost two centuries) served as a reference for many illnesses and was introduced as a subject in medical schools .

Writings on occupational diseases were also found among the Romans and Ancient Greece. We can say that through all time occupational medicine has always held an important place in the concerns of scientists, doctors and researchers.

First occupational physicians appear at the beginning of the industrial era, the late nineteenth and early twentieth century, and in France the onset of occupational medicine is related to forensics served by toxicologists who played the role of tribunal experts at the time, while in other European countries, occupational doctors were experts in hygiene.

The activity of health related focus in labor and actually promoting human health at work, aims, in the general sense at an understanding and elimination of all these negative phenomena generated by work, disruptions of extended production of labor capacity, reducition of the volume of overall social work available and thus its results.

"Occupational medicine is a medical discipline that studies the physiological and pathological relationship of the human body and work, in order to recommend measures to enable the undertaking of professional activities under physiological and hygienic conditions maintaining work ability at a high level and to prevent occupational diseases and work-related diseases. "

In this context, we consider that the application of Geographic Information Systems in the field of occupational medicine allows, at European standards, a more advanced understanding of the relationship between risk factors and also harmonizing occupational health monitoring system.

"Occupational Medicine has close links with almost all clinical specialties and technical disciplines (physics, chemistry, engineering) of which an important place is occupied by" health and safety ".

Health and Safety is a constituent part of the creation, organization and development of production processes and is called upon to prevent, through measures and specific means, malfunctions in the production system, which may have consequences on the human factor, so that it runs under maximum security and efficiency.

The foundations for labor protection comprises a multidisciplinary based system, founded on laws, technical socio-economic, organizational, measures and means, hygienic and occupational health, preservation of health and safety and the preservation of the working capacity of man (Law 319/2006 on safety and health at work).

In occupational health, aside for social requirements which lead / influence the evolution of specialization, some basic elements that define it are of course related to working conditions, risk factors, occupational diseases and work-related disease. Especially, regarding the latter point, it is necessary to have consistent data, scientifically verified by others that underlie our actions.

Working conditions, existence of occupational hazards such as: physical, chemical, biological, organizational (working time, labor relations) are likely to cause detriment to health.

Professional pathology includes occupational diseases but also work-related diseases.

DEFINING GIS AND SPATIAL DATA CHARACTERIZATION

"Geographic Information Systems, GIS for short, are seen as a special case of general systems. The information is derived from data interpretation are symbolic representations of characteristics."

"A geographic information system is a set of subsystems intended for the collection, processing, integration, storage, retrieval, presentation and provision of data and geographic information".

As subsystems we may consider:
- equipment (computers have the main role);
- programs;
- knowledge and databases;
- methods and projection staff;
- execution and operation.

Characteristics of geographic information systems (GIS)
- data processing taking into account its spatial detection, in a land size through it's coordinates;
- singular treatment, of a singular non-redundant database and it's graphics, mapping, topology, and tabular components;
- it includes a collection of active operators on a spatial database to provide geographically objective information. A GIS model is a multitude of data that must represent and interconnect both graphical data (maps) and tabular data (attributes);
- they are used to mimic real situations and events.

The Geographic Information System (GIS) is the only integrated system for collecting, storing and processing information about natural geographic and anthropogenic objects in their interactions with data from other basic information systems, which consist of departmental and territorial unified GIS of national and regional importance, integrated under a single system of identification and coding of items of territorial representation in Romania.

Classification of GIS software from a public health perspective in regard of the cost of these applications and their spread:

A. Comercial Products:

1. Arc GIS: produced by ESRI (Environmental System Research Institute, Inc.) in Redlands, California, USA, is a comprehensive use, management and analysis of geographic information that integrates several softwares for building and managing a geographical system completely.

2. Map Info Professional is support for making, managing and analyzing spatial data.

3. Map Maker Pro: Developed by Map Maker Ltd. in the UK, is a more effective instrument for drawing maps as opposed to spatial data analysis.

B. Free products (freeware):

1. Epi Map: It is made available for free to anyone by the Center for Disease Control in Atlanta (USA). The spatial data analysis component of the Epi Info product is compatible on spatial data format with Arc Info.

2. SIG Epi: This product is available on the website of the Pan American Health Organization. It is characterized by the use of shapefiles as basic geographic data files and detailed instructions for handling the existence of the product in English.

3. The Helth Mapper: It is intended for use by health managers at national and regional level. The product is approved by WHO and creates maps necessary for public health.

Creating GIS data and occupational health indicators in the county of Arad is the main objective.

The paper identified issues within the county information system that can be included in a GIS.

Population on July 1st*;*

• *Area;*

• *Population density;*

• *Economic entities situation (Statistical Yearbook);*

• *Data on new cases of occupational diseases (2001-2011);*

• *New cases of chronic illness, possibly related to occupation (2001-2011), the overall incidence;*

• *Family doctors;*

• *Occupational physicians;*

• *The distribution of risk factors and illnesses by towns and villages (2001-2011);*

• *Fields of activity places: economy, agriculture, trade, mining.*

WORLDWIDE, EUROPEAN AND NATIONAL GEOGRAPHIC INFORMATION SYSTEMS

The National Geographic Information System is intended to reflect the information in the form of a spatial model of the region, making it possible to model the situation and spatial analysis to obtain basic objectiv information about the specific potential natural resources of the country for better quality and efficient administrative decision making in the interest of the development of society.

Geography tools can provide answers to public health issues related to the prevention and control of transmissible and non-transmissible diseases, prevention and control of occupational and work-related diseases.

Results for the implementation of SIG for the benefit of national public health has led to the creation of administrative units level data maps: municipalities, towns and villages, containing the following themes:

- population density;
- infant mortality;
- marriage and divorce;
- the number of housing settlements;
- coverage of primary care (family medicine);
- identify areas where there is no primary health care services.

Application of GIS data in public health and health service access in a friendly way of working and viewing activity results in a format understandable for the general public.

Sharing the obtained maps, including via the Internet, allows empowers the beneficiaries of public health service and facilitates decision making based on existing territorial distribution and pathology.

Encompassing the geographical information system in within the health legislation in Romania provides opportunities to improve public health as related to the implementation of the National Strategy for Public Health Law no. 95/2006, with subsequent amendments and legislation National Health Programs.

The actual implementation of GIS in public health in Romania also requires issuing legislation (Minister of Health decree), staff training on the use of geographic information systems, and the existance of an organizational structure (national or regional) to establish procedures and standards in the field, and to corroborate the data collected at the county level.

The general objectives of the Geographic Information System of Health aim to:

a. Expanding the coverage of the vaccine and to ensure that vaccination is thus one of the most effective means to prevent primary diseases;

b. Develop and introduce standards in the field of early detection through screening of chronic diseases with a major impact on public health;

c. Fostering the preventive component so as to be incorporated into individual clinical practice, especially ambulatory;

d. Consolidation of a system to European standards of health in relation to environmental and behavioral risk factors, harmonizing health monitoring system.

SPECIFIC ASPECTS OF OCCUPATIONAL DISEASES IN ROMANIA

"Occupational diseases are diseases that occur as a result of the exercise of a trade or profession, caused by harmful job specific factors of physical, chemical, biological or psychosocial nature, and overstress of different components and systems of the

body in the process of work, regradless of the type of employment contract existing between the employer and the employee ".

Analyzing the specific aspects of occupational diseases in Romania, socio-economically, in 2009, as shown in the Statistical Yearbook of Romania and the National Institute of Public Health records, there is a peak incidence in the mining industry, followed by manufacturing and production and the supply of electricity and thermoenergy.
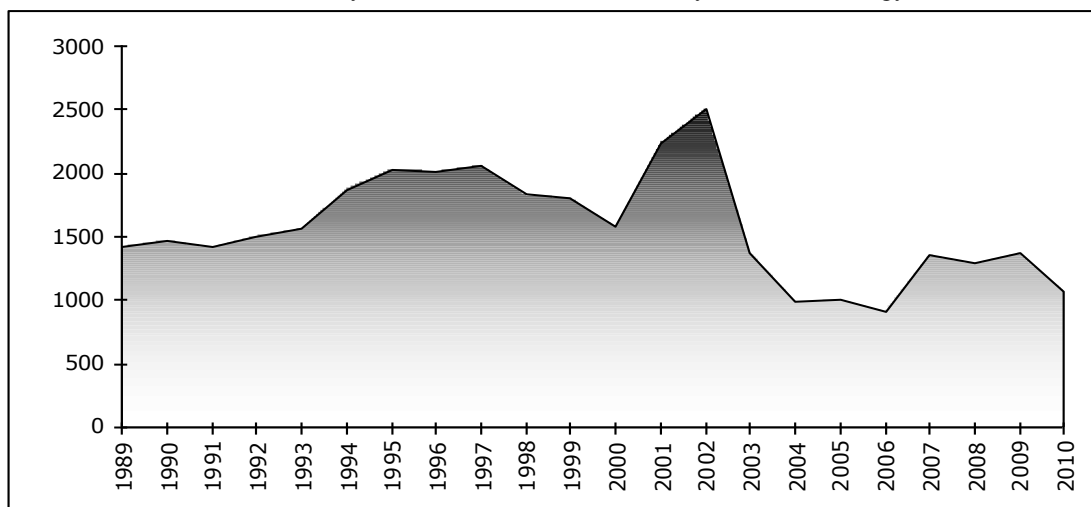

Fig. 1 The evolution of new cases of occupational diseases in Romania, declared over the period 1989-2010 Source: National Institute of Public Health Bucharest, Department of occupational health and working environment, www.insp.gov.ro/

It seems that the highest value of new cases of occupational diseases reported in Romania, were recorded between: 1981-1983, 1995-1997 and 2001-2002, more than 2000 cases.

