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## Geographical Distribution of Gastrointestinal Cancer Mortality in Kurdistan Province

<sup>1</sup>Jamshid Yazdani Cahrati, <sup>2</sup>Faride Khosravi, <sup>2</sup>Masood Moradi, <sup>3</sup>Azar Kabirzade

<sup>1</sup>Assistant Professor, Department of Biostatistics, School of Health, Mazandaran University of Medical Sciences, Sari, Iran

<sup>2</sup>MSc. Student, Department of Biostatistics, School of Health, Mazandaran University of Medical Sciences, Sari, Iran

<sup>3</sup>Instructor, Department of Medical Records and Health Information Technology, School of Allied Medical Sciences, Mazandaran University of Medical Sciences, Sari, Iran

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### ABSTRACT

**Background:** Gastrointestinal cancers are among the most important and the most common causes of cancer-related deaths and disabilities. Geographical features and diets are among the factors which can influence this consequence. This study aimed at recognizing the high risk regions of gastrointestinal cancer death in Kurdistan Province. **Material and Methods:** In this longitudinal descriptive study, the gastrointestinal cancer mortality data recorded in rural and urban regions of Kurdistan Province from 2005 to 2010 were obtained from the Health and Cure Deputy of Kurdistan University of Medical Sciences and were analyzed through appropriate methods at 0.05 level of significance. **Findings:** Out of 3076 gastrointestinal cancer death cases, 38% (n = 1168) were women and 62% (n = 1906) were men. The common gastrointestinal cancers in Kurdistan province in sequence were stomach cancer with 1700 cases (55.3%), liver and biliary cancer with 581 cases (18.9%), oesophageal cancer with 402 cases (13.1%), small intestine cancer with 106 cases (6%), colon cancer with 180 cases (5.9%), lips, mouth and throat cancers with 24 cases (0.8%) and rectal and rectosigmoid cancer with 3 cases (0.1%). **Conclusion:** Since the high risk regions of the province were identified, measures, such as raising awareness and encouraging people to adopt healthier life styles especially correcting food habits, should be taken to help decrease the gastrointestinal cancer mortalities.

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## INTRODUCTION

Cancer mortality statistics, in every country, can serve as an extremely important tool in public health and epidemiologic studies for preventing, controlling, effective screening and cure [1-2]. The changes in the disease burdens observed over the past century indicates that the substantial decrease in the infectious diseases is not exclusive to developed and industrial countries, rather it is experienced in developing countries, as well [3]. Cancer is one the five leading causes of death among different age groups of men and women and in industrial countries, following cardiovascular diseases, it is the second cause of death. This is while in Iran, it is the third leading cause of death which comes after cardiovascular diseases and accidents. This kind of disease is the major cause of death among women of 40 to 60 years of age and men of 60 to 79 years of age [4-5]. In general, 1660290 new cases of cancer and 580350 cases of cancer death were reported in the United States in 2013 which shows that during the recent five years (2005-2009) the contraction rate of cancer had a 6% decrease among men and it was steady among women so that the rate of deaths resulting from cancer had a decrease of 1.8% per year among men and 1.5% among women. Gastrointestinal cancers include the most common malignant tumors and are among the leading causes of cancer deaths. Reportedly, there have been 290200 new cases of gastrointestinal cancers and 144570 such cancer deaths among both genders in the United States in 2013.

Drawing geographical patterns of diseases has been used since early twentieth century and it is one of the important tools for determining the spatial pattern of diseases. Utilizing maps is useful both for contagious and non-contagious diseases. Emphasis on the relationship between health and geographical location has a long history in the literature [8-9].

**Corresponding Author:** Faride Khosravi, MSc. Student, Department of Biostatistics, School of Health, Mazandaran University of Medical Sciences, Sari, Iran.  
E-mail: jamshid\_1380@yahoo.com, Tel: +981513543080-5, Fax: +981513542473

Since gastrointestinal cancers are invasive and lack clear clinical symptoms, most cancer patients who refer to medical centers are at the advanced levels of the disease and have short life spans after the diagnosis [10]. Taking this into account and since Kurdistan province is one of the high risk provinces in Iran in terms of gastrointestinal cancer development; we decided to do the current study.

