CREATING GIS-BASED CANCER DENSITY MAPS FOR TRABZON PROVINCE OF TURKEY

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ABSTRACT

In Turkey, the prevalence of cancer cases increased and cancer became ranked as the second cause of death. Therefore, forming a cancer control program and putting strategic action plans into practice became an important matter for the health industry. The correlation of variations in different societies and environmental factors should be examined spatially with reliable data. To do this, cancer occurrence density maps have to be created. In this study, a database was built with the use of GIS to examine the distribution of cancer cases, and maps relating to cancer events in allocation units were created. Cancer cases data registered in 2004 by the Cancer Struggle Department of Health Directorate of Trabzon Province of Turkey was used. Using ArcGIS, the distribution of cancer cases was presented on cancer maps including allocation units and incidence values, which were calculated for each town-based region. According to the World standards, cancer rates were determined and examined by the spatial analysis power of GIS.

Introduction

Today, cancer is one of the most important health issues. Because of it seems densely in the community, the health is highly mortal disease which leads to disablements and high treatment cost causes important loses in the national economy and labor. In Turkey, cancer is the second mortal disease leading to deaths (Özet, 2005).

In order to make researches for struggling with cancer, firstly, the cancer problem should be defined. This only could be achieved by defining the number of cancer cases, the most common cancer types and the age period in which cancer cases are prevalent.

World Health Organization (WHO) was designed Cancer Control Program (CCP) to reduce frequency of cancer cases and the death rate originated from cancer, and to improve life quality of cancer patients. This program shows how current resources could be best used to get effective and equitable results (URL-1). Firstly, prevalence of the cancer cases, number of cancerous patients and most common cancer types in Turkey should be known to make CCP applicable in Turkey. In order to develop control strategies for cancer, firstly, there is need for descriptive statistics defining dimension of the disease (Şengelen, 2002).

In 1992, "Turkish Cancer Record and Incidence" project was started to make cancer statistics and control programs available. For this purpose, Cancer Record Centers (CRC) were founded in 11 provinces of Turkey and the cancer cases was started to be recorded in the country. One of these centers is located in Trabzon city. The cancer cases of Black Sea Region of Turkey are recorded in this center (URL-2).

The number of total cancer cases for the Black Sea Region recorded in Trabzon CRC in 2004 is 1939. 1216 of these cases are in Trabzon province.

Trabzon province, locating in North Eastern part of Turkey and having coast to the Black Sea, was selected as a pilot area (Figure 1). There are 17 counties and 537 villages in the province. The total area of the province is 4.664 km^2, the population density is 209 and its population is 975.137 (with respect to 2000 year data). Yearly population growth of Trabzon province was about 20,3% between 1990-2000 years (DİE,2002).

