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Incidence Patterns and Spatial Analysis of the Most Common Cancers in Southeastern Iran Using Geographic Information System (GIS)

¹Mahmoud Mobasheri and ²Ali Ahmadi

¹Department of Epidemiology and Biostatistics,
Faculty of Health, Shahrekord, University of Medical Sciences, Shahrekord, Iran

²Department of Epidemiology, School of Public Health,
Shahid Beheshti University of Medical Sciences, Tehran, Iran

Abstract: *Background and aim:* Cancer is the third leading cause of mortality in Iran. By use of Geographic Information System, location-based and accurate analytical and descriptive data can be given to health policy makers. The aim of this study is to identify the incidental patterns of cancers (random, scattered, cluster) and analyze them spatially. *Method(s):* This is a periodical descriptive and analytical study which has investigated all new recorded incidents of cancers in Chaharmahal and Bakhtiari Province in southwestern Iran from 2008 to 2011. The data were analyzed using ArcGIS9.3 and Stata12. Spatial Auto correlation coefficient and Moran I and Getis-Ord, t test, ANOVA and Chi-square were used for data analysis. *Results* revealed that in the age Mean and Standard deviation of the patients was 5/81 ±9/59. The mean age of the patients was meaningful according to gender and different towns (P=0.037). Standardized Incidences of Cancer in Shahrekord, Farsan, Ardal, Kiar, Koohrang, Lordegan and Borougen towns were 220/9, 154/3, 143/8, 80/9, 64/2, 61/1 and 57/2 per one hundred thousand of population, respectively. The most frequency of cancers was related to cancers of the digestive system ((2/25%, skin(2/81%)and urinary system (9/85%) and the least of them was related to cartilage(3/0%). Patterns of cancer incidence in southwestern Iran was random (P=0.13519). In *Conclusions:* Reports of differences in cancer incidence based on age, sex, city of residence and non-cluster cancers in the area studied can support the cancer prevention and screening programs focusing hypothesis and pave the road for decision makers and planners in the health system.

Key words: Cancer • Incidence Rate • Incidence Patterns • Spatial Analysis • Southwestern Iran • Province of Chaharmahal and Bakhtiari

INTRODUCTION

Cancer is the second leading cause of death in the world. Global burden of cancers is increasing. In America, every one of four so far died is attributed to cancer [1]. Aging, increasing life expectancy and increased exposure to environmental carcinogens as well as high-risk behaviors, especially smoking, led to increased burden of cancers [2, 3]. In addition, Sex-hormone binding globulin, the major carrier protein for certain sex hormones in the plasma, may also be involved in the altered risk for these cancers in obese people [4].

Survival of cancer patients in developing countries is less than that of developed countries. In these countries, including Iran, cancer is diagnosed at final stages of the disease and with a limited and inability of standard diagnostic and therapeutic services [5]. According to the latest reports, approximately 20 million people worldwide are living with cancer. It is predicted that this figure will reach over 30 million in 2020 [6, 7]. In Iran, after cardio and scular diseases and accidents, cancers are considered to be the third cause of mortality [8]. Annually, more than 30,000 deaths due to cancer are reported and it is estimated that each year more than 70,000 new cases of

Corresponding Author: Mahmoud Mobasheri, Department of Epidemiology and Biostatistics,
Faculty of Health, Shahrekord University of Medical Sciences, Shahrekord, Iran.

cancer are registered in Iran [9, 10]. Breast, skin, stomach, esophagus and colon cancers can be noted as some of the most common cancers in Iran [11]. The incidence patterns of various types of cancer are different among different populations and is related to factors like employment, social, cultural, ethnic, geographic and nutritional issues [3,12,13]. The geographical distribution of cancer seems different in various provinces of Iran. The incidence of cancer in Ardebil, Mazandaran and Kurdistan provinces is more than other provinces [8, 14, 15]. In addition to the increased incidence of cancer in Iran the mean age of cancer, including breast cancer, has decreased from 49 years to 40 years of age [16]. To fully investigate and determine the epidemiology of diseases, including cancers and understand their epidemiology the use of GIS and spatial analysis is helpful. By using this tool, the descriptive and analytical data will be provided more specifically, more tangibly and location-based [7, 13, 14]. According to searches conducted, so far no credible reports of cancer incidence and spatial distribution has been reported in Chaharmahal and Bakhtiari Province and this is the first report in this field that attempts to analyze cancers for each city of Chaharmahal and Bakhtiari Province in southwestern Iran to, while introducing cancers epidemiology in the provincial areas, provide grounds for the possibility of equitable services to needy patients by health authorities. Relevant information about different types of cancer in specific geographical locations can contribute to planning of health services for treatment and screening of high risk groups [17]. This study was done with the aim of spatial analysis and determination of incidence of cancer in Chaharmahal and Bakhtiari province in southwestern Iran.

