Original Article

Trends in Site-Specific Cancers and Demographic Patterns: A Retrospective Study of 1,300 Malignancy Cases Over Five Years

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Abstract

Background: Cancer remains a major public health concern, with its distribution influenced by demographic, geographic, and lifestyle determinants. Institutional cancer registries provide valuable insights into evolving patterns of malignancy. The present study analyzed site-specific cancer trends, histopathological profiles, and demographic characteristics in a tertiary care teaching hospital over five years. **Material and Methods:** This retrospective study included all histopathologically confirmed malignancies diagnosed between January 2020 and December 2024. Data regarding age, sex, anatomical site, and histological subtype were retrieved from departmental archives. Frequencies, proportions, and year-wise trends were calculated and summarized in structured tables for analysis. **Results:** 1,373 malignancy cases were recorded over the five years, with the annual case load rising from 102 in 2020 to a peak of 481 in 2023. Females (52.6%) slightly outnumbered males (47.4%). Oral cavity cancers (27.5%) and breast cancers (21.5%) together accounted for nearly half of the total burden. Cervical (8.0%), colorectal (6.3%), laryngeal (6.0%), skin (5.9%), and thyroid (3.5%) cancers also contributed significantly. Genitourinary, gynecological, lymphoid, soft tissue, and other less common sites formed the remainder of the spectrum. Histopathological evaluation confirmed site-specific patterns: squamous cell carcinoma dominated the oral cavity, cervix, larynx, skin, and penile tumors; invasive ductal carcinoma was the predominant breast malignancy; papillary carcinoma led thyroid cancers; and adenocarcinoma characterized colorectal, gastric, prostatic, and endometrial tumors. Ovarian cancers were chiefly serous, while renal cancers were predominantly clear cell type, and bladder cancers were mostly transitional cell carcinoma. Lymph node biopsies frequently revealed metastatic deposits, with lymphomas representing both Hodgkin and non-Hodgkin subtypes. The majority of cases occurred in the 41–70 year age group, whereas lymphomas and testicular tumors were more common in younger individuals. **Conclusion:** Oral cavity and breast cancers remain the leading malignancies in this region. The rising trend of gastrointestinal and thyroid cancers highlights the need for regionally tailored strategies, focusing on tobacco cessation, targeted screening, and early detection to reduce overall cancer burden.

Keywords: Cancer registry, histopathology, site-specific malignancies, oral cavity carcinoma, breast carcinoma.

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Introduction

Cancer is a major global health challenge, accounting for significant morbidity and mortality worldwide. According to the GLOBOCAN 2020 report, an estimated 19.3 million new cancer cases and 10 million cancer-related deaths occurred globally, with a steady rise projected over the coming decades. In India, the cancer burden is substantial, with over 1.3 million new cases annually, reflecting regional variations in risk factors, screening practices, and healthcare accessibility.[1,2]

The epidemiological profile of cancers demonstrates considerable heterogeneity, with oral cavity, breast, cervix, lung, and gastrointestinal cancers representing the leading sites in the Indian population.[3] Oral cavity cancers are strongly associated with tobacco chewing, smoking, and alcohol consumption, while cervical carcinoma remains a major concern in women due to inadequate screening and vaccination coverage. