GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND DATA REGISTRATION OF CANCER INCIDENCE. DESCRIPTIVE STUDY FOR THE COUNTY OF BIHOR IN THE YEAR 2004

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Abstract: *The paper presents the model of a geographic information system (GIS) applied for a descriptive study of cancer incidence in the county of Bihor, in the year 2004. Sources of data, computations and the interaction of the GIS application (ArcMap) are also described. If at international level, statistical data about cancer are accessible, both on printed form and with Web-GIS interface, the occurrence in Romania of a new legislation on cancer registration, according to the international standards of cancer registries, will lead to the increase of the analysis and synthesis of cancer data at local, county, regional and national levels.*

Keywords: *cancer, incidence, descriptive study, geographic information system, GIS, standardized rate*

Rezumat: *Lucrarea prezintă modelul unui sistem informatic geografic pentru studiul descriptiv al incidenţei cancerului în judeţul Bihor, pentru anul 2004. Sunt descrise sursele de date, operaţiunile efectuate şi interacţiunea cu aplicaţia informatică GIS (ArcMap). Dacă la nivel internaţional datele statistice privind cancerul sunt accesibile, atât pe suport tipărit, cât şi în cadrul unor aplicaţii web - GIS, apariţia în România a unei noi legislaţii în domeniul înregistrării datelor bolnavilor de cancer, aliniată la standarde internaţionale ale registrelor de cancer, vor conduce în timp, la o creştere a analizei şi sintezei datelor privind neoplaziile la nivel local, judeţean, regional şi naţional.*

Cuvinte cheie: *cancer, incidenţă, studiu descriptiv, sistem informatic geografic, SIG, rată standardizată*

INTRODUCTION

The geographic information system (GIS) represents an ensemble of people, equipments, programmes, methods and norms with the aim of collecting, validating, storing, analysing and visualizing the geographical data. A georeferenced data is a feature of a certain object or phenomenon of the terrestrial space (name of a town or the number of inhabitants, the borders of a county, height of a mountain peak, road line, surface of a parcel etc.). Actually, the geographic information system combines the layers of information about a certain location, in order to better know it; it may easily manipulate large quantities of data, offering the possibility of making complex analyses of the spatial information, advanced possibilities of displaying the results in tables, as well as complex cartographic representations.

In the United States of America, many health departments and state cancer registries provide public access to their data about health, (1) by using GIS applications. For example, in Washington, the EpiQMS (Epidemiologic Query and Mapping System was developed, that presents maps, graphics and tables in combination, for the current statistical data. An initiative of the USA government of promoting the georeferenced data dissemination is called „Geospatial One-Stop". (1)

The Order no. 803 of 2002 of the Romanian Ministry of Health and Family provided the setting up of territorial cancer registries within the oncology ambulatory setting in each county, with a view to register the data regarding the patients suffering from cancer. In 2007, by the Order no. 2027 of the Romanian Ministry of Public Health, which entered into force starting with 1 January 2008, Territorial Cancer Registries (at regional level) were established, coordinating more County Centres for the Evidence of Data Regarding the Cancer Patients. The final purpose of the implementation of the order of the Romanian Ministry of Public Health regarding the registration of the patients suffering from cancer is the conformation to the international standards on the registration of the cancer patients on populational bases and a better establishment of priorities regarding the prevention and control of cancer for the Romanian population. In the county of Bihor, there is a scientific tradition for the registration and publishing of data on the cancer incidence, according to the recommendations of the World Health Organization and of the International Association of Cancer Registries (IARC). For the first time, the publishing of the data regarding the oncologic morbidity of the county of Bihor took place in 1997, in "Territorial Cancer Registry of Bihor", written by Dr. Vasile Păcurar and the mathematician Emilia Drâmbărean. The publication included data relative to the new cases of cancer for the year 1996, with their presentation from the point of view, both of the topographic localization of the tumour and of the patients' residence territory (within the county of Bihor).

MATERIAL AND METHOD

The purpose of the article is to present one of the

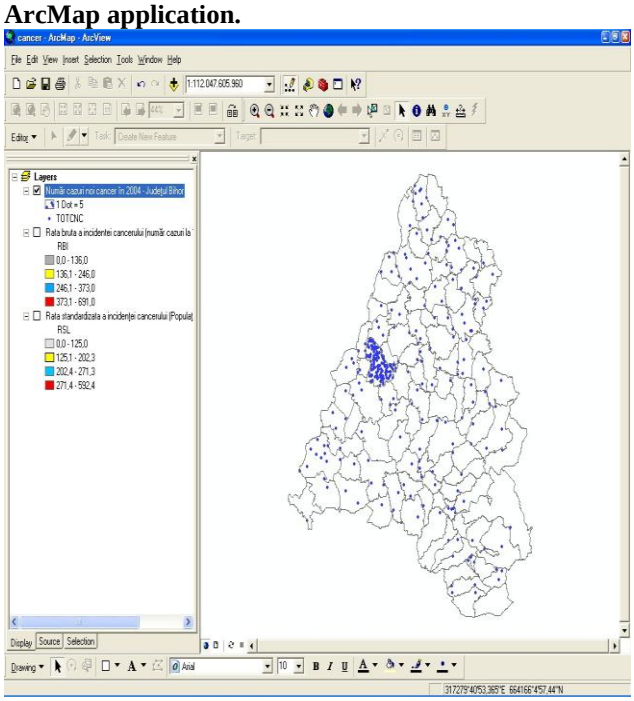
methodologies for the implementation of GIS, regarding the descriptive study of the cancer incidence at the level of a county. I included in the study data regarding the cancer incidence relative to the year 2004 within the county of Bihor and I used the AcrMap product as the informatics application.

