

Trend of cancer in Iraq 2000-2016

Ashraf MA Hussain^{1*} and Riyadh K Lafta²

¹Department of Family and community Medicine, College of Medicine, University of Babylon

²Department of Family and community Medicine, College of Medicine, Mustansiriya University, Global Health Department, University of Washington, Seattle, USA

Received: 7 February 2020

Accepted: 13 July 2020

**Corresponding author: ashrafhussain1981@yahoo.com*

DOI 10.5001/omj.2021.18

Abstract:

Background: Precise and quantitative assessment of the trend of cancer burden enables the policy makers and health managers to better prioritize diseases, allocate resources, infer what caused a decrease or increase in the rate of cancer occurrence, and if denotes timing of implementation of a control measure, it presents the impact, on the disease rate .

The objective of this study was to evaluate trends in child and adult cancer in Iraq since the year 2000 forward.

Methods: We used the registries of the Iraqi Ministry of Health, that were gathered from all governorates during the period from 2000-2016. Data were presented as incidence rates to depict the trends of different types of cancers distributed by age, gender, and governorates.

Results: Breast Cancer witnessed a significant increase with predominance in females, Lung cancer rate increased significantly from 4.08 to 6.08/100000 ($p=0.038$), affecting males more than females. The trend of brain cancer showed a bimodal pattern (two peaks in 2004 and 2011) with no significant trend change ($p=0.788$). Both genders were similarly affected. The trend of stomach and colorectal cancer showed an accelerated increase after 2007.

Conclusion: Almost all cancers (particularly lung and gastrointestinal) showed constantly raising trends especially after 2007. Only cervical and laryngeal cancer had a dropping trend. Most of cancers were predominant in males.

Introduction:

Cancer represents a growing threat to public health worldwide with its incidence rates been rising in most countries since 1990 owing to the population growth, aging and the raised prevalence of unhealthy behaviors and certain risk factors including smoking. ^{1, 2} The number of cancer cases reached 17.5 million worldwide, raised by 33% since 2005. ^{3,4}

Republic of Iraq is a an Arabic country located in the South- East of Asia Continent bordered by Turkey, Iran from the north and east and Jordan, Syria, Saudi Arabia and Kuwait from the south and west and one coastal margin at the north of Arabian Gulf. The Capital is Baghdad. Iraq is characterized by diverse ethnic groups including Arab, Kurd, Turkmen and others and two main official

languages: Arabic and Kurdish. The total area of Iraq is about 438,000 Km² occupied by about 38 million population as 2018 estimate, with more clustering in the Capital (about eight million), Iraq was in a state of continuous wars for the last four decades that caused a great damage to the infrastructure of the health care services, besides, the prevalence of some risk factors of cancer (obesity, smoking, unhealthy diet, diabetes) has recently changed in Iraq with no sufficient preventive measures been implemented. Iraq has high incidence rates in breast, lung and bladder cancers respectively besides a growing burden of many others. ⁵

Precise and quantitative assessment of the trend of cancer burden enables the policy makers and health managers to better prioritize diseases, allocate resources, infer what caused a decrease or increase in the rate of cancer occurrence, and if denotes timing of implementation of a control measure, it presents the impact, on the disease rate. ⁶

This study was designed to be a descriptive one; we didn't aim to prove any relation between the weaponry used during the last US invasion to Iraq (2003) and the change in the trend of cancer as digging for causal relation needs a long prospective design that was not feasible at that time from practical point of view considering the available resources.

The objective of the study was to sketch a picture for the trend of different types of cancer in Iraq during this time of chaos (attributed to continuous conflicts) that

caused a severe damage to the infrastructure of the health care services (and all the supporting services like electricity, safe water supply, environmental health,...) in addition to the change in the life style of the people.

Methods: In this descriptive study we used the registries of the Surveillance Department of the Iraqi Ministry of Health, that were gathered from all governorates' health Directorates and health facilities during the period from 2000 through 2016. These data were supported and confirmed by the Iraqi cancer centers, chemotherapy and radiotherapy centers and then referred to the Iraqi Cancer Board. Data were presented as incidence rates, reviewed, double-checked, and analyzed to depict the trends of different types of cancers in Iraq distributed by age (regarding child cancer), gender, and governorates, the total of each disease for each governorate was computed, and then summed to obtain the total for Iraq. We categorized Iraq geographically into three regions to ease sketching the trend. These were: the North region that includes Erbil, Sulaymaniyah, Dohuk and Nineveh, Middle region that includes Baghdad, Babel, Najaf, Karbala, Al-Qadisiyah, Salaheddin, Diyala, Anbar, Kirkuk and Wasit, and the South region that includes Basrah, Thi Qar, Missan, and Muthanna.

The total population for each governorate (and for Iraq) was obtained from the Central Statistical Organization. In respect to child cancer, we subdivide child age

into three categories; less than five, five to less than ten, and ten to less than 15 years of age to make it more specific.

Data about different adult and child cancers were collected with more focus on the most prevalent cancers, namely: Breast cancer, Lung and Bronchus, Bladder, brain, cervix, ovary, prostate, larynx, stomach, colon, rectum, Liver, pancreas and thyroid, in addition to leukemia, Hodgkin and Non Hodgkin lymphoma.

Data after 2016 were not available as cancer data are usually collected, analyzed and interpreted every four years. The Statistical Package for Social Sciences (SPSS version 23) was adopted to treat the data, and to estimate the rates.

Results: The results revealed that **Breast Cancer** had witnessed a significant increase ($p= 0.007$) with predominance in female gender (female to male ratio 29:1) mostly involved adult age group. **Lung cancer** rate increased significantly from 4.08 to 5.64/100000 ($p= 0.038$). It affected males more than females with a ratio of about 3:1, and tends to increase with age. The trend of **brain cancer** showed a bimodal pattern (two peaks in 2004 and 2011) with no significant trend change ($p=0.788$). Both genders and age groups were similarly affected. (Figure 1) **Bladder cancer** depicted a non-significant change over the studied period, male cases were three times more than female's with predominance in (more than 45 years) age group. **Ovarian cancer** showed a significant increase in rate since the year 2007, while the trend of **cervical cancer** went down significantly with p value

of 0.008. **prostatic cancer** significantly rose over the studied period from 1.85 to 4.13 with p value of 0.041 as shown in Figure 2.

Figure 3 demonstrates the trend of **GIT** cancers; stomach cancer showed an accelerated increase in the rate after 2007 ($p = 0.0001$). Both genders showed similar rates, and the prevalence was increased with age. Colorectal cancer depicted a significant increase in occurrence after 2007 (p value 0.0002). Both genders were similarly affected, while Liver cancer started with a rate of 0.4/100000 in the year 2000, with a peak in 2005, then increased from 2008 to 2016 (0.82/100000 to 1.91/100000), both genders were equally affected. Pancreatic cancer more than doubled between the years 2000 and 2016 from 0.72 to 1.46/100000.

Thyroid cancer showed a significant elevated trend since 2007 from 0.62 to 2.96/100000 with p value of 0.003. Male to female ratio was 2.5:1.

The trend of **laryngeal cancer** presented a significant down slopping rate. Males were affected more than females with a ratio of 3:1, as shown in Figure 4.

