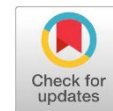


Research Article

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Epidemiological surveillance Profile Of Cancer In Eastern Benghazi, Libya 2021

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Abstract

Cancer remains a major public health concern globally and is the second leading cause of death in Libya. Despite its growing burden, comprehensive data on cancer incidence in eastern Libya remains limited. This study aims to estimate the incidence and distribution of cancer types in the eastern region of Benghazi, Libya, and compare findings with regional and global data to support health planning, training, and research efforts. A retrospective observational surveillance study was conducted using data from oncology departments at Tobruk Medical Center and Al-Bayda Oncology Center. All cancer cases diagnosed and registered from January 1 to December 31, 2021, were included. A total of 398 confirmed cases were analyzed by sex, type, and frequency. Statistical analysis was performed using IBM SPSS v26 with chi-square tests applied for gender related differences. The overall incidence was 61.23 cases per 100,000 population. Females constituted 58.5% of cases, with breast cancer being the most prevalent (24.1%), followed by colon (9%), uterine (8.2%), and lung cancers (7.78%). Male patients were more affected by colon, lung, and prostate cancers. Hematological malignancies and rare cancers were also observed, with statistically significant gender-based differences ($p < 0.001$). Comparisons with data from Misurata and global estimates revealed similar trends for certain cancers but also notable local variations, particularly in colon and esophageal cancer rates. This study provides critical epidemiological insight into cancer incidence in eastern Libya. The findings highlight the need for sex-specific cancer strategies and reinforce the importance of establishing a comprehensive national cancer registry for improved disease surveillance and healthcare planning.

Keywords: Eastern Libya, Oncology, Cancer, Incidence, Surveillance.

INTRODUCTION

Cancer is one of the most significant and widespread diseases globally. It is the second leading cause of death in Libya, accounting for approximately 13% of mortality. Consequently, cancer remains one of the most prevalent health challenges in the country, reflecting both regional and global public health concerns (WHO, 2022). Globally, cancer remains a leading cause of morbidity and mortality. According to GLOBOCAN 2021 estimates by the International Agency for Research on Cancer (IARC), approximately 19.96 million new cancer cases and 9.74 million cancer-related deaths occurred worldwide in 2021 (Sung et al., 2021).



The most frequently diagnosed cancers globally in 2021 were lung cancer with 2.5 million new cases (12.4% of all cancers), female breast cancer with 2.3 million cases (11.6%), colorectal cancer with 1.9 million cases (7.3%), and stomach cancer with 970,000 cases (4.9%) (Bray et al., 2024).

In terms of mortality, lung cancer was the leading cause of cancer death, accounting for 1.8 million deaths (18.7% of all cancer deaths). This was followed by colorectal cancer (900,000 deaths; 7.8%), female breast cancer (670,000 deaths; 6.9%), and stomach cancer (660,000 deaths; 6.8%) (Ferlay et al., 2021).

In the eastern region of Libya—located east of Benghazi and covering a geographical area estimated between 450,000 and 500,000 square kilometers—the disease has also shown a notable presence (Bureau of Statistics and Census, 2021). This region is home to approximately 653,711 residents and includes several oncology departments and cancer treatment centers that have recorded numerous confirmed cases (Gusbi et al., 2021; Abu Fekirin et al., 2015).

Knowledge of cancer epidemiology contributes not only to national health surveillance but also serves to guide strategic health planning, structural organization, capacity building, staff recruitment, and medical research, education, and training. Establishing a national cancer registry is a central duty of the Ministry of Health and is recommended by the WHO and IARC (WHO, 2022; IARC, 2020). Cancer registries play a crucial role in planning and conducting research on cancer etiology and are useful for evaluating prevention and control programs targeting cancer within the population. Currently, limited reports on cancer incidence in Libya are available, with data primarily derived from the Benghazi region and the western region of Libya (Ismail et al., 2020).

This study was conducted to provide the first report on cancer incidence based on data from the oncology department at Tobruk Medical Center and the Albaide Oncology Center, located east of Benghazi, Libya.

Aim of Study

This study aims to estimate the incidence and distribution of cancer types in the eastern region of Benghazi, Libya,

MATERIALS AND METHODS

Study Design

This project utilized a retrospective observational surveillance design. A sample of patients was selected from multiple departments across the region (a city-wide survey) to calculate the annual incidence of cancer in the region east of Benghazi, Libya.

