



Incidence rate of thyroid cancer in Iranian population, trend analysis from 2003 to 2009

Nastaran Hajizadeh¹, Mohamad Amin Pourhoseingholi^{2*}, Ahmad Reza Baghestani¹

¹Biostatistics Dept., Shahid Beheshti University of Medical Sciences, Tehran, I.R. Iran;

²Gastroenterology and Liver diseases Research Center, Shahid Beheshti University of Medical Sciences, Tehran, I.R. Iran.

Received: 16/Oct/2014 Accepted: 30/Nov/2014

Original article

ABSTRACT

Background and aims: Thyroid cancer is the most common endocrine malignant and papillary cancer and three times more prevalent in women than men. The aim of this study was to evaluate the incidence rate and trend of thyroid cancer in Iranian population.

Methods: National incidence was rated by Iran National Cancer Registry data derived from Iran's annual national cancer registration reported from 2003 to 2009. The crude rate and age standardized rate were used to express the incidence of thyroid cancer.

Results: The results indicated that, the incidence of thyroid cancer increased from 2003 to 2009. The age standardized rate for women and men increased from 2.02 and 0.82 to 4.2 and 1.36 per 100,000, respectively.

Conclusion: This study indicated remarkable increasing trends in thyroid cancer incidence. So, attention to high risk groups and public programs is necessary to reduce the incidence of this cancer in future.

Keywords: Thyroid cancer; Incidence; Trend analysis; Iran.

INTRODUCTION

Cancer is a major cause of morbidity and mortality worldwide and its burden is globally increasing. Although endocrine cancers are relatively uncommon, they may be one the most important and potentially treatable cancers. In fact, thyroid cancer is the most prevalent form of endocrine cancer, accounting for 1% of all new cancers (0.5% of cancers in men and 1.5% of cancers in women).¹⁻³ The worldwide incidence rate of thyroid cancer (TC) is generally lower than 3 per 100,000 in men and 5 per 100,000 in women.⁴⁻⁸ TC is indeed one of 10 (the eighth) leading common cancers among women in the world.⁹

TC has four main histological types; papillary (PTC) accounts for 80%, follicular (FTC) 10-15%, medullary (MTC) 5-7%, and anaplastic (ATC) 1-2% of all thyroid cancer types. In addition, PTC is the most prevalent type, and it is three times more common in women than men.^{5,8,10} Five-year survival rate for PTC is higher than 90%, for FTC higher than 90%, for MTC 30-80%, and for ATC 1-17%.¹¹ TC is mostly diagnosed among people aged from 45-54 years with median age of diagnosis of 50 years. The percentage of mortality from TC is highest among people aged 75-84 with median age of 73 years at death.¹²

*Corresponding author: Mohamad Amin Pourhoseingholi, Biostatistics Dept., Shahid Beheshti University of Medical Sciences, Tehran, I.R. Iran; Tel: 00982122432515; E-mail: amin_phg@yahoo.com.

In a survey conducted by the Iranian Cancer Institute, 1.8% of all cancers and 76.1% of all endocrine cancers constituted by the neoplasm of thyroid gland; for example, in a study in Iran, mean age of Iranian patients was 42.8 years (95% CI: 41.9-43.7) with markedly older male patients.^{8,13} Also, the female to male ratio was about 1.8, while this ratio was 1.3 for anaplastic carcinoma due to the higher proportion of the affected men.^{8,14} The aim of this study was to determine the trends of TC incidence in Iranian general population from 2003 to 2009.

METHODS

The data were extracted from Iran National Cancer Registry data derived from Iran's annual national cancer registration reported from 2003 to 2009 (Islamic Republic of Iran Ministry of Health and Medical Education, Center for Disease Control and Prevention, Noncommunicable Deputy Cancer Office, 2009).¹⁵ The Iran Ministry of Health and Medical Education registers all the new cancer cases, according to pathology reports, in all provinces and the data are publicized after revision.

Age standardized rate (ASR) and crude death rate (CDR) of TC (ICD-9: 193) for men and women from 2003 to 2009 were expressed per 100,000 as the annual incidence, overall and for all provinces. Then, the trend of ASR, CDR, and five most common morphologies of TC in Iran were drawn.

