

WORK METHODOLOGY FOR GEOGRAPHIC INFORMATION SYSTEM - SIGEPI

LADINIA ARDEU¹, DORIN IOSIF BARDAC², CARMEN DANIELA DOMNARIU³

¹PhD candidate "Lucian Blaga" University of Sibiu, ^{2,3}"Lucian Blaga" University of Sibiu

Keywords: maps, administrative and territorial units, SIGEpi application, date base, SIGEpi geographic information system

Abstract: Administrative and territorial units' map of Arad County was performed at a scale of 1:100000 using scanned cartographic support, georeferenced, this map digitizing being made available by the Faculty of Geography from Babeş-Bolyai University of Cluj Napoca (Prof.Univ.Dr. Ionel Haidu and his collaborators.) The data base used in this work consists of three tables: general data table of administrative and territorial units, table for occupational diseases and a table for work-related diseases. The steps required for loading, processing and presenting the data sets using geographic information system SIGEpi: Opening the SIGEpi application START/PROGRAMS/SIGEpi; Opening the data base; Loading the tables in database in our case three tables: table with general data, table for occupational diseases and the table for diseases related to profession; Loading the layer to be analyzed with geographic data, in our case the map of administrative and territorial units of Arad County; The opening of the attribute table corresponding to geographic data layer; Creation of thematic maps (Thematic Maps). SIGEpi program offers the possibility of identifying those geographic regions which present certain features highlighted in the form of one or more conditions.

Cuvinte cheie: hărți, unități administrativ-teritoriale, aplicația SIGEpi, baze de date, Sistem informatic geografic SIGEpi

Rezumat: Harta unităților administrativ-teritoriale a județului Arad a fost realizată la o scară de 1:100000 utilizând suport cartografic scanat, georeferențiat, digitizarea acestei hărți fiind pusă la dispoziție de către Facultatea de Geografie din cadrul Universității „Babeş-Bolyai” din Cluj Napoca (Prof. Univ. Dr. Ionel Haidu și colab.) Baza de date utilizată în lucrare este formată din trei tabele: tabel cu date generale despre unitățile administrativ-teritoriale, tabel pentru bolile profesionale și un tabel pentru bolile legate de profesie. Pașii necesari încărcării, prelucrării și prezentării seturilor de date cu ajutorul sistemului informatic geografic SIGEpi: Deschiderea aplicației SIGEpi: START/PROGRAMS/SIGEpi; Deschiderea bazei de date; Încărcarea tabelelor în baza de date, în cazul nostru, a celor trei tabele: tabelul cu date generale, tabelul pentru bolile profesionale și tabelul pentru bolile legate de profesie; Încărcarea stratului de analizat, cu datele geografice, în cazul nostru, harta cu unitățile administrativ teritoriale ale județului Arad; Deschiderea tabelii atribut corespunzătoare stratului cu date geografice; Crearea hărților tematice (Thematic Maps). Programul SIGEpi oferă posibilitatea de a identifica acele regiuni geografice care prezintă anumite particularități evidențiate sub formă de una sau mai multe condiții.

INTRODUCTION

The administrative and territorial units map of Arad county was performed at a scale of 1:100000 using scanned cartographic support, georeferenced, this map digitizing being made available by the Faculty of Geography from Babeş-Bolyai University Cluj Napoca (Prof.Univ.Dr. Ionel Haidu and his collaborators.)

Descriptive data

The data base used in this work consists of three tables: general data table of administrative and territorial units, table for occupational diseases and a table for work-related disease.

The first table contains general features for each administrative and territorial unit namely: number of inhabitants, area, population density, number of family doctors, number of occupational medicine doctor, number of agricultural units, number of industrial units, number of mining units,

number of trade units, those information being provided by the County Department of Statistics (number of inhabitants, area, population density), Department of Public Health Arad (number of occupational medicine doctors), Chamber of Commerce, Industry and Agriculture Arad (site www.ccia-arad.ro).

