Parasitic influences on cancer patterns: An Analytical study from Al Hawari hospital of Benghazi, Libya

Abstract:

Carcinogenesis, the process of cancer development, can in some cases be associated with certain parasitic infections. In this study, key points regarding the relationship between parasites and carcinogenesis are discussed.

Aims: Through analysing medical records from cancer patients at Al-Hawari Hospital and researching previous studies regarding the present parasite, relationships between parasites and cancer diseases quantifying the types of cancer present in Libya were discovered.

Method: The study was conducted in Benghazi, Libya, and analysed medical records for 248 patients with cancer from January through March 2024. Data from 13 cities across Libya. Utilising a retrospective design, it incorporates both an analysis of collected medical data and a review of over 20 related literature sources. Statistical analysis was done using SPSS software to assess relationships between age and cancer types, applying the Chi-square test for categorical variables.

Result: Breast cancer was the most prevalent cancer type, 41.1%, followed by uterine cancer at 16.9%. Benghazi had the highest cancer incidence rate, accounting for 54.8% of recorded cases, while the age group with the highest frequency of cancer was 51-60 years (29%). The study also linked specific parasites to various cancers, such as Toxoplasma gondii to breast cancer and Schistosoma species to bladder and rectal cancers. The Chi test shows a significantly significant relationship between age and infection with a test value of 125.304 and a p-value of 0.000.

Conclusion: There are many parasites that are present in Libya linked to cancer. Therefore, the study emphasises the need for continued research into the role of infection in the development of cancer.

Key words: Cancer development, Parasitic associations, Infections, Malignancies, Parasite-induced inflammation

11: Introduction

Parasitic infections are believed to be a contributing factor in the development of cancer. Different parasites can cause various diseases, including cancer, and some parasites have been classified as dangerous carcinogens (1, 2).

These parasites may manipulate host cellular processes, leading to uncontrolled cell proliferation and inflammation, which are factors in tumorigenesis. Research has identified certain parasites that could induce carcinogenesis in their hosts, leading to the development of cancerous growths. Carcinogenic parasites, such as the liver fluke *Opisthorchis viverrini* and the blood fluke *Schistosoma haematobium*, have been associated with various types of cancer, including cholangiocarcinoma and bladder cancer, respectively (3, 4). These parasites have evolved sophisticated mechanisms to manipulate host cellular processes, leading to uncontrolled cell proliferation and tumour formation. For example, *Opisthorchis viverrini* secretes excretory/secretory products that disrupt normal cell signalling pathways and promote inflammation, which can contribute to the development of cancer in the biliary tract (5).

Understanding the interactions between these parasites and their hosts is essential for developing strategies to prevent and treat parasite-induced cancers, highlighting the significance of studying carcinogenic parasites in the context of cancer research (6).

The parasite-cancer interaction has revealed that, in addition to parasites that can cause cancer directly, parasites can indirectly encourage cancer development via a variety of pathways. On the other hand, it is known that the immune response to certain parasites might have antitumoural effects on the body. Parasitic agents can have tumoral and antitumoural properties (7). Certain Parasites can be carcinogenic. A bladder infection with *Schistosoma haematobium* can result in long-term inflammation and scarring, both of which increase the risk of cancer. *Clonorchis sinensis*, a different kind of parasite, has also been connected to bile duct and pancreatic cancer (8). The frequency of parasitic infection is related to its spread; therefore, when cancer occurs in areas endemic with parasitic infections, there is strong suspicion that it is related to parasites. In tropical

regions, parasitic infestation is endemic and represents a major public health risk. In great part, human activity has caused the proliferation of several parasites and their current global distribution (9).

The intricate mechanisms by which parasites function remain largely unexplored; understanding the interplay between these parasitic infections and cancer initiation could provide valuable insights into preventive measures and therapeutic interventions. In addition, the links between parasitic infections and different cancers suggest that new methods of cancer prevention should be included with parasite prevention in general and included with public health initiatives specifically designed to effectively address the burden of cancer within communities. In this study, we aimed to discover the relations between parasites and cancer diseases.