Leukemia: Leukemia showed a non significant increasing trend, started with a rate of 3.24/100000 in the year 2000 and ended with a rate of 4.37 in 2016 with a peak of 5.9 in the year 2004, both genders were equally affected.

Hodgkin disease also showed a non significant increase (from 1.39 to 1.44/100000), affecting both sexes equally, while **Non Hodgkin Lymphoma**

showed a significant increase in its rate since 2007 forward, affecting both genders equally as shown in figure 5. **Skin cancer** showed a gradual decrease till 2008, followed by a gradual increase for both sexes.

Child cancer trend has not been significantly changed over the studied time. It tended to affect males more than females (1.5:1) and was slightly higher in children less than five years of age. (Figure 6)

Figure 7 shows the trend of total cancer in Iraq by governorates, the Middle region showed the highest trend followed by the South and then the North.

Table (1) shows the percent change in incidence rate of all cancers for the periods: (2000-08), (2008-16), (2000-16).

Discussion: The trend of total cancers In Iraq during the period 2000-2016 showed an overall up slop, more obvious after 2007. This can't be explained merely by the improvement in case detection or registration as the health system is still suffering from many weaknesses. There are many factors that thought to be responsible for this increase, related mainly to the successive wars since 1980 to present that caused a great devastation of the infrastructure especially that of the health system.

⁷⁻⁹ However, as this study was designed to be a descriptive one to sketch the trend of cancer in time of war, this design did not allow us to prove a causal relation

between different types of cancer and the probable risk factors like radioactive contamination or changes in the life style.

The rate of cancers had increased from 44.5 to 67.5/100000 in the period 2008-16 with a percent change of more than 50%. This finding goes with a similar regional and global trend but these were more gradual and stepwise. The global trend of 2005-15 had a percent change of 6.4%.¹⁰ Unfortunately, we couldn't find previous reliable studies in Iraq about the trend of cancer before the war to compare.

Breast cancer incidence rate increased progressively from 8.43 in the year 2000 to 8.56/100000 in 2008 (1.54% change) and then to 13.19 in 2016 (54.09% change). This increase is classically thought to be related to a higher prevalence of some known risk factors like smoking, high body mass index, physical inactivity, low intake of fruits/vegetables, and family history of breast cancer in addition to age.¹¹ Iran already has a higher incidence of breast cancer of 22/100000 but with a percent change of 15.2, while it is 12.9/100000 in Saudi Arabia.¹²⁻¹⁴ In Oman; the 20-year trends data show breast cancer to be the most common malignancy affecting Omani women (21.2% of all cases of cancer).¹⁵

Lung cancer incidence rate increased from 4.08 in the year 2000 to 4.31 in 2008 up to 5.60 in 2016, still lower than many regional countries, the median Arab countries rate is 16.33/100000.¹⁶ The burden of lung and breast cancers is represented by their high mortality rate as they occupy the first leading cause of

cancer deaths in both males and females respectively, higher in low and middle income countries,¹⁷ this is in addition to their financial burden as the estimated per patient cost of breast cancer can reach up to US\$15000.¹⁸

The trend of brain cancer showed a bimodal pattern (two peaks in 2004 and 2011) with no significant trend change, and both genders were similarly affected. A significantly raised trend was seen in the period 2000-2004 that regressed down later to 2.03 to increase again in 2008 and thereafter but ended with a rate of 2.97 in 2016. This rate was lower than the regional countries such as Jordan and Iran (5.1 and 2.74/100000 respectively), and the global rate (3.4/100000),¹⁹ however, weak registration and preference of most of the patients to seek treatment outside Iraq (attributed to the distrust in the deteriorated health system recently) might serve in the apparently low incidence of brain cancer compared to some of the regional countries. Brain tumors are considered the most common solid tumors that develop during childhood comprising 20% of all neoplasm, and the primary cause of cancer deaths in this age group.²⁰ Those who survive may suffer long term sequels from the tumor or its treatment.²¹

The incidence rate of bladder cancer in 2016 was 3.75 rising from 3.44 in the year 2000. This rate is still lower than many regional countries such as Lebanon (18.8), Turkey (14.4) and Iran (7.7)/100000.²²

GIT cancers (including stomach, colorectal, liver and pancreatic cancers) witnessed an overall rise in its trend which became steady and more significant after 2008, most obvious with liver cancer which increased from 0.4 in the year 2000 to 1.91/100000 in 2016. The same was true regarding stomach cancer that ended with a rate of 2.04/100000 which was opposed by a declined trend worldwide ²³ and regionally, as in Oman. ²⁴ The raised trend of Colorectal cancer was similar to other low and middle income countries including regional countries where the trend was continuously rising, while it was stabilized or started to decrease in the high income countries. ^{12, 15, 25}

Although the occurrence of both liver and pancreatic cancers in Iraq is apparently lower than the regional countries such as Iran ²⁶ or Saudi Arabia; the rapidity of increase in the rate of liver cancer is alarming (as these cancers were not commonly seen in Iraq previously), while it is decreasing in Saudi Arabia. ²⁷

The burden of these cancers is attributed mainly to its high mortality rate where they come after lung cancer in the list as stomach, colorectal and liver cancer represent the second, third and fourth leading causes of cancer deaths worldwide. ³

Cancer of hematopoietic and lymphoid tissue including Leukemia, Hodgkin and non-Hodgkin lymphomas showed the same swinging trend till 2008, followed by a gradual rise till 2016. Leukemia rate increased from 3.24 up to 4.37 with a peak in

2004 that reached up to 5.9/100000. Such trend was also seen in Saudi Arabia (3.15/100000) and Iran (6.25/100000).^{28, 29}

Cervical cancer was one of two cancers (the other was Laryngeal cancer) that witnessed a decrease in its rate compared to that of the year 2000. It dropped down from 1.5/100000 to 1.14 in 2016, apart from an increase that occurred in 2008 (0.7/100000), this goes with the trend of many countries as reported by Globocan study,³⁰ Saudi Arabia²⁷ and Jordan.³¹ Cervical cancer remains the fourth most common female cancer contributing to 7.5% of all female cancer deaths in 2012,¹⁹ but it forms less than 5% of female cancer deaths in Iraq.³²

In contrary, both ovarian and prostatic cancers showed a raised trend during the study period 2000-16. Ovarian cancer incidence rate increased from 2.11 in the year 2000 to 3.05/100000 in 2016 and prostatic cancer from 1.85 to 4.13/100000 in 2016. Although the rising trend of prostatic cancer seems to be global,³³ but the rapid increase in incidence by 2.2 fold indicates an alarming change in the occurrence of this cancer that needs a thorough searching for the possible changes in the risk factors, however, many regional countries have the same rising trend but with a higher incidence like Iran (10.37/100000),³⁴ and Turkey (27.7/100000).³⁵ The burden of Prostatic cancer is from its financial cost required for diagnosis, surgery and post-surgical therapy with a least estimation of about US\$5000,³⁶ besides, prostatic cancer is the second most diagnosed malignancy and the fifth

leading cause of cancer deaths in male with age standardized global mortality rate of 7.8/100000 and Western Asia rate of 13.7/100000.³³