MATERIALS AND METHODS

This is a periodical descriptive and analytical study. People living in Chaharmahal and Bakhtiari province, southwest Iran are the study population. Chaharmahal and Bakhtiari Province is one of the 31 provinces of Iran. Its capital is Shahrekord. The province is 16,332 square kilometers which equals one percent of the total area of Iran and is the twenty-second largest province of country in terms of area. Chaharmahal and Bakhtiari Province is considered as a mountainous area of the central plateau of Iran and is located between 31 degrees and 9 minutes to 32 degrees and 38 minutes north latitude and 49 degrees and 30 minutes to 51 degrees and 26 minutes east

longitude of Greenwich. Isfahan province in the North and East, Khuzestan province in the west, Kohgiluyeh and Boyer-Ahmad province in the south and Lorestan province in the north-western are its neighbors [18, 20]. The target population is all patients suffering from cancer who were recorded in the Cancer Registry Program of Shahrekord University of Medical Sciences during the years 2008 to 2011 and were selected through census sampling. Cancer diagnosis was performed based on Pathology Laboratory, the coding of ICD-O2 book and International Classification of Diseases and Injuries [7]. The data were collected using the information form available in cancer registry center and a checklist prepared by the researcher. Using data from new cancer cases recorded and demographic information from Statistics Center of Iran crude incidence rates were calculated and using the WHO standard population the age standardized incidence rates were calculated. Standardized incidence rate per hundred thousand population was described and drawn in terms of geographical residence on map. The data were analyzed using t-test, Chi-square, Spatial Autocorrelation and Moran's I Index. For spatial analysis in two global and spatial scales, Spatial Autocorrelation and the statistics of LISA, Global Moran's I and Getis-Ord were used with null hypothesis (random distribution of cancer establishment) is assessed. ArcGIS9.3 software was used for data analysis.

RESULTS

During this four year period study, 1324 new cases of cancer were recorded and analyzed. Mean and standard deviation age of male patients were $2/17 \pm 04/63$, of women $3/19 \pm 2/55$ and of all patients $5/18 \pm 9/59$, respectively. The mean age of the patients was significantly lower in women than in men ($P = 0.001$). The overall mean age of patients among different cities was significant ($P = 0.037$). The lowest mean age was related to the city of Ardal ($22 \pm 7/52$) and the highest mean age to the city of Kiar ($12 \pm 2/62$), respectively. The highest incidence was in 79-75 year olds with 16.12% and the lowest incidence in 34-30 year olds with 1.3%. 7.39% of cancers were in women ($n = 525$) and 3.60% in men ($n = 799$), respectively. 93% of patients were married and 34% of patients had a history of cancer in first-degree relatives. The annual incidence rate of the province was