Study Setting

Two centers located east of Benghazi were selected for the study: the Oncology Department at Tobruk Medical Center and the Al-Bayda Oncology Center in Al-Bayda City. The study included all patients diagnosed with cancer and registered in these oncology departments over a 12-month period, from January 1, 2021, to December 31, 2021. Only public healthcare hospitals were included in this study; private facilities were excluded.

Ethical Approval and Population

Ethical approval was granted by Tobruk Medical Center and Al-Bayda Oncology Center. All data

were anonymized and analyzed solely for medically relevant parameters. A total sample size of 398 patients was included in the study, stratified by cancer type and sex.

Inclusion and Exclusion Criteria

Inclusion Criteria:

All public healthcare hospitals in the region east of Benghazi were included.

All patients aged 15 years and older.

All patients who had undergone cross-sectional imaging (Computed Tomography [CT] or Magnetic Resonance Imaging [MRI]) or had a pathological sample taken.

Reports indicating a malignant histopathological diagnosis.

Exclusion Criteria:

Non-malignant histopathology reports.

Imaging reports with non-malignant findings.

Data Collection Procedure:

Pathology and imaging reports were collected directly from the clinical team by the research team on a regular basis (weekly to monthly, depending on the workload). These documents were filtered to exclude non-malignant reports. The research team reviewed the reports only, rather than the raw images or biological samples.

Patients or their relatives were contacted to confirm the diagnosis. Toward the end of the data collection period, imaging and pathology reports for each patient were consolidated to ensure each cancer case was recorded as a single entry in the database. Patients without a confirmatory pathological diagnosis were contacted via telephone by the research team to ascertain if, when, and where a cancer diagnosis had been confirmed or excluded. Cases involving missing information were discussed within the research team to reach a consensus regarding their inclusion or exclusion. All confirmed cancer cases were recorded in a data spreadsheet. Further processing, including filtration, sorting, matching, and final analysis, was conducted using the same dataset.

Statistical Analysis:

Data were analyzed using IBM SPSS version 26 (IBM Corp., 2019). Frequencies and percentages were computed, and comparisons were made using Chi-square analysis to examine the significance of relationships between different variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 398 cancer cases were analyzed. The distribution by sex showed that 58.5% (n = 233) were female and 41.5% (n = 165) were male. The types of cancer and their respective proportions among the total cases are as follows most common was Breast Cancer: 24.1% (n = 96) Predominantly affected female (99%), followed by Colon Cancer: 9% (n = 36), More common in males (58.3%). Uterine Cancer: 8.2% (n = 33), Ovarian Cancer: 5.5% (n = 22) While Lung Cancer: 7.78% (n = 31), Predominantly male (87%), Prostate Cancer: 4.2% (n = 17).

All types of G.I.T cancers as Pancreatic Cancer: 4% (n = 16) Stomach Cancer: 4% (n = 16), Liver Cancer: 1% (n = 4) Rectal Cancer: 4.5% (n = 18), as well as Renal Cancer: 3.2% (n = 13), Brain Cancer: 1.7% (n = 7), Bone Cancer: 1.7% (n = 7), Unknown Primary: 2.26% (n = 9) and Multiple Myeloma: 0.7% (n = 3) are More common in males with percentage ranging between 53.5% and 100%.

While the hematological cancers as Non-Hodgkin Lymphoma (NHL): 3% (n = 12) , Hodgkin Lymphoma (HL): 2% (n = 8) Leukemia: 0.7% (n = 3), and Thyroid Cancer: 3% (n = 12) are more common in females with percentage 66.6%(n=8). On other hand ,the cancers as Nasopharyngeal Cancer: 2.5% (n = 10), Urinary Bladder Cancer: 1.5% (n = 6) , and Gall Bladder Cancer: 0.5% (n = 2)are equal distribution in both sexes.

Also, rare cancers as Salivary Gland Cancer, Pleural Cancer ,Testicular Cancer, 0.25% (n = 1) were found in males, while rare others types of cancers ,included Immature Teratoma, Pituitary Gland, Skin Cancer, Supra Renal Gland Cancer, Esophageal Cancer, Thymus Tumor 0.25% (n = 1) ,were found in females.