This table also contains the population density indicator on each community, value calculated by performing the ratio between the number of inhabitants and the area of each locality.

The following figure shows the corresponding attribute table of the first table, achieved with the help of the application SIGEpi, for each administrative and territorial unit.

¹Corresponding author: Ladinia Ardeu, Str. Simion Balint, Nr. 10, Arad, România, E-mail: ardeul@yahoo.com, Tel: +40742 015232
Article received on 25.04.2013 and accepted for publication on 01.07.2013
ACTA MEDICA TRANSILVANICA December 2013;2(4):297-302

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Table no. 1. Table with administrative-territorial units accomplished with SIGEpi application

Udenumire	nr locuitori	supratata	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	2867	12187	2	0	0,218839747271683	0	0	0	0
Chisineu-Cris	7576	11729	3	0	0,645920368317845	0	3	0	0
Curci	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	0,49147420677466	0	0	0	0
Lipova	9539	13400	9	0	0,711865671641791	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	0,530901250469395	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

The second table contains data related to new cases of occupational disease for each administrative and territorial unit of Arad County between 2001 and 2011. Data are organized according to the risk factors causing the declared occupational and professional diseases, thus having: noise risk factor which causes professional diseases such as deafness and occupational hypoacusis, risk factor SiO2 powder which causes silicoses, silico-siderosis, risk factor mineral oils and other chemicals that determines dermatosis and also risk factor welding gas and iron oxides which causes siderosis.

Within this table, there has been calculated for each county's locality, the total number of occupational diseases for each of those 4 risks, by summing the columns related to each risk factor for each of the years concerned in study between 2001 and 2011 (example total_noise=z_2001+z_2002+z_2004+z_2009).

This table contains the calculation of the indicator "frequency index for occupational disease", calculated based on the number of illness reported for each locality, after the formula:

$$FBP = \frac{\text{număr cazuri boli profesionale} * 100}{\text{număr personal muncitor}}$$

The data on the number of workers, number of new occupational disease for each individual year were provided by the Public Health Department Arad (number of new cases of occupational disease) and the structure of this table, obtained in the application SIGEpi, is presented in the following figure, respectively the attribute table with the number of new cases of occupational disease.

Table no. 2. Data corresponding to the number of new cases of occupational diseases for each administrative-territorial unit of Arad County

Udenumire	nr locuitori	supratata	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	2867	12187	2	0	0,218839747271683	0	0	0	0
Chisineu-Cris	7576	11729	3	0	0,645920368317845	0	3	0	0
Curci	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	0,49147420677466	0	0	0	0
Lipova	9539	13400	9	0	0,711865671641791	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	0,530901250469395	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

The third table contains data concerning the new cases of chronic diseases possibly related to the professions, which are grouped in: chronic respiratory conditions and osteomusculoarticular conditions. Among chronic respiratory conditions encountered, we may include: chronic bronchitis, chronic hypertrophic rhinitis, chronic laryngo-bronchitis, bronchial asthma, upper respiratory tract irritation,

pneumoconiosis, pulmonary fibrosis, pulmonary tuberculosis, BPOC, and between osteomusculoarticular conditions we encountered: discopathies, spondylosis, gonarthroses. This data was provided by the Public Health Department of Arad.

Within this table the indicator "overall incident index" was calculated according to the formula:

$$It = \frac{\text{number of newly detected cases of illness}}{\text{number of inhabitants}} \times 1000$$

this indicator being useful in the comparative study of similar units assigned and with similar population, and as comparison in time of the incidence; it is a relevant method

in knowing the state of health and efficiency of the sanitary activity.

The following figure represents the corresponding attribute table, achieved with application SIGEpi, and

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attribute table with the data concerning new cases of chronic

diseases, possibly related to the profession.