The number of occupational doctors in Romania has increased in the period between 2004-2010, it has been increasing gradually, in 2010 the number of these specialists has doubled since 2004.

We also note that the most common occupational diseases in 2010, refer to illnesses related to overexhaustion (especially musculoskeletal), silicosis, hearing loss and deafness. In 2000, most occupational diseases recorded were: silicosis, occupational diseases caused by noise and poisoning (especially lead poisoning). Asthma, infectious and parasitic diseases, in that specific timeframe showed oscillating values.

Analysis of numerical distribution of cases on production branches shows that in Romania, in 2010, most cases of disease were reported in manufacturing industry of motor vehicles, trailers and semitrailers (204 cases - 19.15% of all illness declared), in manufacture of machinery and equipment (181 cases - 17.00%) and metallurgy (71 cases - 6.67%).

Occupational diseases caused by musculoskeletal overuse were at a level as high as in 2009, first place in the morbidity structure, in line with global trends. Silicosis shows a slight increase (in the total number of cases) and is ranked second in the morbidity structure. A fall in cases of professional hearing loss and deafness are ranked third, while an increase in professional chronic bronchitis made the illness rank fourth. Source: Counties illnesses situation reported in 2010.

In 2010, occupational diseases caused by silicogenic powders were ranked second in terms of number of illness cases: 28.54% (304 cases of silicosis, out of 1065), a high level taking into account disease severity.

Occupational poisoning ranked seventh in the structure causes new cases of disease with decreasing trend over the past four years in the total number of new cases reported. In 2010 there were reported 16 new cases of occupational poisoning, representing a rate of 1.50% of all occupational diseases in Romania.

The total number of cases of occupational bronchial asthma disease within 2010 showed a decrease compared to previous years.

The study of occupational diseases in Romania highlights a number of general and also specific aspects, namely:

- Fair recognition of occupational risks and supervision at work is the basic work of occupational health physicians, imposing access to occupational health services for all workers in Romania, regardless of work for a realistic assesment and containment of these problems.

- The occupational physician is the employer specialist concerning issues related to Health Risk Management, a member of the committee on health and safety at work, having a duty to report and communicate occupational risks to aid decision making by those responsible, and ensure early medical technical and organizational preventive measures..

THE WORKING HYPOTHESIS, STUDY MATERIALS, WORKING METHODOLOGY

The starting point was the premise that specific GIS operations on spatial data make these systems not only effective tools for visualizing multiple data as maps but also tools for analyzing information regarding areas.

The study material covers aspects in the information system of Arad county that can be included in a geographic information system, as follows:

I. Demographic data
   a. Resident population by towns and villages as of 1st of July
   b. Population density
II. Economic data
   a. Economic units according to their branch of industry
   b. Number of workers per economic units, industries and areas
   c. Risk factors per economic units and areas
III. Morbidity data
   a. professional morbidity
   b. Occupational morbidity
      morbidity of diseases possibly profession related
   c. Incidence of chronic diseases
IV. Medical specialty.
   a. Family physicians

The implementation of a geographic information system for the submission of data and occupational health indicators in the county of Arad.

The objectives set in the projection using GIS are the following:

• Acquiring skills to develop a project using GIS in the field of occupational health;

• Analysis of occupational health information system at county level;

• Establising a set of data and indicators for inclusion in geographic information system (indicators of incidence, frequency indicators);

• Creation of a project using Geographic Information System for Arad county;

• A presentation of all the results.

DATABASE ORGANIZING
Geographic data:

The map of administrative-territorial units, Arad county, was carried out at a scale of 1: 100,000 using cartographic scanning, georeferencing, the digitization of the maps being made available by the Faculty of Geography at the Babes-Bolyai University in Cluj Napoca (prof .Dr. Ionel Haidu, Univ. Dr. Ionut Augustin Craciun)

Descriptive data:

The database used in this paper consists of three tables: Table with general data about the administrative-territorial units, occupational diseases table and a table for diseases possibly profession related.

The first table contains general characteristics for each of the administrative-territorial units namely: number of inhabitants, area, population density, number of family doctors, number of occupational physicians, number of agricultural units, number of units in the industry, number of mining units, number of trade units, this information is provided by the Department of Statistics (number of inhabitants, area, population density), the Public Health Department Arad (number of occupational physicians), Chamber of Commerce, Industry and Agriculture Arad (website www.ccia -arad.ro).

Denumire	nr locuitori	suprafata	nr medici de familie	nr medici de medicina muncii	densitate	nr# Unit agricole	nr unit ind	ind miniera	nr unit comert
Arad	146353	23406	110	35	7,01	13	66	0	42
Beliu	3011	9272	1	0	0,33	0	0	0	0
Cermei	2667	12187	2	0	0,218839747271683	0	0	0	0
Chisineu-Cris	7576	11729	3	0	0,645920368317845	0	3	0	0
Curtici	6849	7265	7	0	0,94273916035788	1	3	0	0
Dorobanti	1561	2818	0	0	0,553938963804116	0	1	0	0
Fintinele	2950	4184	2	0	0,705066921606119	0	1	0	0
Felnac	2838	4960	1	0	0,572177419354839	0	0	0	0
Frumuseni	2484	4315	2	0	0,57566628041715	0	0	0	0
Gurahont	3940	16852	3	0	0,23380014241633	0	0	0	0
Halmagiu	2801	8403	3	0	0,333333333333333	0	0	2	0
Iratosu	2277	4633	2	0	0,491474206777466	0	0	0	0
Lipova	9539	13400	9	0	0,711855671641791	3	1	0	2
Macea	5449	7264	2	0	0,750137665198238	0	0	0	0
Moneasa	884	6824	1	0	0,129542790152403	0	0	0	0
Nadlac	7178	13315	5	0	0,539091250469395	0	0	0	0
Pecica	11842	23717	7	0	0,499304296496184	0	0	0	0
Sagu	3671	10266	2	0	0,357588155075005	1	0	0	0
Sanpetru-german	2596	4560	2	0	0,569298245614035	0	0	0	0

Table no. 1. Table of general characteristics for each attribute for administrative territorial unit

The second table contains data on new cases of occupational diseases for each administrative territorial unit of Arad county, during 2001-2011. The data is organized on the basis of the risk factors that cause illnesses and diseases reported as follows: noise related risk factor that causes illnesses such as deafness and occupational hearing loss, powders of SiO2 risk factor that causes silicosis, silico-siderosis, mineral oil risk factor and other chemicals that cause skin diseases and welding gas risk factors and iron oxides which cause siderosis.