Cancer of the Larynx was the second cancer that witnessed a decrease in its trend over the study period. It went down from 2.39/100000 to 0.51/100000. Such a trend was also seen in Iran and Lebanon but with higher incidence rates (9.1 and 5.7/100000 respectively).^{37, 38} Thyroid cancer had an increased overall trend from 1.22 to 2.96/100000, more obvious after 2007 with a significant drop in 2003. This goes with the global trend of low and middle income countries,³⁹ and with regional countries such as Iran (2.2/100000)⁴⁰ and Jordan (2.6/100000).⁴¹ These two cancers (larynx and thyroid) revealed a gender difference with male predilection in laryngeal cancer (Male: Female ratio 3:1) and female predilection in thyroid cancer (Female: Male ratio 3:1) that seems to be a worldwide trend.⁴²

The trend of child cancer showed no significant change over the study period and remained between 9.55 and 9.92/100000. This represents 7.5-8.5% of the total cancers in Iraq and a mean of 1000 child cancer per year. Although this goes with the global rate of 10/100000⁴³ and some regional rates such as Jordan (9.9/100000)⁴⁴ and Iran (17.5/100000),⁴⁵ there still is a burden from its high mortality that reaches up to 98% in the developing countries whereas it is as low as 15% in the developed. A study in Iraq in 2007 concluded that childhood leukemia rates in Basra more than doubled over a 15-year period (1993-2007).⁴⁶

The trend of total cancers in Iraq revealed a clear up going slop especially after 2008, and particularly in the middle region, might be attributed to the fact that this region was the main target during the 2003 war and exposed to a huge amount of bombing, However, cancer rates in Iraq seem to be lower than the regional and global rates. This might be due to poor registration, besides, many cancer cases in Iraq are diagnosed in the private sector (which is unfortunately not linked to the national surveillance system), and many of those patients seek treatment outside the country, this created a sort of underestimation.

Limitations of the study: As the main source of data was the registries of the Ministry of Health, there was no possible way to check for the completeness of data or the percentage of missing cases, therefore, validity could not be assured

Conclusion: It can be concluded from the results of this study that almost all cancers (particularly lung and gastrointestinal) showed constantly raising trends especially after 2007. Only cervical and laryngeal cancers had a dropping trend. Most of the cancers are predominant in males. Generally, if the trend kept on going in this ascending curve, then the coming years may possibly witness (with better reporting) a dramatic increase in the trend of cancers in Iraq.

References:

1. Global Burden of Disease Cancer Collaboration. The Global Burden of Cancer 2013. JAMA Oncology 2015; 1(4): 505–27. <http://doi.org/10.1001/jamaoncol.2015.0735>.

2. Badwe R, Dikshit R, Laversanne M, Freddie B. Cancer Incidence Trends in India. *Japanese journal of clinical oncology* 2014; 44(5): 401–407 DOI: [10.1093/jjco/hyu040](https://doi.org/10.1093/jjco/hyu040).
3. Global Burden of Disease Cancer Collaboration. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-years for 32 Cancer Groups, 1990 to 2015. A Systematic Analysis for the Global Burden of Disease Study. *JAMA Oncology* 2017; 3(4):524–48. <http://dx.doi.org/10.1001/jamaoncol.2016.5688>.
4. WHO. Cancer/ fact sheet/ media center. Available at: <http://www.who.int/mediacentre/factsheets/fs297/en/>. Accessed 1 April 2018.
5. WHO IARC. Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012. fact sheet. Population Fact sheet. Available at: http://globocan.iarc.fr/Pages/fact_sheets_population.aspx. Accessed 21 February 2018.
6. Funk S, Bogich T, Kilpatrick A, Mand Jones K, Daszak P. Quantifying Trends in Disease Impact to Produce a Consistent and Reproducible Definition of an Emerging Infectious Disease. *PLoS ONE* 2013; 8(8): e69951. <https://doi.org/10.1371/journal.pone.0069951>. Accessed 15 March 2018.
7. Fathi R, Matti L, Al-Salih H, Godbold D. Environmental pollution by depleted uranium in Iraq with special reference to Mosul and possible effects on cancer and birth defect rates. *Medicine, Conflict and Survival*; 29(1): 7-25 DOI: <https://doi.org/10.1080/13623699.2013.765173>. Accessed 17 March 2018.
8. AL-Hashimi M, Wang X. Trend of leukemia in Ninawa/Iraq. *Clinical and Experimental Medical Sciences* 2013; 1 (5-8): 353-62. <http://dx.doi.org/10.12988/cems.2013.13029>.
9. Lafta RK, Al-Neami MA. War or health, a four decade armed conflict in Iraq. *Medicine, Conflict and Survival* 2019. <https://doi.org/10.1080/13623699.2019.1670431>.
10. GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*; 388(10053): 1545–602. [https://doi.org/10.1016/S0140-6736\(16\)31678-6](https://doi.org/10.1016/S0140-6736(16)31678-6). Accessed 1 May 2018.

11. Lafta RK, Saeed EQ, Isa SA. Risk Factors of Breast Cancer among Women (A Sample from Baghdad). *IJCM* 2013; 26(1): 1-6.
12. Rafiemanesh H, Salehiniya H, Lotfi Z. (Breast Cancer in Iranian Woman: Incidence by Age Group, Morphology and Trends. *Asian Pacific Journal of Cancer Prevention*;17(3):1393-97. <http://dx.doi.org/10.7314/APJCP.2016.17.3.1393>. Accessed 20 March 2018.
13. Jazayeri S, Saadat S, Kaviani A, Ramezani R. Incidence of primary breast cancer in Iran: Ten-year national cancer registry data report, *Cancer Epidemiology* 2015; 39(4): 519-27. <https://doi.org/10.1016/j.canep.2015.04.016>.
14. Alghamdi I, Hussain, I., Alghamdi, M., El-Sheemy, M. The incidence rate of female breast cancer in Saudi Arabia: an observational descriptive epidemiological analysis of data from Saudi Cancer Registry 2001–2008. *Breast Cancer : Targets and Therapy*; 5: 103–9. <http://doi.org/10.2147/BCTT.S50750>. Accessed 1 April 2018.
15. Al-Lawati NA, Al-Bahrani BJ, Al-Raisi SS, Al-Lawati JA. Twenty-year trends of cancer incidence in Omanis, 1996-2015. *Oman Med J* 2019 Jul;34(4);361-87.
16. Salim A, Jazieh A, Moore M. Lung Cancer Incidence in the Arab League Countries: Risk Factors and Control. *Asian Pacific Journal of Cancer Prevention* 2011; 12(1): 17-34.
17. Jemal A, Bray F, Center M, Ferlay J, Ward E, Forman D. (2011). Global cancer statistics. *Cancer Journal for Clinicians*; 61. 69-90. <https://doi.org/10.3322/caac.20107>.
18. Daroudi R, Akbari A, Kalaghchi B, Najafi M, Zendehtdel K, Nahvijou A. The Economic Burden of Breast Cancer in Iran. *Iranian Journal of Public Health* 2015; 44(9): 1225–33.
19. Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. *International Journal of Cancer* 2015; 136(5), E359–86. DOI: <http://dx.doi.org/10.1002/ijc.29210>.
20. Askari K, Janeshin S, Taherzadeh-Amlashi M, Seyed-Saadat S, Mashouf M. Central Nervous System Tumors in Guilan, Iran: Epidemiological Features Over 10 Years. *Caspian Journal of Neurological Science* 2015; 1 (1):19-26.
21. Gunn M, Lähdesmäki T, Malila N, et al. Late morbidity in long-term survivors of childhood brain tumors: a nationwide registry-based study in Finland, *Neuro-Oncology* 2015; 17(5): 747–56. , <https://doi.org/10.1093/neuonc/nou321>