Table no. 3. Table obtained with SIGEpi application with data on new cases of chronic diseases, possible work-related chronic diseases

Denumire	nr locuitori	suprafata	nr# muncitori	bronsita	rata_bronsi	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
Cernei	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

The steps required for loading, processing and presenting the data sets using geographic information system SIGEpi:

1. Opening the application SIGEpi: *START/PROGRAMS/SIGEpi*
2. Opening of the data base

Figure no. 1. Data base description

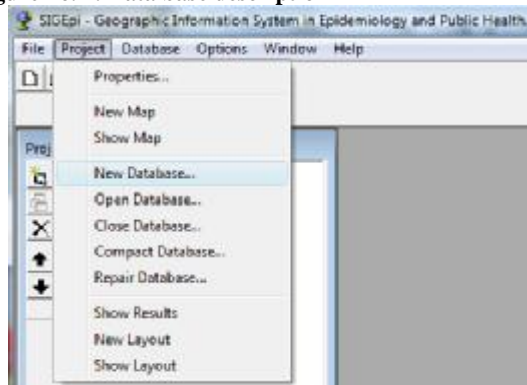
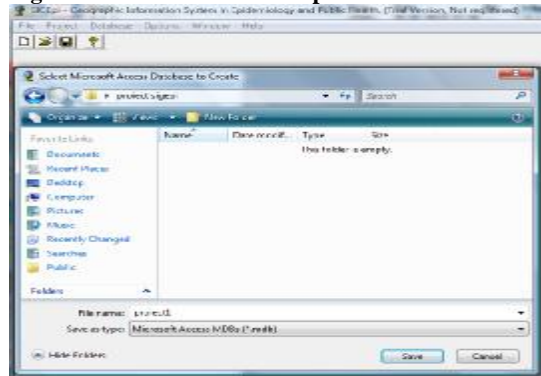


Figure no. 2. Data base description



3. Loading the tables in database, in our case three tables: table with general data, table for occupational diseases and the table for diseases related to profession. Because all the tables were created in "Excel" format, it is mandatory the import of those tables, as follows:

Figure no. 3. Importing the tables from Excel in SIGEpi



Figure no. 4. Importing the tables from Excel in SIGEpi

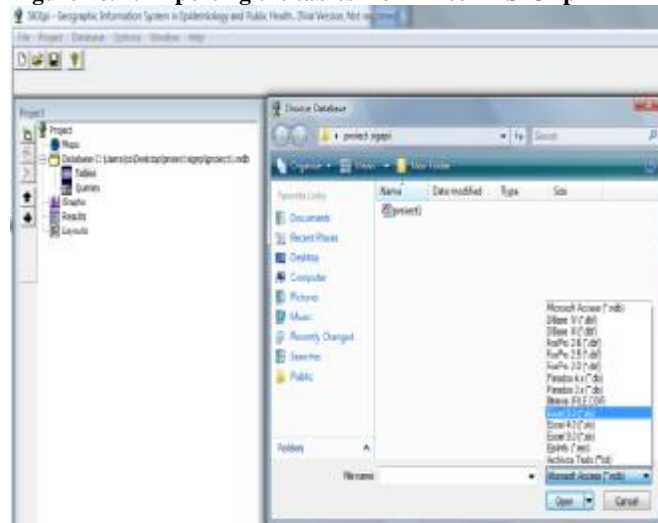
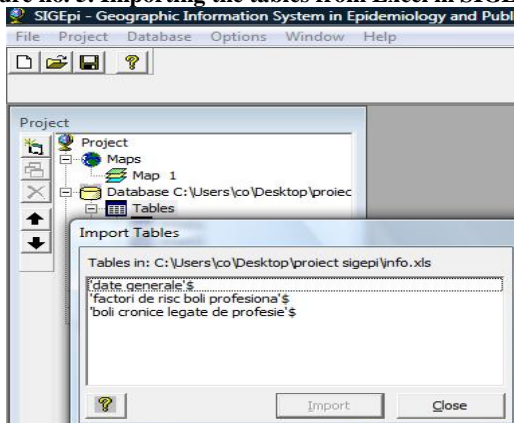
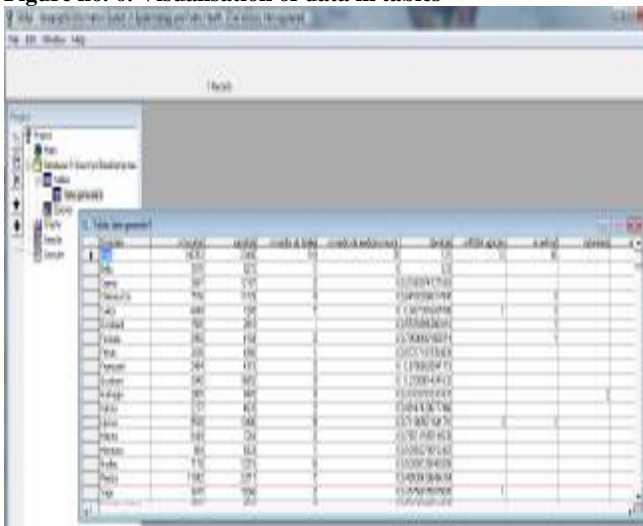


