

Recent Trends and Geographical Distribution of Thyroid Cancer in Iran from 2004 to 2009

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Abstract

Background: To prevent and control the cancers in Iran, the Iranian Department of Health has released the cancer rates data of the country. As the report has suggested, the incidence rate of thyroid cancer would be the most rapidly increasing among all the cancers. The study has aimed to carry out a qualitative assessment of thyroid cancer in Iran, during the 2004 to 2009, in a cross-sectional setting.

Methods: The incidence rates, the trend of individual provinces, the mean age at which the disease occurred, the correlation between incidence rate and median urinary iodine concentration were the parameters evaluated in our study.

Results: The average annual incidence rate during these six years was 2.17 per 100000. Chaharmahal-o-bakhtiari, had the highest incidence rate, but the East Azerbaijan provinces had the lowest incidence rates respectively. The age of diagnosis was the lowest in Ardebil but the highest in West Azerbaijan. In our study, we have found the positive correlation between thyroid cancer incidences with low urinary iodine concentration among all provinces (p-value=0.025).

Conclusion: Presently, the only recognized measure procedure for reducing thyroid cancer risk would be perhaps the correction of median urinary iodine concentration. Further researches have seemed to be required for investigation the other factors, in order to introduce preventive measures in Iran.

Keywords: Thyroid cancer (TC); Incidence rate; Cancer registry; Urinary iodine concentration; Iran

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Introduction

Among the all cancers, thyroid cancer has shown the most rapid rise of incidence worldwide; that is, 6.8% per year among the males since 1998, and 6.9% per year among the females since 2002 [1]. The incidence rate has estimated to be 2.13 per 100000 persons in 2008 [2]. It would be the 9th most common cancer in women around the world. However, only 0.003% of the budget on cancer research has invested in thyroid cancer all over the world [1].

According to the data has recently released by the American National Cancer Institute (NCI), thyroid cancer has increased at a rate of 6.5 percent per year from 1997 to 2006, emerging as the fastest

increasing cancer among the men and women [3]. In the United States, just in 2013, about 45,000 women and 15,000 men have diagnosed as thyroid cancer patients. The majority of this population were older than 45 [4].

The age-standardized incidence rate for thyroid cancer was 14 per 100,000 persons in Canada in 2012 [5].

Thyroid cancer was the second most common malignancy among females at King Faisal Specialist Hospital and Research Centre (KFSH & RC) in Saudi Arabia in 2008 [6].

The incidence of new cases on the basis of 2005 data was 8.44 per 100 000 persons in Turkey, That was the third cancer in that country [7]. On the other hand, thyroid cancer has shown a relatively

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smaller incidence in Baluchistan of Pakistan in comparison to USA and UK, due to the lack of education and health care facilities [8].

In Iran, a survey has reported by the cancer institute of Iran, have been suggesting that thyroid carcinoma constituted 76.1% of all cases of endocrine cancer [9], and the incidence rates of females and males were 3.5 and 1.0 per 100,000 persons respectively [10].

Not only the marked increase in the thyroid carcinoma incidence worldwide, but the information of incidence and causes of the disease in Iran has shown the limited rates. Since 2004, the Iranian Department of Health has been promoting the Iran Cancer Data System regarding the prevention and control of any communicable diseases, as a key strategy in its fight against cancers in Iran. It has provided us the opportunity to report the trend for the incidence of thyroid cancer in Iran.

The objective of our study would be to examine the geographic variation of thyroid cancer in Iran over a period from 2004 to 2009.

Materials and Methods

Study population

The data of the thyroid cancer cases has diagnosed in Iran during 2004–2009, have obtained from the Iran Cancer Data System Registry (ICDR), which has covered the whole country. The collected subjects have sent, from both of the pathologic and non-pathologic centers, of the country to the provincial medical centers, where the data have corrected and coded and then sent to the non-contagious diseases unit of the cancer bureau. The report has then scrutinized in terms of coding and demographics, and correction has done after finding the duplications. Finally, the cases that have newly occurred in the recent years have extracted. There was likely to be patients who previously had a certain type of tumor but now have investigated for their new tumor case.