22. Pakzad R, Hafshejani M, Salehiniya H, Mohammadian M. Incidence and Mortality of Bladder Cancer and their Relationship with Development in Asia. *Asian Pacific Journal of Cancer Prevention* 2015; 16 (16): 7365-74. <http://dx.doi.org/10.7314/APJCP.2015.16.16.7365>.
23. Balakrishnan M, George R., Sharma A. Graham D. Changing Trends in Stomach Cancer throughout the World. *Current Gastroenterology Reports* 2017;19 (8): 36. <https://doi.org/10.1007/s11894-017-0575-8>.
24. Al-Mahrouqi H, Parkin L, Sharples K. Incidence of Stomach Cancer in Oman and the Other Gulf Cooperation Council Countries. *Oman Medical Journal* 2011; 26(4): 258-62 DOI:<https://doi.org/10.5001/omj.2011.62>.
25. Arnold M, Sierra M, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global patterns and trends in colorectal cancer incidence and mortality. *Gut* 2017; 66(4):683-91. DOI: <https://doi.org/10.1136/gutjnl-2015-310912>.
26. Almasi Z, Abdollah M, Hamid S. Incidence, mortality, and epidemiological aspects of cancers in Iran; differences with the world data. *Official Journal of the Balkan Union of Oncology* 2016; 21(4): 994-1004.
27. Bazarbashi, S., Eid, H. A., Minguet, J. Cancer Incidence in Saudi Arabia: 2012 Data from the Saudi Cancer Registry. *Asian Pacific Journal of Cancer Prevention: APJCP* 2017; 18(9): 2437–44. <http://doi.org/10.22034/APJCP.2017.18.9.2437>.
28. Alghamdi I Hussain, I, Alghamdi M, Dohal A, El-Sheemy M. The incidence of leukemia in Saudi Arabia. Descriptive epidemiological analysis of data from the Saudi Cancer Registry 2001-2008. *Saudi medical journal* 2014; 35(7): 674-83.
29. Koochi F, salehiniya H, Shamlou R, Eslami S, Ghogh Z, Kor Y, Rafiemanesh H. Leukemia in Iran: Epidemiology and Morphology Trends Leukemia in Iran: *Asian Pacific Journal of Cancer Prevention*; 16 (17): 7759-63 DOI: <http://dx.doi.org/10.7314/APJCP.2015.16.17.7759>. Accessed 11 April 2018.
30. IARC. Cervical Cancer, Estimated Incidence, Mortality and Prevalence Worldwide in 2012. Available at: <http://globocan.iarc.fr/old/FactSheets/cancers/cervix-new.asp>. Accessed 12 April 2018.

31. Sharkas G, Arqoub K, Khader K, et al.. Trends in the Incidence of Cervical Cancer in Jordan, 2000–2013. *Journal of Oncology*; 2017, Article ID 6827384, 4 pages. DOI:<http://doi.org/10.1155/2017/6827384>. Accessed 15 April 2018.
32. WHO. Cancer Country Profiles-Iraq. Available at: http://www.who.int/cancer/country-profiles/irq_en.pdf . Accessed 15 April 2018.
33. Wong C, Goggins B, Wang H, et al. Global Incidence and Mortality for Prostate Cancer: Analysis of Temporal Patterns and Trends in 36 Countries. *European Urology*; 70(5):862-74. DOI:<http://doi.org/10.1016/j.eururo.2016.05.043>. Accessed 15 April 2018.
34. Pakzad R, Rafiemanesh H, Ghoncheh M, et al. Prostate Cancer in Iran: Trends in Incidence and Morphological and Epidemiological Characteristics. *Asian Pacific Journal of Cancer Prevention* 2016;17(2): 839-43. DOI: <http://doi.org/10.7314/APJCP.2016.17.2.839>.
35. Zorlu F, Zorlu R, Divrik R, Eser S, Yorukoglu K. Prostate Cancer Incidence in Turkey: An Epidemiological Study. *Asian Pacific journal of cancer prevention*; 15(21): 9125-30. DOI: <http://doi.org/10.7314/APJCP.2014.15.21.9125>. Accessed 25 April 2018.
36. Roehrborn C, Black L. The economic burden of prostate cancer. *British Journal of Urology international* 2011. 108(6): 806-13. DOI:<http://doi.org/10.1111/j.1464-410X.2011.10365.x>.
37. Mirzaei M, Hosseini S, Ghoncheh M, et al. Epidemiology and Trend of Head and Neck Cancers in Iran. *Global Journal of Health Science*; 8(1): 189–93. DOI: <http://doi.org/10.5539/gjhs.v8n1p189>. Accessed 19 April 2018.
38. Shamseddine A, Saleh A, Charafeddine M, et al. Cancer trends in Lebanon: a review of incidence rates for the period of 2003–2008 and projections until 2018. *Population Health Metrics*; 12(1): 4. <https://doi.org/10.1186/1478-7954-12-4>. Accessed 19 April 2018.
39. La Vecchia C, Malvezzi M, Bosetti C, et al. Thyroid cancer mortality and incidence: A global overview. *International Journal of Cancer* 2014; 136(9): 2187–95. DOI:<https://doi.org/10.1002/ijc.29251>.

40. Safavi A, Azizi F, Chaibakhsh S, Safavi A, Jafari R. Thyroid Cancer Epidemiology in Iran: a Time Trend Study. *Asian Pacific Journal of Cancer Prevention* 2016; 17(1): 407-12. <https://doi.org/10.7314/APJCP.2016.17.1.407>.
41. Sharkas GF, Tarawneh MR, Nimri OF, AL- Zughul MJ, Arqoub KH. Epidemiology of Thyroid Cancer in Jordan from 1996 to 2008. *Middle East Journal of Cancer*; 2 (3 & 4): 117-23 <https://doi.org/10.13140/RG.2.1.2337.2325>. Accessed 22 April 2018.
42. Dorak MT, Karpuzoglu E. Gender Differences in Cancer Susceptibility: An Inadequately Addressed Issue. *Frontiers in Genetics*, 3: 268. <http://doi.org/10.3389/fgene.2012.00268>. Accessed 22 April 2018.
43. Fathi A, Bahadoram M, Amani F, et al. Epidemiology of Childhood Cancer in Northwest Iran. *Asian Pacific journal of cancer prevention*; 16(3): 5459-62. <http://doi.org/10.7314/APJCP.2015.16.13.5459>. Accessed 22 April 2018.
44. Ismail S, Soubani M, Al-Zeer A, Monther N. Cancer Incidence in Jordan from 1996 to 2009-A Comprehensive Study. *Asian Pacific journal of cancer prevention* 2013; 14(6): 3527-34. <http://doi.org/10.7314/APJCP.2013.14.6.3527>.
45. Khazaei S, Khazaei S, Mansori K, Ayubi E. Childhood Cancer Patterns in Iran: Challenges and Future Directions. *Iranian Journal of Public Health* 2017; 46(8): 1145-46.
46. Amy Hagopian, Riyadh K Lafta, Tim K Takaro, Jenan Hassan, Scott Davis, Dana Mirick. Trends in Childhood Leukemia in Basra, Iraq, 1990-2007. *AJPH* June 2010. <http://ajph.aphapublications.org/cgi/doi/10.2105/AJPH.2009.164236>. Accessed 1 May 2018.