Table (1). Estimated number, incidence and for all cancer types in east of Benghazi by sex-2021

Cases	Total%	Male	Female
All cancer	398(100%)	41.5%(165)	58.5%(233)
Breast	24.1%(96)	1%(1)	99%(95)
Colon	9%(36)	58.3%(21)	41.6%(15)
Uterus	8.2%(33)		100%(33)
Lung	7.78%(31)	87%(27)	12.9%(4)
Ovary	5.5%(22)		100%(22)
Rectum	4.5%(18)	61.1%(11)	38.8%(7)
Prostate	4.2%(17)	100%(17)	
Pancreas	4%(16)	93%(15)	7%(1)
Stomach	4%(16)	62.5%(10)	37.5%(6)
Renal	3.2%(13)	53.8%(7)	46%(6)
NHL	3%(12)	66.6%(8)	33.3%(4)
Thyroid	3%(12)	33.3%(4)	66.6%(8)
Nasopharyngeal	3%(12)	33.3%(4)	66.6%(8)
unknown	2.5%(10)	50%(5)	50%(5)
H.L	2.26%(9)	77.7%(7)	22.22%(2)
Brain	2%(8)	37.5%(3)	62.5%(5)
Bone	1.7%(7)	85.7%(6)	14%(1)
Urinary bladder	1.7%(7)	100%(7)	
Liver	1.5%(6)	50%(3)	50%(3)
Multiple myeloma	1%(4)	75%(3)	25%(1)
Leukemia	0.7%(3)	66.6%(2)	33.3%(1)
Gall bladder	0.7%(3)	33.3%(1)	66.6%(2)
Salivary gland	0.5%(2)	50%(1)	50%(1)
Pleural	0.25%(1)	100%(1)	
Testicular	0.25%(1)	100%(1)	
Immature Teratoma	0.25%(1)	100%(1)	
Pituitary gland	0.25%(1)		100%(1)
skin	0.25%(1)		100%(1)
Supra renal gland	0.25%(1)		100%(1)
Esophageal	0.25%(1)		100%(1)
Thymus	0.25%(1)		100%(1)

