RESEARCH ARTICLE

Cancer Incidence Patterns in Saudi Arabia: A Descriptive Analysis of 2022–2023

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ARTICLE INFO	ABSTRACT
	Cancer represents a significant public health challenge in Saudi Arabia, with incidence patterns reflecting the complex interplay of demographic transitions, lifestyle changes, and healthcare system developments. Comprehensive population-level analyses are essential for informing healthcare policy, resource allocation, and the development of targeted prevention and control strategies. Objective: To characterize cancer incidence patterns in Saudi Arabia for 2023 and compare with 2022 data to identify emerging trends, sex-specific patterns, age distributions, and changes in the relative frequency of major cancer types among the Saudi population. Methods: A retrospective analysis of Saudi Cancer Registry data for 25,864 cases diagnosed in 2023 was conducted. Age-standardized incidence rates (ASR) were calculated per 100,000 population using the Segi world standard population. Year-over-year percentage changes were computed to compare 2023 findings with 2022 data. Descriptive statistics characterized cancer distribution by site, sex, and age group. Results: Among Saudi nationals, females accounted for 58.2% of cases (n = 11,927) with an ASR of 172.0 per 100,000, compared to 135.1 for males. The five leading cancers were breast (20.3%), colorectal (13.1%), thyroid (9.2%), non-Hodgkin lymphoma (4.7%), and leukemia (4.2%). Breast cancer demonstrated a significant 24.7% increase from 2022 (3,334 to 4,159 cases including males). Thyroid cancer cases increased by 12.8%, while non-Hodgkin lymphoma cases decreased by 12.8%. Childhood cancers (n=777) represented 3.8% of all Saudi cases, with leukemia (25.5%) and brain/central nervous system (CNS) tumors (19.0%) as the leading diagnoses. The median age at diagnosis varied by cancer type, ranging from 37 years for female leukemia to 69 years for males' prostate cancer. Conclusion: The findings reveal distinct sex-specific cancer patterns with a notable increase in breast cancer incidence and divergent trends in male versus female age-standardized rates. These data provide critical evidence for developing targeted screening programs, informing cancer control strategies, and guiding healthcare resource allocation.

INTRODUCTION

Cancer is a major global public health challenge and remains one of the leading causes of morbidity and mortality worldwide. Recent GLOBOCAN 2022 estimates report nearly 20 million new cancer cases and 9.7 million deaths annually, underscoring the scale of the problem and the need for robust surveillance and prevention strategies (Bray et al., 2024). Global cancer patterns continue to shift due to aging populations, urbanization, and evolving risk factors, particularly in low- and middle-income countries where limited resources contribute to delays in diagnosis and treatment (Soerjomataram and Bray, 2021).

Similar transitions are evident in the Middle East, including Saudi Arabia, where rapid population growth and lifestyle changes have increased the burden of non-communicable diseases such as cancer (Alkhudair et al., 2021). Cancer is now the fifth leading cause of mortality in the Kingdom, with projections indicating continued growth in incidence (Organisation for Economic Co-operation and Development [OECD], 2024).

Epidemiological studies from Saudi Arabia highlight distinct cancer patterns compared to Western populations, including differences in site distribution, age at diagnosis, and sex-specific trends (Bazarbashi et al., 2017; Alsanea et al., 2015). A systematic review further documents significant regional variation across the country's 13 administrative regions, with notable geographic heterogeneity in site-specific incidence rates (Alsuhaymi et al., 2024).

The Saudi Cancer Registry (SCR), established in 1992 as a population-based cancer surveillance system, provides essential data for tracking these trends and informing cancer control policies (Aseafan et al., 2022). The registry follows international standards for cancer registration, including case definition, classification, and data quality assurance procedures, with mandatory reporting from all healthcare facilities across the Kingdom.