RESULTS

All incidence records of TC from 2003 to 2009 were included in the analysis. The ASR of TC dramatically increased during

these years from 1.42 to 2.78 per 100,000 for both men and women. In women, this rate varied from 2.02 to 4.2 per 100,000 and in men from 0.82 to 1.36 per 100,000. The CDR of TC increased from 1.24 to 2.57 per 100,000 for both men and women. In women, it varied from 1.75 to 3.96 per 100,000 and in men from 0.74 to 1.17 per 100,000 (Table 1 and Figure 1). The highest ASR of TC was derived in Isfahan province for all years under study. For some provinces, no data reported (Table 2).

Table 1: Crude rate (CR) and age standardized rate (ASR; per 100,000) for thyroid cancer incidence in Iran

Years	ASR		CR	
	females	males	females	Males
2003	2.02	0.82	1.75	0.74
2004	2.8	1.06	2.42	0.9
2005	3.47	1.16	2.93	0.98
2006	3.76	1.3	3.32	1.12
2007	3.4	1.11	2.98	0.95
2008	4.47	1.51	3.85	1.31
2009	4.2	1.36	3.96	1.17

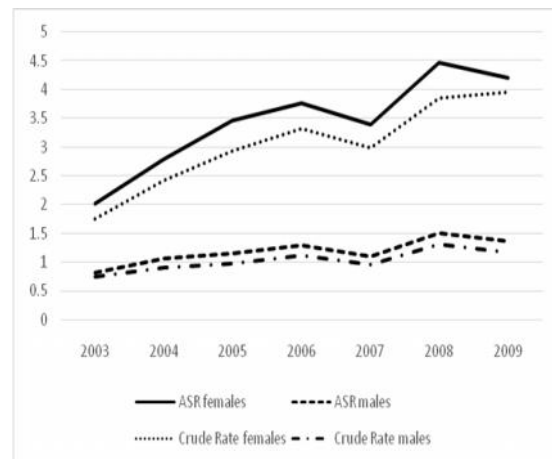


Figure 1: Age standardized rate (ASR) and crude rate (CR) of thyroid cancer for female and male in Iran (2003-2009)

Table 2: The age standardized rate (ASR) for thyroid cancer incidence (per 100,000) from all provinces in Iran