2: Methods and Material

The study analysed the medical records of 248 patients from 13 cities and small villages around Libya, according to the patients' residential addresses that were found in the medical records from Al-Hawari Hospital. The study showed patients from several cities in Libya and its suburbs (Benghazi, Tazrboo, Tripoli, Takns, Alquba, Sirt, Darna, Tawakura, Karkura, Alrajma, Qabr Jira, Sabha, Tobrok, Basos, Alabyar, Sabrata, Ajdabia, Solog, Almaraj, Albayda, Shahhat), which accounts for around 26.5% of all cities in Libya.

Study Design

The study was retrospective and cross-sectional, done by assessment of recorded information and literature reviews. It was divided into two parts:

Part 1. Data Analysis:

The data collected was examined in many cases from several regions of northeastern Libya. It started by quantifying the types of cancer present in Libya by a small sample indicator from the medical records of cancer patients from the oncology department at Al-Hawari Hospital, and then an inventory of the types of cancer present during the three months from January to March 2024 was done.

Part 2. Literature Review

Reviewing more than 20 pieces of literature and articles about the subject, then comparing the conclusion results with the results from analysis data in Part 1. Corresponding with monitoring the types of parasites that had proven to present in several Libyan cities through recent studies. Finally, linking and analysing the prevalence of infection rates of certain types of cancer with the presence of certain types of parasites that cause these types.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) software version 23 was used to examine the data collected. The study used the Pearson Chi-Square test to examine the relationship between categorical variables. specifically between age groups and types of cancer. Additionally, Microsoft Excel was used to create the graphs. Regarding the tests, the chi-square test was used for the relationship between the two categorical variables because the variables are not quantitative. A P-value of less than 0.05 was significant. The Chi-square test was chosen over ANOVA or T-tests as the data involved categorical variables only. Graphs were created using Microsoft Office Excel version 2021.

3: Results:

Part 1: Analysis data.

According to the medical records taken from Al-Hawari Hospital alone and from looking at the 248 patients' residential addresses, the study included patients from several cities in Libya and its suburbs. Breast cancer accounted for the highest proportion (41.1%), followed by uterine cancer (16.9%). Lung cancer represents 6.5%, a noteworthy segment of cases, while rectal cancer represents 7.3%. Both brain tumours and sarcoma represent 4.8%. Moreover, urinary bladder cancer (1.6%), prostate cancer, and palliative cancers (both at 3.2%) indicate the broader range of affected organ systems. Bone metastases, neck cancers, and other unspecified types show lower frequencies but are crucial to understand within a holistic cancer management framework. Generally, the data highlights the variation in cancer prevalence by city, with Benghazi reporting the highest frequency as shown in Fig. 1.
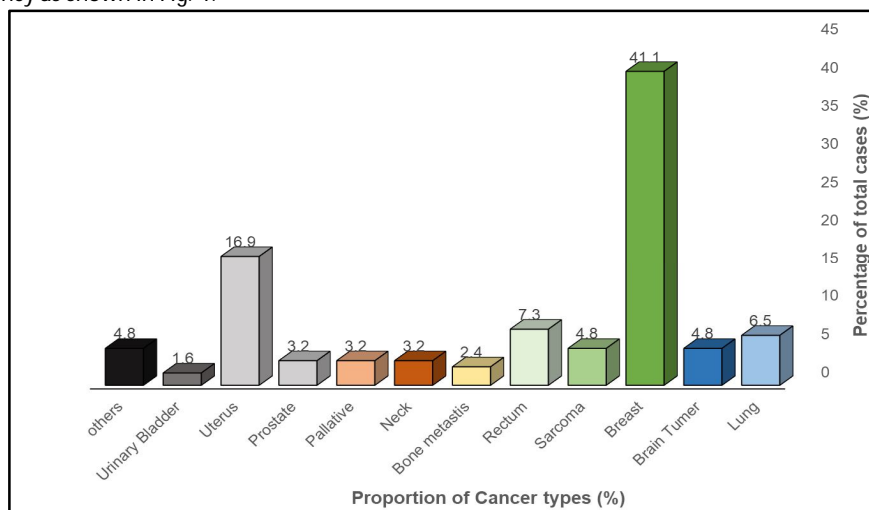
Figure 1. Distribution of cancer types across Libyan cities (January–March 2024).
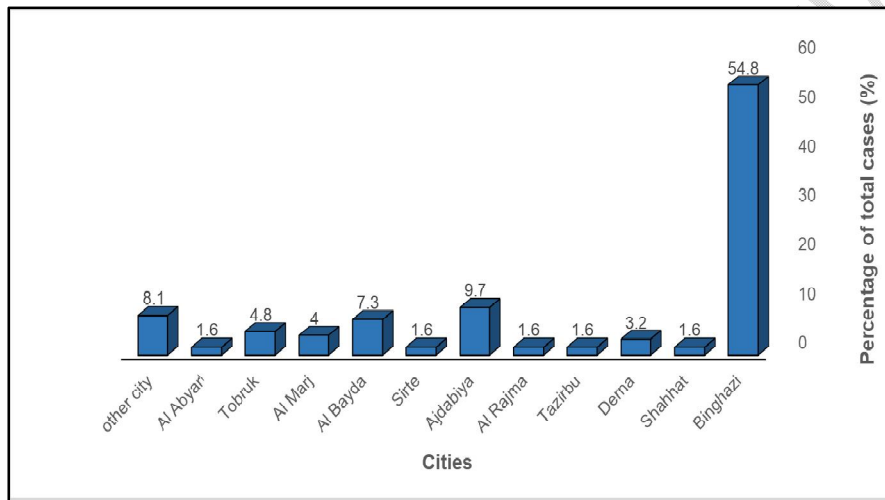