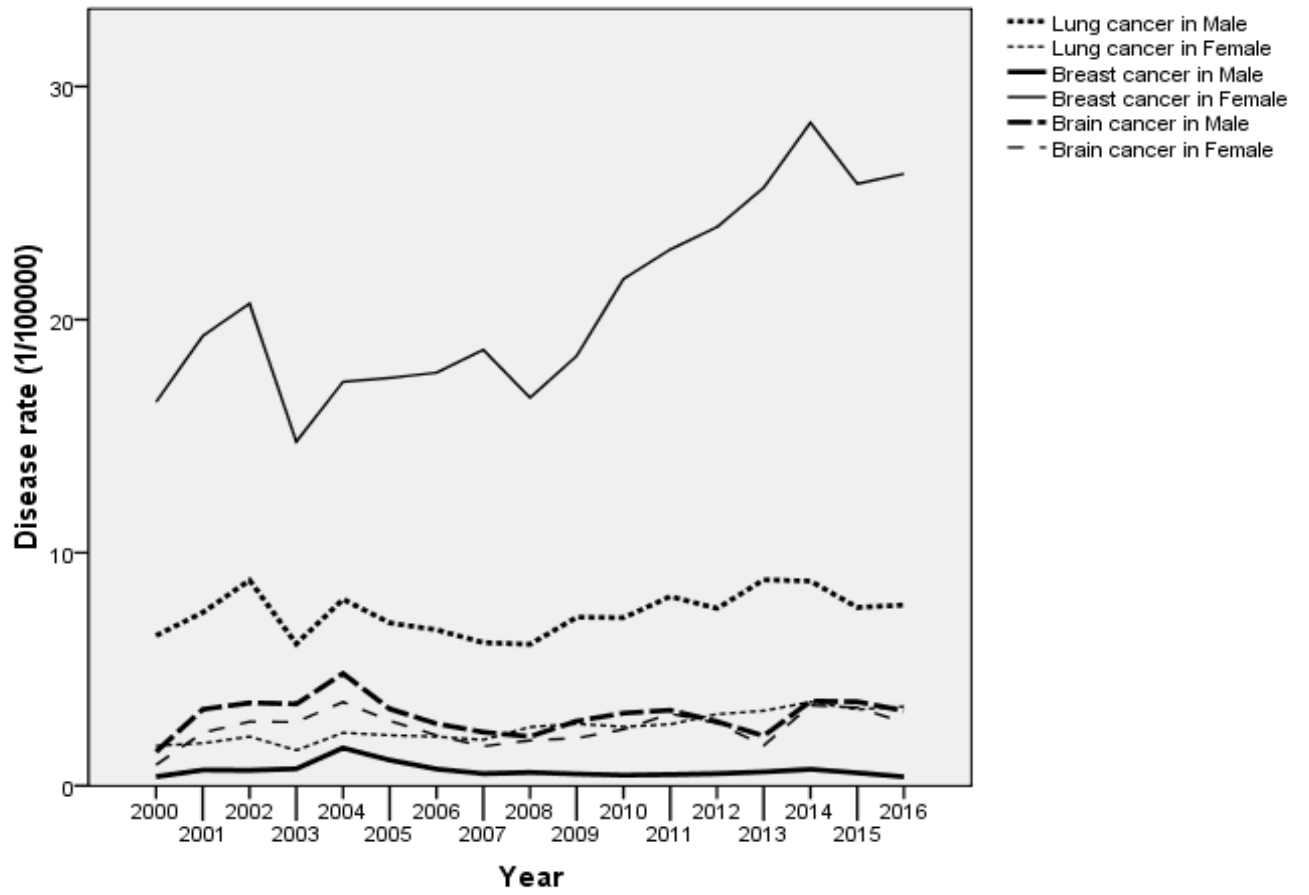


Figure (1): Breast, brain and lung cancer

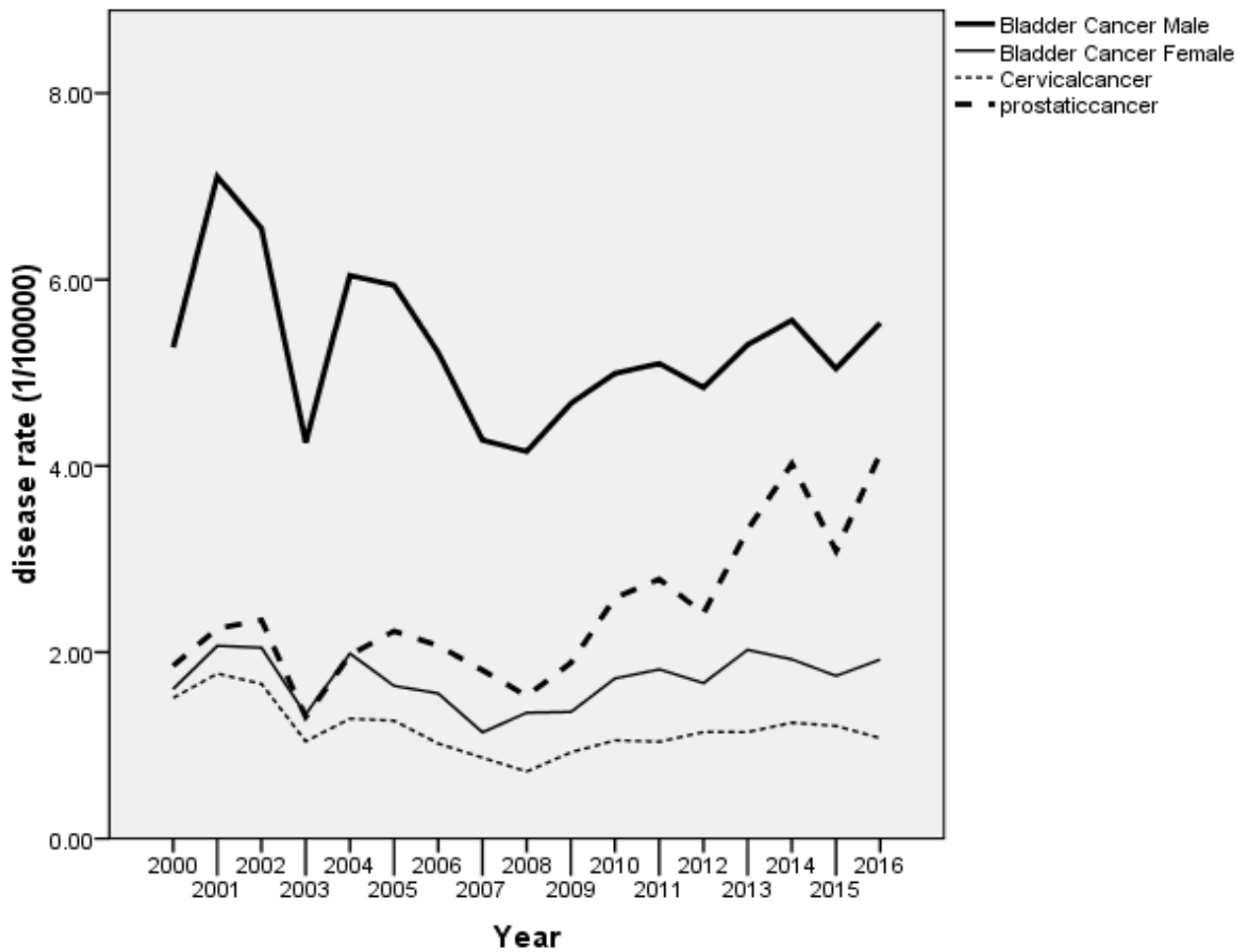


Figure (2): Bladder, cervical and prostatic cancer

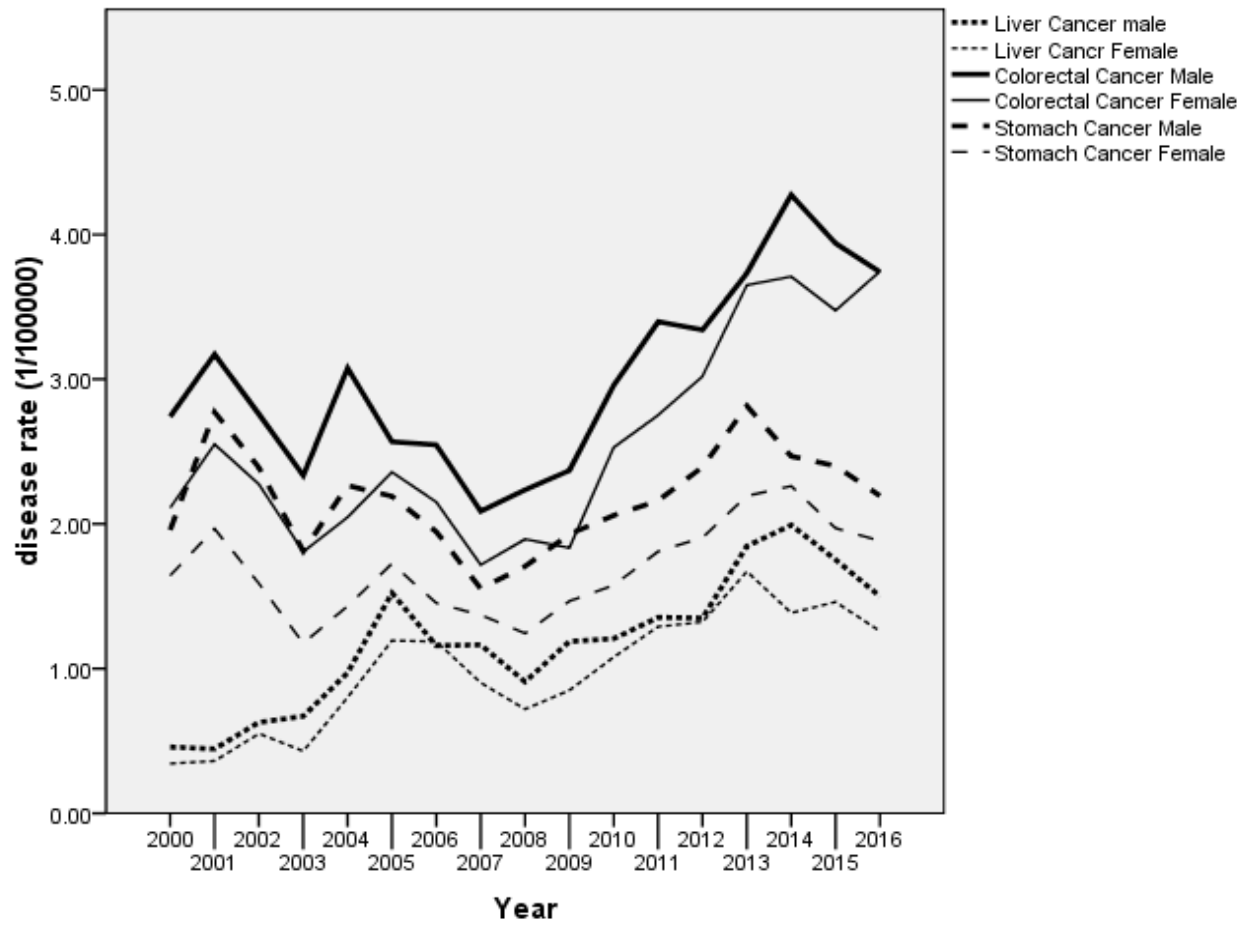


Figure (3): Stomach, liver and colorectal cancer

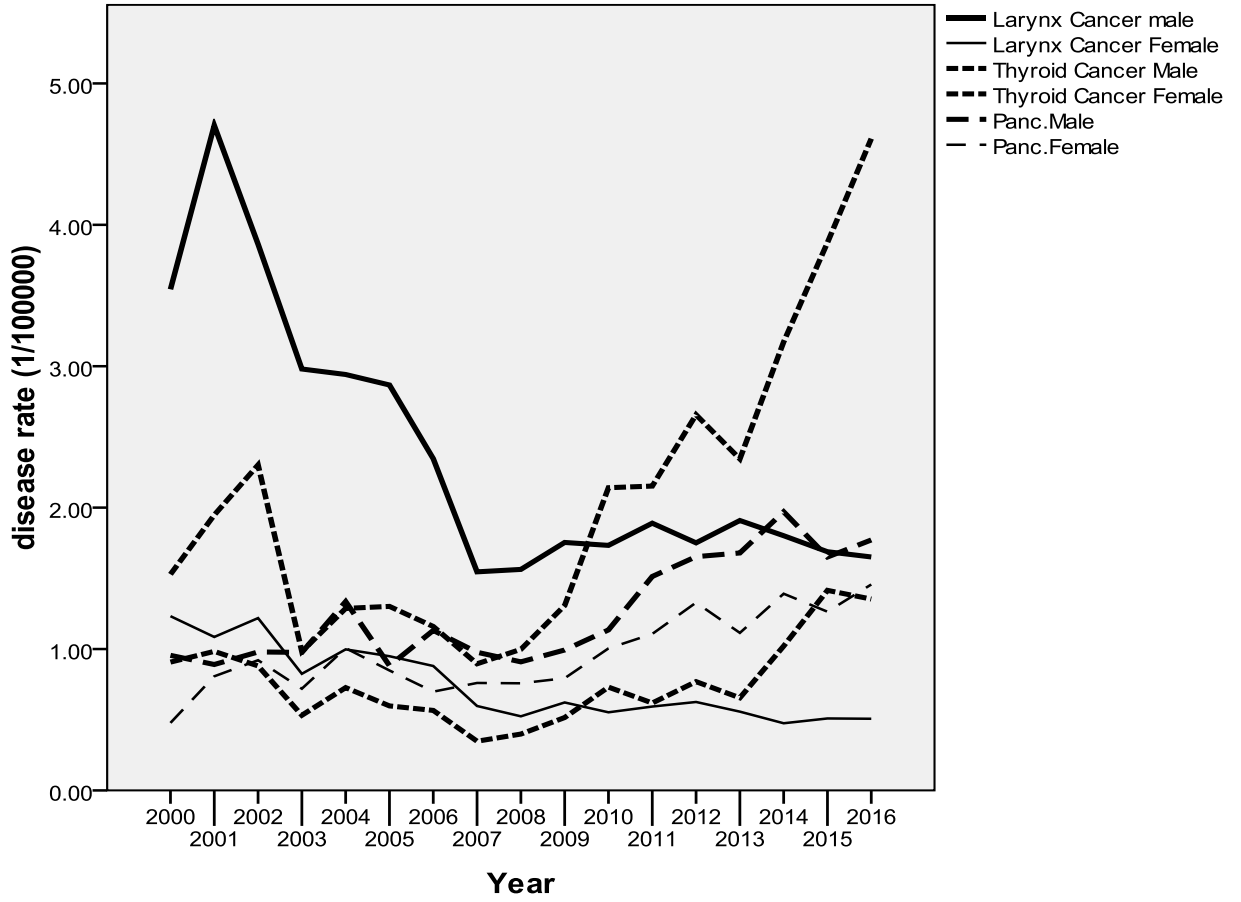


Figure (4): Thyroid and lung cancers

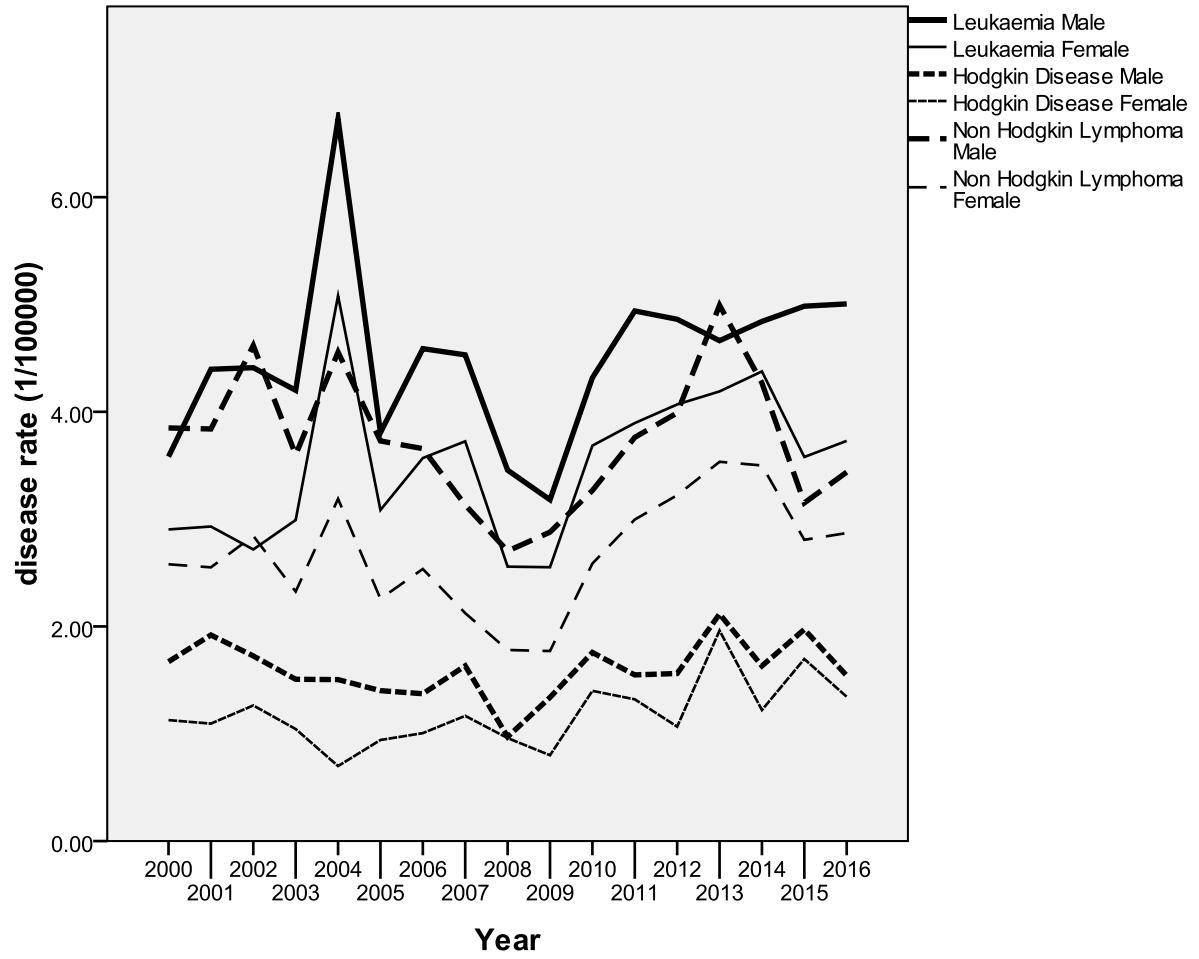


Figure (5): Leukaemia, Hodgkin and non Hodgkin disease

