

The Comprehensive Epidemiological Study on Cancer Patterns in Iraq: A National Analysis of Gender and Geographical Disparities

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Article history

Received: 5/1/2026

Revised: 16/2/2026

Accepted: 17/3/2026

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Abstract: Background: One of the most common cancers in Iraq is Colorectal and Bronchus & Lung and leukemia and Brain, CNS. **Objectives:** In this study, Iraq national cancer registry [2022] is employed to analyses the gender and regional disparities of four common cancers [colorectal, leukemia, brain/CNS, and lung/bronchus]. **Methods:** This study was conducted among 9577 patients. The data from Iraqi National Cancer Registry [2022] - Ministry of Health. Data were analyzed using statistic. **Results:** Statistics showed that Baghdad recorded the highest number of cases [2,225], while Muthanna recorded the lowest [89]. An increase in lung cancer [73.9%] and leukemia [61.3%] cases was observed among males, while females were the most common gender among leukemia cases in Dhi Qar [59 females compared to 38 males]. Using statistical tests, we observed highly significant spatial variations [Moran's coefficient = 0.42, $p < 0.001$] and gender disparities [$p < 0.05$]. **Conclusions:** These findings underscore the need for targeted prevention strategies and environmental research in high-risk governorates.

Keywords: Cancer, Geographical, National, environmental.

1. Introduction

Cancer was formerly thought to be a disease that only affected wealthy nations. Still, it is today one of the most significant public health issues on the globe, with its incidence and fatality rates rising quickly. The growing incidence of cancer is a reflection of the growth in life expectancy and decrease in fertility are partly due to the changes in globalization and socioeconomic development in the economy, society, and lifestyle [1].

The primary characteristic of cancer is the lack of genetic regulation of cell division and development. As a result, although it is a hereditary illness, environmental

and lifestyle factors are mostly responsible for the disease process. These include, among other things, food, alcohol use, tobacco use, excessive body weight and obesity, physical inactivity, and sun exposure, air pollution suggesting that there is a significant chance of preventing cancer. [2-3]

One of the most common cancers in Iraq is Colorectal and Bronchus & Lung and leukemia and Brain, CNS. One of the most prevalent cancers that affect people worldwide is leukemia. With 437,033 cases and 309,006 fatalities, leukemia was the fifteenth most prevalent cancer diagnosed worldwide in 2018 and the eleventh leading cause of death from malignant illnesses.

Leukemia has a global geographic distribution, with more industrialized nations having greater prevalence and total death rates. However, emerging nations have a higher death rate [4].

Also, with over 1.85 million diagnoses and 850,000 deaths per year, colorectal cancer [CRC] ranks third globally in terms of cancer mortality. Twenty per cent of newly diagnosed patients with colorectal cancer had metastases upon presentation, and another twenty-five per cent of patients with localized disease now have metastases [5]. Cancers of the brain and central nervous system [CNS] are a diverse and intricate category of malignant tumors that originate from the brain and its surrounding tissues. In 2020, there were 251,329 cancer-related fatalities globally, and 308,102 new instances of brain and central nervous system malignancies were reported, according to Global Cancer Statistics 2020. Prior research has shown that brain and central nervous system malignancies rank among the top 10 causes of mortality and are the second most common cause of cancer-related fatalities among teenagers [6].

Further, the 2.2 million cases and about 1.8 million fatalities in 2020 by bronchus, and lung cancer [TBL]. Also is the second most frequent disease worldwide and the leading cause of cancer-related mortality [7].

The environment, including the workplace, contains hundreds of natural or artificial compounds that might cause cancer. There are several indoor and outdoor danger factors, such as automobiles, factories, and tobacco smoke, as well as agricultural practices, fires, and domestic combustion appliances [8].

The last 20 years have seen widespread war-related pollution of Iraq's land, air, water, and healthcare system. Iraq's environmental problems, including the consequences of air, water, and soil pollution, have a significant negative influence on the country. In Iraq, studies have demonstrated a clear relationship between the prevalence of war and cancer-related morbidities and deaths [9].

Burning fuels produce toxic pollutants that contaminate the air while also providing the energy required for household and industrial operations. The main air pollutants in Iraq are known to be sulphur dioxide [SO₂], nitrogen dioxide [NO₂], volatile organic compounds [VOCs], and particle matter [PM_{2.5} and PM₁₀] [10].

Iraq's cancer burden is expanding, compounded by decades of violence and environmental deterioration. Recent studies show an increase in the prevalence of

various cancer forms, although comprehensive countrywide evaluations are still limited.

This study analyses 2022 registry data to quantify gender inequalities in cancer incidence.

1. Identify hotspots using spatial epidemiology.
2. Investigate potential environmental correlations.
3. The study focuses on Iraq's 18 governorates and establishes the first post-pandemic [COVID-19] baseline for cancer management plans.