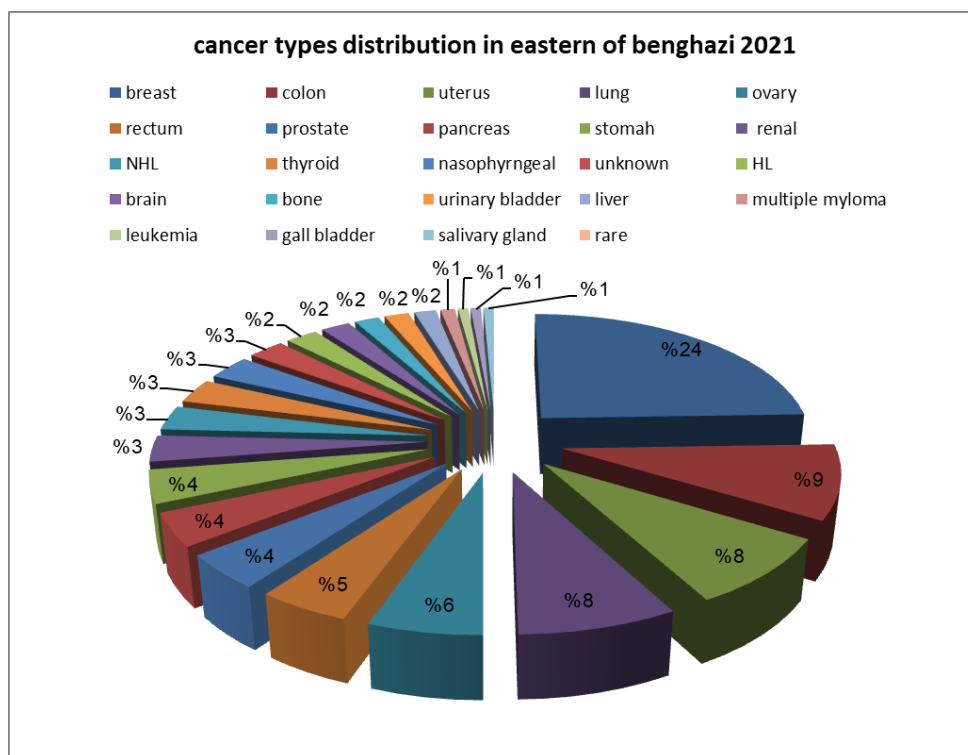


Figure (1). cancer types distribution in eastern of Benghazi 2021

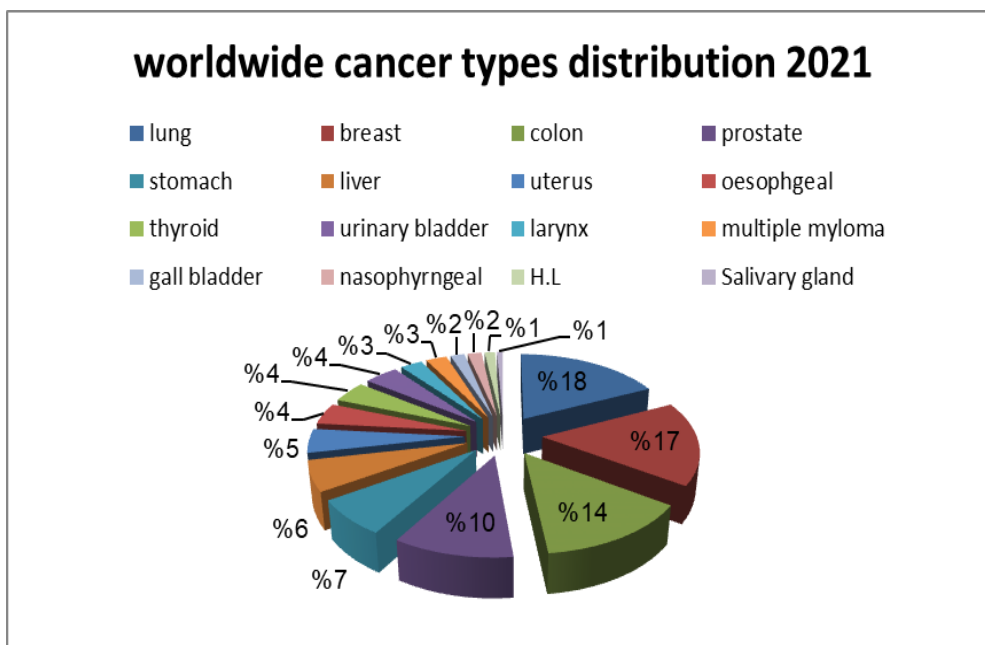


Figure (2). worldwide cancer types distribution 2021

A Chi-square test of independence was performed to assess the association between cancer type and gender. The results showed a statistically significant relationship($p < 0.001$). indicating that the distribution of cancer types significantly differs between males and females(Ferlay et al ., 2021)

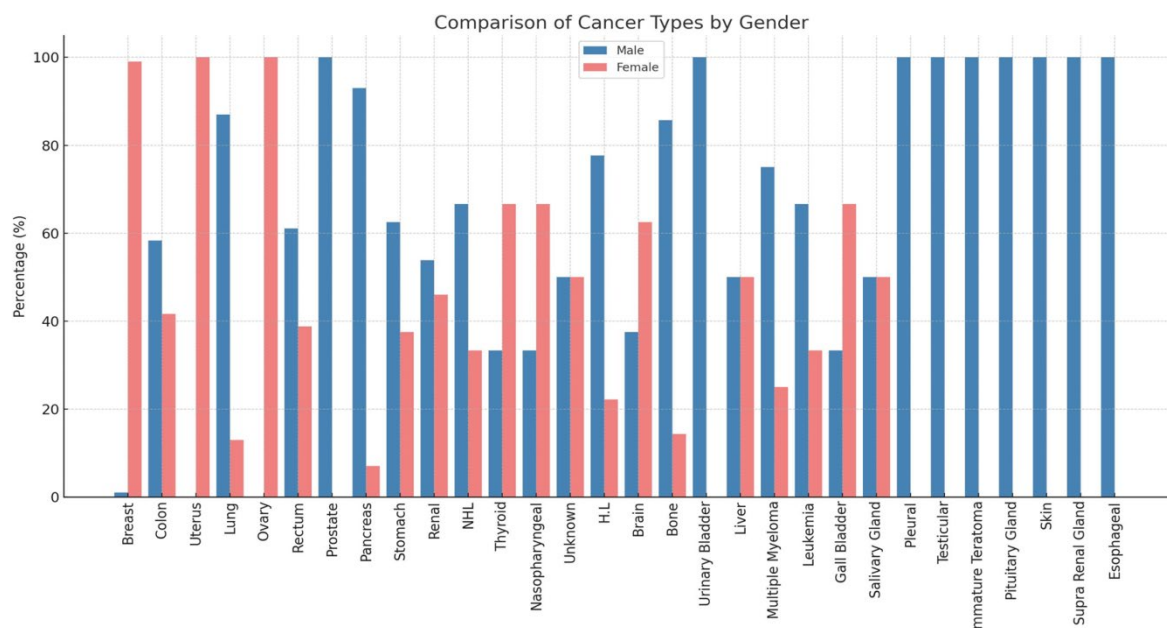


Figure (3).comparison of cancer types by gender, The results showed a statistically significant relationship ($p < 0.001$)