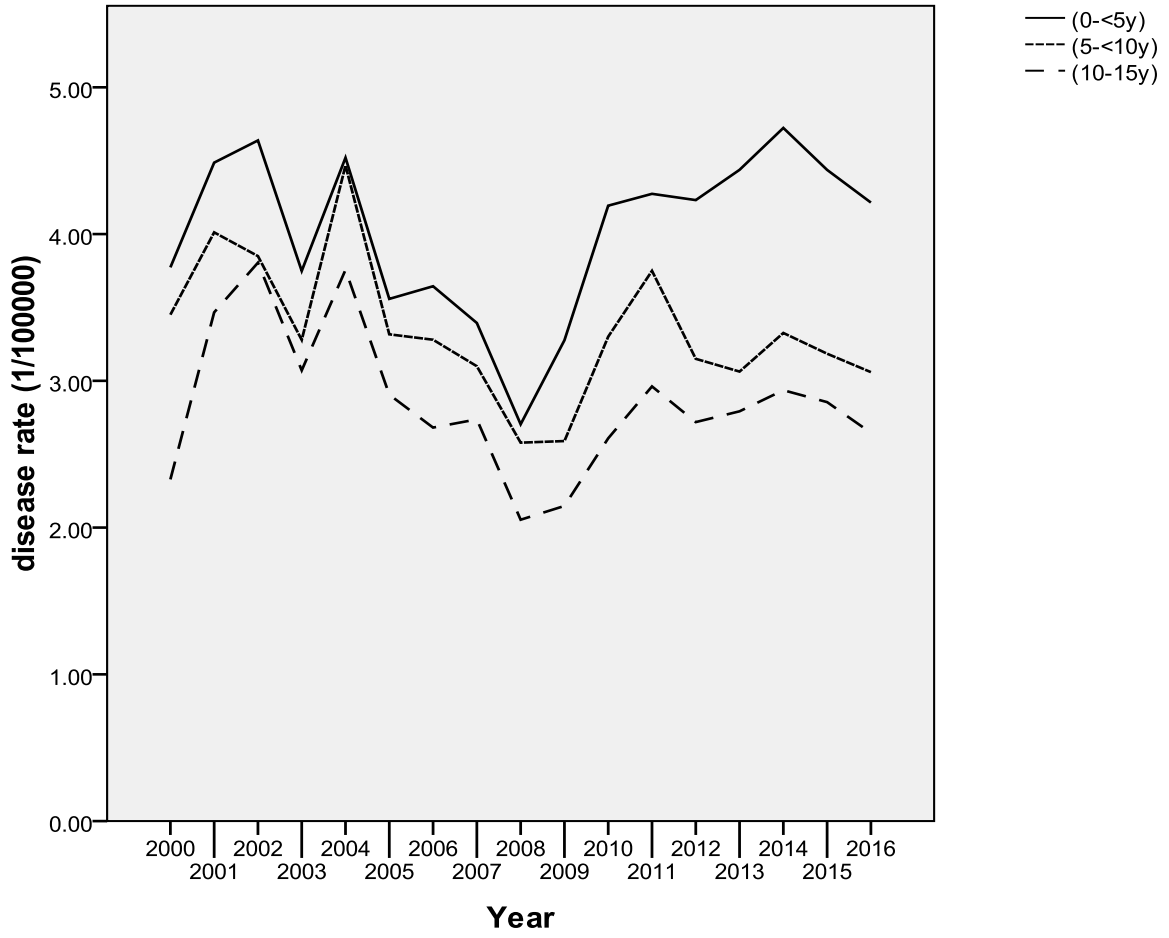


Figure (6): Child Cancer distributed by age group

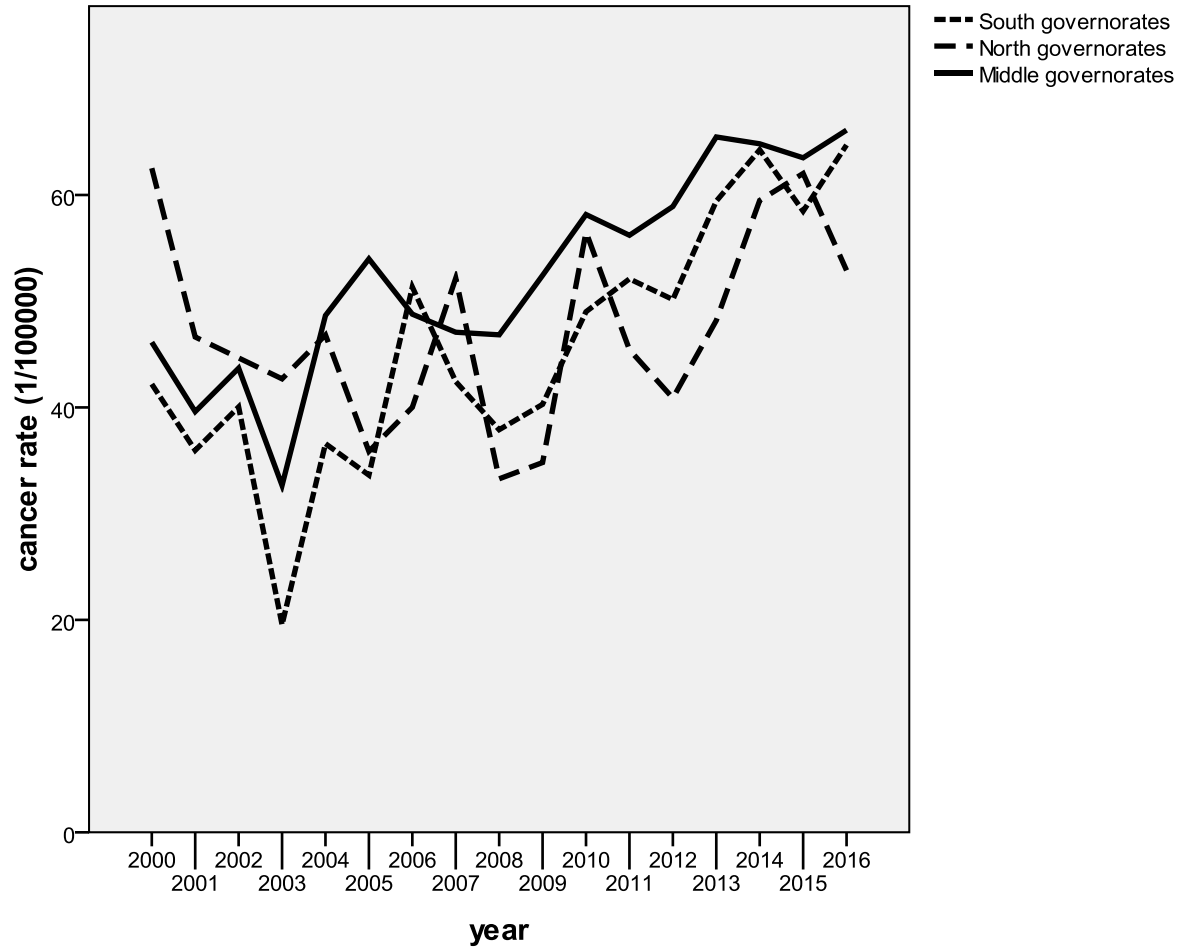


Figure (7): Total cancer rate in Iraq distributed by Iraq province

Table (1): Percent change in incidence rate of cancers (2000-08), (2008-16), (2000-16)

ID	Disease	Rate 2000	Rate 2008	Percent change 2000-08	Rate 2016	Percent change 2008-16	Percent change 2000-16
1	Breast cancer	8.43	8.56	1.54	13.19	54.09	56.47