Definition of cases

The data has provided by the registry included the year of diagnosis, gender, age group (<9 years, 80+, and 10-year categories in between), and province of diagnosis for each case. The incidence rates and the trends of individual provinces have calculated for the period of 2004 to 2009. The mean age at which the disease has occurred and the correlation between the incidence rate and median

urinary iodine concentration have measured for different provinces.

Statistical analysis

Continuous and categorical variables have reported by means (SDs) and frequencies (percentages) respectively. The trend of incidence rate has measured by a chi-square test of trend. The level of significance has considered below 0.05. All the analyses have performed using an SPSS version of 11 and R. To compute the mean annual incidence rate, weighted mean has used.

Results

A total of 9138 cases of thyroid cancer aged between 0 and 100 years have reported to the Iran Cancer Data System Registry during 2004 to 2009. The total annual incidence rate in the six years was 2.17 per 100000, most of whom were women (73.8%). Among the thyroid cancers, the most frequent type was Papillary Carcinoma (81.8%).

Total trend

Using a chi-square test for evaluating the trend, the incidence of thyroid cancer has shown a significant increase during 2004-2009 (p -value<0.0001). The trend has illustrated in Figure 1.

Incidence rates in provinces

Table 1 has shown the annual incidence rates (based on the mentioned six years) in a descending order. Chaharmahal-O-Bakhtiari, Isfahan and Fars provinces had the highest incidence rate respectively. However, Eastern Azerbaijan, Sistan va Baluchistan and Hormozgan had the lowest incidence rate respectively. Figure 2 has shown the concentration map in Iran.

Total trends in different provinces

The incidence rates of all the provinces in Iran have computed for the period of 2004 to 2009. The corresponding trends have illustrated in figures 1-3. The incidence has found to be significantly increasing in every province except for Hamadan, Qazvin, Qhom, Semnan, and Zanjan. Most of the p -values were below 0.0001 (Table 1). The total annual incidence rate in these six years was 2.17 per 100000. Although the trend of the disease in East Azerbaijan, Sistan va Baluchistan, and Hormozgan was significant, the incidence rates of these provinces were low. The trend in Qazvin was not significant, but the incidence rate was almost high.

Age in provinces

The ages of diagnosis in Ardebil and West Azerbaijan were the lowest and the highest of all the

Table 1. The incidence rate of thyroid cancer in different provinces of Iran.

p-value for test of trend	Incidence rate peryear	provinces
0.047	3.60	CharmahalBakhtiari
<0.0001	3.43	Esfahan
<0.0001	2.62	Fars
<0.0001	2.47	Kerman
0.049	2.41	Yazd
<0.0001	2.01	Mazandaran
<0.0001	2.01	KohgiroleBoyerahmad
0.325	1.95	Ghazvin
<0.0001	1.84	Kermanshah
<0.0001	1.81	Tehran
<0.0001	1.80	Gilan
0.005	1.64	Boshehr
0.006	1.64	Golestan
0.0003	1.56	Lorestan
0.098	1.54	Hamedan
0.031	1.53	Markazi
<0.0001	1.48	KhorasanRazavi
<0.0001	1.47	Khozestan
<0.0001	1.40	West Azerbaijan
0.83	1.38	Semnan
0.002	1.18	Kordestan
0.78	1.14	Ghom
<0.0001	1.11	Ardebil
0.93	1.07	Zanjan
0.42	0.94	Ilam
<0.0001	0.90	Hormozgan
0.001	0.77	SistanvaBaluchistan
<0.0001	0.76	East Azerbaijan

provinces. As indicated in Table 2, the range of mean age was 10.45 (48.63-38.18).

Correlation between incidence rate and median urinary iodine concentration

The Spearman correlation between the incidence rates in provinces and the median urinary iodine concentration has calculated and found to be 0.44, which was statistically significant (p-value=0.025).

The incidence rate of thyroid cancer in different provinces of Iran

Considering all the provinces, the mean age of patients at the time of diagnosis was the lowest and the highest in Ardebil and West Azerbaijan respectively. The range of mean age was from 48.63 to 38.18, namely as wide as 10.45.

Discussion

To the best of our knowledge, this report would be the largest study ever done on thyroid cancer patterns in Iran and the first one to compare the incidence rates in different provinces of the country. Our results have revealed that thyroid cancer incidence would be on the rise in most of our provinces. The highest annual incidence rates have seen in two provinces including Charmahal Bakhtiari and Esfahan.

