

## Epidemiology of Thyroid Cancer in Jordan from 1996 to 2008

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### Abstract

**Background:** The incidence of thyroid cancer has varied from 2 per 100,000 in Europe to 21 per 100,000 in the Hawaiian Chinese population and is 2-3 fold more common in females. Middle East Cancer Consortium figures from 1996-2001 have recorded different age standardized incidence rates that ranged from 2 per 100,000 in Egypt to 7.5 per 100,000 among Israeli Jews. In Jordan the age standardized incidence rate of thyroid cancer was 3 per 100,000 during that period. This study aimed to define the incidence of thyroid cancer in Jordan and to explore the epidemiological characteristics of patients and tumors.

**Methods:** This was a descriptive epidemiological study that utilized data reported to the Jordan Cancer Registry during 1996-2008.

**Results:** The incidence rate in Jordan varied during the period from 1996 to 2008; however the recorded rate (2.6 per 100,000) in 1996 and 2008 was similar. The incidence rate was higher among Jordanian females. Age specific incidence rate and age standardized incidence rate were parallel during the study period with no peaks. The most common morphological type of thyroid cancer in Jordan was papillary carcinoma (76%). The average annual incidence during the study period was highest (3.3 per 100,000) in Amman and (2.2 per 100,000) in Jarash governorates.

**Conclusion:** The results of our study are consistent with international studies. The incidence of thyroid cancer in Jordan is not high when compared with other countries. The high incidence of thyroid cancer in Amman and Jarash governorates in comparison to the incidence in other governorates needs further assessment.

**Keywords:** Thyroid, Cancer, Jordan, JCR, ASR, Epidemiology

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### Introduction

Cancer is a chronic, fatal disease that results from a tendency of normal body cells toward uncontrolled

multiplication, growth, invasion and destruction of adjacent tissues, as well as metastasis to other sites of the body through the lymph or blood,

with resultant damage and malfunction of invaded organs.<sup>1</sup> There are more than 100 types of cancers which have been named according to the organ or cell of origin.<sup>2</sup>

According to the World Health Organization the burden of cancer has doubled between 1975 and 2000; the incidence is still increasing and may triple by the year 2030 with an estimated 20-26 million new cancer cases and 13-17 million deaths annually.<sup>3</sup>

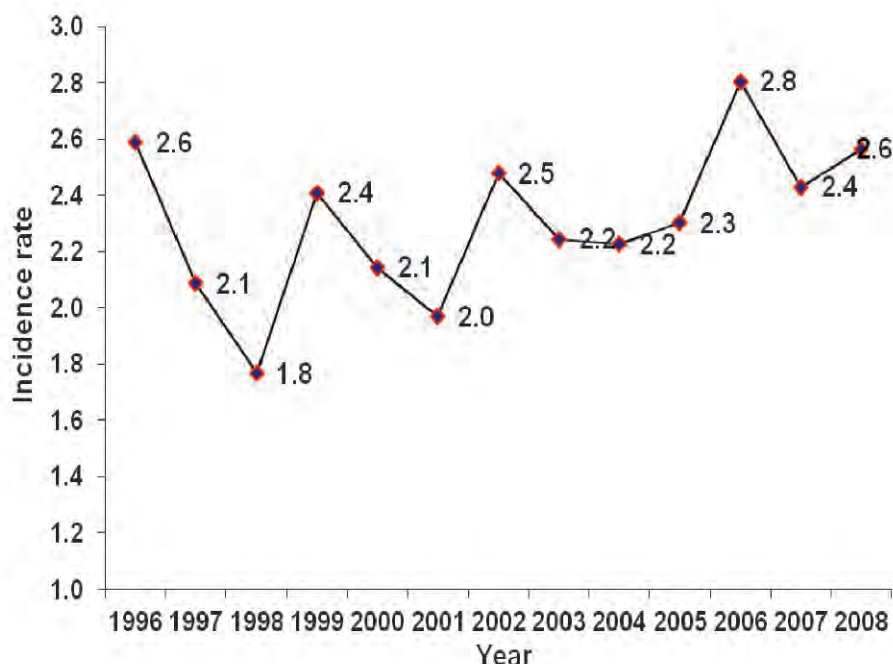
The thyroid gland is one of the largest endocrine glands in the human body. This is a vital gland responsible for T3, T4, and calcitonin hormone secretion. It maintains the body's temperature, metabolic rate, heart rate, blood pressure and weight.<sup>4</sup> Thyroid cancer represents a group of malignant tumors that affect the thyroid gland, and are divided into the following types: Papillary, Follicular, Medullary, and Anaplastic based on microscopic malignant cell morphology.<sup>2</sup> Thyroid cancer is a relatively rare tumor, but is considered the most common tumor of the endocrine glands; it represents 1% of the overall cancer cases. The worldwide incidence ranges between 0.5 and 10 per 100,000 population.<sup>5</sup> Incidence levels for thyroid cancer vary from approximately 2 per 100,000 in Europe to its