Denumire	nr locuitori	suprafata	nr muncitori	zgomot	z_2001	z_2002	z_2004	z_2009	total_zgomot	incidenta_zgomot	nr muncitori1	pulberi_SIO2	s_2001	s_2002	s_2003	s_2004	s_2005	s_2006	s_2007	s_2008
Arad	146353	23406	544	1	5	3	3	0	11	1,68195718654434	1492	1	23	10	6	4	3	1	6	4
Beliu	3011	9272	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cermei	2667	12187	0	0	0	0	0	0	0	30	1	0	0	0	1	0	0	0	0	
Chisineu-Cris	7576	11729	0	0	0	0	0	0	0	532	1	0	0	0	0	0	0	0	0	
Curtici	6849	7265	0	0	0	0	0	0	0	60	1	0	0	0	0	0	0	0	0	
Dorobanti	1561	2818	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Fintinele	2950	4184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Felnac	2838	4960	0	0	0	0	0	0	0	644	1	1	0	0	0	0	0	1	0	
Frumuseni	2484	4315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gurahont	3940	16852	0	0	0	0	0	0	0	30	1	1	0	0	0	0	0	1	0	
Halmagiu	2801	8403	0	0	0	0	0	0	0	120	1	0	1	1	1	0	4	2	2	
Iratosu	2277	4633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Lipova	9539	13400	50	1	1	0	0	0	1	2	0	0	0	0	0	0	0	0	0	
Macea	5449	7264	0	0	0	0	0	0	0	550	1	0	1	0	0	0	0	0	0	
Moneasa	884	6824	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
Nadlac	7178	13315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pecica	11842	23717	0	0	0	0	0	0	0	550	1	1	0	0	0	0	0	1	0	
Sagu	3671	10266	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sampetru-german	2596	4560	0	0	0	0	0	0	0	30	1	0	0	0	0	1	0	0	0	

Fig. 2 Table attribute number of new cases of occupational diseases

The third table contains data on new cases of chronic diseases possibly profession related, which are grouped into: chronic respiratory diseases and osteo-musculo-articular diseases. Among the chronic respiratory diseases encountered we can include chronic bronchitis, chronic rhinitis hypertrophic laringobronquitis chronic asthma, irritation of the upper respiratory tract, pneumoconiosis, pulmonary fibrosis, pulmonary tuberculosis, COPD, and of the osteo-musculo-articular disorders we can mention: discopathy, spondylosis, gonarthroses, this data being provided by the Public Health Department Arad.

In this table we calculated the following indicator "total incidence index" according to this formula:

$$It = \frac{num\breve{a}r\ cazuri\ de\ \hat{i}mboln\breve{a}viri\ nou\ depistate}{num\breve{a}r\ de\ locuitori} \times 1000$$

This indicator is useful in comparative study of similar assigned units with similar population and as tool of comparing the incidence being an important method in monitoring the efficiency of healthcare.

Denumire	nr locuitori	suprafata	nr# muncitori	bronsita	rata_bronsita	nr# muncitori1	rinita	rata_rinita
Arad	146353	23406	1138	27	0,184485456396521	2632	2	1,36655893627052E-02
Beliu	3011	9272	0	0	0	0	0	0
Cermei	2667	12187	0	0	0	0	0	0
Chisineu-Cris	7576	11729	0	0	0	0	0	0
Curtici	6849	7265	250	1	0,14600671630895	0	0	0
Dorobanti	1561	2818	0	0	0	0	0	0
Fintinele	2950	4184	0	0	0	0	0	0
Felnac	2838	4960	0	0	0	0	0	0
Frumuseni	2484	4315	60	1	0,402576489533011	0	0	0
Gurahont	3940	16852	0	0	0	0	0	0
Halmagiu	2801	8403	0	0	0	0	0	0
Iratosu	2277	4633	0	0	0	0	0	0
Lipova	9539	13400	0	0	0	0	0	0
Macea	5449	7264	0	0	0	0	0	0
Moneasa	884	6824	0	0	0	0	0	0
Nadlac	7178	13315	0	0	0	0	0	0
Pecica	11842	23717	0	0	0	0	0	0
Sagu	3671	10266	0	0	0	0	0	0
Sampetru-german	2596	4560	0	0	0	0	0	0

Fig. 3 Table attribute data on new cases of chronic diseases possibly related to profession

The following are the necessary steps for loading, processing and presentation of data sets using the geographical information system SIGEpi

5.2. Opening SIGEpi: Start / Programs / SIGEP
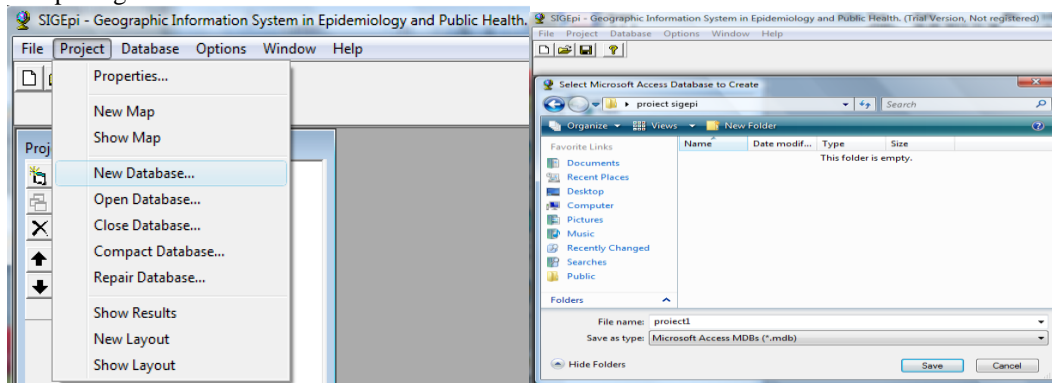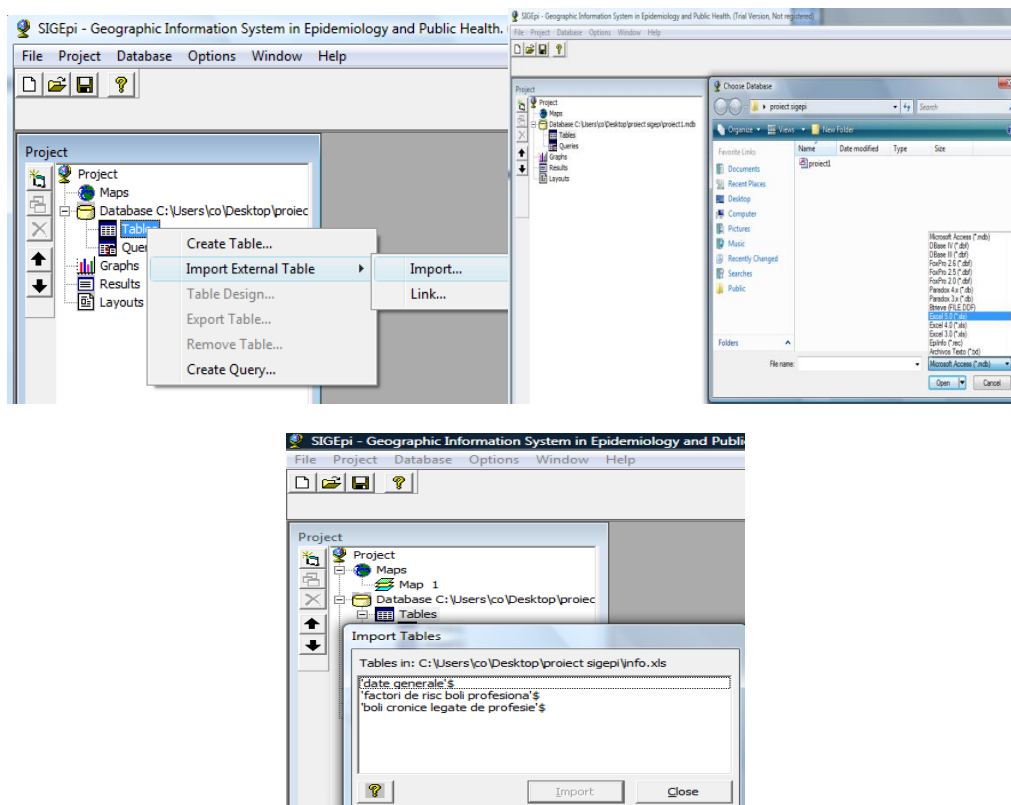5.2.1. Opening database