The present study addresses this research gap by providing a detailed comparative analysis of cancer incidence patterns in Saudi Arabia for the year 2023, with year-over-year comparison to 2022 data. The Saudi Cancer Registry, the national population-based system, provides essential data for tracking these trends and informing cancer control policies. Building on these efforts, the present study offers a comparative analysis of cancer incidence in Saudi Arabia for 2023 relative to 2022. It examines overall case burdens, sex-specific patterns, major cancer sites, childhood cancers, and age distributions. The study aims to support national cancer control planning by identifying emerging trends, guiding resource allocation, and highlighting priority areas for research and intervention.

MATERIALS AND METHODS

Study Design and Data Source

This retrospective analysis utilized population-based cancer registry data from the Saudi Health Council for calendar years 2022 and 2023, accessed via the Saudi Data and Artificial Intelligence Authority (SDAIA) National Open Data Platform. The dataset included all newly diagnosed cancer cases reported to the Saudi Cancer Registry, which employs standardized case reporting procedures and captures data from healthcare facilities across all 13 administrative regions of the Kingdom (Saudi Health Council, 2024; Saudi Health Council, 2025).

All incident cancer cases meeting registry inclusion criteria during 2022–2023 were extracted and analyzed. The total sample for 2023 consisted of 25,864 incident cancer cases, of which 20,496 (79.2%) occurred among Saudi nationals and 5,368 (20.8%) among non-Saudi residents. A total of 300 cases were excluded from analysis, comprising 68 cases of unknown nationality and 232 cases that could not be converted to ICD-10 codes.

Variables and Measures

Cancer site was classified according to the International Classification of Diseases for Oncology, Third Edition, (1st Rev.) (ICD-O-3) (WHO, 2013), with subsequent aggregation into major site categories for analysis. The primary outcome variables included the number of incident cases, percentage distribution by cancer site, age-standardized incidence rates (ASR), and median age at diagnosis.

Age-standardized incidence rates were calculated using the direct method, with the Segi World Standard Population serving as the reference population. ASR was expressed per 100,000 person-years and calculated separately for males and females among Saudi nationals. Sex-specific analyses examined the distribution of cancer types among males and females separately. Childhood cancer analysis included all cases diagnosed among individuals aged 14 years or younger.

Statistical Analysis

Descriptive statistics were employed to characterize the cancer burden. Frequencies and percentages were calculated for categorical variables including cancer site, sex, and nationality. Median age at diagnosis was computed with corresponding age ranges for each cancer site and sex group. Age-standardized incidence rates were calculated using the direct standardization method with the Segi World Standard Population as the reference. Year-over-year percentage changes were calculated as (2023 value – 2022 value) / 2022 value × 100. All analyses were conducted using Stata version 16.1 (StataCorp LLC, College Station, TX, USA).

Ethical Considerations

The study used publicly available, de-identified, and aggregated data from SDAIA's National Open Data Platform, which obtains cancer data from the Saudi Cancer Registry under the Saudi Health Council (Saudi Health Council, 2024; Saudi Health Council, 2025). All data accessed through the National Open Data Platform are fully anonymized and classified as public under Saudi data governance regulations, including the Personal Data Protection Law (PDPL) and National Data Management Office (NDMO) guidelines. Because the dataset contains no identifiable information and poses minimal risk, neither individual consent nor Institutional Review Board (IRB) approval is required, consistent with National Committee of Bioethics (NCBE) standards. All analyses complied with the Saudi Open Data License, which permits reuse for research purposes (Digital Government Authority, 2025).

RESULTS

Overall Cancer Burden

The Saudi Cancer Registry recorded 25,864 incident cancer cases in 2023, compared with 24,470 cases in 2022, representing a 5.7% increase. Among Saudi nationals, cases increased by 6.6% (from 19,233 in 2022 to 20,496 in 2023). In 2023, Saudi nationals accounted for 20,496 cases (79.2%), while non-Saudi residents contributed 5,368 cases (20.8%). Among Saudi nationals, females represented 58.2% of cases (n = 11,927) and males 41.8% (n = 8,569), yielding a female-to-male case ratio of 1.39:1 and reflecting the marked female predominance in this population. The age-standardized incidence rate among Saudi females (172.0 per 100,000) exceeded that of Saudi males (135.1 per 100,000), corresponding to a female-to-male ASR ratio of 1.27:1 and a divergence from 2022, when female and male ASRs were 159.1 and 144.9 per 100,000, respectively.