Province	2004			2005			2006			2007			2008		
	ASR F	ASR M	ASR total	ASR F	ASR M	ASR total	ASR F	ASR M	ASR total	ASR F	ASR M	ASR total	ASR F	ASR M	ASR total
East Azarbaijan	2.89	1.24	2.065	1.14	0.4	0.77	0.35	0.48	0.415	4.46	1.67	3.065	7.09	2.44	4.765
West Azarbaijan	1.47	0.43	0.95	1.5	0.45	0.975	3.21	0.84	2.025	2.82	1.34	2.08	2.74	1.2	1.97
Ardebil	4.25	0.95	2.6	0.27	0.19	0.23	3.76	1.3	2.53	2.49	0.2	1.345	3.03	1.8	2.415
Esfahan	4.01	2.09	3.05	5.48	1.3	3.39	5.85	1.54	3.695	5.62	1.48	3.55	8.17	2	5.085
Ilam	3.28	2.2	2.74	1.03			2.2	0.84	1.52	0.24	0.89	0.565	2.38	0.66	1.52
Bushehr	1.36	0.67	1.015	2.18	2.02	2.1	2.21	0.83	1.52	3.36	0.63	1.995	2.93	0.62	1.775
Tehran	2.76	0.64	1.7	3.57	1.14	2.355	3.59	1.22	2.405	2.8	0.93	1.865	5.29	1.74	3.515
Chaharmahalbakhtiari	2.93	2.89	2.91	8.19	1.8	4.995	7.99	1.02	4.505	5.12	0.78	2.95	5.52	2.53	4.025
South Khorasan				0.86	0.32	0.59	0.37	0.43	0.4	0.76			2.08	1.52	1.8
KhorasanRazavi	1.98	1.24	1.61	1.9	0.78	1.34	3.66	1.19	2.425	2.43	0.86	1.645	3.01	0.99	2
North Khorasan				1.97	0.74	1.355	0.69	0.33	0.51	1.45	0.56	1.005	2.11	2.56	2.335
Khozestan	2.47	1.06	1.765	2.08	0.47	1.275	2.84	0.56	1.7	1.99	0.64	1.315	4.1	0.87	2.485
Zanjan	1.85	0.67	1.26	2.71	0.17	1.44	2.23	0.9	1.565	1.78	0.56	1.17	2.11	0.43	1.27
Semnan	2.34	1.53	1.935	1.7	1.13	1.415	3.9	1.15	2.525	1.2	0.97	1.085	1.68	0.64	1.16
Sistanbalochestan	1.25	0.32	0.785	0.79	1.03	0.91	1.26	0.57	0.915	0.88	0.64	0.76	1.53	0.72	1.125
Fars	2.2	0.82	1.51	3.54	1.3	2.42	3.34	1.36	2.35	5.61	1.59	3.6	6.25	1.87	4.06
Ghazvin	4.04	0.62	2.33	3.83	1	2.415	3.9	0.97	2.435	3.51	1.05	2.28	2.92	1.56	2.24
Qom	1.63	1.28	1.455	2.37	0.35	1.36	2.74	0.93	1.835	2.9	0.47	1.685	1.18	0.48	0.83
Kordestan	1.61	0.33	0.97	1.18	0.36	0.77	2.16	0.59	1.375	2.16	1.06	1.61	2.71	1.22	1.965
Kerman	2.89	2.16	2.525	3.28	0.37	1.825	3.61	1.15	2.38	3.77	1.47	2.62	4.61	1.1	2.855
Kermanshah	1.42	1.05	1.235	2.83	1.36	2.095	3.44	0.43	1.935	3.05	1.46	2.255	4.26	1.46	2.86
Kohgiloyebayerahmad	4.76	1.24	3	1.39	1.25	1.32	1.86	1.61	1.735	5.85	0.36	3.105	4.39	0.93	2.66
Golestan	2.65	0.75	1.7	1.78	0.64	1.21	3.42	1.36	2.39	2.26	0.51	1.385	2.93	1.41	2.17
Gilan	1.99	0.54	1.265	2.29	0.67	1.48	2.49	1.2	1.845	1.72	1.33	1.525	5.77	1.61	3.69
Lorestan	1.91	0.35	1.13	1.63	0.28	0.955	2.32	1.31	1.815	2.28	0.81	1.545	2.82	1.95	2.385
Mazandaran	2.8	0.78	1.79	3.28	1.33	2.305	4.3	0.85	2.575	3.51	0.86	2.185	3.9	1.69	2.795
Markazi	1.46	0.66	1.06	3.42	0.36	1.89	3.78	1.28	2.53	2.5	0.63	1.565			
Hormozgan	2.04	0.19	1.115	1.66	0.55	1.105	1.47	0.45	0.96	1.58	0.13	0.855			
Hamedan	1.95	0.89	1.42	3.02	0.6	1.81	3.2	1.47	2.335	1.92	0.62	1.27			
Yazd	5.01	0.22	2.615	4.26	0.99	2.625	3.62	2.38	3	4.63	0.9	2.765			

M: Male, F: Female

The trend of five most common morphologies of TC in Iran from 2003 to 2008 was also assessed; the papillary adenocarcinoma was the most common

thyroid tumor followed by papillary carcinoma follicular variant, follicular adenocarcinoma, medullary carcinoma, and anaplastic carcinoma (Table 3).