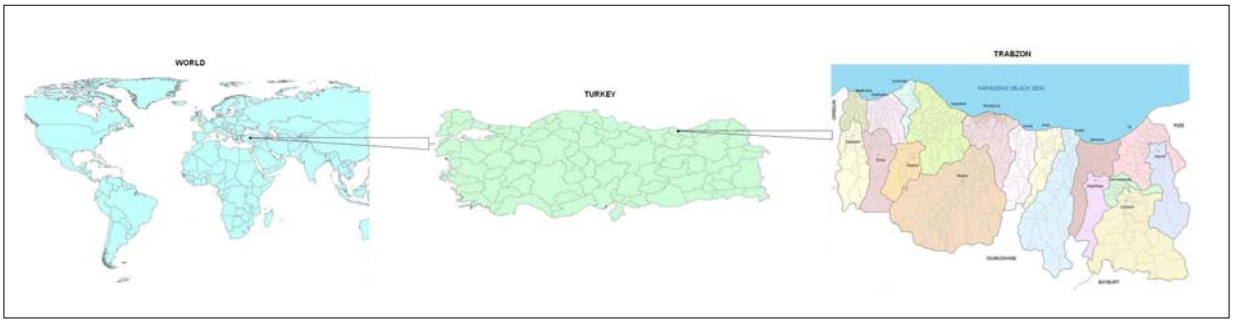

Figure 1: The location of Trabzon Province in Turkey

In this study, firstly, a database using Geographical Information Systems (GIS) set up and then the statistical maps displaying cancer density of settlement areas were with regard to the cancer cases of Trabzon province. In constitution of statistical cancer maps, the cancer cases data recorded in the Cancer Struggle Department of Health Directorate of Trabzon for the year 2004 was used. The cancer cases and related information were displayed on the maps by GIS techniques to make cancer data in spatial meaning. Therefore, distribution of the cancer cases could have been investigated in spatial base.

Purpose:

The main purpose of this study is to design a GIS to present regional distribution of cancer cases within a smart maps formats which based on settlement areas and to carry out some spatial analyses with the geographically interpretation.

This study is a pilot application for the production of cancer maps which are guiding base maps for putting into force the cancer control program effectively and throughout the nation. The method for producing cancer maps will be tested in view of reaching effective results in the usage of these maps for nationwide cancer controls. When cancer maps are produced, there will be opportunities for determining the regions with a considerable density and studying the factors triggering the cancer cases in these regions.

Method:

Data Collection:
In this study, Trabzon province was selected as case study area. The cancer data for Trabzon province was acquired from the CRC which serves within the Cancer Struggle Department of Health Directorate of Trabzon Province. The data recorded in the CRC during the year 2004 was used in producing cancer density maps. During 2004 year, 1939 cancer cases in Black Sea Region were registered within the CRC in Trabzon. Out of this dataset, 1216 cases occurred within the administrative boundaries of Trabzon province were selected for this study. However, after the data quality analysis, some records of cancer cases lacking adequate address information were excluded. After this elimination, a total of 1150 cancer cases were used in the production of cancer maps.

Base Map:
Administrative unit map of Trabzon which was last updated in 2002 was used as the base map for the application. In this base map, there are graphical information representing the boundaries and the centers of administrative units. The data in the map includes boundaries of counties and villages, and their centers. The base map was transferred into topological data structure using ArcGIS 9.x software and the data was stored in the shape (.shp) files. This dataset comprises of two data layers, one is administrative boundaries in polygons and the other is administrative centers in points.

Mapping:
After the determination of the cancer cases applicable for the study, the data was arranged in a ".dbf" file using Microsoft Office Excel. ArcGIS software was used in transferring the cancer data into the base map. In this process, the previously arranged graphical data of

administrative boundaries of Trabzon province together with district boundaries in the city centre of Trabzon were used as the base graphical data. Each case was marked on the map with a point with the guidance of its address information, generating a new cancer distribution layer.

Statistical Study:
With the production of distribution map of cancer cases for Trabzon province, geographical distributions of cancer cases within Trabzon province for the year 2004 were able to be observed. However, in order to be able to perform some statistical analysis and comparisons, calculation of cancer incidence values for each administrative unit was needed. A cancer incidence rate is the number of new cancers of a specific type occurring in a specified population during a year, usually expressed as the number of cancers per 100,000 population at risk (URL-3). For this purpose, the number of cases for each administrative unit was determined. With using case numbers and census data of the year 2000, incidence values for each unit was calculated as in the equation below. In this equation the coefficient "k" is 100.000.

$$\text{Incidence rate} = (\text{New cancers} / \text{Population}) \times k \qquad (k=100\,000)$$

Results:

Producing Statistical Maps:
Statistical map presentations are required to examine the distribution of cancer data geographically. ESRI ArcGIS 9.x software was used at map production phase. Cancer cases were pointed with point symbol on the map. The geographic distribution of each case can be seen with point symbol on Density Map Of Cancer Cases in Trabzon Province (Figure 2). Also, the distribution of cancer cases in view of cancer types can be seen on this produced map. In addition to this, the prevalence of cancer cases based on villages for each county was presented visually.