Fig. 4 Database opening

Fig nr. 5 Table import from the excel format into the SIGEpi
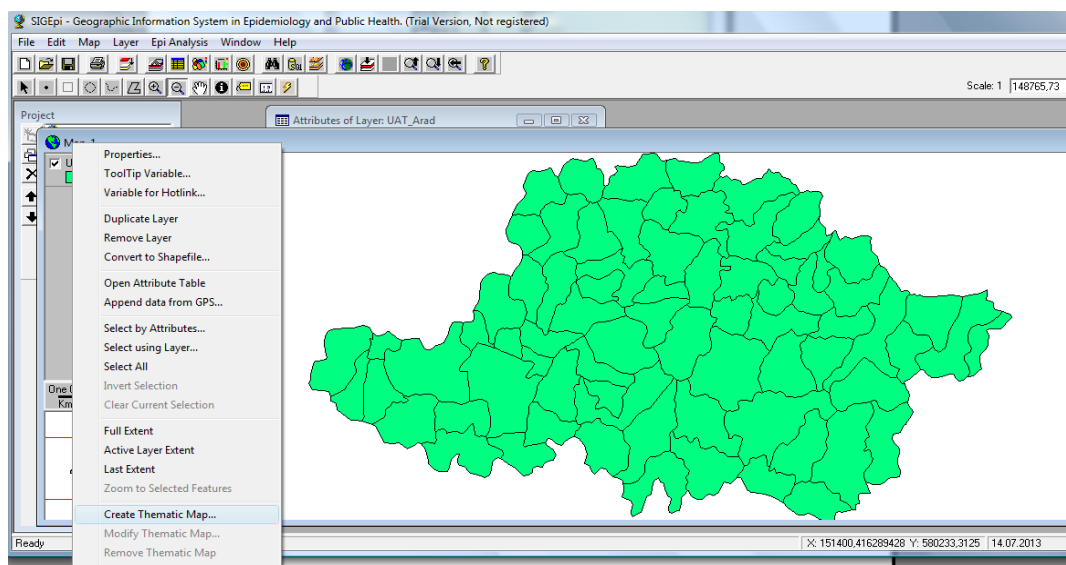

Fig. 6 Creation of themed maps

USE OF GEOGRAPHIC INFORMATION SYSTEM FOR MONITORING SIGEpi DISEASES AND THE POSSIBLE PROFESSION CONNECTED DISEASES IN ARAD COUNTY

Arad county is comprised of 75 settlements with population over 300 and under 150 000 inhabitants, the most populated areas are underneath marked in red, in the western part of the county, with over 5,000 inhabitants.
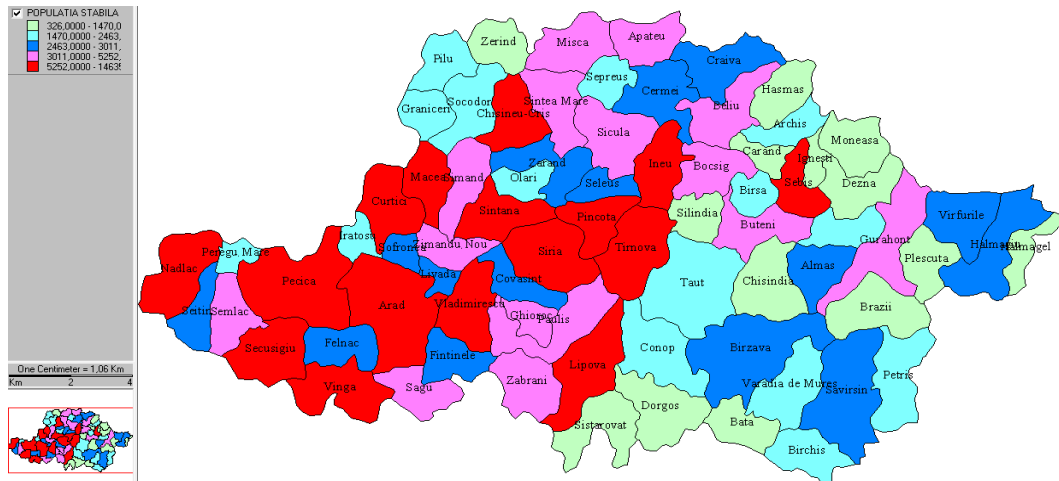
Fig. 7 Resident population (2012) in Arad county

The areas of these settlements are between 200o to 26,000 hectares, totaling 775 409 hectares, the largest settlements hovering mostly in the south central, west, those being with more than 10,000 hectares.
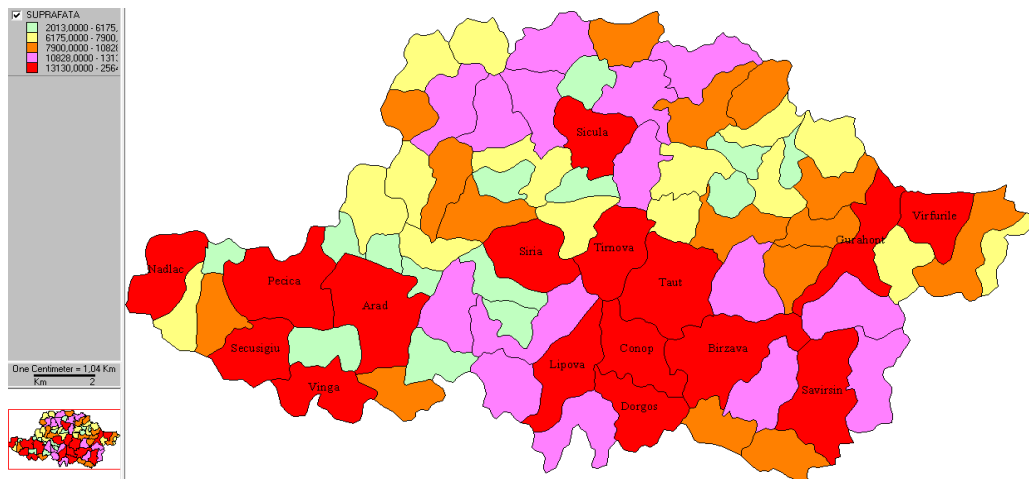
Fig. 8 Arad county Areas

Population density is highest in the western part of the county, the most populous settlements being: Arad, Vladimirescu, Livada, Şofronea, Curtici, Macea, Santana, Fantanele, Lipova, Pâncota, Chişineu-Criş, Ineu Sebiş.
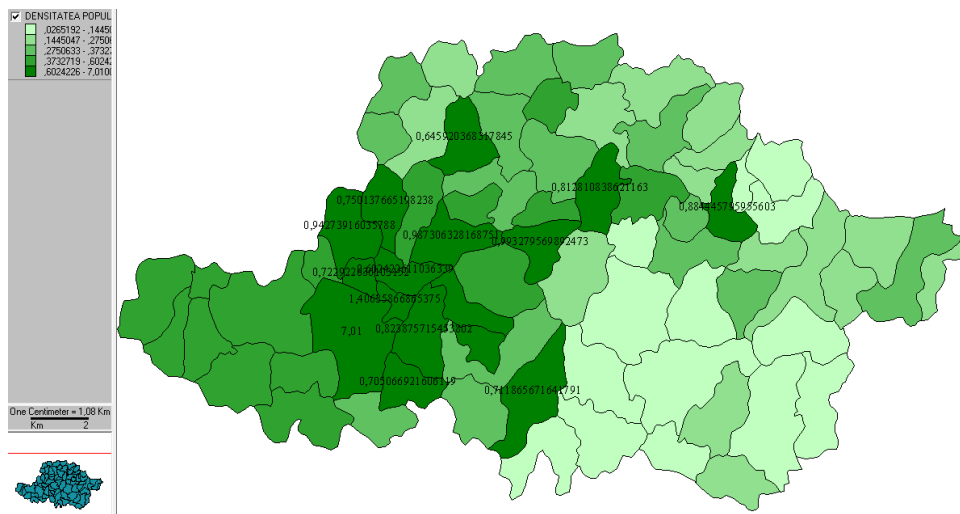
Fig. 9 Population density (2011) Arad County

45% of the settlements in the county have one single GP, 25% have two family physicians, the largest number of family doctors are, as expecte, found in the city of Arad, 110.
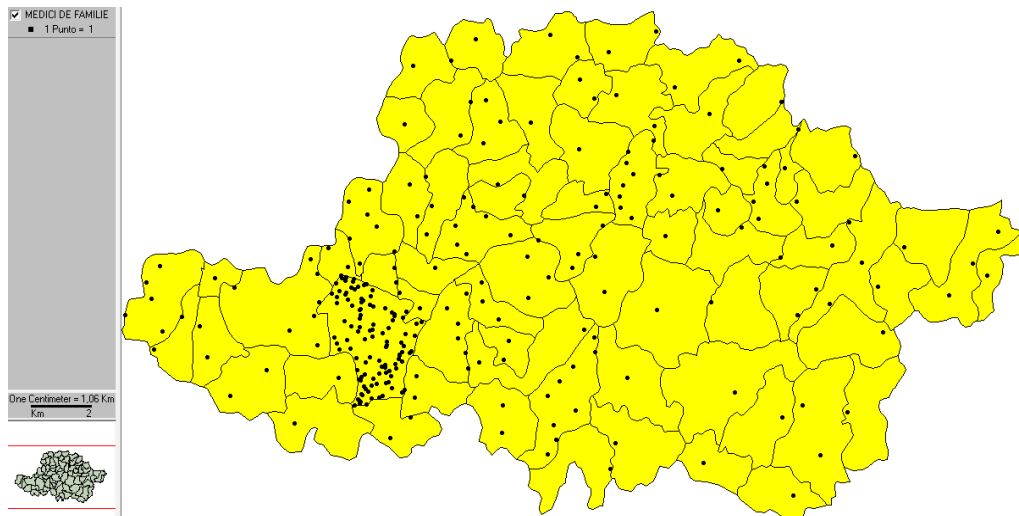
Fig. 10 Number of family doctors in Arad county