**Table 1.** Thyroid cancer cases in Jordan (1996 to 2008) according to tumor morphology.

Morphology	Frequency	Percent (%)
Papillary carcinoma, NOS	1479	76.4
Follicular adenocarcinoma	165	8.5
Medullary carcinoma, NOS	74	3.8
Carcinoma, NOS	67	3.5
Oxyphilic adenocarcinoma	42	2.2
Carcinoma, anaplastic	25	1.3
Neoplasm, malignant	14	0.7
Squamous cell carcinoma	8	0.4
Carcinoma, undifferentiated	7	0.4
Other	55	2.8
Total	1936	100

NOS: Non Otherwise Specified

highest level in the Hawaiian Chinese population (21 per 100,000).<sup>4</sup> For unknown reasons, thyroid cancer is 2-3 fold more common in females, with the peak incidence at 45 to 49 years of age in women, and 65 to 69 years of age in men, but it affects younger age groups.<sup>6</sup> The incidence of thyroid cancer, particularly papillary thyroid carcinoma, is increasing in many parts of the world. The postulated reason may be the improvement of detection and screening programs.<sup>7</sup> Epidemiological studies have revealed an increasing incidence of thyroid cancer in the United States since 1980, which is possibly due to better detection techniques including ultrasound



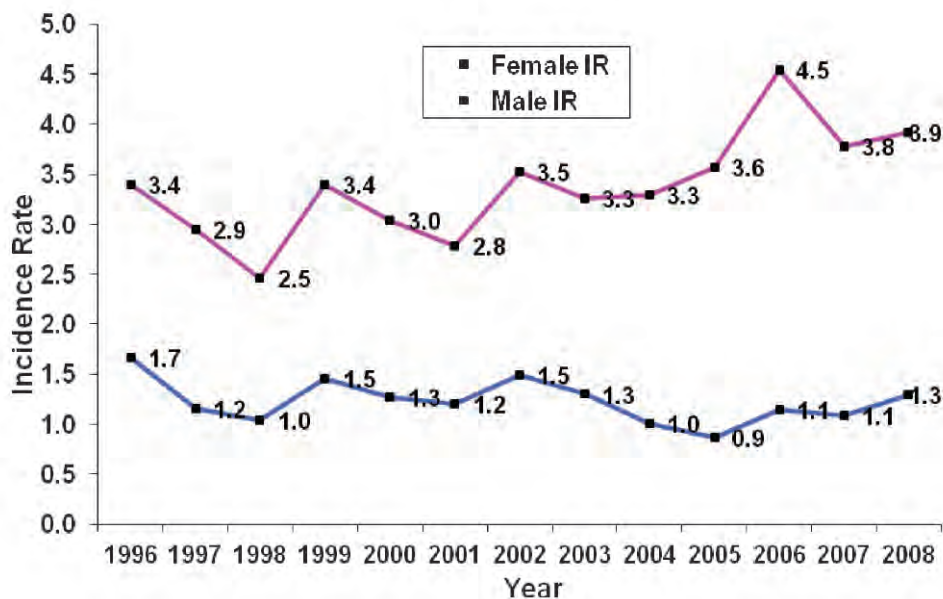
**Figure 1.** Thyroid cancer incidence rate in Jordan from 1996-2008/100,000