Pediatrics malignancies were not included in this study since such patients are recorded at the Department of pediatrics and their data were not made available.

DISCUSSION

This cancer epidemiological survey identified a total of 398 new cancer cases in the region east of Benghazi over a 12-month period. Given the total population of 653,711, this yields a cancer incidence rate of 61.23 per 100,000 population. The study methodology mirrors that of a similar study conducted in Misurata City during the same year, which registered approximately 430 new cases and reported an incidence rate of 71.7 per 100,000 population (Zarmouh et al., 2021).

Overall, females constituted the majority of patients, accounting for 58.5% ($n = 233$) of cases, compared to 41.5% ($n = 165$) for males. This female predominance was largely driven by the high incidence of breast cancer. Breast cancer was the most frequently diagnosed malignancy in this study, representing 24.1% of all cases and affecting females almost exclusively (99%). This distribution is comparable to findings in Misurata, where breast cancer accounted for 19.5% of cases (Zarmouh et al., 2021). The number of risk factors significant and included both modifiable and non-modifiable factors breast cancer. (S lukasiewicz et al 2021) . the risk of developing breast cancer can be minimized through specific preventive activities , these include change lifestyle , diet , screening for woman with high risk , diagnosis of breast cancer in early stages has been positively linked to decrease in the mortality and morbidity of the disease (Oussama M.N.2025). However, globally, breast cancer ranked as the second most common cancer in 2021, comprising 11.6% of total cancer cases (WHO, 2022; IARC, 2020). Furthermore, the incidence of breast cancer among women in our study appears elevated compared to the 2014 Benghazi cancer registry, where it was recorded as the second most common cancer type (Zuhir et al., 2014).

Colon cancer was the second most frequently recorded malignancy (9%), with a higher prevalence in males (58.5%). This pattern parallels the distribution observed in Misurata in 2021, where colon cancer accounted for 19.3% of cases (Zarmouh et al., 2021). Notably, the incidence rate for colon

cancer in Libya appears to be the highest in the region. We suspect a strong association between this high rate and the dietary and lifestyle habits of the Libyan population (Bray et al., 2024). Conversely, while global data for 2021 identified lung cancer as the most common malignancy (11.6%) (WHO, 2022; IARC, 2020), it ranked fourth in the region east of Benghazi (7.7%). Consistent with global trends, lung cancer in our study was predominantly found in males (87%). A similar male predominance was observed in the 2014 Benghazi registry, which reported a male-to-female ratio of 8:6 (Zuhir et al., 2014).

The distribution of other malignancies—including hematological cancers (e.g., Non-Hodgkin Lymphoma, multiple myeloma), as well as thyroid, nasopharyngeal, and salivary gland cancers—mirrored the findings in Misurata City (Zarmouh et al., 2021) and aligned with global distributions for 2021 (WHO, 2022; IARC, 2020). Finally, esophageal cancer was identified as a rare malignancy in the region east of Benghazi (0.2%), a figure identical to that reported in Misurata (0.2%) (Zarmouh et al., 2021). This contrasts significantly with the global distribution, where esophageal cancer accounts for approximately 4% of cases (Ferlay et al., 2021).

CONCLUSION

This study offers critical epidemiological insights into cancer incidence in the eastern region of Libya. The findings underscore the necessity for sex-specific cancer strategies and reinforce the importance of establishing a comprehensive national cancer registry to enhance disease surveillance and healthcare planning.

ETHICS

The authors declare that there are no ethical issues expected to arise following the publication of this manuscript..

Duality of interest: The authors declare that they have no duality of interest associated with this manuscript.

Author contributions :author 1: developed the theoretical formalism, performed the analytic calculations and performed the numerical simulations ,contributed to the final version of the manuscript , supervised the project and authors 2, 3,4 collected of data.

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