Table 3: The number of cases according to five most common morphologies of thyroid cancer in Iran

Years	a			b			c			d			e		
	F	M	Both	F	M	Both	F	M	Both	F	M	Both	F	M	Both
2003	414	180	594	50	18	68	47	12	59	27	23	50	9	8	17
2004	568	204	772	78	22	100	44	21	65	25	26	51	16	7	23
2005	695	260	956	78	19	97	64	16	80	48	30	78	16	9	25
2006	824	270	1094	91	25	116	55	14	69	43	29	72	18	10	28
2007	757	233	990	112	32	144	13	4	17	38	27	65	11	14	25
2008	960	322	1282	90	21	111	66	11	77	48	43	91	14	9	23

a) Papillary Adenocarcinoma, NOS; b) Papillary Carcinoma, Follicular Variant; c) Follicular Adenocarcinoma; d) Medullary Carcinoma, NOS; e) Carcinoma, Anaplastic, NOS; M: Male, F: Female.

Estimated TC incidence, mortality, and 5-year prevalence, based on GLOBOCAN2012, for the whole world, more developed regions, less developed

regions, ASIA, Islamic Republic of Iran, WHO Americas region (PAHO), and WHO Europe region (EURO), are presented in Table 4.

Table 4: Estimated thyroid cancer incidence, mortality, and 5-year prevalence according to GLOBOCAN 2012

Varieties	Gender	Incidence			Mortality			5-year prevalence		
		Number	%	*ASR (W)	Number	%	*ASR (W)	Number	%	Prop.
World	Men	68179	0.9	1.9	12627	0.3	0.3	271270	1.8	10.4
	Women	229923	3.5	6.1	27142	0.8	0.6	934805	5.6	36.0
	Both sexes	298102	2.1	4.0	39769	0.5	0.5	1206075	3.7	23.2
More Developed Regions	Men	29672	0.9	3.6	3651	0.2	0.3	121600	1.4	24.3
	Women	93104	3.3	11.1	6740	0.5	0.4	392196	4.7	72.7
	Both sexes	122776	2.0	7.4	10391	0.4	0.4	513796	3.0	49.4
Less Developed Regions	Men	38507	0.9	1.4	8976	0.3	0.4	149670	2.2	7.1
	Women	136819	3.6	4.7	20402	0.9	0.7	542609	6.1	26.4
	Both sexes	175326	2.2	3.0	29378	0.6	0.6	692279	4.4	16.7
ASIA	Men	32858	0.9	1.5	7127	0.3	0.3	129384	2.1	0.8
	Women	111621	3.6	5.0	15286	0.8	0.7	451739	6.3	28.9
	Both sexes	144479	2.1	3.2	22413	0.5	0.5	581123	4.4	18.3
Islamic Republic of Iran	Men	513	1.1	1.4	181	0.6	0.5	1885	2.4	6.4
	Women	1512	3.8	4.0	429	1.8	1.4	5772	6.4	20.0
	Both sexes	2025	2.4	2.7	610	1.1	0.9	7657	4.5	13.1
WHO Americas Region (PAHO)	Men	19401	1.3	3.7	1879	0.3	0.3	81176	2.1	23.0
	Women	66065	4.6	12.1	3372	0.5	0.5	280246	6.8	76.0
	Both sexes	85466	3.0	8.0	5251	0.4	0.4	361422	4.5	50.1
WHO Europe Region (EURO)	Men	14036	0.7	2.5	2379	0.2	0.3	54900	1.1	15.4
	Women	48775	2.8	8.1	5088	0.6	0.5	192534	3.9	49.5
	Both sexes	62811	1.7	5.4	7467	0.4	0.4	247434	2.5	33.2

*ASR: age standardized rate

DISCUSSION

This study, indicated a remarkable increasing trend in TC incidence, based on the national registry data from 2003 to 2009. This trend was different for men and women. Enhanced detection could contribute to the increased TC incidence in the past decades, but cannot fully explain the increase, suggesting that maybe a true increase exists.¹⁶ In addition, when the main reason is the increasing detection, the improvement in small and early-stage tumors should be accompanied by a progressive decline of larger and more advanced tumors. The TC increases, while most prominent for small tumors and across all tumor sizes and stages, suggesting that

increasing of detection is not the only reason.¹⁷⁻¹⁹ The remarkable increase in incidence of TC in advanced stages, usually clinically apparent, is too difficult to be explained by increased detection. Moreover, the TC increase has been almost exclusively observed for papillary tumors, while improved detection must affect all histotypes.¹⁷ Finally, when increasing of detection is the only reason, it is expected that the cancer increase to be observed in all age and gender categories. Indeed, the age-adjusted incidence rates of TC have increased in women more than in men (158% vs. 106%) with a clear birth cohort pattern, possibly reflecting changes in risk

factors and the birth cohort contribution which suggest that the increasing of detection is not the only reason of the increased incidence of TC.^{17, 20}