2. Methodology

Data Sources

This study was conducted among 9577 patients. The data from Iraqi National Cancer Registry [2022] - Ministry of Health. Data were analyzed using statistic

Statistical Analysis

-Descriptive Statistics

- Age-specific rates and age-standardized incidence rate [ASIR] were computed based on WHO standard population.
- Male to female ratios were then calculated and 95% confidence intervals constructed.

- Spatial Analysis

At the end, the hot spot value was calculated using the Getis-Ord Gi statistic.

- Inferential Statistics

Gender comparisons were tested by Mann-Whitney U tests

Environmental factors multivariate regression model to study the risk of factors.

3. Results and discussion

Demographic Patterns

Statistical data showed that cancer rates are highest in Baghdad, followed by Basra and then Nineveh. This is considered the highest rate compared to other governorates. Table 1 presents the number of cancer cases, along with Figure 1, which displays the rates for all governorates.

Table 1. Cancer Incidence by Governorate [Top 3]

Governorate	Total Cases	ASIR/100,000	Male: Female Ratio
Baghdad	2,225	38.7	1.2:1
Basrah	736	29.1	1.4:1
Al-Sulaymaniyah	738	29.5	1.5:1

❖ ASIR: Age-standardized incidence rates

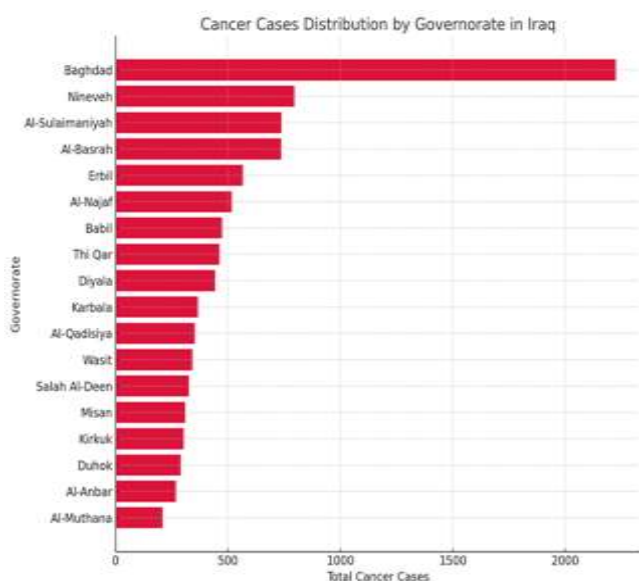


Fig 1: Total cancer cases

The reasons for the emergence of high rates of cancer infections in Baghdad are due to the huge number of residents. The population of Baghdad is estimated to be 9 million as of 2024. The area of Baghdad Governorate is [5169] square kilometers, according to statistics from the Central Statistical Organization and the Iraqi Ministry of Planning. In addition to pollution resulting from car exhausts, an estimated 4 million cars are passing through the streets of Baghdad, according to statistics from the General Traffic Directorate. It also contains several factories and an oil refinery in the city of Dora, which is considered one of the most prominent air pollutants and increases the chance of contracting cancer.

-The Emissions from Generators

According to studies conducted in Lebanon, the usage of generators that run on diesel has increased the incidence of cancer. According to one research, for instance, the usage of generators in Beirut increased the

number of cancer cases by 30% because of the harmful particles they released into the air. [11]

-Insufficient Knowledge and Prompt Identification

A rise in cancer cases may result from a lack of awareness and early detection. According to research, 70% of women in Baghdad, for instance, are unable to undertake breast self-examination, which results in delayed detection and a higher incidence of cancer [12]. Numerous environmental, geographic, health, and military variables are blamed for the high cancer rates in the Basra Governorate [southern Iraq]:

● **War-related radioactive contamination**

Depleted Uranium [DU]: In the 1991 First Gulf War and the 2003 invasion of Iraq, US and British forces employed depleted uranium in their weapons.

This kind of uranium produces metallic and radioactive dust that lingers in the environment for a long time. Exposure to depleted uranium alters DNA and causes genetic changes; it also has poisonous, chemical, and radioactive effects. It causes several cancers, including bladder and lung cancer, lymphoma, and leukemia. The high incidence of cancer in adults and children has been connected to military activities regions by both local and international research [e.g., WHO, UNEP] [13-14].

-Environmental and Industrial Pollution Oil, Gas, and Petroleum Derivatives:

With refineries, oil extraction facilities, and transportation hubs, Basra is a major worldwide oil center. Toxic substances including toluene and benzene, as well as polycyclic aromatic hydrocarbons [PAHs], are released when gas used for oil extraction is burned.

The International Agency for the Prohibition of Chemical Weapons [IARC] has designated these substances as carcinogenic. They have an impact on the reproductive system, liver, and lungs.

Pollution of Water and Soil: The Shatt al-Arab River is contaminated as a result of oil and industrial waste being dumped into waterways. Carcinogens enter the food chain through the use of contaminated water for agriculture and irrigation [15].