2	Lung cancer	4.08	4.31	5.64	5.60	29.93	37.25
3	Brain cancer	1.17	2.03	73.50	2.97	46.31	153.85
4	Bladder cancer	3.44	2.76	-19.77	3.75	35.87	9.01
5	Stomach cancer	1.80	1.48	-17.78	2.04	37.84	13.33
6	Colorectal cancer	2.43	2.07	-14.81	3.74	80.68	53.91
7	Liver cancer	0.40	0.82	105.00	1.91	132.93	377.50
8	Pancreatic cancer	0.72	0.76	5.56	1.46	92.11	102.78
9	Skin cancer	2.23	1.15	-48.43	1.92	66.96	-13.90
10	Larynx cancer	2.40	0.52	-78.33	0.51	-1.92	-78.75
11	Thyroid cancer	1.22	0.70	-42.62	2.96	322.86	142.62
12	Leukemia	3.24	3.01	-7.10	4.37	45.18	34.88
13	Hodgkin dis.	1.40	0.97	-30.71	1.44	48.45	2.86
14	NHL	3.20	2.24	-30.00	3.16	41.07	1.25
15	Ovarian cancer	2.11	1.78	-15.64	3.05	71.35	44.55
16	Cervical cancer	1.51	1.02	-32.45	1.14	11.76	-24.50
17	Prostate cancer	1.85	1.53	-17.30	4.13	169.93	123.24
18	Child cancer	9.55	7.34	-23.14	9.92	35.15	3.87
19	Total cancer	52.00	44.46	-14.50	67.46	51.73	29.73