In this study, incidence values were used as comparison criterion for statistical research. Calculated incidence values present cancer prevalence in allocation areas. The maps presenting cancer prevalence in Trabzon was produced for province and city center separately. Cancer Density Map of Trabzon Province was formed for each allocation unit as to calculate incidence values (Figure 3).

According to WHO, it is expected that 150-300 people are taken cancer illness for 100.000 population (URL-4). In the map, allocation units having incidence value higher than 300 were determined as risky districts in view of cancer density. These figure outs were presented on the map. In the allocation units having incidence value between 150 and 300 have expected results in view of cancer density, according to world standards (Table 1).

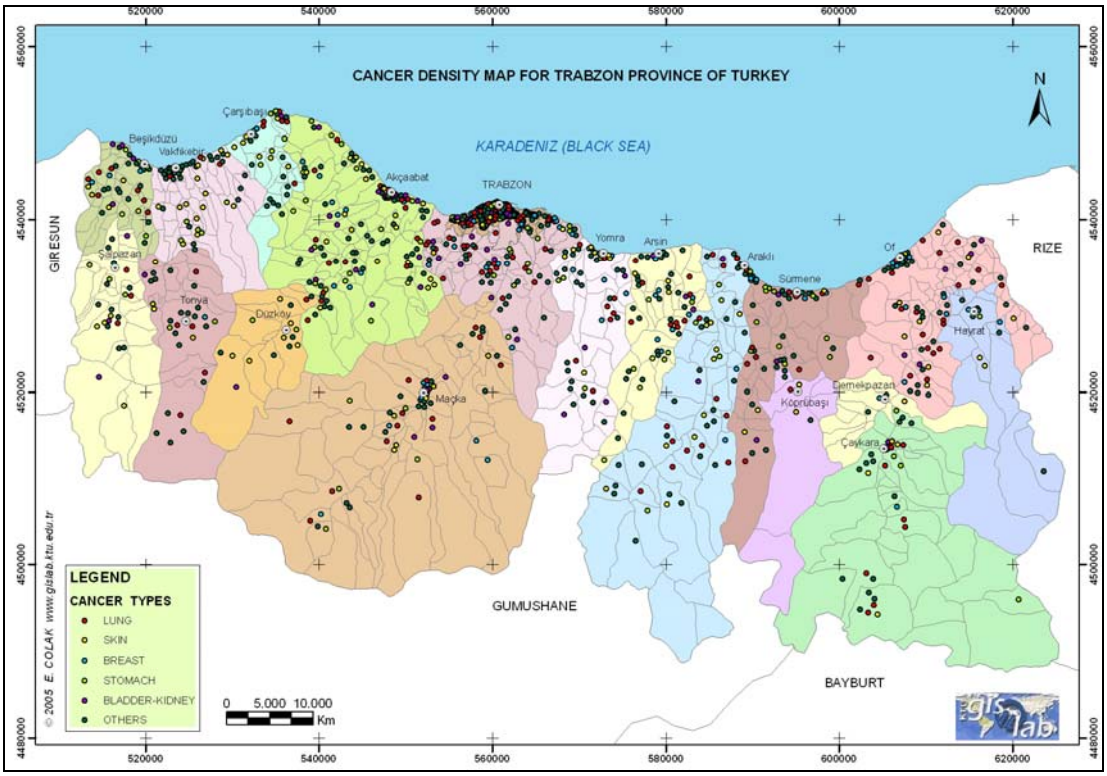

Figure 2: Cancer Density Map for Trabzon Province of Turkey

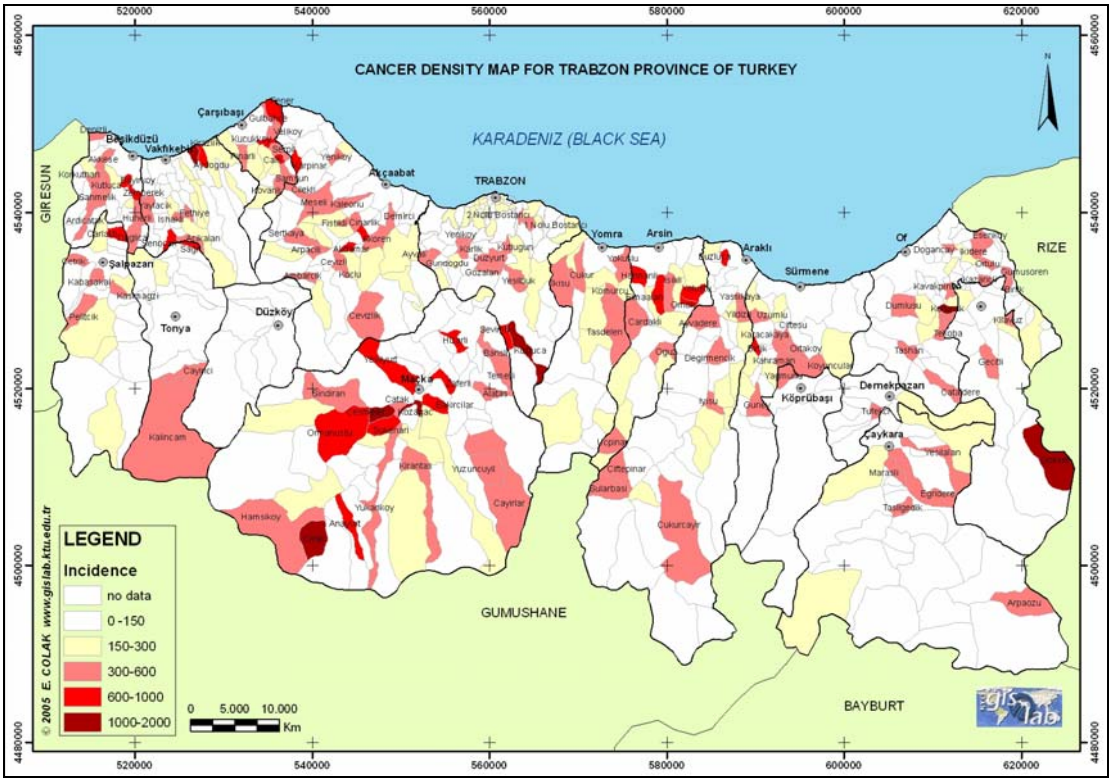

Figure 3. Cancer Density Map of Trabzon Province

Table 1. Allocation Units as to Incidence classes on Cancer Density Maps of Trabzon Province

Classes of Incidence	Number of Allocation Units
0 – 150	349
150- 300	109
300 <	138

Another map which produced by GIS and titled "The Distribution of Skin Cancer Cases in Trabzon Province" as to aspect was produced as a result of statistical works (Figure 4). Existing skin cancer cases were determined and distribution of these was presented on the map with point symbol. The reason for skin cancer cases is indicated to be exposed sunlight too much (Bingöl, 1978). In this way, aspect map was used as base map to present skin cancer cases. The Aspect Map shows solar orientations of slopes with different orientations and districts affected by sunlight so much can be seen on this map. Relation between skin cancer cases and districts affected by sunlight so much can be examined on this map.