The findings of a clustery pattern and the wide geographical variation of thyroid cancer incidence in our provinces have made us to investigate a relevant impact of one or more exposures or nutrition-related factors of this variation.

From 2003 through 2007, a rising incidence rate has seen in the female population in most provinces of Canada [1]. Between 2000 and 2009, in 18 geographical registries in the United States, the incidences have shown a two-fold difference, from Alaskan natives to Connecticut [11].

Between 1996 and 2000, a population-based registry has conducted in Iran. Comparing the data from this study with those of a similar study has performed in Tehran in 1998-99, the patients have found to be younger and the age difference between male and female cases was lower in this study [10].

In the series of such research, a study in Tabriz has shown a rising incidence for thyroid cancer [12].

In a study that has conducted between 1998 and 2001, 429 cases of primary thyroid cancer have registered in Tehran Metropolitan Area Cancer Registry. Thyroid cancer has reported to exit in patients of one to eighty years of age. In TUM study (i.e. one of the largest studies in the country, carried out in Tehran University of Medical Sciences), the

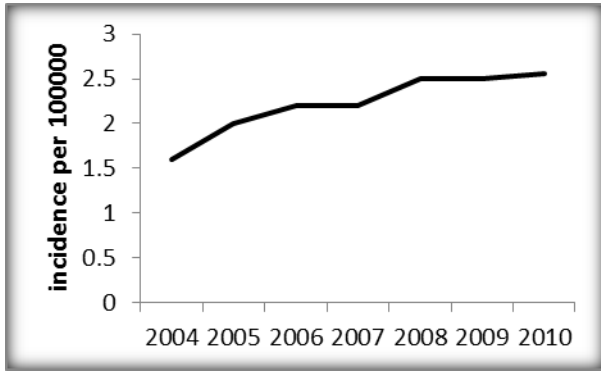


Figure 1. The trend of thyroid cancer during 2004-2009

mean age of the Iranian patients was 42.8 ± 0.9 with male patients being markedly older. Thyroid cancer was also more common among women.

Seventy percent of the tumors were papillary, 11% follicular, 6.2% medullary, and the rest were other subtypes. The patients have affected by the anaplastic type were older at the time of diagnosis, a

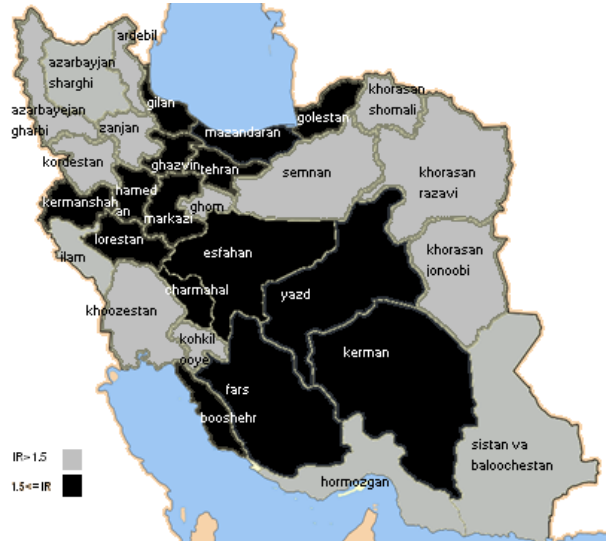


Figure 2. The concentration map of incidence rate in Iran

finding in agreement with the worse prognosis of this type of thyroid cancer [10]. It would be comparable to another study in Iran on 602 patients,