Figure no. 5. Importing the tables from Excel in SIGEpi



For viewing the data in the tables, after positioning the desired table, click right and select "Open Table".

Figure no. 6. Visualisation of data in tables

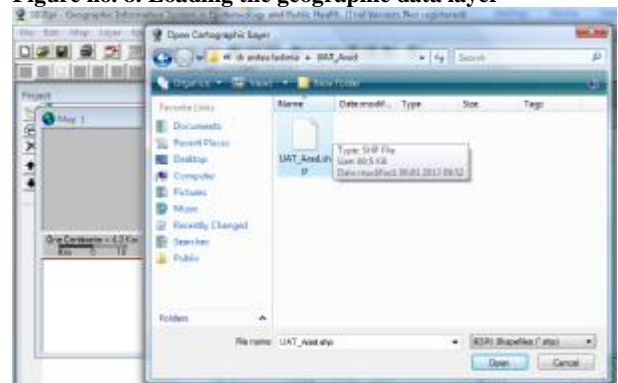


4. Loading the layer to be analyzed with geographic data, in our case the map of administrative and territorial units of Arad County.

Figure no. 7. Loading the geographic data layer

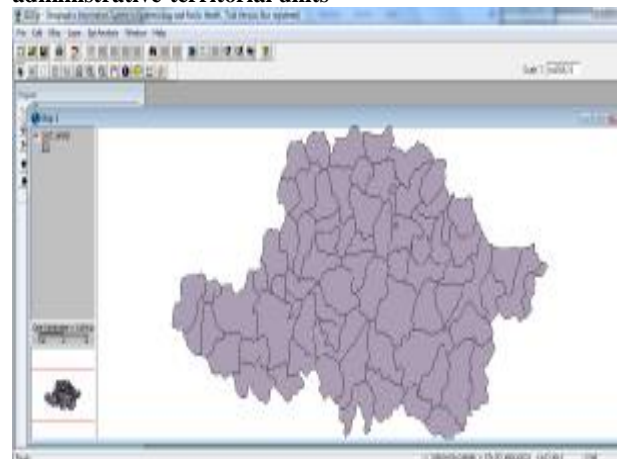


Figure no. 8. Loading the geographic data layer



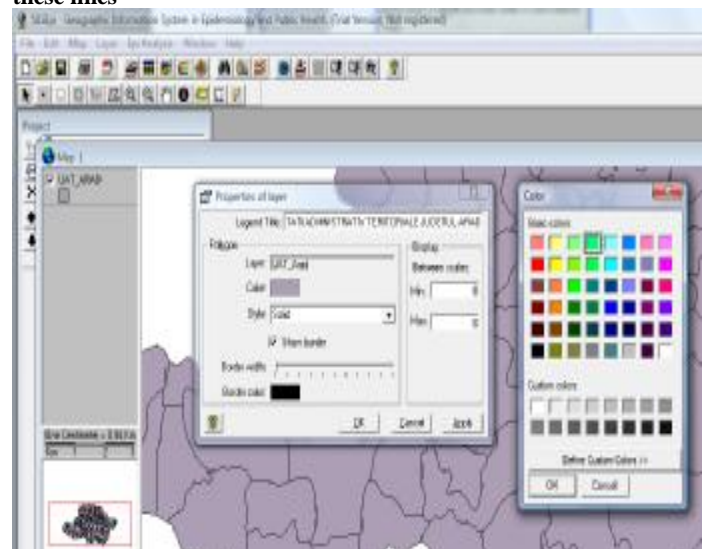
The program allows viewing the demarcation of administrative and territorial units by creating maps of the form:

Figure no. 9. Visualisation of delimitation of the administrative-territorial units



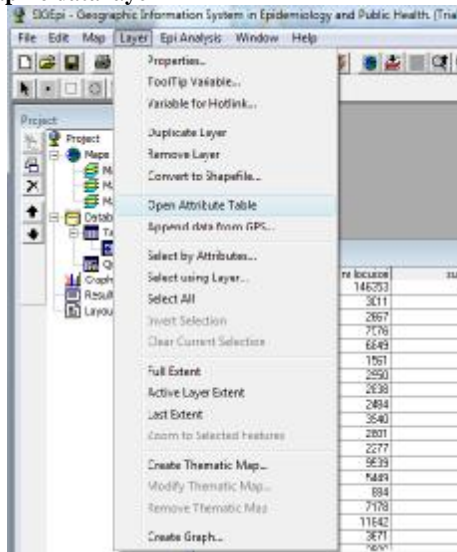