Occupational physicians, according to the existing records in the Public Health Department Arad, the city of Arad being the only area.
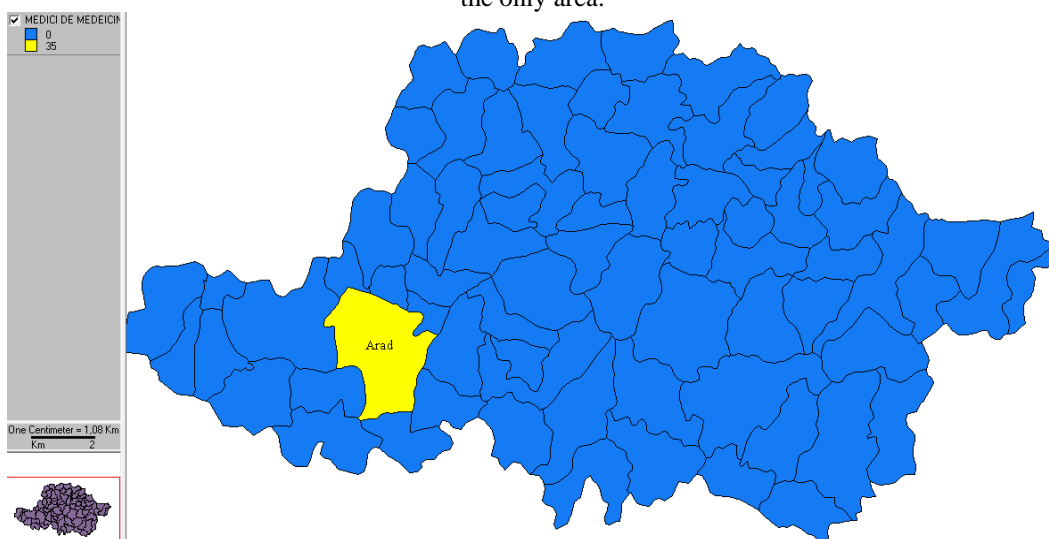
Fig. 11 Number of occupational physicians in Arad

REPARTITION OF RISK FACTORS FOR CAUSING OCCUPATIONAL DISEASES, OCCUPATIONAL DISEASES REPORTED (2001-2011), OTHER HEALTH EFFECTS

The results are in the form of maps who's further utility is analyzing and prioritizing the problems of occupational medicine, devising strategies for action.

- Population on July 1, population is comprised of people living in the settlement and also residing at the time;
- Population density in settlements has been calculated by taking the ratio between the population and area of each settlement. In a first phase a transformation was done in square km from hectare; then dividing per the total population of each settlement.
- Health services have included two types of service providers:
  o general practitioners, family doctors
  o doctors specialized in occupational medicine
  - The number of economically active units per 1000 inhabitants
  - Morbidity data

a. Occupational morbidity is available on its declaration by occupational doctors from the Public Health Department Arad

b. Incidence of work-related diseases is calculated, if necessary, at the economic units level, by occupational doctors and / or medical doctors with a degrees in entreprise medicine. They are not notifiable, but their record are kept in the observation unit.

Our study estimated possibly profession related morbidity, based on the official table "work-related diseases and their main potential causes." Were considered chronic diseases, according to that table, the annual report by settlements as according to medical practitioners / family doctors, provided by the Statistical Service of the Department of Public Health Arad. Also professional causative factors are occupational risk factors for the economic unit of a specific settlement. *There were no data to calculate relative risk and professional etiologic fraction. We calculated the index of overall incidence assimilated to that of profession possibly related diseases.*

noise → deafness, occupational hearing loss

The risk factor "noise" occurs in units of Arad, Lipova, Târnova and peaks at workers coming from industrial units such as: Ministry of Industry (SC IMAR SRL, SC ASTRA Wagons SRL, SC IMAR SRL, SC Termoelectrica SA, SC CET SA) for Arad, (SC CIMVEST) for Lipova, (SC SILFOR SRL) Vârfurile, (SC Foraj Sonde) for Târnova.
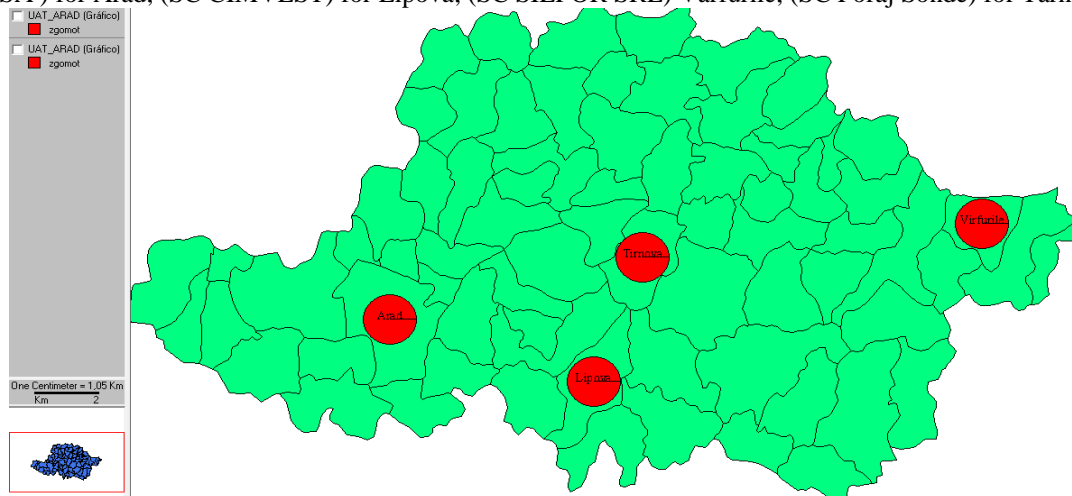

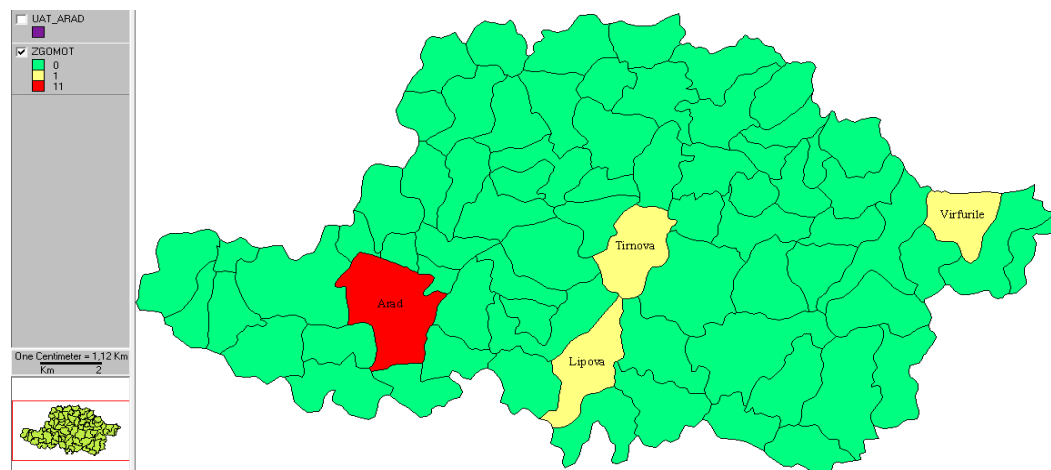**Fig. 11 Presence of the „noise" risk factor**

Fig. 12 Distribution of cases of occupational diseases caused by noise: deafness, occupational hearing loss
Frequency index of occupational diseases caused by noise took values between 2 and 5 with an average of 0.154, the highest incidence being in the village Vârfurile (5).