Figure 2. The geographical distribution of cancer cases across libyan cities (January – March 2024)

Figure 2 presents the percentage distribution of cancer cases across various cities in Libya during the three-month study period. Benghazi reports the highest proportion of cases (54.8%), likely due to the hospital's central location and its role as a referral centre. The second-highest percentage comes from Ajdabiyah. Other cities, including Tobruk and Al Bayda, show lower proportions, reflecting regional variations in cancer incidence. Figure 3 illustrates the percentage distribution of cancer cases across different age groups, highlighting the age-specific burden of cancer. The highest percentage of cancer cases (29%) is observed in individuals aged 51–60 years. This age group represents the peak prevalence, indicating that cancer risk substantially increases as individuals approach middle age. Combined, the age groups 41–50 years (22.6%), 61–70 years (16.9%), and 51–60 years (29%) account for the majority of cases. This trend reflects a strong association between ageing and cancer incidence, as is commonly seen globally. Age groups below 40 years show a markedly lower proportion of cancer cases;31-40 years represent 10.5% of total cases, while 21-30 years and under 20 represent 1.6% each. This suggests that cancer is relatively rare in younger populations. aligning with general epidemiological trends. Cancer prevalence in individuals aged 71–80 years (13.7%) and 81–90 years (4%) decreases slightly compared to middle-aged groups. This reduction could reflect survival bias, underreporting, or competing causes of mortality in this older demographic.
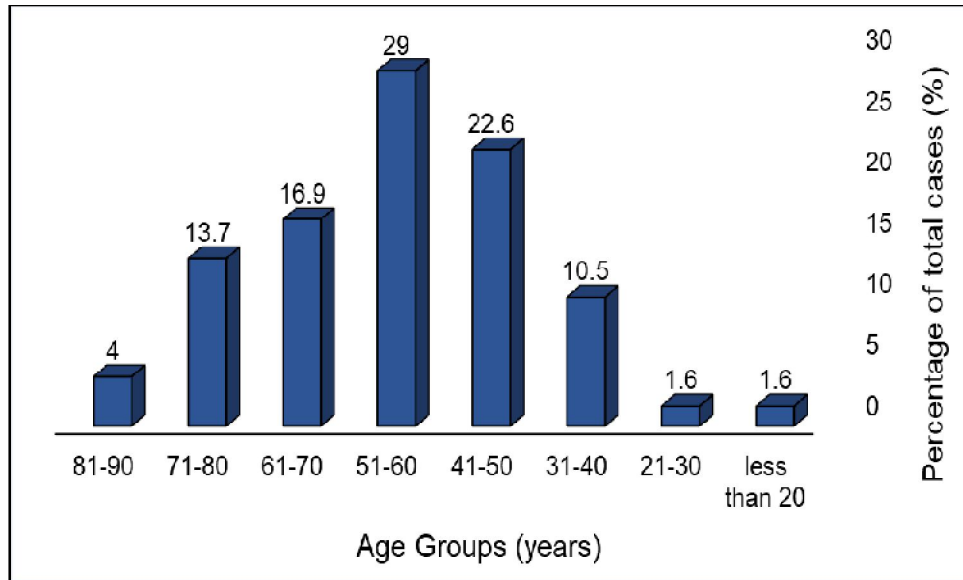
Figure 3. Age-wise distribution of cancer cases (January–March 2024).