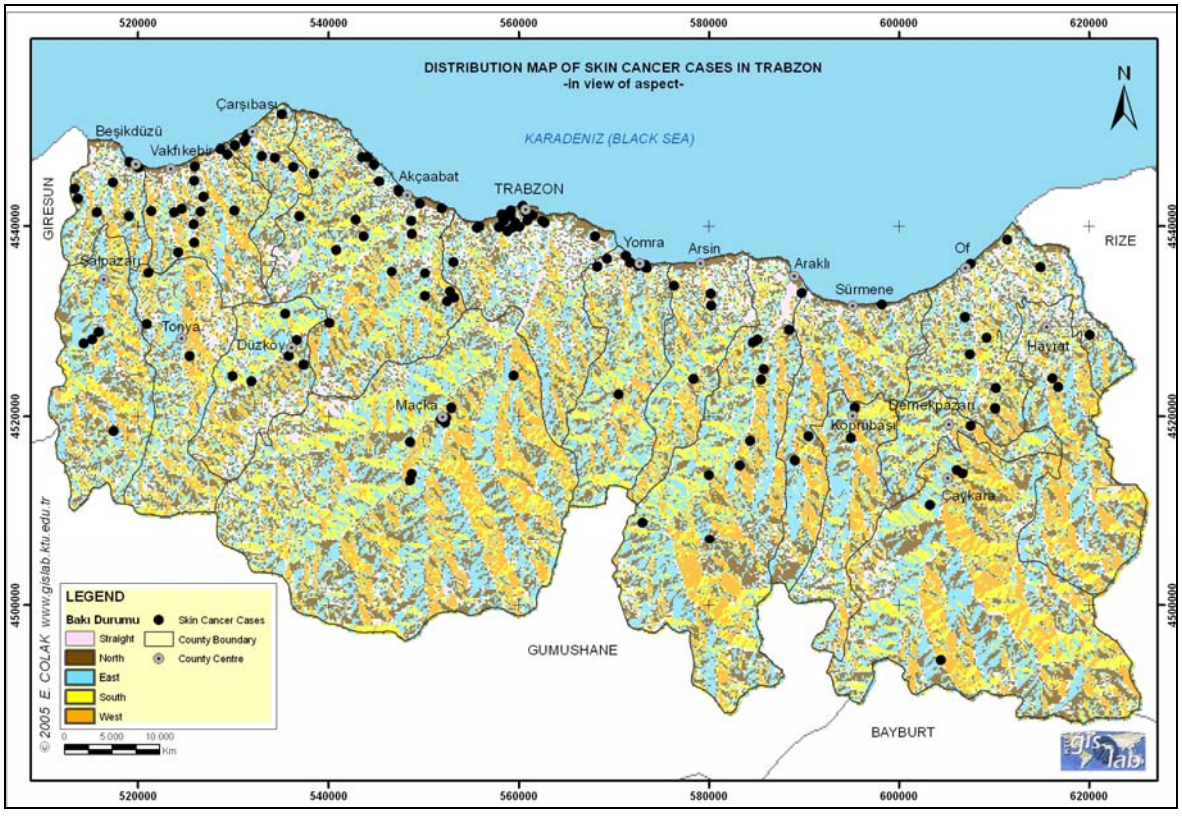

Figure 4. Distribution Map of Skin Cancer Cases overlaid on aspect layer in Trabzon province

Conclusion:

It was determined that totally 138 allocation units out of 596 in Trabzon exceeded the expected number of cancer cases in 100.000 population. 23% of all allocation units exceeded the value accepted as top limit, 300 incidences. But, incidence value in Trabzon province was calculated about 118. This value is under expected cancer risk that is accepted between 150-300 regards 100.000 populations.

When the prevalence of cancer cases with point symbol is examined, it is determined that cancer risky regions have more population density than other regions. It can be perceived on the map that allocations areas in coastal regions, across valley, and city center have more cancer cases. In respect of cancer types, lung, skin, breast, stomach, and urinary bladder can be count as first 5 cancer types in order. As a result of this, it was understood that Trabzon province of Turkey has the same cancer types risks also expected in the world. The most seen cancer types for men are lung, skin, urinary bladder, stomach, and prostate in order. The most seen cancer types for women are breast, skin, thyroid, stomach, and lung.

This study can be seen as a pilot application for presenting the distribution of cancer cases on the maps, producing control programs against cancer, and examining environmental factors causing cancer spatially. This study proved that cancer data should be collected regularly and quite a few researches about biostatistics and epidemiology can be made. It is firstly emphasized that existing cancer cases in Turkey can be recorded completely.

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