Most Common Cancers: 2022 and 2023 Comparison

Table 1 presents the overall cancer burden by nationality and sex for both 2022 and 2023, highlighting the year-over-year changes. The total number of cancer cases in Saudi Arabia increased from 24,470 in 2022 to 25,864 in 2023, representing a 5.7% increase. Among Saudi nationals, the increase was 6.6%, with female cases rising by 9.1% and male cases by 3.3%. The age-standardized incidence rate (ASR) for Saudi females increased from 159.1 to 172.0 per 100,000, while the ASR for Saudi males decreased from 144.9 to 135.1 per 100,000.

Table 1. Overall cancer burden by nationality and sex, Saudi Arabia (2022 vs. 2023)

Category	2022 Male	2022 Female	2022 Total	2023 Male	2023 Female	2023 Total	Change (%)
Saudi Nationals	8,748	10,485	19,233	8,569	11,927	20,496	+6.6%
Non-Saudi	2,593	2,644	5,237	2,584	2,784	5,368	+2.5%
Grand Total	10,889	13,581	24,470	11,153	14,711	25,864	+5.7%

Note. ASR = age-standardized incidence rate per 100,000 populations (Segi World Standard). Saudi national ASR for 2022: males = 144.9; females = 159.1 per 100,000. Saudi national ASR for 2023: males = 135.1; females = 172.0 per 100,000.

Figure 1 presents the ten most frequently diagnosed cancers among Saudi nationals in 2023 compared to 2022. Breast cancer ranked first, accounting for 4,159 cases (20.3% of all Saudi national cases) with an ASR of 58.1 per 100,000 among females. This represents a substantial 24.7% increase from 2022 (3,334 cases), the most significant year-over-year change observed in the analysis. Colorectal cancer ranked second, with 2,680 cases (13.1% of total), with sex-specific ASRs of 24.1 per 100,000 for males and 19.9 per 100,000 for females, representing a 5.7% increase from 2022. Thyroid cancer ranked third, comprising 1,891 cases (9.2%) with an ASR of 17.5 per 100,000 among females and 6.0 per 100,000 among males, representing a 12.8% increase from 2022.

Non-Hodgkin Lymphoma (NHL) ranked fourth with 957 cases (4.7%), but notably showed a 12.8% decrease from 2022. Leukemia ranked fifth with 867 cases (4.2%), showing a modest 2.8% decrease. Corpus uteri cancer ranked sixth with 695 cases (3.4%) and a 7.4% increase. Lung cancer and

bladder cancer entered the top 10 for 2023, replacing liver and kidney cancers from the 2022 rankings. Prostate cancer ranked eighth with 650 cases and an ASR of 12.6 per 100,000 among males (Saudi Health Council, 2024; Saudi Health Council, 2025).

Sex-Specific Cancer Patterns

Table 2 displays the five most common cancers by sex, revealing marked differences in cancer profiles between males and females. Among males, colorectal cancer was the leading site (n = 1,430, 16.7% of male cases), followed by prostate cancer (n = 650, 7.6%), NHL (n = 553, 6.5%), bladder cancer (n = 552, 6.4%), and leukemia (n = 503, 5.9%). The predominance of colorectal cancer among males highlights the importance of colorectal cancer screening programs targeting the male population.

Among females, breast cancer dominated the cancer profile (n = 4,079, 34.2% of female cases; excluding male cases n = 80), followed by thyroid cancer (n = 1,442, 12.1%), colorectal cancer (n = 1,250, 10.5%), corpus uteri cancer (n = 695, 5.8%), and NHL (n = 404, 3.4%). The breast cancer burden among females is particularly striking, accounting for more than one-third of all female cancers and highlighting the critical importance of breast cancer prevention, early detection, and treatment services.