For these maps, the following features can be determined: title, colour, style, thickness of the lines bounding the settlements, the colour of those lines

Figure no. 10. Determining the map: title, colour, style, thickness of lines bounding the settlements, the colour of these lines



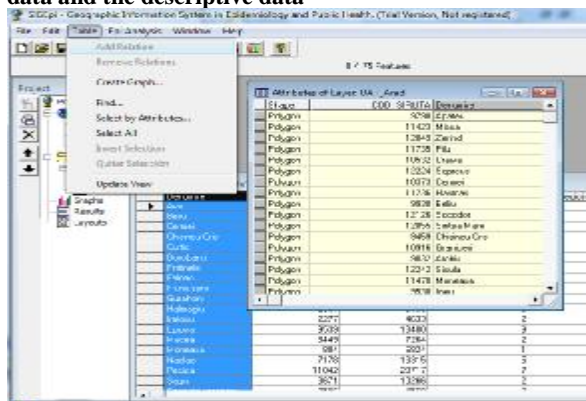
- The opening of the attribute table corresponding to geographic data layer

Figure no. 11. Opening the table corresponding to the geographic data layer



The opening of these tables is necessary for making the connection between the geographic data and the descriptive data, using the option "Add Relation":

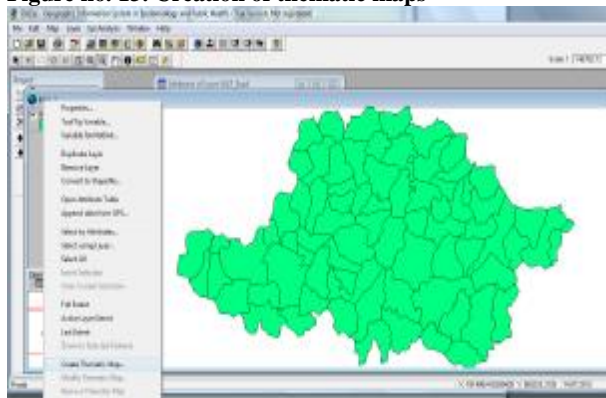
Figure no. 12. The connection between the geographic data and the descriptive data



Enabling this option will result in getting a new table that contains both geographic data and the descriptive data from the related table.