SiO$_2$ powder → silicosis, silico-siderosis

The risk factor "with **SiO$_2$** powder" appears in establishments in localities Arad and places around it: Pecica, Felnac, Vinga ,, Zabrani, Vladimirescu Zimandu New Curtici, Macea, Simand, Santana and units from northeast County: Chişineu-Cris, Sepreus, Cermei, Sebiş, Moneasa, Gurahonţ, Vârfurile, Hălmagiu and in the center: Şiria, Târnova, Taut, unit profile activity: machinery and industrial equipment, cleaning castings mining.
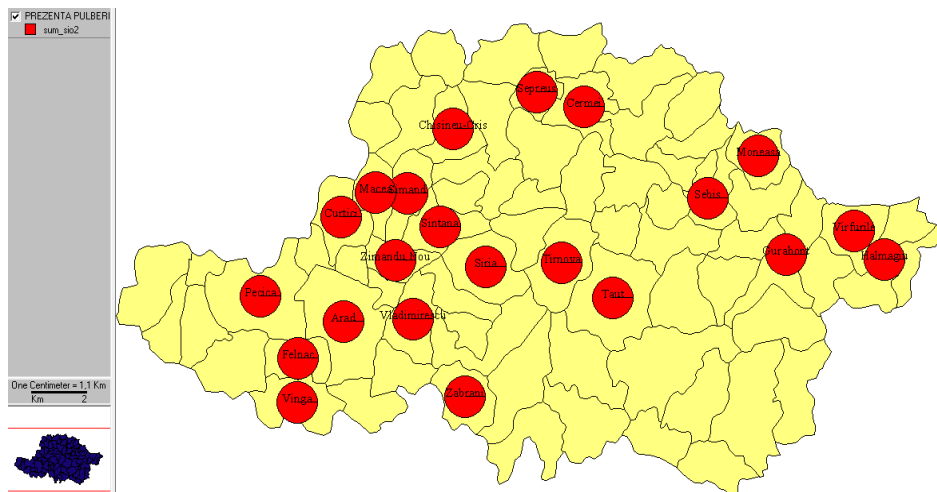
Fig. 13 Presence of " SiO₂ powder"risk factor

In Arad were reported a total number of 138 cases of occupational diseases caused by risk factor " SiO₂ powder" (silicosis, silico-siderosis), such cases are reported each year, between 2001 to 2011, most cases being encountered in Arad (93), Hălmagiu (14), Vladimiresu (3), Simand (3), Târnova
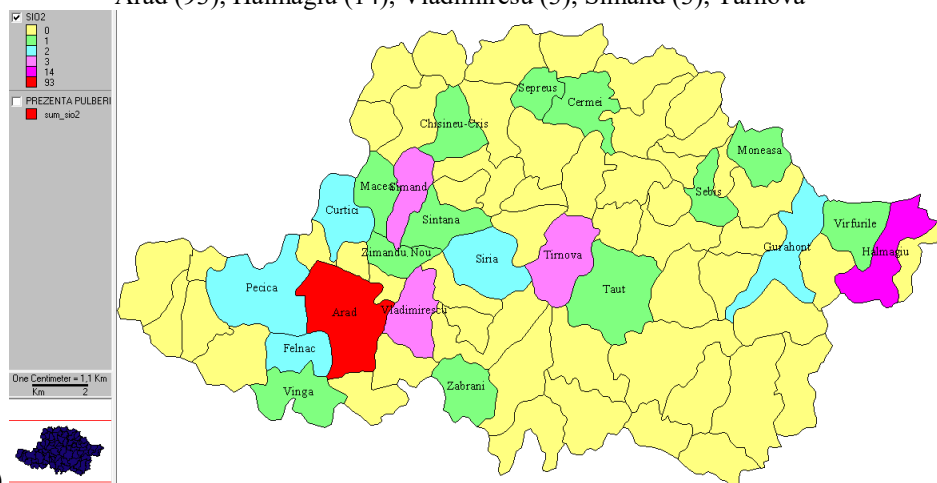
(3).

Fig. 14 Distribution of cases of occupational diseases due to SiO2 powders: silicosis, silico-siderosis

Mineral oil, other chemicals → dermatoses

The risk factor "mineral oil and other chemicals" appears in establishments in: Arad, Sagu, Zimandu-New Santana Curtici, Simand, Chişineu-Cris, affecting workers coming from units which have the following activity: machine building industry, locksmith, Ministry of agriculture
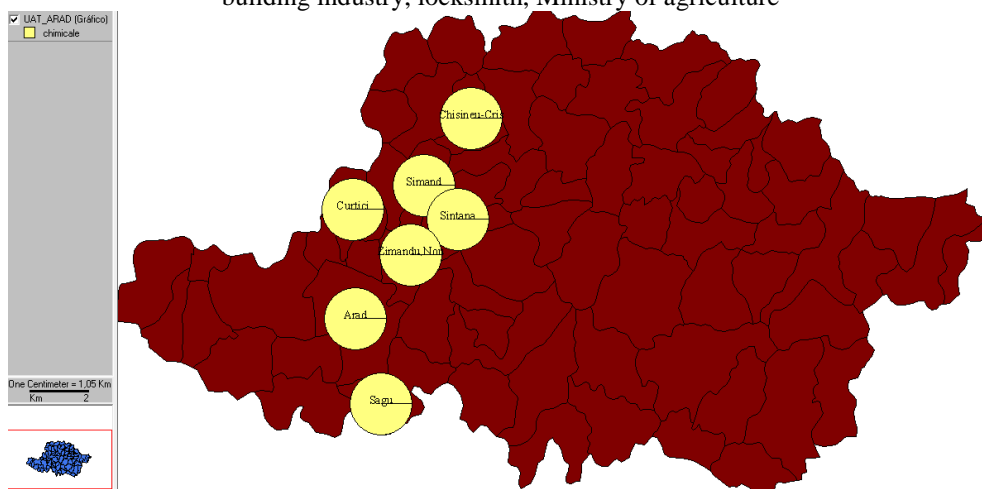
Fig. 14 The presence of "mineral oil and other chemicals" risk factors

There have been identified a total of 27 cases of occupational diseases due to the factor "mineral oil and other chemicals", most cases of dermatoses found in Arad (21) the other six locations each reporting a case between 2003-2004, 2007-2011.

Welding gases, iron oxides → siderosis

The risk factor " **Welding gases, iron oxides** " appears in the units in settlements from the central-western part of the county of Arad, Iratosu, Sofronea, Zimandu-Nou, Vladimirescu, Fantanele, Pecica, Vinga, Nădlac, Seitin, Semlac, Cermei to workers coming from units which mainly have the following activities: engineering industry, welders.
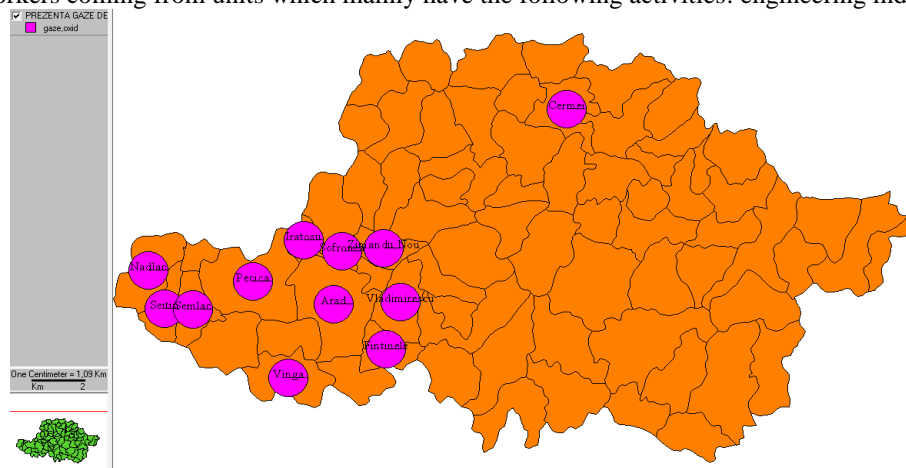

Fig. 15 Presence of the " Welding ga**s**es**, iron oxides" risk factor**
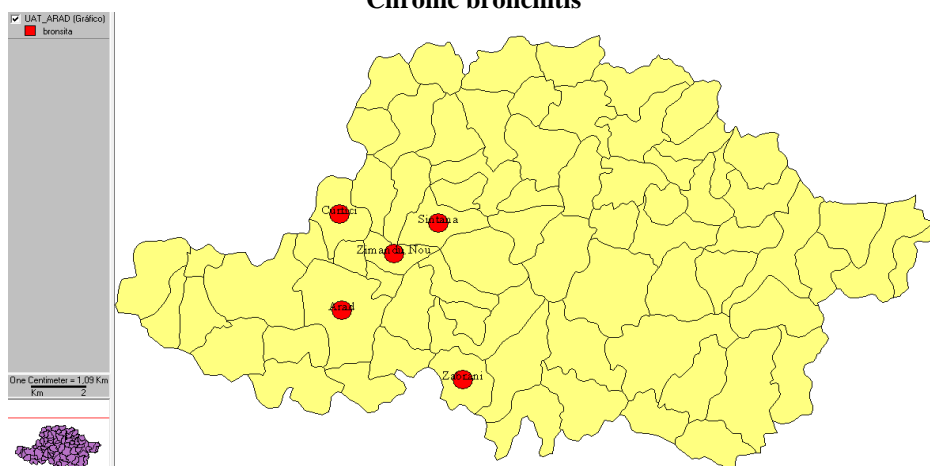
Chronic bronchitis