Table 2. Top five cancer sites by sex, Saudi nationals, Saudi Arabia, 2023

Rank	Male Cancer Site	Rank	Female Cancer Site
1	Colorectal — 1,430 (16.7%*)	1	Breast — 4,079 (34.2%*)
2	Prostate — 650 (7.6%)	2	Thyroid — 1,442 (12.1%)
3	NHL — 553 (6.5%)	3	Colorectal — 1,250 (10.5%)
4	Bladder — 552 (6.4%)	4	Corpus Uteri — 695 (5.8%)
5	Leukemia — 503 (5.9%)	5	NHL — 404 (3.4%)

*Percentage is age specific

Year-over-Year Comparative Analysis

The comparison between 2022 and 2023 data reveals several significant shifts in cancer incidence patterns (Figure 1). Total cancer cases increased from 24,470 in 2022 to 25,864 in 2023, representing a 5.7% increase. Among Saudi nationals specifically, cases increased by 6.6% (from 19,233 to 20,496). This parallel increase suggests that the overall growth in cancer burden is not primarily driven by changes in the non-Saudi population, but reflects genuine increases in cancer incidence among Saudi nationals.

The most dramatic change was observed in breast cancer, with a 24.7% increase in cases (3,334 to 4,159). This increase far exceeds population growth rates and suggests a combination of factors including improved screening participation, enhanced awareness, and potentially true increases in incidence related to changing reproductive patterns, obesity rates, and other risk factors. The breast cancer ASR increase of 16.9% (from 49.7 to 58.1 per 100,000 among females) confirms that the rise is not merely due to population growth.

Thyroid cancer also showed a substantial increase of 12.8% in cases, with the female ASR rising from 16.5 to 17.5 per 100,000 between 2022 and 2023. Conversely, non-Hodgkin lymphoma showed the largest decrease at 12.8%, with cases declining from 1,098 to 957. Male ASR decreased by 6.8% (from 144.9 to 135.1 per 100,000), while female ASR increased by 8.1% (from 159.1 to 172.0 per 100,000).
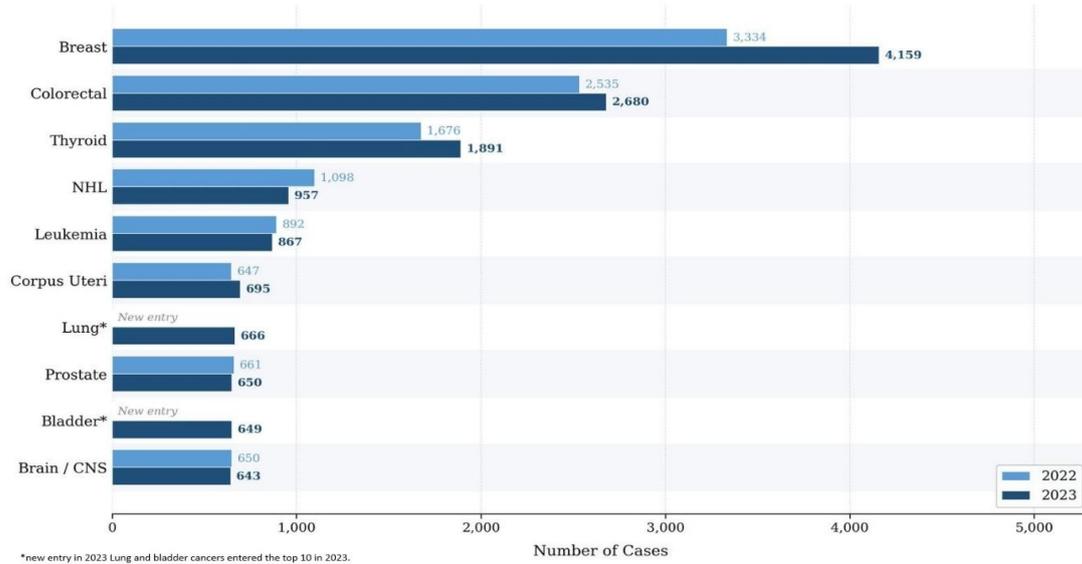
*new in 2023 Lung and bladder cancers entered the top 10 in 2023.