**Table 2.** Thyroid cancer incidence rate in Jordan per 100,000 population by governorate (1996-2008).

Year	Incidence rate per 100,000													Average annual Incidence
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
<b>Governorate</b>														
Amman	4.4	3.1	2.8	3.2	3.7	2.9	3.5	3	3.3	3.5	3.6	2.1	3.7	3.3
Balqa	1	1	0.6	1.8	1.8	1.5	1	2.2	0.3	1.1	2.1	1.6	2	1.4
Zarqa	1.7	1.4	1.8	1.2	1.4	2.3	1.6	1.3	1.1	1.2	1.7	1.5	2.4	1.6
Madaba	2.6	2.5	0.8	0.8	2.3	0.8	1.5	1.4	0	1.5	5	0.7	0.7	1.6
Irbid	1.3	0.8	1	2.9	0.9	1	2.5	2.7	1.9	2.5	2.5	2.3	2.1	1.9
Maftaq	0.5	2	1	1.9	1.7	0.4	0.4	1.2	2	2.7	3	2.6	1.5	1.6
Jarash	0.7	3.6	0	2	2	2	3.8	0.6	3.1	0.6	3.6	2.3	4	2
Ajloun	1	0	1.8	1.8	0	1.7	4.2	1.7	0	0.8	1.6	2.3	1.5	1.4
Karak	1.6	2.6	2	2	1.5	1.9	1.4	1.8	2.8	2.3	2.8	1.3	1.3	1.9
Tafilah	0	0	0	2.7	0	0	1.2	1.2	0.5	1.3	0	1.3	0	0.6
Maan	1.2	4.5	0	0	0	0	1.9	1.9	2	1.9	1.9	0.9	0.9	1.3
Aqaba	3.5	0	1.1	1.1	0	1	0.9	0	0.9	1.7	1.7	0.8	0	1.0
Jordan	2.6	2.1	1.8	2.4	2.1	2	2.5	2.2	2.2	2.3	2.8	2.4	2.6	2.3

and image guided biopsy, or to an actual increase in tumor incidence.<sup>8</sup> In the United States 44670 new cases of thyroid cancer have been estimated to occur annually, with 1690 deaths in 2010.<sup>2</sup> A study of differentiated thyroid cancer in the United States from 1988 to 2005 by Chen AY et al. from Emory University in USA revealed an increased incidence of differentiated thyroid cancer in both males and females, with similar trends between whites and blacks.<sup>8</sup> A study in Italy that compared thyroid cancer trends in two time periods revealed

that the incidence rates of thyroid cancer were two-fold higher in 2001-2005 compared to 1991-1995, with higher rates in women; the tumor was nearly exclusively papillary carcinoma.<sup>9</sup> The death rate from thyroid cancer has remained stable despite of the increase in incidence. In general more than 90% of patients survive for 10 years after diagnosis, possibly because most have differentiated thyroid carcinoma, which is considered to be the least aggressive type of thyroid cancer and has an excellent prognosis.<sup>6</sup>

**Figure 2.** Thyroid cancer incidence rate in Jordan by gender from 1996-2008/100,000

**Table 3.** Thyroid cancer in Jordan from 1996–2008 by percent of stage at time of diagnosis according to the Surveillance Epidemiology and End Results Staging System (SEER).