#### Methods:

In this study, digestive system cancer mortality data recorded in rural and urban regions of Kurdistan Province from 2005 to 2010 were obtained from the Health and Cure Deputy of Kurdistan University of Medical Sciences and were classified based on the classification in the second chapter of International Classification of Disease, 10th edition (ICD10). Then the data were fed into SPSS 19 software and were analyzed through appropriate methods. In order to check the relationships between variables, Poisson regression was utilized. Since comparing the mortality rates of populations with different age ranges is complicated, direct and indirect standardization methods are used first. In the indirect method, which is more common, the number of expected deaths can be used but the index which is used more is the ratio of expected deaths to the real deaths which is called Standardized Mortality Ratio [11]. In order to assess the significance of deaths in rural and urban areas, the proportion of urban and rural populations were taken into account as the baseline values and Binomial test was used. To calculate the hazard ratios STATA software was used and to identify high risk and low risk areas, after comparison through indirect method and estimation of SMRs, GIS software was used.

#### Findings:

Out of 3076 death cases from gastrointestinal cancers, 38% (n = 1168) were women and 62% (n = 1906) were men Binomial test indicated that the gender ratio in Kurdistan province was significant (0.05). The mean age of the deceased was  $68.23 \pm 14.69$ . The ratio of city dwellers to villagers was also significant (0.05). 55.7% (n = 1713) of deaths occurred in villages and 44.3% (n = 1360) of death occurred in cities and a significant statistical difference was observed between the mean age of the deceased in villages and cities ( $P < 0.05$ ). A total of 246 deaths occurred in Bane, 133 deaths in Sarvabad, 513 deaths in Saghez, 715 deaths in Sanandaj, 467 deaths in Ghorve, 289 deaths in Bijar, 185 deaths in Kamyaran, 236 deaths in Marivan and 29 deaths occurred in other cities.

Mortalities from the gastrointestinal cancers common in Kurdistan province in consequence include stomach cancer with 1700 cases (55.3%), liver and biliary cancer with 581 cases (18.9%), oesophageal cancer with 402 cases (13.1%), small intestine cancer with 106 cases (6%), colon cancer with 180 cases (5.9%), lips, mouth and throat cancers with 24 cases (0.8%) and rectal and rectosigmoid cancer with 3 cases (0.1%). Most deaths occurred in the seventh decade of life (32.4%). The largest number of gastrointestinal cancer deaths (n= 569, 18.5%) were recorded in 2008. The highest rate of gastrointestinal cancer death among women was in Divandare with the rate of 125 per 1000 deaths and among men it was 121.9 per 1000 deaths. The rate of gastrointestinal cancer deaths in rural areas equaled 568.91 and in urban areas it equaled 464.64 per 1000 deaths. Hazard ratio was used to investigate the demographic features in different cities of the province. In all cities except Bane, Divandare and Ghorve, the hazard ratio of men to women was obtained to be more than one. The highest hazard ratio was in Marivan and it equaled 1.392.

As Table 1 displays, the hazard ratio of urban areas to rural areas was obtained more than 1 in Bane and Sarvabad and in other cities, the risk of rural areas was higher. Gastrointestinal cancers in rural areas had a death risk 1.462 times more than those in urban areas and in all cities except Bane and Sarvabad this ratio was significant.