Figure 1. Year-over-Year Comparison of Top Cancer Sites, 2022 vs. 2023 (Saudi Nationals)

Childhood Cancers

Among Saudi children aged 14 years or younger, 777 cancer cases were diagnosed in 2023, representing 3.8% of all Saudi cancer cases (down from 4.4% in 2022). This represents a 9.1% decrease in childhood cancer cases from 2022 (n = 855). The childhood cancer burden included 439 cases among males (56.5%) and 338 cases among females (43.5%) (Figure 2).
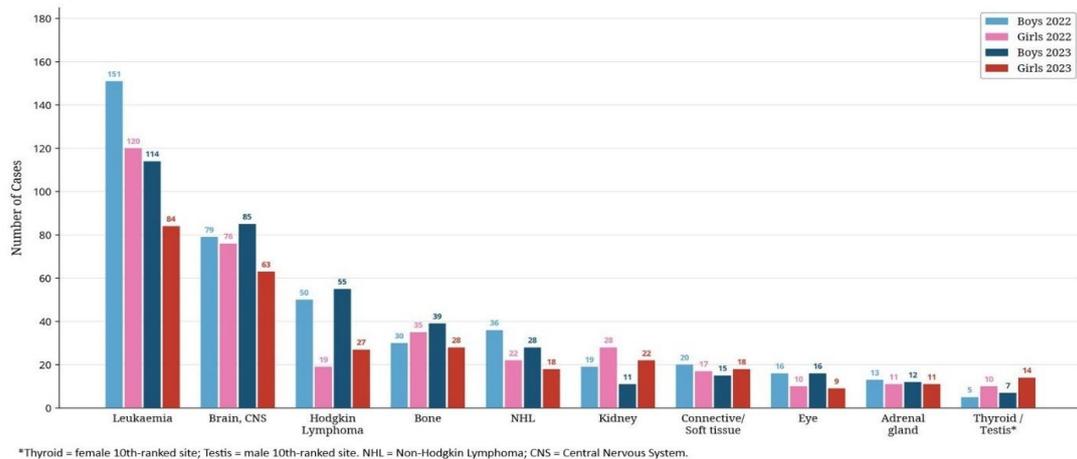

*Thyroid = female 10th-ranked site; Testis = male 10th-ranked site. NHL = Non-Hodgkin Lymphoma; CNS = Central Nervous System.

Figure 2. Top 10 Childhood Cancers (Age 0–14 years) Among Saudi Nationals by Sex and Year, 2022 vs. 2023

As presented in Table 3, leukemia was the most common childhood malignancy (n = 198, 25.5% of childhood cases), followed by brain and central nervous system tumors (n = 148, 19.0%), Hodgkin lymphoma (n = 82, 10.6%), bone tumors (n = 67, 8.6%), and NHL (n = 46, 5.9%). The distribution of childhood cancers in Saudi Arabia is broadly consistent with global patterns, where leukemia and brain tumors represent the leading diagnostic categories in pediatric oncology (Arnold et al., 2020).

Table 3. Top five childhood cancers (age ≤ 14 years), Saudi nationals, Saudi Arabia, 2023

Rank	Cancer Site	Total Cases (%)	Change from 2022
1	Leukemia	198 (25.5%)	−26.9%
2	Brain, CNS	148 (19.0%)	−4.5%
3	Hodgkin Lymphoma	82 (10.6%)	+18.8%
4	Bone	67 (8.6%)	+3.1%
5	NHL	46 (5.9%)	−20.7%

Note. CNS = central nervous system; NHL = non-Hodgkin lymphoma. Percentage changes calculated relative to 2022 Saudi national childhood cancer case counts

Age Distribution at Diagnosis

The median ages at diagnosis by cancer site and sex were found to vary substantially across malignancy types. Prostate cancer demonstrated the highest median age at diagnosis (69 years, range 26–96), followed by lung cancer among males (65 years, range 4–96) and corpus uteri cancer among females (62 years, range 9–91). Colorectal cancer had median ages of 60 years for males (range 10–93) and 59.5 years for females (range 10–106), consistent with patterns observed in other populations.