This study investigated the distribution of various cancer types across different age groups and geographic locations (Table 1), revealing significant trends and relationships. The data indicate marked variations in cancer prevalence based on age, type, and city of residence. Breast cancer demonstrates the highest prevalence among individuals aged 31-40 years (31.4%) in Benghazi, gradually decreasing with age, showing 25.5% in the 41-50 age group, 11.8% in the 51-60 age group, and 9.8% in the 61-70 age group. Lung cancer predominantly affects the 51–60 age group, with a prevalence of 50% in Benghazi, highlighting a higher concentration in this demographic. Uterine cancer is mainly observed in the 41–50 age group, with a prevalence of 42.9% in Benghazi. Both rectal and bone cancers exhibit a prevalence of 33.3% in the 41-50 and 61-70 age groups, primarily in Benghazi. Prostate cancer shows the highest concentration in the 61–70 age group, with a remarkable prevalence of 75% in Benghazi. The distribution of cancer also varies significantly by city. Benghazi city represents the highest cancer burden across all types, with 56.9% for breast cancer, 62.5% for lung cancer, 42.9% for uterine cancer, 66.7% for rectal cancer, 33.3% for bone cancer, and 75% for prostate cancer. Tobruk city shows notable prevalence of sarcoma (33.3%) and other cancers (16.7% in the elderly). The isolated observations from Al-Marj include a 50% prevalence of bladder cancer in older adults (71–80 years). The lower prevalence rates are observed in Ajdabiya, Al Bayda, and Shahat cities, with sporadic cases of bone cancer and other cancers.

Recent research has emphasised the prevalence of carcinogenic parasites across various species (Table 2). Construction on these findings, multiple studies have established a connection between cancer and parasitic infections. Using insights from these studies, this research aimed to identify and analyse the associations between specific parasites and cancer types (Table 3).

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Table 1: Distribution of Cancer Types by Age Group and City

Age Group	Breast Cancer	Lung Cancer	Uterine Cancer	Rectal Cancer	Bone Cancer	Brain Cancer	Prostate Cancer	Bladder Cancer	Sarcoma	Neck Cancer	Other Cancer	Total %	Total number
Age													
11–20	-	-	-	-	-	-	-	-	-	-	-	1.6%	4
21–30	-	-	-	-	-	-	-	-	-	-	-	1.6%	4
31–40	31.4%	-	-	-	-	-	-	-	-	-	-	10.5%	26
41–50	25.5%	-	42.9%	33.3%	-	-	-	-	33.3%	50%	-	22.6%	56
51–60	11.8%	50%	-	-	-	-	-	-	-	-	-	29%	72
61–70	9.8%	-	-	-	33.3%	33.3%	75%	-	-	-	-	16.9%	42
71–80	-	-	-	-	-	-	-	50%	-	-	16.7%	13.7%	34
81–90	-	-	-	-	-	-	-	-	-	-	-	4%	10
City													
Benghazi	56.9%	62.5%	42.9%	66.7%	33.3%	50%	50%	50%	50%	75%	83.3%	54.8%	136
Ajdabia	5.9%	-	-	-	33.3%	16.7%	-	-	-	25%	-	9.8%.	24
Tobruk	7.8%	12.5%	-	-	-	-	25%	-	33.3%	-	16.7%	4.8%	12
Al Bayda	5.9%	-	14.3%	-	33.3%	-	-	-	-	-	-	7.3%	1
Marj	-	-	9.5%	-	-	-	-	50%	-	-	-	4%	10
Shahhat	-	-	9.5%	22.2%	-	16.7%	-	-	16.7%	-	-	1.6%	4
Rajma	-	12.5%	-	-	-	-	25%	-	-	-	-	1.6%	4
Sirt	2%	-	-	11%	-	-	-	-	-	-	-	1.6%	4
Derna	3.9%	-	9.5%	-	-	-	-	-	-	-	-	3.2%	8
Other	7.1%	12.5%	4%	-	-	16.5%	-	-	33.3%	25%	-	9.7%	24
Total number	102 (41.1 %)	16 (6.5 %)	42 (16.9 %)	18 (7.3%)	6 (2.4%)	12 (4.8 %)	8 (3.2 %)	4 (1.6 %)	12 (4.8 %)	8 (3.2 %)	12 (4.8 %)	100%	248

The Chi test also shows that there is a significant relationship between age and infection with a test value of 125.304 and a significance value of p-value = 0.000, which is less than the value of 0.05.