**Table 1:** Distribution of gastrointestinal cancer deaths by geographical areas.

City	Hazard ratio of urban to rural regions	95% confidence interval		Level of significance
		Low bound	High bound	
Bane	1.69	0.902	1.522	0.112
Bijar	0.704	0.552	0.897	0.001
Divandare	0.676	0.484	0.928	0.005
Sarvabad	1.534	0.718	2.918	0.103
Saghez	0.6	0.502	0.716	0.000
Sanandaj	0.784	0.668	0.923	0.001
Ghorve	0.709	0.584	0.86	0.000
Kamyaran	0.587	0.394	0.854	0.001
Marivan	0.511	0.387	0.672	0.000
The whole Province	0.684	0.637	0.735	0.000

Since mortality rate is a cumulative magnitude, all independent variables need to be in cumulative form. After fitting the Poisson regression model, the risk of deaths due to digestive system cancers among men was 1.53 times more than that among women and in rural areas it was 1.13 times more than urban areas. One of the

advantages of Poisson regression is that in these models, the effect of several risk factors can be investigated. The results of such an investigation are shown in the below tables.

**Table 2:** Results of the Poisson regression fitting.

	Hazard ration on a numerical scale	Level of significance	Confidence interval
Gender	1.53	0.6	(0.132,3.248)
Geographical location	1.13	0.88	(0.178,4.381)
Mean age	1.22	0.001	(1.08,1.37)
Ratio of rural to urban areas	1.12	0.11	(0.97,1.29)

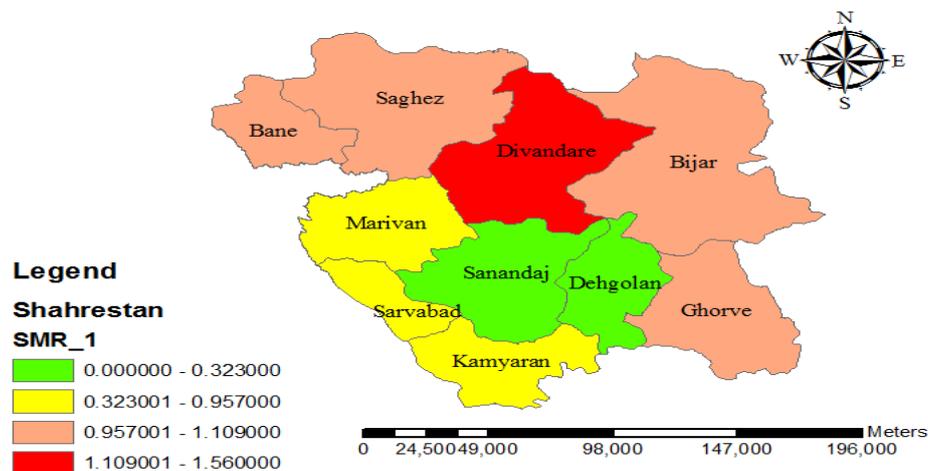
As Table 3 shows, stomach cancer with a mortality rate of 110.51 per 100,000, is the most fatal gastrointestinal cancer in the province, and its hazard ratio in men to women is 1.05 and in urban to rural areas is 0.713. The hazard ratios of men to women in oesophageal and colon cancers were significant. Moreover, the risk ratio of mortality in urban to rural areas in stomach, colon and small intestine were also significant.

**Table 3:** Distribution of mortality rate by type of gastrointestinal cancer.

Cancer	Mortality rate per 100,000 persons	Risk ratio of men to women	Level of significance	Risk ratio of urban to rural areas	Level of significance
Stomach	110.51	1.05	0.14	0.713	0.000
Oesophageal	26.13	0.68	0.000	0.88	0.11
Colon	11.7	0.78	0.05	1.69	0.000
Liver and biliary	37.77	0.89	0.08	1.01	0.46
Small intestine	11.9	0.78	0.053	0.61	0.000
Rectal and rectosigmoid	0.19	1.14	0.48	4.11	0.1
Lips, mouth and throat	1.56	1.14	0.39	0.514	0.06

In order to determine high and low risk areas of the province, after calculating the Standardized Mortality Ratio (SMR) through indirect methods, the related map was drawn. Map 1 displays the observed values of SMRs for gastrointestinal cancer mortality during 2006-2010.

As the map shows, Divandare with an SMR of 1.56 is the highest risk city in the province. A high risk cluster drawn from the southeast to the northwest of the province is observable on the map.