Breast cancer had a median age of 52 years (range 15–105), while thyroid cancer showed the youngest median age among major adult cancers (43 years for females, 46 years for males). Leukemia demonstrated the youngest median ages overall (40 years for males, 37 years for females), reflecting the bimodal age distribution characteristic of this malignancy with peaks in childhood and older adulthood.

DISCUSSION

The findings of this study provide an updated comparative overview of cancer incidence in Saudi Arabia for 2023, highlighting key shifts from 2022 and their implications for cancer control policy and practice. The analysis of 25,864 cancer cases, the most recent population-level data from the Saudi Cancer Registry, underscores a growing burden of malignant neoplasms in the Kingdom.

The most notable finding is the 24.7% increase in breast cancer cases between 2022 and 2023 (3,334 to 4,159 cases). This rise exceeds what would be expected from population growth alone and likely reflects a combination of expanded screening, improved diagnostic practices, and possible true increases in incidence related to changing risk factor profiles (Ibrahim et al., 2008). The breast cancer ASR of 58.1 per 100,000 among Saudi females, although lower than that in many Western countries, represents a major public health priority because breast cancer now accounts for more than one-third of all female cancers (Alghamdi et al., 2013; Alshamsan et al., 2025; Batran and El Saghir, 2025). The rapid increase in breast cancer incidence, with an estimated average annual percentage change of 5.6%, is among the highest reported globally (Alshamsan et al., 2025).

Sex-specific trends in age-standardized rates further emphasize these shifts. Male ASR declined by 6.8% (144.9 to 135.1 per 100,000), whereas female ASR increased by 8.1% (159.1 to 172.0 per 100,000), widening the female–male gap. This divergence, largely driven by rising breast and thyroid cancer incidence—both predominantly affecting women—contrasts with many global settings where male cancer rates typically exceed female rates, often due to higher tobacco use and occupational exposures among men (Bray et al., 2024).

Thyroid cancer increased by 12.8%, remaining the third most common cancer overall and the second among females. The female ASR rose from 16.5 to 17.5 per 100,000, with a female-to-male ratio of 3.2:1, consistent with international patterns (GBD 2019 Diseases and Injuries Collaborators, 2020). This female predominance likely reflects both biological factors, including hormonal influences, and increased detection through imaging and clinical screening (Lim et al., 2017). The relatively young median age at diagnosis among females (43 years) underscores the need for heightened clinical vigilance for thyroid abnormalities in younger women (Rahbari et al., 2010).

In contrast, non-Hodgkin lymphoma showed a 12.8% decrease in cases, which may reflect changes in diagnostic classification, reporting practices, or true epidemiological shifts. The 9.1% decline in childhood cancers similarly warrants cautious interpretation and continued surveillance to distinguish genuine trends from artefacts of case ascertainment. The persistent predominance of leukemia and brain tumors among childhood malignancies aligns with global experience and reinforces the need for specialized pediatric oncology services (Arnold et al., 2020).

The emergence of lung and bladder cancers among the top 10 cancers, displacing liver and kidney cancers from the 2022 rankings, suggests evolving risk factor profiles, including tobacco use and environmental or occupational exposures. These changes have direct implications for prevention, particularly strengthening tobacco control and occupational health measures. Although colorectal cancer remains a major contributor to the cancer burden—especially among males, where it is the leading site—its incidence is still lower than that reported in Western Europe and North America,

possibly reflecting differences in diet, lifestyle, and screening uptake (Alsanea et al., 2015; Mosli and Al-Ahwal, 2012).