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Table 2. Studies Demonstrating the Relationship Between Parasites and Cancer

	Author	*Date*	*the relationship between parasites and carcinogenesis*	*Ref.No*
1	Elhassan	2016	Studies revealed a significant association between schizophrenia and cancer.	10
2	Ogbeche	2017	Proved the Impact of Schistosomiasis on Bladder Cancer Risk in Nigeria	11
3	Fernandes	2018	Conducted a link between chronic schistosomiasis infection and the development of malignant lesions in the bladder.	12
4	EL –Sayed	2019	Proved The Association Between Schistosomiasis and Bladder Cancer in Egyptian Patients	13
5	Franco Pls	2023	Suggests a potential association between Trypanosoma cruzi infection and an increased risk of stomach and oesophageal cancer	14
6	AL- Sharifi	2022	The study found that a significant number of patients with malignant cancers showed evidence of schistosomiasis infection.	15
7	Sithithaworn	2023	Finds positive association between the presence of Opisthorchis viverrini, which is type of liver fluke, and the development of liver cancer	16
			Parasites That Found In Libya	
8	Gashout A	2017	Libya,where a significant proportion of patients are infected with intestinal parasites, including Giardia lamblia, Entamoeba histolytica, and Ascaris lumbricoides.	17
9	Sadaga GA	2007	High prevalence of intestinal parasites among primary schoolchildren in Derna District, Libya	18
10	Ibrahim HMS	2015	High Prevalence of Intestinal Parasitic Infections Among People in Sabha City	19
11	F. Dagdag	2023	Prevalence of Giardia Lamblia, Entamoeba Histolytica, pinworms, and Cryptosporidium Parvum Parasites among People in Al - khoms City, Libya	20
12	Bajnok J,	2019	High frequency of infection of lung cancer patients with the parasite Toxoplasma gondii	21
13	Saad	2022	large percentage of pregnant women in the city of Tobruk are suffering from Toxoplasmosis infection	22
14	Al-Farsi	2023	The study conducted found that approximately 25% of the population tested positive for at least one intestinal parasite. The most common parasites identified were Giardia and Cryptosporidium.	23
15	Hussain A,	2019	The study showed that approximately 38% of the population was infected with intestinal parasites. The most common parasites identified were Giardia lamblia	24
16	El. khnefer	2023	Exposed out the existence of Schistosoma in Darna Waterfall. he and his group found evidence of Schistosoma parasites in water	25
17	Ghenghesh KS	2016	The study identified several risk factors associated with E. histolytica and Giardia lamblia infections in the Libyan population	26
18	León-Ramos OL	2024	Schistosomiasis is the most important trematode infection globally and an important carcinogen. The squamous cell carcinoma was the most frequent. and its relationship Schistosome infection was present in more than 90% of biopsies.	27

Table 3: Association Between Parasites and Cancer Types

PARASITE	FREQUENCY	TYPE OF CANCER
Toxoplasma gondii and Trichomonas vaginalis.	41.1%	Breast
WuchereriaBancrofti And BrugiaMalayi	4.8%	Sarcoma
Schistosoma Haematobium	6.5%	Endometrial
StrongyloidesStercoralis	6.5%	Lung
Schistosoma Mansoni	7.3%	Rectum
Trichomonas Vaginalis	0.8%	Cervix
Entamoeba &Gardia Lamblia	3.2%	Colon
Leishmania& Toxoplasma	2.4%	Bone metastis
Taenia Solium (Pork Tapeworm)	4.8%	Brain tumor
Trichomonas Vaginalis	16.9%	Uterus
Echinococcus Granulosus	0.8%	Thyroid
Trichomonas Vaginalis	3.2%	Prostate
Schistosoma Haematobium	1.6%	Urinary bladder

Discussion

This study investigated the patterns of cancer prevalence at Al-Hawari Hospital, Benghazi, Libya, with a particular focus on the influence of parasitic infections. The findings reveal breast cancer as the most prevalent type (41.1%), followed by uterine cancer (16.9%), with the majority of cases reported in Benghazi. These findings align with global cancer patterns, underscoring the need for focused interventions in the region.