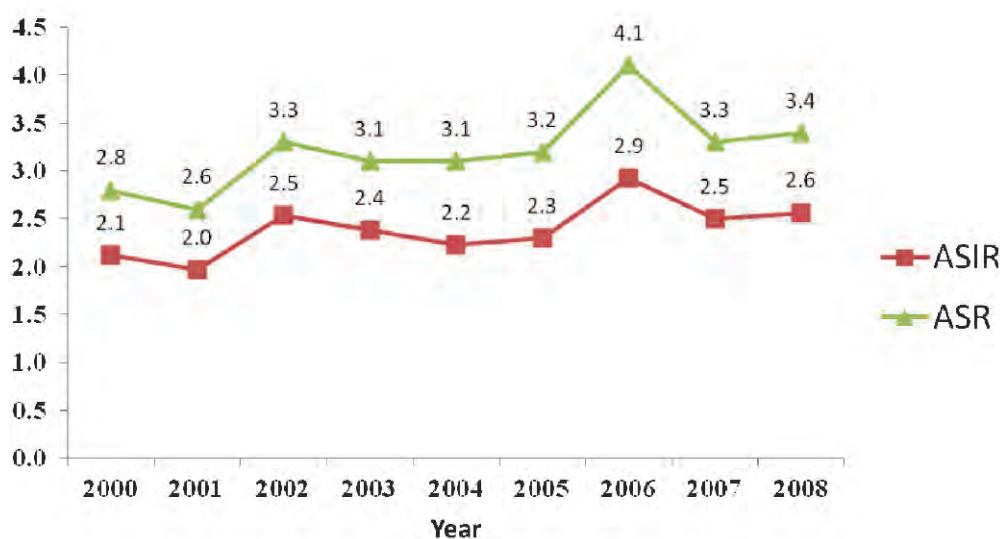
Stage	Frequency	Percent (%)
In situ	4	0.20
Localized	547	32.10
Regional (direct)	75	4.40
Regional (LN)	84	4.90
Regional (direct & LN)	24	1.40
Regional (NOS)	35	2.10
Distant/systemic	110	6.50
Unknown/unstaged	823	48.40
Total	1702	100.00

Thyroid cancer figures from the Middle East Cancer Consortium (MECC) which include Egypt, Israel, Jordan, Cyprus, the Palestinian Authority (PA) and Turkey reported a spectrum of age standardized incidence rates (ASRs) that ranged from 2 in Egypt to 7.5 per 100,000 for Israeli Jews during the period 1996 to 2001. The ASR of thyroid cancer in Jordan was reported in 2005 to be 3 per 100,000, which was an apparent increase in the trend of tumor incidence.<sup>10</sup> In 2005, the percent of female thyroid cancer out of all female cancers in the Arab countries were as follows: Saudi Arabia (6.4%), Kuwait (6.1%), other Gulf countries (6%), and Jordan (4.9%).<sup>11</sup> Similarly, in a report of cancer incidence in Jordan from 1996 to 2005, thyroid cancer was the fourth most common cancer among adult females

(4.9%).<sup>12</sup> In all Gulf countries the incidence rate of thyroid cancer in 2010 was higher in females than males, and ranked as the second most common cancer that affected females, after breast cancer. In decreasing order, the highest ASR per 100,000 of thyroid cancer were in Qatar (13.5), Kuwait (7.7), Bahrain (7.6), UAE (6), Oman (5.9), and KSA (5).<sup>13</sup> Therefore, this study aims to define the incidence of thyroid cancer in Jordan from 1996 to 2008, and to explore the epidemiological characteristics of patients and tumors.

### Materials and Methods

This was a descriptive epidemiological study that examined all cases of thyroid cancer registered in Jordan during the period from 1996 to 2008. Data were obtained from the records of the