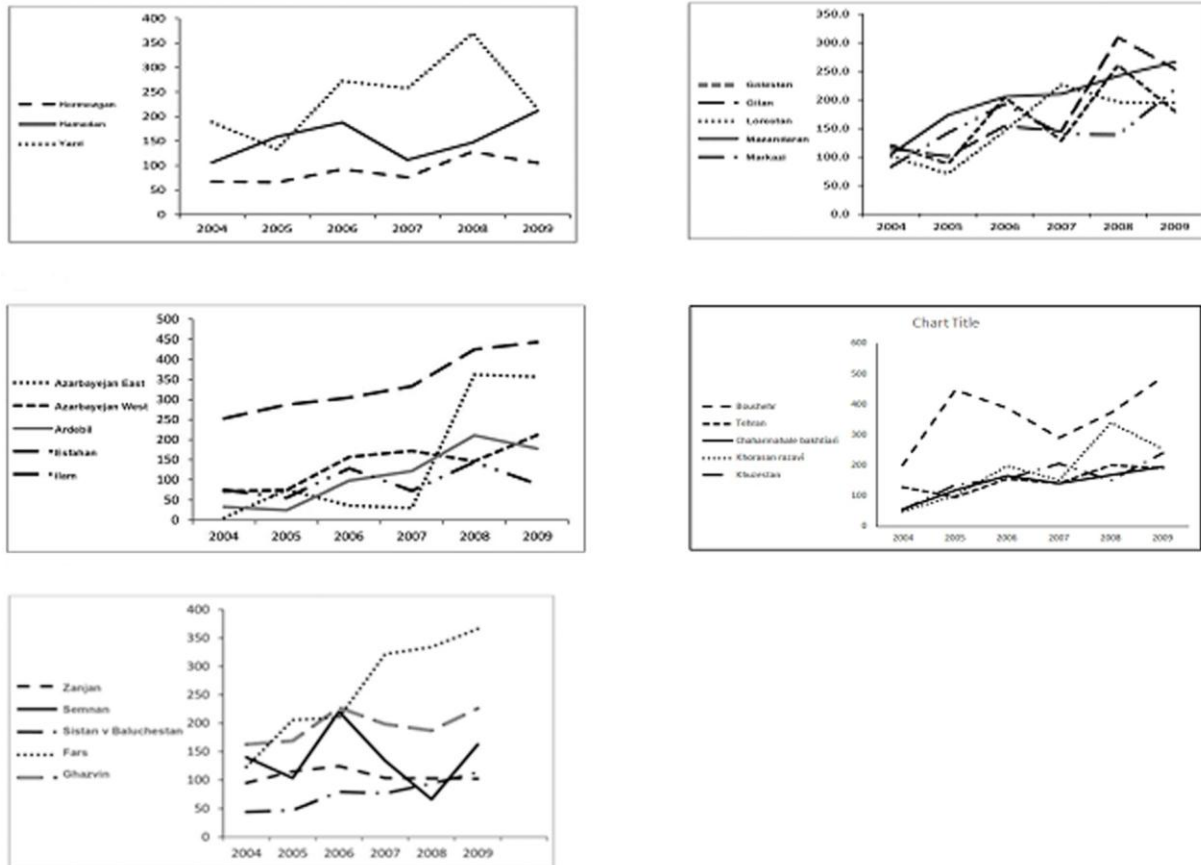


Figure 3. The trend of thyroid cancer per 100000 persons in different provinces of Iran, 2004-2009.

Table 2. Mean age of thyroid cancer in different provinces.

Mean (Sd)	Province code
38.18(16.78)	Ardebil
40.12(17.77)	SistanvaBaluchistan
40.65(14.31)	Semnan
40.98(14.76)	Lorestan
41.05(15.86)	Golestan
41.12(15.84)	Boshehr
41.29(18.6)	Hormozgan
41.73(16.0)	Esfehan
42.10(17.85)	Ghom
42.43(17.94)	KhorasanRazavi
42.47(16.76)	CharmahalBakhtiari
42.52(17.2)	Khuzestan
42.63(17.43)	Mazandaran
42.64(17.70)	Ghazvin
42.78(17.46)	Fars
42.86(16.16)	Hamadan
42.94(14.33)	Yazd
43.64(16.73)	Gilan
44.23(17.12)	KohgiroleBoyerahmad
44.95(12.75)	Kordestan
45.16(17.26)	Tehran
45.27(16.67)	East Azerbaijan
45.45(18.37)	Kerman
45.61(22.10)	Ilam
45.9(17.66)	Kermanshah
47(19.31)	Markazi
47.76(18.92)	Zanjan
48.63(18.07)	West Azerbaijan

which has reported 73.3%, 8.4%, 6.4%, 2.7% for papillary, follicular, medullary and anaplastic type respectively [13]. Both genders were similar in a five-year survival rate; the similarity was about 82.2% (with a median survival of 66 months and a 95% confidence interval of 63 and 69 months). The incidence of thyroid cancer was slightly high, but the

descriptive epidemiology of the disease in Iran has not manifested a unique feature. The Iranian patients have experienced a high rate of survival, and this survival rate was not significantly different in the male and female populations [12].