Fig. 16 The incidence of chronic bronchitis based on settlements

This disease were reported in workers from the following units: Ministry of Industry (SC Imar, SC Impex SRL, SC Astra Trinity SRL) with professions as follows: carpenter/painter, ansamble maker , upholsterer, sculptor.
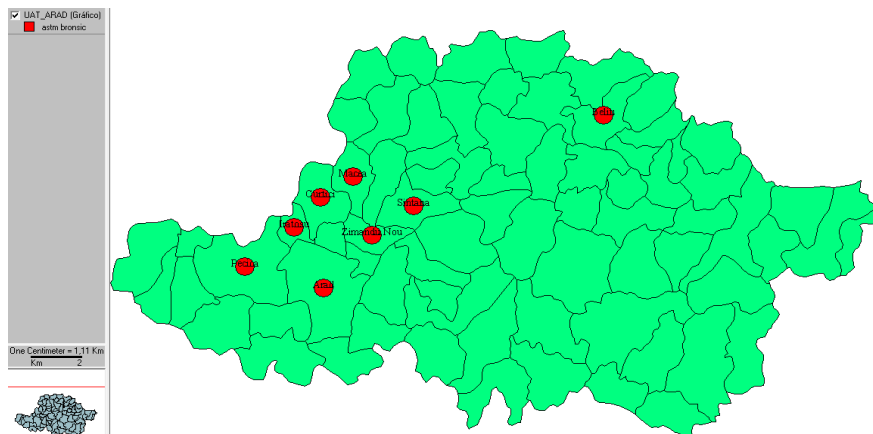
Bronchial asthma

Fig. 17 The incidence "Bronchial asthma"

Bronchial asthma was identified in workers from units: Ministry of Industry, food industry, hospitals, having the profession of painter, baker, laundress, nurse.
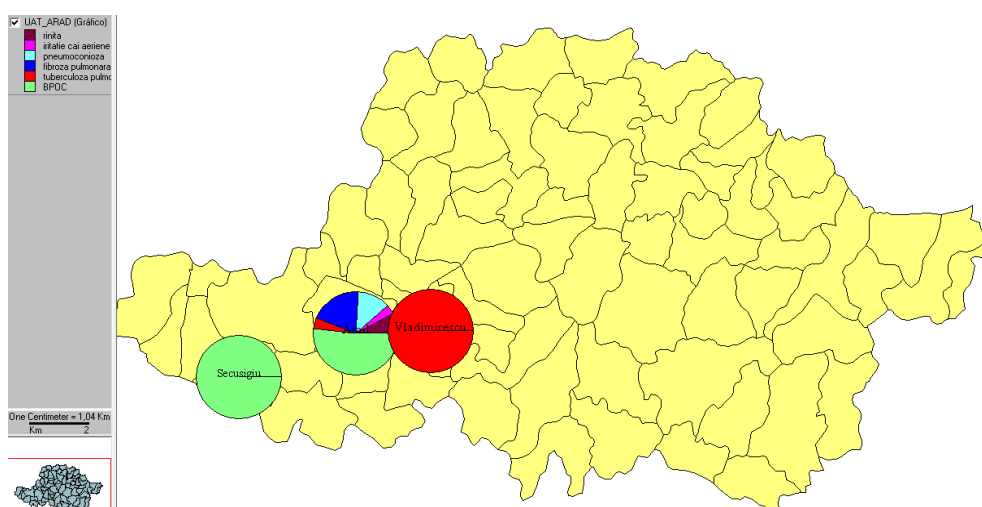

Fig. 18 Incidence based on settlements for rhinitis, upper respiratory tract irritation, pneumoconiosis, pulmonary fibrosis, pulmonary tuberculosis, COPD
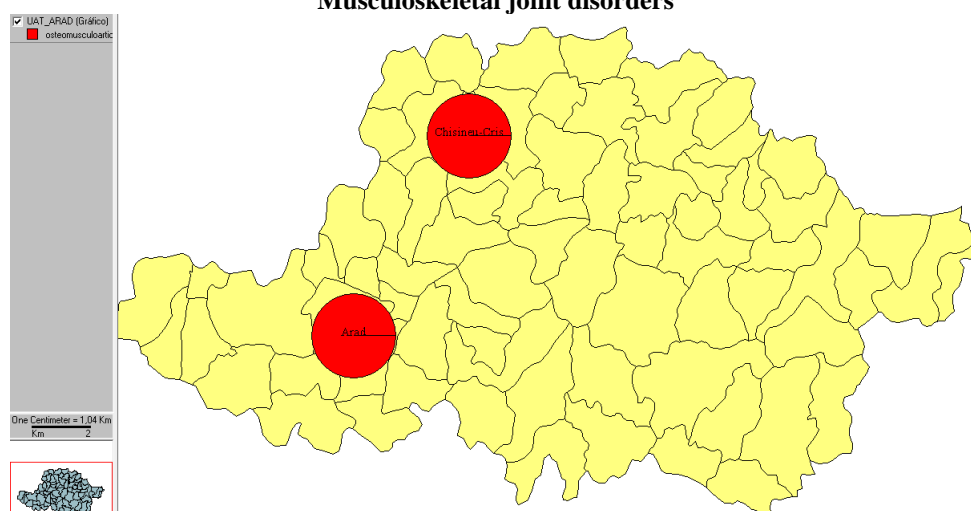
Musculoskeletal joint disorders

Fig. 19 Incidence based on settlements for Musculoskeletal joint disorders

CONCLUSIONS AND PROPOSALS

The informational society, information society and knowledge society are concepts known and used in all language. In this society, man is in the spotlight.

Policies and strategies must be citizen oriented, to improve living conditions, working conditions, to become an active and conscious player in the community.

The major advantages of GIS is the ability to enable effective communication, based on maps and data on occupational medicine. GIS implementation at national or county level may facilitate:
- monitoring and evaluation of occupational and work-related diseases;
- financial allocations;
- detection of risk factors and keeping them under control, or even attempting to eliminate them;
- consequently improve the health of the population, which would be reflected in the health indicators.

The paper identified aspects within the county information system that can be included in a geographic information system.

The results are in the form of maps which can then be used in analyzing and prioritizing issues related to occupational and work-related diseases and can help establish an action strategies.

Arad county encompasses a number of 75 settlements, with a population of over 300 and under 150,000 inhabitants, the most heavily populated being the city of Arad, with a population of 164,208 inhabitants.

Population density is highest in the western part of the county, the three cities with the highest density: Arad, Santana Pâncota.

Organizing care for the working population is conducted by occupational doctors in the city of Arad, and in the county by physicians certified in occupational health, practitioners and medical doctors.

Health and safety can be represented in GIS. At present the legislation, does not forbid the using of geographic information systems.

The contractual framework Directive 89/391 / EEC, on health and safety at work, states that "employers have a duty to ensure the health and safety of workers in every aspect."

World Health Organization, the past decade has defined seven components of wellbeing: the physical, professional, environmental, social, spiritual, emotional and intellectual.component.

În hărțile elaborate după sistemul SIG ar putea fi configurate elemente de bază, incluzând factori determinanți ai stării de sănătate astfel:

In the maps produced by GIS, basics elements could be configured, including wellbeing influencing factors such as:

Risk factors (physical, chemical, biological, organizational or related to overuse of organs or body systems) are likely to cause health detriment:
- Work-related accidents
- Occupational diseases
- Work-related diseases:
a) Diseases having employment or working conditions as a contributing factor
b) Diseases for which occupational exposure may accelerate or exacerbate the development of evolution, or lead to an accentuation of symptoms
c) Disease whose prognosis can be favorably influenced by occupational health intervention or an undertaken action to improve working conditions

Indicators can be used as follows:
➢ incidence (total or specific)
➢ prevalence
➢ profesional illnesses frequency indicators
➢ demographic: general population, active population size of the administrative-territorial units, population density
➢ indicators of medical work organization and occupational health: occupational medicine cabinets and number of physicians, general practice and family doctors and many doctors offices for doctors with degrees in enterprise medicine. The training program addresses all these staff.
➢ aspects of lifestyle and work:, smoking, diet, exercise, compliance with hygiene and safety norm.