**Figure 3.** Age Specific Incidence Rates (ASIR) and Age Standardized Rates (ASR) for Thyroid Cancer, Jordan 2000–2008.

**Table 4.** Thyroid cancer in Jordan from 1996-2008 by percent of grade at time of diagnosis.

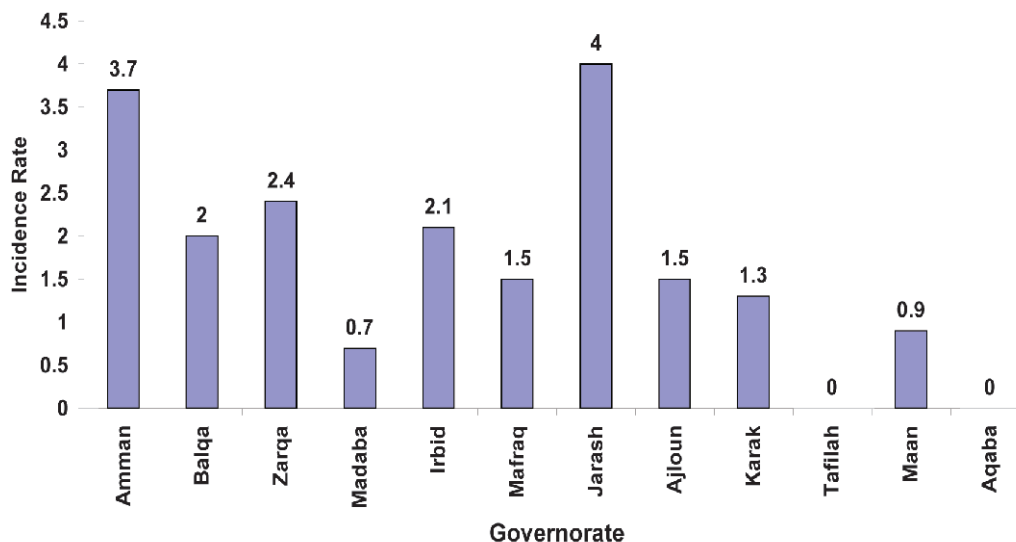
Grade	Description	Frequency	Percent (%)
1	Well-differentiated Differentiated, NOS	83	4.3
2	Moderately differentiated Moderately well-differentiated Intermediate differentiation	16	0.8
3	Poorly differentiated	133	6.9
4	Undifferentiated, anaplastic	50	2.6
9	Grade not determined, not stated, or not applicable	1642	84.8
Total		1936	100

\*Grades 5, 6, 7, and 8 are from the 6<sup>th</sup> Digit Code for Immunophenotype Designation for Lymphomas and Leukemias.

□ ICD-O: International Classification of Diseases for Oncology.

National Jordan Cancer Registry (JCR). The JCR was established in 1996 as a population-based registry and includes all malignant and in situ malignancies that have been diagnosed since January 1996 in people who are residents of Jordan. Cancer registry data are collected actively from all government, military, private and university hospitals as well as clinics and laboratories throughout Jordan. The collection process is performed by trained registry personnel through regular field visits; cancer data are collected based on clinical and/or histopathological diagnosis.<sup>14</sup> The other method of data

collection is passive, where trained focal points throughout Jordan report cancer cases to JCR by the completion of a special form that includes various identification data (name, ID, sex, age), demographic information (address, telephone number, nationality) and tumor variables (date of diagnosis, primary site, histopathology, behavior, grade, stage and basis of diagnosis). Duplicate entries are avoided by a cross check of the name, age, diagnosis and place of residency. Identification of incident cases of cancer in the JCR is based mostly on histopathological reports. Laboratory pathological data are compared to

**Figure 4.** Thyroid cancer incidence rate in Jordan governorates in 2008/100000.

hospital reports, and active follow up for missing data is performed by registry personnel. Data validity is verified through internal, external and computer software checks. Cancer data are classified by the primary site (topography) and histopathology (morphology), then coded according to the International Classification of Diseases for Oncology, 3rd edition (ICDO-3) published in 2000 by WHO.<sup>15</sup>

Records included in our study consisted of any Jordanian or non-Jordanian patients who resided in Jordan and were diagnosed with thyroid cancer by histopathological diagnosis. Diagnosis was made either inside or outside of the country. Patients were diagnosed during the period from 1/1/1996 until 31/12/2008. Data entry and analysis were performed with CanReg 4.31 software as developed by the International Agency for Research on Cancer (IARC, Lyon, France) in addition to Excel and Epi info software. We used world standard populations for standardization of rates for national and international comparisons. Before conducting the study, administrative approval was obtained, and rules of confidentiality were ascertained by the researcher.