Furthermore, by the report of GLOBOCAN 2012, annually 298102 new cases of TC occurred around the world.⁹ In the United States, TC is the ninth leading cancer and it is estimated that new cases would register 62,980 in 2014. Five-year survival was about 97.8% in 2004-2010. Using statistical models of analysis, rates of new TC cases have been rising on average by 5.5% per year over the last 10 years.¹² In the United Kingdom 2,727 people were diagnosed with TC in 2011. Around 75.0% of adult TC patients (74.2% of men and 78.9% of women) in England and Wales survived five years or longer during 1996-1999.²¹ TC represents 2.1% of all new cancer cases in the world, 3.0% in WHO Americas region, 2.4% in Iran, 2.2% in less developed regions, 2.1% in Asia, 2% in more developed regions, and 1.7% in WHO Europe region.⁹

Study of potential etiologic and risk factors of TC showed that radiation exposure, genetic factors, pre-existing thyroid disease, hormonal and reproductive factors (as the cancer is more frequent in women), and dietary factors (specially iodine) could play the main roles in pathogenesis of TC.^{22,23}

The limitation of this study was the incomplete data which were collected from all provinces before 2004 and no published information for provinces after 2008. In addition, from 2003 to 2009, the coverage of registered new cancer cases was increasing. So, for the early years under the study, the collected data could suffer from underestimation.

CONCLUSION

This study indicated an increasing incidence of TC in Iranian population. Since many cases of TC could be treated successfully, it is expected to diagnose TC at

early stages. Therefore, the development of a guideline can be helpful to diagnose TC at early stages. Moreover, attention to high risk groups and setting awareness programs should be focused to reduce the incidence of this cancer in the future.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

ACKNOWLEDGMENT

We gratefully thank all workers assisted us in conducting this research.

REFERENCES

1. Deandrea M, Gallone G, Veglio M, Balsamo A, Grassi A, Sapelli S, et al. Thyroid cancer histotype changes as observed in a major general hospital in a 21-year period. *J Endocrinol Invest.* 1997; 20(2): 52-8.
2. De Jong SA. Thyroid cancer: a comprehensive guide to clinical management. *Arch Pathol Lab Med.* 2000; 124(9): 1391.
3. Haghpanah V, Soliemanpour B, Heshmat R, Mosavi-Jarrahi AR, Tavangar SM, Malekzadeh R, et al. Endocrine cancer in Iran: based on cancer registry system. *Indian J Cancer.* 2006; 43(2): 80-5.
4. Franceschi S, La Vecchia C. In: Doll R, Fraumeni JF Jr, Muir CS. Eds. *Trends in cancer incidence and mortality.* Woodbury, NY: Cold Spring Harbor laboratory Press; 1994. P: 393-422.
5. Negri E, Dal Maso L, Ron E, La Vecchia C, Mark SD, Preston-Martin S, et al. A pooled analysis of case-control studies of thyroid cancer. II. Menstrual and reproductive factors. *Cancer Cause Control.* 1999; 10(2): 143-55.
6. Ferlay J, Bray F, Steliarova-Foucher E, Forman D. *Cancer incidence in five continents, CI5plus.* IARC CancerBase No. 9. Lyon: International Agency for Research on Cancer; 2014. Available from: <http://ci5.iarc.fr>, accessed [date].