The analysis of age and cancer distribution showed that breast cancer incidence peaked in the 51–60 age group, followed by uterine cancer. Such trends are consistent with the established understanding that age-related hormonal changes and prolonged exposure to risk factors increase the likelihood of cancer development in women. Variability measures, such as 95% confidence intervals, confirm the reliability of these observations.

Parasitic infections were evaluated for their potential role in carcinogenesis, building on evidence that chronic parasitic infections may trigger inflammation, immune modulation, and cellular damage. Studies have demonstrated that Schistosoma infections are significantly associated with bladder cancer. For instance, Schistosoma haematobium has been linked to bladder cancer in Egypt and Nigeria (11, 13), with chronic infections leading to malignant lesions in the bladder (12). Furthermore, Schistosoma-related cancers have also been observed in Libya, where waterborne exposure contributes to disease prevalence (25). Additionally, liver cancer is significantly associated with *Opisthorchis viverrini*, a liver fluke parasite common in other regions, which induces chronic inflammation and fibrosis, ultimately leading to carcinogenesis (16). Similarly, *Trypanosoma cruzi* has been associated with increased risks of stomach and esophageal cancers (14). These findings suggest that parasitic infections play a crucial role in cancer development through mechanisms such as inflammation and immune dysregulation. The geographical variation observed in cancer prevalence across Libyan cities, with Benghazi recording the highest number of cases, underscores the importance of local healthcare accessibility and environmental factors. Urban areas may reflect more accurate reporting and improved diagnostic capacities compared to rural regions, where parasitic infections might be more widespread due to poor sanitation and limited healthcare services (15, 18). While this study provides valuable insights into

cancer patterns and their potential associations with parasitic infections, certain limitations must be addressed. First, this study was limited to data from a single hospital, potentially under-representing cancer cases in rural areas. Second, while the links between parasitic infections and cancer are supported by global research, detailed molecular studies specific to Libya are needed to confirm these associations. Future research should aim to include a broader dataset from multiple healthcare centres and incorporate parasitological investigations to explore causative links between specific parasites and cancers in Libya. Such efforts can inform public health interventions, combining cancer prevention programs with parasite control strategies to mitigate risks in vulnerable populations.

Recommendations

- ❖ Paying more attention to the medical history of oncology patients, especially previous parasitic infections.
- ❖ Organizing awareness campaigns for medical staff and society regarding the issue due to its importance
- ❖ Strengthening the public health infrastructure
- ❖ Improving access to clean spaces and good sanitation to reduce infectious parasitic infections that may be the cause of many cancers
- ❖ Integrating screening for parasitic infections with tumour prevention programs

Conclusion

The recent analysis of cancer cases from January to March 2024 has provided significant insights into the cancer landscape in various regions, highlighting breast cancer as the most diagnosed type, accounting for 41.1% of total cases. This statistic emphasises the urgent need for prioritising breast cancer awareness, screening, and intervention programs. Uterine cancer followed, representing 16.9% of cases, while other cancer types occurred at notably lower rates, indicating a crucial opportunity for targeted prevention initiatives that effectively address these prevalent forms of cancer

Regionally, Benghazi reported the highest incidence, contributing to 54.8% of the cases, underscoring the need for healthcare resources tailored to this community. Moreover, the variation in cancer types across different cities suggests that public health strategies must be customised to meet local needs. The analysis also points to a significantly higher incidence of cancer among adults aged 51–60, reinforcing the importance of early detection and proactive healthcare for older adults.

Additionally, the investigation into the links between parasitic infections and specific cancers highlights a multifactorial aspect of cancer development. These findings underscore the importance of continued research and customised public health initiatives to address the cancer burden effectively. health initiatives to mitigate the cancer burden, calling for collaborative efforts among healthcare professionals, researchers, and public health officials to improve early diagnosis and treatment outcomes and ultimately reduce cancer incidence in affected communities.

Ethical approval

The study protocol of collecting medical records for cancer patients' information from the oncology department in Al-Hawari Hospital is all authorised by the Department of Environmental Health Administration in the Public Health faculty. The study was authorised by the hospital administration and the head of the oncology department.

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Reference:

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