The number of new cases per groups of age and municipalities was provided in Excel format (data base) by the Territorial Cancer Registry of the county of Bihor (today, it is called the County Centre for the Evidence of Data Regarding the Cancer Patients). I obtained the data regarding the population per groups of age and municipalities from the Statistics Direction of the County of Bihor.

I turned the Excel format of the data base into a Dbase format, in order to be able to import it in the GIS application. Within the GIS application, I created 3 thematic layers (Picture no.1), as follows:

- A thematic layer regarding the **total number** of cases per each municipality;
- Another thematic layer that comprised the data regarding the **incidence gross rate;**
- **The incidence standardized rate,** with a view to compare the territorial-administrative units, was included in another thematic layer.

Picture no. 1. Creation of the thematic layer with the ArcMap application.



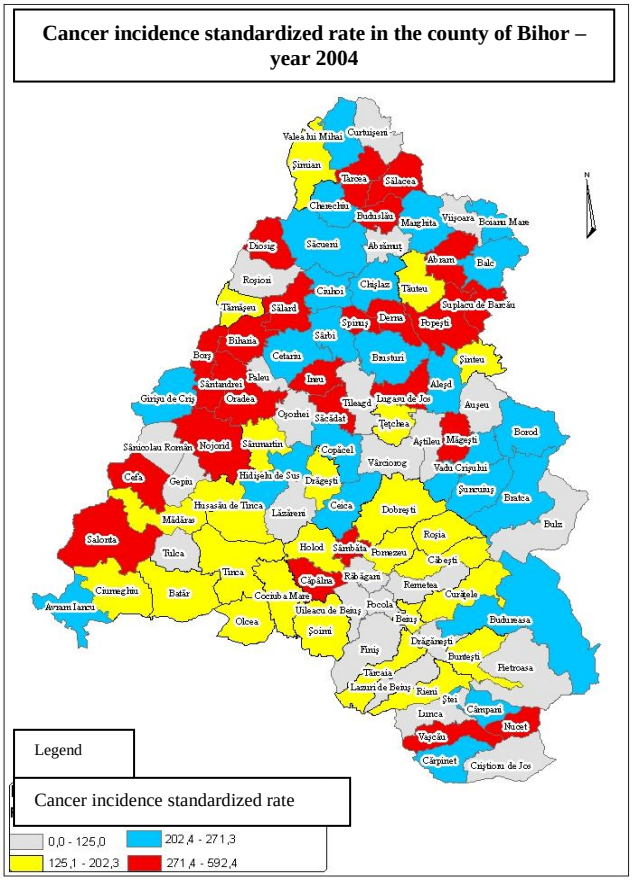
The total number of cases, per each municipality was obtained by summing up the cases of the municipality per each age group. The incidence gross rate was expressed by the relation between the total number of cases and the population of that municipality, to 100.000 inhabitants. For the estimation of the incidence standardised rate, I used the incidence direct standardization, by using the age group structure of the European standard population (Jenicek, 1995) and Cancer Incidence in Five Continents Volume IX. (3) The estimation of rates and their presentation within maps aimed at surprising the differences between the morbidity level in different municipalities, without being able to make judgements on their causality.

The use of GIS in the analysis of the cancer patients has certain limitations due to the quality of the data regarding the patients, population and the geographical support.

RESULTS AND DISCUSSIONS

Although, the geographic information system allows the creation of maps with the incidence gross data (number of cases per municipalities, incidence gross rate per municipalities), the manual issued by the North American Cancer Association of Central Cancer Registries (4) recommends the presentation of incidence under the form of standardized rates per age groups.

Picture no. 2. Map – Cancer incidence standardized rate in the county of Bihor – year 2004



The map drawn up with the ArcGIS application (Map 1) includes each municipality within an interval of the incidence standardized rate for the year 2004. The intervals were established by the software application, based on the data introduced („quantile"). The error factors may occur due to the quality of the incidence data and of the wrong estimation of the standardized rates. It is considered "that a map may tell more than one thousand words". But a map does not tell everything about a phenomenon. The above map shows the municipalities with the highest rates of the cancer incidence (interval

271,4-52,4) and those that may become intervention priorities for the subsequent preventive actions. Still, the model does not provide guidelines on causality and for a more accurate establishment of the priorities, data of many years are needed.

CONCLUSIONS

- The inclusion in the descriptive study of data of many years, in a cumulative manner;
- The future approaches may lead to the accomplishment of incidence maps, according to the topographic localization of neoplasias (cervical cancer, breast cancer, lung cancer etc.) and/or to the stage upon detection, according to the ICD-O-3 classification;
- There is need for the creation of an infrastructure of the cancer spatial data, based on the Territorial Cancer Registries, which should allow analytical causality studies at local level (headquarters, villages, towns), where the aggregation of cases is significantly high.

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