In this context we consider that the implementation of geographic information systems in the field of occupational medicine allows, at European standards, a more advanced understanding of the relationship between risk factors and a harmonizing of the occupational health monitoring system.

BIBLIOGRAPHY

1.Marcu A. și colaboratorii, Sănătate publică și Management Sanitar, Editura All, București, 2002;

2.Vulcu L., Sănătatea este un bun economic, Editura Universității Lucian Blaga, Sibiu, 2005;

3.Oțelea M., Comunicarea eficientă în promovarea sănătății la locul de muncă, Revista Română de medicina Muncii, Vol. 63, nr.1-2, 2012;

4.Agenția de Cercetare pentru Tehnică și Tehnologii Militare, Studii de Cercetări pentru dezvoltarea unor algoritmi de culegere automată și semiautomată a datelor geografice și de determinare a preciziei bazelor de date rezultate, 2008;

5.Bardac D.I, Berca C., Aspecte ale Medicinei Muncii oglindite în paginile Sfintei Scripturi și ale Sfinților Părinți, referate, Universitatea "Lucian Blaga" Sibiu, Biserica Sfinții Împărați Sopot Slatina, AMT, vol. II, nr. 4, 2011;

6.Bardac D.I., Mihaela Stoia, Elemente de Medicina Muncii și Boli Profesionale, Editura ULB Sibiu, 2007;

7.Bardac D.I., Viața ți opera lui Bernardino Ramazzini, părintele medicinei muncii. Carte de abstracte. Conferința Națională de medicina Muncii cu participare internațională, Galați, 18-21 septembrie, 2013;

8.Cocârlă A., Tefas L., Petran M. - Manual Medicina Muncii, Ed. Universitară I. Hațieganu, Cluj, 2000;

9. Enăchescu D., Sănătatea publică şi Management Sanitar, Ed. All, 1998;

10. Doru Vlad Popovici, Raluca Matei, Terapie ocupațională pentru persoane cu deficiențe, Editura Muntenia, Constanța, 2005;

11. H.J.Hall, Scurt istoric al terapiei ocupaționale- Psihiatrie document online, 2003;

12. Popescu O., De la Hipocrate-ncoace, Caleidoscop medical, Editura Fiat Lux, Bucureşti, 2001;

13. Țârt D.P., Aplicații ale Sistemelor Informatice Geografice în Sănătatea Publică, Editura Universității din Oradea, 2009;

14. Ion Toma, Medicina muncii, Editura Sitech, Craiova,2006;

15. Niculescu Toma „Manual de boli profesionale", Ed. Medmun, Bucureşti Vol I, 2008;

16. Norme generale de protecția muncii, Ministerul Muncii și Solidarității Sociale, Ministerul Sănătății, 2002;

17. Furtunescu F., Caracteristicile climatului organizațional în principalele structuri din sistemul de sănătate românesc și posibilitățile concrete de optimizare a acestuia, Acta Medica Transilvanica, 2009;

18. HG nr. 355/2007 privind supravegherea sănătății lucrătorilor, cu modificările și completările ulterioare;

19. Legea nr. 418/18 octombrie 2004 privind statutul profesional specific al medicului de medicina muncii;

20. Legea 90/1996 privind protecția muncii, Normele metodologice de aplicare

(actualmente abrogată). A fost înlocuită cu Legea 319/2006;

21. Niculescu T., Toma I., Pavel A. - Medicina muncii, vol.I, Editura Medmun, Bucureşti 1999;

22. Niculescu T., Curs de Medicina Muncii, Medmun, Bucureşti, 1995;

23. Kraus A., Estimates of the Extent of Morbidity and Mortality Duet o Ocupation Diseases in Canada, American Journal of Industrial Medicine, 1994;

24. HG 355/2007, privind supravegherea sănătății lucrătorilor,cu modificările și completările ulterioare;

25. Marilena Oargă, Boala profesională, Considerațiuni generale din Medicina ocupațională, Vol. I-Cocârlă A, Editura Medicală Universitară Iuliu Hațieganu, Cluj-Napoca, 2009;

26. Journal of Occupational &Environmental Medicine, 1997;

27. Standard ISO 9000, Sistem de Management al Calității (SMC);

28. Organisation Mondiale de la Santé, Criterés d'hygiene d'environment, Le bruit, Geneve, 1980;

29. Legea nr. 46/2003, Legea drepturilor pacientului, M.O. nr. 51/29 ianuarie 2003;

30. Opincaru C., Gălățeanu E.M., Imbri E., Managementul calității serviciilor în unitățile sanitare, Editura C.N.I. Coresi, 2004;

31. Donabedian A., An introduction to quality assurance in health care, Oxford Univ., Press, New York, 2003;

32. Oprea S, Sorina Pop, Tendințe actuale în asistența medicală, Conferința Națională- Factori de risc în bolile cronice și medicul de familie, Editura Academica Vasile Voiculescu Buzău, Editura Tehnică Științifică și Didactică CERMI, Iași, 2002;

33. Bușoi G., Diagnosticul și terapeutica sănătății în Medicină Generală, Editura medicală, Bucureşti, 1990;

34. Pavel A., Manual de medicina muncii, Editura Europa Nouă, Bucureşti, 2002;

35. Ivan A., Medicina omului sănătos, Editura Medicală, Bucureşti, 1993;

36. Ivan N., Crăciun I., Lotreanu C., Istoria medicinei, Editura Universității "Lucian Blaga" Sibiu;

37. Georgeta Oprea, Asistența primară a omului sănătos, Cluj-Napoca, 2000;

38. Legea 319/2006 privind securitatea și sănătatea în muncă;

39. Legea 346/2002 privind asigurarea pentru accidente de muncă și boli profesionale;

40. Todea Adriana, Rusea Daniela „Cunoaşterea riscurilor profesionale: mijloc de protecție a sănătății lucrătorului" Ed. Fundației "România de mâine", 2008;

41. Todea Adriana „Ghidul medicului de medicina muncii privind stabilirea aptitudinii în muncă" Ed. Fundației "România de mâine", 2007;

42. Toma I., Medicina muncii, vol.I, Editura Reduta, Craiova, 1999;

43. Flahault A., Boelle Z.P., Breart G., Caillard J.F., Carrat F., Chauvin P., Thomas G.,Valleron J.A.- Sante publique. Medicine legale. Medicine du travail. Medicine sociate. Etique, Ellipses Edition Marketing S.A., Paris, 2003;

44. Toma I., Medicina muncii. Lucrări practice, Editura Sitech, Craiova, 1998;

45. Surcel D., Priorități și tendințe în Medicina Muncii, Editura Alma Mater, Cluj-Napoca, 2000;

46. Nițu C., Nițu C., D., Tudose C.E., Vişan M.C., Sisteme Informaționale Geografice și Cartografie Computerizată, Editura Universității din Bucureşti, Bucureşti, 2002;

47. Sisteme Informatice Geografice (SIG/GIS), 2010, www.scritube.com/stiinta/informatica/SISTEME INFORMATIONALE-GEOGRAFICE;

48. Mihăescu L., Sisteme Informaționale și Aplicații Informatice în Administrarea Afacerilor, Editura Universității "Lucian Blaga",Sibiu, 2009;

49. Botezatu C., Algoritmi și structuri de date, Editura Universitară, Bucureşti, 2004;

50. Bălteanu D., Sistem Informațional geografic (GIS) pentru studiul dezastrelor naturale, Academia Română, 2010;

51. Dimitru Mihai George, Sisteme Informatice Geografice GIS, Editura Albastră, Cluj Napoca, 2001;

52. Imbroane M.A., Moore D., Inițiere în GIS și Teledetecție, Presa Universitară Clujeană, 1999;

53. Herbei O., Herbei M.V., Sisteme Informatice Geografice, Fundamente Teoretice și Aplicații, Editura Universitas, Petroșani,2010;

54. Melnik L.A., Introduction to Geographic Information System in Publuc Hearth, Aspen Publishers, Mayland, 2002;

55. G.E. Glass, J.L. Aron, J.H. Ellis, S.S. Yoon, Applications of technology to disease control, Baltimore, Maryland, 1993;

56. Ablimit Aji, Fusheng Wang, Hoang Vo, Rubao Lee, Qiaoling Liu, Xiaodong Zhang, Joel Saltz, Hadoop-Gis: a high performance spatial data warwhousing system over MapReduce;

57. Longley, Geographic Information System and Science, Chichester Wiley, 2005;