## Results

The thyroid cancer incidence rate was 2.6 per 100,000 in 1996, which was the same value in 2008 (mean 2.8, standard deviation 0.44; Figure 1). There were 1562 patients during the study period, of which there were 1169 (74.8%) female patients and 393 (25.2%) male patients with a female to male ratio of about 3:1. Jordanian patients constituted 81% of the cases and non-Jordanians comprised 19%. The mean age was 41.95 years, with a standard deviation of 16.34. The minimum age was 2 years; and the maximum was 89 years. Figure 2 shows the thyroid cancer incidence rate in Jordan per 100,000 by gender during the period from 1996 to 2008. From 2000 to 2008, the Age Specific Incidence Rate (ASIR) increased from 2.1 to 2.6 and the ASR increased from 2.8 to 3.4 (Figure 3). Papillary carcinoma, Follicular Adenocarcinoma and Medullary Carcinoma constituted 76.4%, 8.5%

and 3.8% of thyroid cancer morphological types respectively (Table 1). Table 3 shows the thyroid cancer cases in Jordan during the study period by percentage of stage at the time of diagnosis according to the Surveillance Epidemiology and End Results staging system (SEER). Table 4 shows the thyroid cancer cases in Jordan during the study period by percentage of grade at time of diagnosis. Table 2 shows Thyroid Cancer Incidence Rate in Jordan per 100,000 population according to the governorates during the study period. Figure 4 shows the thyroid cancer incidence rate in Jordan governorates per 100,000 in the year 2008 (last year of the study).

## Discussion

Thyroid cancer incidence rate in Jordan varied from 1996 to 2008; there was a similar recorded incidence rate (2.6 per 100,000) in 1996 and 2008 (Figure 1). This rate in Jordanian females increased slightly from 3.4 per 100,000 in 1996 to 3.9 per 100,000 in 2008. The female to male ratio was about 3:1 which was consistent with a study by Larijani et al, where the female to male ratio was 3.5:1.<sup>16</sup> and the Rebecca et al. study where the rate of female cancer was 2-3 fold more common in females than males.<sup>6</sup> In males the incidence rate slightly decreased from 1.7 per 100,000 in 1996 to 1.3 per 100,000 in 2008 (Figure 2). The ASIR and ASR of thyroid cancer were in parallel during the study period with no peaks (Figure 3). The most common morphological type of thyroid cancer in Jordan for the study period was papillary carcinoma (76%; Table 1), a result that was consistent with a study by Larijani et al. from Iran where papillary thyroid carcinoma constituted 70% of the 429 thyroid cancer cases,<sup>16</sup> the study by Al-Nuaim et al. (KSA) where papillary thyroid carcinoma constituted 88% of the 233 thyroid cancer cases,<sup>17</sup> and a study by Wartofsky. L (USA), where papillary thyroid carcinoma was the most common morphological type.<sup>7</sup> The average annual incidence of thyroid cancer during the study period was highest in the Amman governorate (3.3 per 100,000), located in the central region of Jordan, followed by the Jarash governorate (2.2

per 100,000) which is located in the north region; no governorate in Jordan recorded any outstanding incidence figures during the study period. (Table 2). Upon revising the incidence rate in Jordan governorates in the year 2008 (the last year of the study), it is noted that Amman (3.7 per 100,000) and Jarash (4 per 100,000) recorded the highest incidence rates (Figure 4). There is no explanation for the high incidence in these two governorates. Deficient data about staging and grading of thyroid cancer in JCR during the study period were detected, for the stage was stated as Unknown/Unstaged in 48.4% of cases. A possible explanation was that staging and grading were not included in the early years of JCR, and thereafter missing data were encountered due to incomplete filling of the forms by physicians and an improper filing system. In the remainder of the cases the most common stage was stage 2 (localized, 32%) followed by stage 7 (distant/systemic, 6.5%; Table 3). About 85% of thyroid cancer cases were not graded; the most common grade noted was grade III (poorly differentiated) in about 7% of cases (Table 4). Occupation item in the JCR data form was not completed by the focal points; therefore we could not obtain information about the occupations of patients with thyroid cancer.

## Conclusion

The results of our descriptive study are consistent with international studies. The incidence of thyroid cancer in Jordan is not elevated in comparison with the incidence in other countries. The high incidence of thyroid cancer in Amman and Jarash governorates compared to the incidence in other governorates needs further assessment. It is recommended to stress data completion of occupation in JCR forms.

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