When contextualized globally, the Saudi cancer profile shows both convergence and divergence with regional and international patterns. The predominance of breast cancer in women mirrors trends across the Middle East and North Africa (Batran and El Saghir, 2025), whereas the comparatively high ranking of thyroid cancer exceeds that observed in many Western countries. Overall ASRs in Saudi Arabia remain below those of most high-income Western nations, consistent with the epidemiological transition model in which cancer burden rises with economic development and lifestyle change (Soerjomataram and Bray, 2021).

Several limitations should be considered. The cross-sectional design describes incidence at specific time points but cannot evaluate long-term trends or causal relationships. Reliance on registry data may introduce underreporting or incomplete case capture, although the Saudi Cancer Registry applies standardized procedures to enhance data quality. The absence of mortality, survival, and stage-at-diagnosis data restricts assessment of overall cancer outcomes and healthcare system performance, and the lack of treatment information precludes evaluation of care quality.

Despite these limitations, the findings carry important policy implications. The marked rise in breast cancer incidence supports continued expansion of breast cancer control efforts, including accessible mammography services, training of healthcare providers in clinical breast examination, and public awareness campaigns promoting early presentation and screening (World Health Organization, 2020). The relatively young median age at diagnosis (52 years) suggests that organized screening should prioritize women in their 40s and 50s.

The substantial colorectal cancer burden—particularly among men—supports implementation or strengthening of organized colorectal screening programs using fecal occult blood or immunochemical tests and colonoscopy. Given a median diagnosis age around 60 years, screening should begin at about 50 years, with earlier initiation for individuals with a family history or other high-risk features (Alsanea et al., 2015). Addressing known barriers in Saudi Arabia, such as limited physician recommendation and the absence of a comprehensive national program, will be critical (Al-Hajeili et al., 2019).

The inclusion of lung cancer among the top 10 cancers further underscores the need for robust tobacco control as a cornerstone of cancer prevention. Saudi Arabia has already implemented smoke-free policies, taxation, and health promotion campaigns; sustaining and intensifying these measures, alongside accessible smoking cessation services, is essential. Given the substantial economic and health impact of a rising cancer burden noted in international analyses (OECD, 2024), these efforts should be aligned with broader national health objectives under Saudi Vision 2030.

Finally, although childhood cancers represent a smaller share of total cases, they demand dedicated resources, including well-equipped pediatric oncology units, age-appropriate chemotherapy and radiotherapy, and comprehensive supportive care. The predominance of leukemia and brain tumors in this group supports ongoing investment in specialized pediatric oncology capacity and survivorship services.

CONCLUSION

This comparative analysis of 25,864 cancer cases diagnosed in Saudi Arabia in 2023, with explicit comparison to 2022, demonstrates a dynamic and evolving national cancer landscape. The most prominent finding is the nearly 25% rise in breast cancer cases, accompanied by an 8.1% increase in female ASR and a 6.8% decline in male ASR, underscoring the need for sex-specific prevention and control strategies tailored to the differing cancer profiles of men and women. Additional shifts— including a 12.8% increase in thyroid cancer, a 12.8% decrease in non-Hodgkin lymphoma, and the emergence of lung and bladder cancers among the ten most common sites—suggest changing risk factor patterns and emphasize the importance of robust surveillance to monitor emerging trends. Policy priorities arising from these results include expansion of breast cancer screening for women aged 45–60 years, prioritization of colorectal cancer screening particularly among men, strengthening of tobacco control and environmental health initiatives, and continued development of specialized pediatric oncology services. Collectively, these findings support sustained investment

in comprehensive cancer surveillance, prevention, early detection, treatment, palliative care, and survivorship programs as core components of the national cancer strategy under Saudi Vision 2030.

Authors' Contribution

MA (Mohammed Alsuliman) and MAK (Mohammed Alkharaiji) conceived the study idea, designed the research methodology, and drafted the initial manuscript. MA conducted the data analysis and interpretation. MAK provided critical revisions and supervised the project. Both authors read and approved the final manuscript.

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Running Title: Cancer incidence patterns in Saudi Arabia

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