7. Whelan SL, Parkin DM, Masuyer E. Patterns of cancer in five continents. IARC Sci Pub. 1990(102): 1-159.
8. Larijani B, Aghakhani S, Haghpanah V, Mosavi-Jarrahi A, Bastanagh M. Review of thyroid cancer in Iran. *Aust-Asian J Cancer*. 2005; 4(4): 199-203.
9. International Agency for Research on Cancer. Estimated cancer incidence, mortality and prevalence worldwide in 2012. Available from: <http://globocan.iarc.fr>.
10. Mulla ZD, Margo CE. Primary malignancies of the thyroid: epidemiologic analysis of the Florida Cancer Data System registry. *Ann Epidemiol*. 2000; 10(1): 24-30.
11. Gramza A, Kebebew E. Cancer: thyroid cancer bone metastases and high morbidity rates. *Nat Rev Endocrinol*. 2012; 8(8): 454-5.
12. Howlader N, Noone AM, Krapcho M, Garshell J, Miller D, Altekruse SF, et al. SEER Cancer Statistics Review, 1975-2011, National Cancer Institute, 2014. Available from: http://seer.cancer.gov/csr/1975_2011/.
13. Larijani B, Aghakhani S, Khajeh-Dini H, Baradar-Jalili R. Clinico-pathological features of thyroid cancer as observed in five referral hospitals in Iran--a review of 1177 cases. *Acta Oncol*. 2003; 42(4): 334-7.
14. Bacher-Stier C, Riccabona G, Totsch M, Kemmler G, Oberaigner W, Moncayo R. Incidence and clinical characteristics of thyroid carcinoma after iodine prophylaxis in an endemic goiter country. *Thyroid*. 1997; 7(5): 733-41.
15. Center for Disease Control and Prevention, Noncommunicable Deputy Cancer Office. Iranian Annual National Cancer Registration Report 2005 – 2006 [in Persian]. Tehran (Iran): Ministry of Health and Medical Education; 2007.
16. Li N, Du XL, Reitzel LR, Xu L, Sturgis EM. Impact of enhanced detection on the increase in thyroid cancer incidence in the United States: review of incidence trends by socioeconomic status within the surveillance, epidemiology, and end results registry, 1980-2008. *Thyroid*. 2013; 23(1): 103-10.
17. Pellegriti G, Frasca F, Regalbuto C, Squatrito S, Vigneri R. Worldwide increasing incidence of thyroid cancer: update on epidemiology and risk factors. *J Cancer Epidemiol*. 2013; 2013: 965212.
18. Enewold L, Zhu K, Ron E, Marrogi AJ, Stojadinovic A, Peoples GE, et al. Rising thyroid cancer incidence in the United States by demographic and tumor characteristics, 1980-2005. *Cancer Epidemiol Biomarkers Prev*. 2009; 18(3): 784-91.
19. Rego-Iraeta A, Perez-Mendez LF, Mantinan B, Garcia-Mayor RV. Time trends for thyroid cancer in northwestern Spain: true rise in the incidence of micro and larger forms of papillary thyroid carcinoma. *Thyroid*. 2009; 19(4): 333-40.
20. Zhu C, Zheng T, Kilfoy BA, Han X, Ma S, Ba Y, et al. A birth cohort analysis of the incidence of papillary thyroid cancer in the United States, 1973-2004. *Thyroid*. 2009; 19(10): 1061-6.
21. Office for National Statistics. Cancer Statistics Registrations. England (Series MB1), 2012, No. 43. Available from: <http://www.ons.gov.uk/ons/rel/vsob1/cancer-statistics-registrations--england--series-mb1-/no-43--2012/index.html>.
22. Larijani B, Shirzad M, Mohagheghi M, Haghpanah V, Jarahi AM, Tavangar S, et al. Epidemiologic feature of thyroid cancer based on cancer registry data system. *Iranian J Publ Health*. 2005; 34(4): 62-6.
23. Schneider AB, Ron E, Braveraman LE, Utiger RD. Carcinoma of the follicular epithelium. 8th ed. Philadelphia: Lippincott and Williams & Wilkins; 2000.

How to cite the article: Hajizadeh N, Pourhoseingholi MA, Baghestani AR. Incidence rate of thyroid cancer in Iranian population, trend analysis from 2003 to 2009. *Int J Epidemiol Res*. 2015; 2(1):12-17.