-Desertification and Climate Change

Increased concentrations of dust packed with pollutants are caused by high temperatures, little precipitation, and frequent dust storms. Wind-borne radionuclide and heavy metal particle transportation. Chronic inhalation of carcinogenic particles is more likely in these settings.

-Early diagnosis and a weak health system

Case detection has been delayed as a result of the lack of early detection programs. The absence of radiographic and laboratory tools for diagnosing tumors. Rapid intervention and monitoring are impacted by the absence of a reliable national cancer registry. [16].

Potential Reasons for the High Sulaymaniyah Province Cancer Rates

-Pollution of the environment and industry

Research shows that industrial pollutants, including gas flaring in oil fields, might raise the chance of developing cancer. Gas flaring at Iraq's Rumaila field, for instance, is thought to have led to a rise in leukemia cases since the flared gas is said to contain harmful compounds associated with a higher risk of cancer.

-War-Related Exposure to Hazardous Materials

Cancer risk may rise as a result of wartime exposure to harmful chemicals. For instance, survivors of the chemical weapons assault on the Iraqi city of Halabja experienced a rise in cancer incidence due to exposure to harmful compounds like mustard gas.

-Diet and Lifestyle

According to studies, diet and lifestyle choices might affect a person's chance of developing breast cancer. One research, for instance, found that poor diet and inactivity might raise the risk of breast cancer in Iraqi women.

Gender Disparities

Lung cancer showed strongest male predominance [2.83:1 ratio, $p=0.003$] [exceeds global averages [typically 2:1]], particularly in industrial governorates:

- Baghdad: 378 [male] VS 199 [female]
- Basrah: 132[male] VS 40 [female]

There is compelling evidence that the biggest risk factor for lung cancer is still tobacco smoking. The incidence, mortality, and survival of lung cancer are strongly associated with cigarette smoking. Smokers have a 30 times higher risk of developing cancer than non-smokers. In Iraqi society, men are more prone than women to smoke [smoking prevalence 32% males vs 2% females], which contributes to the greater prevalence of lung cancer in men.[17]

Spatial Clusters

Statistical data showed that the governorates with the highest incidence of cancer [$p<0.01$] are the following:

- Lung cancer: Baghdad-Nineveh [relative risk value = 2.3].

In Iraq, tobacco use has spread like wildfire. Post-traumatic stress disorder [PTSD] and sociocultural settings are the primary determinants of smoking prevalence. According to the study, many Iraqi smokers are unaware of the harmful consequences smoking has on their health. [17].

- Leukemia: Southern of Iraq [in female more than male] [Thi Qar relative risk value =1.9].

Due to the presence of oil fields like the Nasiriyah, Gharraf, and Subba fields, which are a part of the oil investments and contribute to environmental pollution, which in turn causes diseases to spread among the province's residents, as well as wars, environmental pollution, and sites contaminated with radioactive uranium, the incidence of blood cancer has increased in Dhi Qar. [18.]

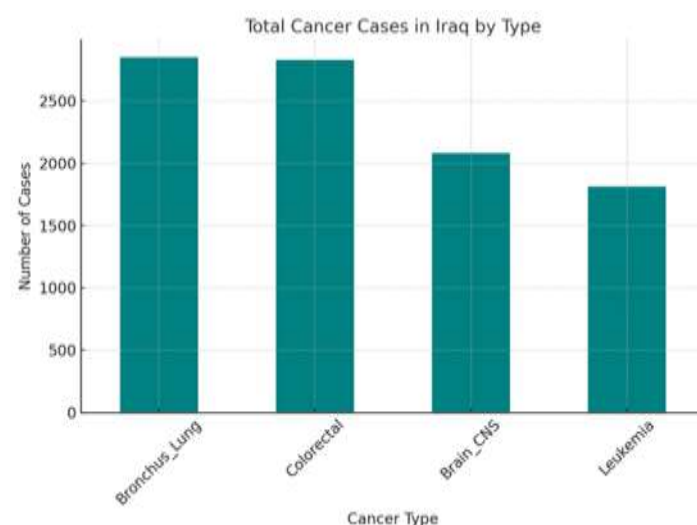


Fig 2: cancer type

-Policy Implications

1. Priority screening programs for males in urban centers
2. Environmental remediation in southern leukemia clusters
3. Enhanced diagnostics in rural governorates

Conclusion

This study establishes 2022 baseline data for Iraq's cancer control strategy, Highlighting the stark differences between genders and geographical areas.

Investigating possible environmental carcinogens and managing environmental pollution urgently are necessary due to the high frequency of female leukemia in Dhi Qar, and the high cancer rates in Baghdad, Sulaymaniyah Governorate, and Basra.

Acknowledgement

We would like to express our sincere thanks to all those who helped me complete this research successfully

Funding Information

Author

Author's Contributions

Each author made an equal contribution to the study.

Ethics

This study does not require approval from the research ethics committee, and publication consent has been obtained from both participants and researchers.

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