**Fig. 1:** Map of the gastrointestinal cancer deaths across Kurdistan province.

Many studies show that SMRs in less populated regions are a little higher [11]. After calculating the density of population in each city and performing the correlation tests, no statistically significant result was observed.

#### Discussion:

In Iran, because of its geographical features and nutritional habits of people, a lot of digestive system cancers are observed in the country and these cancers account for a considerable number of deaths. Prevalence of these cancers is to a great extent different in different parts of the world and among different ethnic groups. A study done in Korea shows that from 1999 to 2008, there has been a 3.1 increase in the annual incidence rate of all cancers [19]. Stomach cancer is the second leading cause of death from cancerous tumors in the world and the highest percentage of stomach cancer development is reported from China, Korea, and South American countries which may result from different diets [6-15]. This cancer with the mortality rate of 110.51 per 100,000 was found to be the most fatal gastrointestinal cancer in Kurdistan province. Oesophageal cancer forms about

5.5% of malignant tumors of the digestive system and considerable changes have occurred over the past thirty years in its epidemiology in North America and most western countries, and there has been a rapid increase in its incidence [5]. Oesophageal cancer with a mortality rate of 26.13 is the third leading cause of death from cancer in Kurdistan. Oesophageal and stomach cancers together as the cancers of upper digestive system are still among the most widespread causes of cancer death in the north of Iran and they are the cause of 16% of annual mortality across the world [13-14]. According to a study done by Molanaei and colleagues in 1999 on oesophageal and stomach cancers in Kurdistan province, the risk factors of these cancers were different from those of other regions and alcohol and smoking had a less important role in their incidence [17].

Colorectal cancer with an annual incidence of one million and a mortality of more than 500,000 is regarded a global concern and is the second leading cause of death from cancer. In a study done in 2006 in Kurdistan, periodic outbreak of colorectal cancers during 1995-1999 was about 7 cases per 100,000 populations [16].

As Mohammadpour Tahmtan and colleagues report, hazard ratio of mortality from digestive system cancers in Mazandaran and Golestan provinces in men was 55% more than women [8]. After fitting the Poisson regression model, the hazard ratio of death from cancer among men was 1.53 times more than that among women and in rural areas it was 1.13 times more than urban areas. One reason for this may be more alcohol and tobacco use by men than women. In addition, the hazard ratio in rural areas of all cities except Bane and Sarvabad was higher which may be caused by insufficient awareness to prevent the disease, scarcity of health facilities, hospitals and health care centers in these areas. In the Poisson regression model, the effects of mean age and the ratio of urban to rural areas were compared for the cities of the province. Regardless of urban or rural areas, with each year of increase in the mean age, the gastrointestinal cancer death risk increases by 1.22 times and in equal age conditions, the gastrointestinal cancer death risk in rural areas is 1.12 times more than the urban areas.

Drawing geographical maps is of high importance for decision makers in health arenas of the society for preventing and cure purposes [17]. In a study done by Asmari and colleagues on preparing the geographical maps of the incidence of stomach cancer in Iran over a five year span, as the result of Kriging regression indicate, Divandare with a variance of 1.01 showed the highest incidence (16.36). Results have shown that the north and northwest of Iran (especially provinces of Ardabil, Mazandaran, and Kurdistan) have a higher incidence of stomach cancer than the south and desert regions [18]. The relationships between SMRs and the density of the populations in the cities were not found statistically significant. However, in a similar study, the relationships between SMRs of the road accidents and population densities in Mazandaran province were found to be significant [12]. As the geographical map indicates, a high risk cluster draws from the southeast to the northwest areas. Sanandaj and Dehgolan with an SMR of 0.323 were found to be the lowest risk cities in the province. This shows that the levels of health, health facilities and people's awareness have increased in these cities. High risk cities of Kurdistan province in order are Divandare with an SMR of 1.56, Ghorve with an SMR of 1.09, Saghez with an SMR of 1.07 and Bijar with an SMR of 1.045. The results of the available studies imply the necessity of another study in Divandare to investigate the causes of gastrointestinal cancer development and deaths in this city.

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