There were some factors that vary with time, which might contribute to the rising incidence of thyroid cancer. Increased radiation exposure in childhood due to the greater use of pediatric computed tomography scanning, has been suggested as potentially related to the increasing rates of the disease in recent decades [14]. Some other factors that potentially have contributed to the temporal trend were polychlorinated biphenyls, dioxins, use of fertility drugs, changes in reproductive patterns, and insulin resistance syndrome [15].

Iran has considered as an endemic, iodine-deficient area until fairly recently. However, regarding the effect of improvement in the iodine intake in previously deficient communities, which has associated with an increase in the incidence of papillary carcinoma, in comparison to other histologic types, the frequency and distribution of histological types of thyroid carcinoma in the country were closer to what could be seen in iodine-rich areas [9]. Due to the lack of data on radiation exposures, we have not been able to analyze thyroid incidence in association with the radiation exposures indifferent provinces.

Studies that have aimed to identify cancer risk factors that have been belonging to diet and lifestyle, have provided controversial results because food and drinks have contained a great number of different constituents (many unmeasured or highly variable) and dietary intake and lifestyle might significantly change in the same individual over time [7].

Nitrate has been a frequent contaminant of drinking water in areas of intense agricultural industry and has found at high levels in some vegetables and processed foods. A high average level of nitrate in water supplies has associated with an increased risk of thyroid cancer (highest versus lowest quartile, RR = 2.9) [11]. Some other agents, like a diet rich in fish and seafood have also associated with an increased incidence of thyroid cancer. However, we have known that fish might differentially affect the incidence of thyroid cancer and its various histological types, with a protective effect only on endemic goiter areas where people have a suboptimal intake [11].

The study findings of Dr Delshad [16] have shown that our provinces could be divided into four

groups in terms of median urinary iodine concentration:

1. 50µgram/dl<
2. 30-40 µgram/dl
3. 20-29 µgram/dl
4. 13-20 µgram/dl

In our study, we have assessed the effect of median urinary iodine concentration on the thyroid cancer trend, and found a positive correlation between them (p-value=0.025). Regarding the lack of data about diet, BMI environmental factor, and lifestyle, we have not been able to analyze thyroid incidence in association with these factors in different provinces of Iran.

Limitation of this study has included unavailability of reports on recent cases of thyroid cancer in the form of an integrated online database in the Iranian Health Department, and Cancer section. It has highly recommended organizing documenting the new cases to provide a better and on-time chance of reporting. The Iranian Department of Health, and the Forensic Medical Council should work together to report cancer-caused deaths by organizing and implementing an effective uniform database system about the survival rate of thyroid cancer in Iran.

Again, we have underlined the need for gathering the data about diet, BMI environmental factors, and lifestyle; these data has actually served as a fundamental requirement for future studies of thyroid carcinoma risk factors in Iran. In summary, perhaps the only presently recognized measure for reducing TC risk would be the correction of median urinary iodine concentration as related to thyroid cancer. Further attempts have required investigating this potential carcinogen, and other factors as well as their functional mechanism if any preventive measures could be taken to control the continuous increase of thyroid cancer.

Conclusion

Among thyroid cancer risk factors, median urinary iodine concentration might be the only recognized factor compatible to the clustery pattern of this type of cancer in Iranian provinces. It has seemed that more studies that have needed to investigate other factors in order to take preventive measures against thyroid cancer in Iran.

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Conflict of Interest

The authors have declared that no competing financial interests exist.

Authors' Contribution

Ali Safavi has designed the study, and Rozita Jafari has contributed to literature review and has written the paper. Samira Chaibakhsh and Amir Ali Safavi have contributed to the data entry, data analysis, and writing-up process. Rashid Ramezani and Mansour Rezaei have contributed to the study design and analysis. All the authors have read and approved the final manuscript.

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