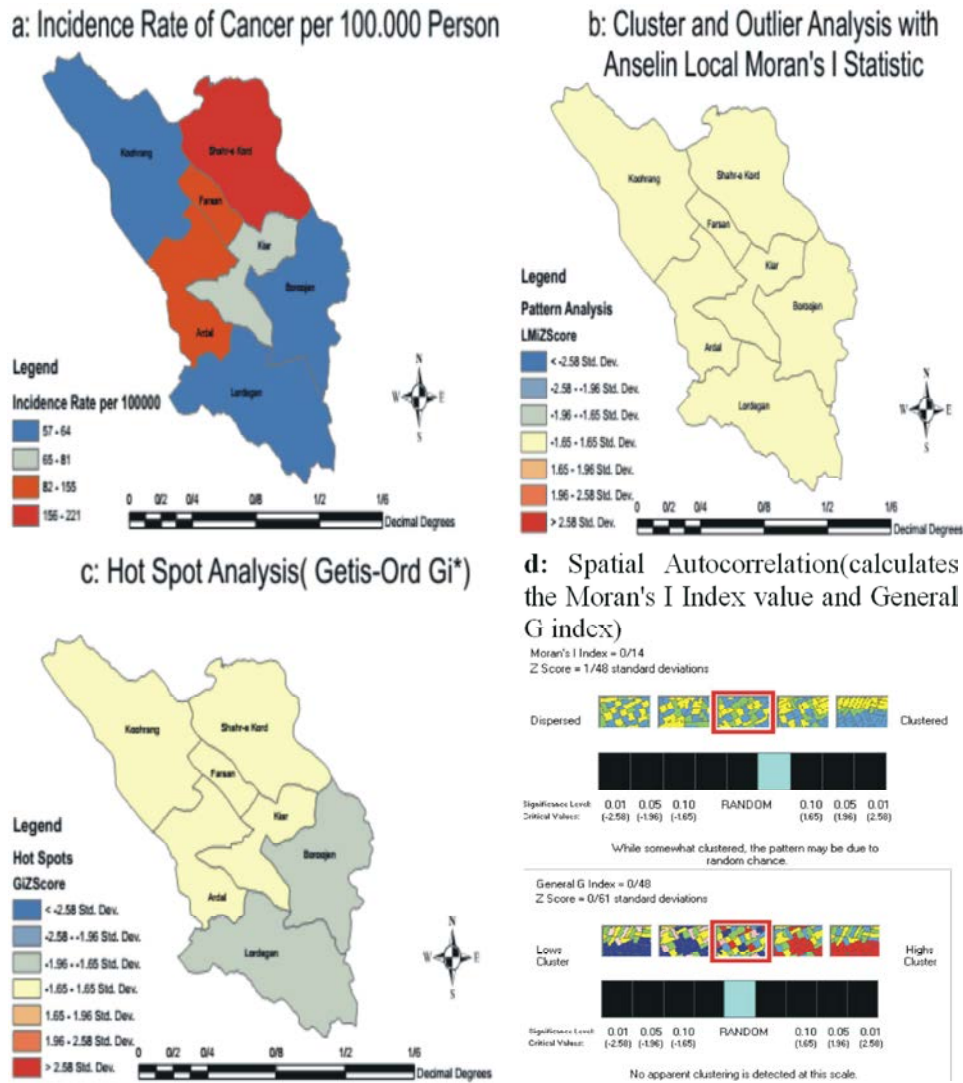


Fig. 1: Spatial Analysis of Cancer in Chaharmahal and Bakhtiari Province- in the southwestern of Iran

147.9 in one hundred thousand populations. Standardized incidence rate for males was 177.3 in one hundred thousand population and for women 118.1 in one hundred thousand population. Cancer incidence in men was significantly more than women ($P = 0.027$). Annual Cancer incidence rate in cities of Shahr-e Kord, Farsan, Ardal, Kiar, Koohrang, lordegan and Borougen was 220.09, 154.43, 143.38, 80.09, 64.4, 60.01 and 57.72 in one hundred thousand populations, respectively. Topography of most frequency of cancers was related to cancers of the digestive system (25.2%), skin (17.2%), urinary tract (15.9%), breast (1.9%) and reticuloendothelial system (6.6%) and the least of them have been related to cartilage (3.0%), peritoneum and soft tissue (9.0%). Based on the coefficient of global autocorrelation

(Spatial Autocorrelation) no specific pattern has been observed in the distribution of cancer in different cities (Moran's Index: 0.146 and riance: 0/044, Z-Score: 1/493942 and p-andlue: 0/135191). Standardized incidence of cancer is presented in map no.1.

DISCUSSION

Our findings in this study show that the mean age of onset of cancer is significantly different by gender, age and location (city). Cancer incidence in men is more than women. In this study patterns of cancer incidence for the first time in Chaharmahal and Bakhtiari Province in southwestern Iran is calculated and then reported. Our findings are not consistent with those of a study in

Mazandaran province, northern Iran that has reported the common cancers in men are stomach, skin, esophagus and cancers of the women are breast, colorectal, skin. In our study, the incidence of cancer in the male: female ratio was 1/52 but in the study of Mazandaran this ratio was close to 1 [12]. Cancer incidence rate in southwestern Iran seems greater than and different from a study performed in Tehran that reported incidence rate of cancer is 72 in one hundred thousand population [17, 19]. The results of our study seem the same as those of a study performed in Ilam[19]. Also, the results of our study are consistent with a study in Semnan province in central Iran that reported the mean age of the patients to be 59 years. In Semnan province, the most common cancer, also, was reported to be Gastrointestinal Cancer with 47% of all cases. But in our study, this figure is 25%.

The results of our study is also different from the results of a study in Kurdistan province of Iran, located in the West. In Kurdistan, skin, stomach and esophageal cancers were the most common. The limitations of this study include the lack of the availability of cancer registry data for 2011 and later. In case of access to these data, we could consider determining the incidence progress of cancers. It is suggested to be considered in future studies.

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Conflict of Interest: The authors of the present work declare no conflict of interest.

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