- Creation of thematic maps (Thematic Maps)

Figure no. 13. Creation of thematic maps



SIGEpi program offers the possibility of identifying those geographic regions which present certain features highlighted in the form of one or more conditions. Under the conditions, there can be used mathematical operators (<,>=,etc.) and the values can be: effective values of the variables, the value of cumulated frequencies, quartiles. For the creation of composed conditions, it can be checked as appropriately, the logical operators "Not" for denying the condition, "And" for simultaneous verification of several conditions. The final condition is displayed in the window "SQL Condition", and as result, in the table there are marked (in figure below with black) the lines that meet the selection condition.

Figure no. 14. Identification of priority and critical areas

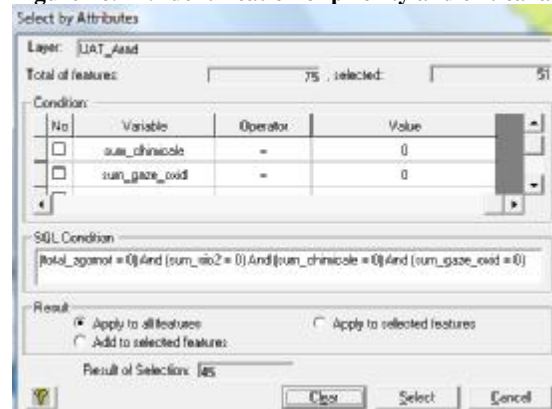
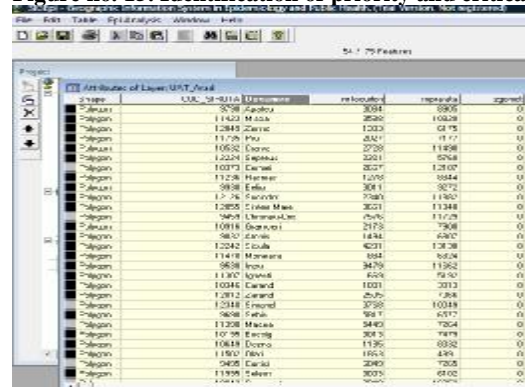


Figure no. 15. Identification of priority and critical areas



By using geographic information system SIGEpi:

- We monitor occupational diseases and work related disease in Arad;
- We identify the risk factors which are causing occupational diseases:
 - Noise → deafness, occupational hypoacusis;
 - Descriptive statistics for the risk factor "noise";
 - Reparation of occupational disease cases caused by noise: deafness, occupational hypoacusis;
 - Frequency index for the risk factor "noise";
 - Presence of risk factor "Powders with SiO2";
 - Powders with SiO2 → silicosis, silicosiderosis;
 - Descriptive statistics for the risk factor "Powders with SiO2";
 - Repartition of occupational diseases cases caused by powders with SiO2: silicosis, silicosiderosis;
 - Frequency index of occupational disease caused by "powders with SiO2";
 - Mineral oil, other chemicals → dermatosis;

- Presence of risk factors “mineral oil and other chemicals”;
- Descriptive statistics of the risk factors “mineral oil and other chemicals”;
- Repartition of occupational diseases cases caused by “mineral oil and other chemicals”: dermatosis;
- Welding gas, iron oxides → siderosis;
- Presence of risk factor “welding gas, iron oxides”;
- Descriptive statistics of the risk factor “welding gas, iron oxides”;
- Repartition of occupational diseases cases caused by “welding gas, iron oxides”: siderosis;
- Frequency index of the occupational diseases caused by “welding gas, iron oxides”;
- Frequency index of the occupational diseases caused by those 4 risk factors.

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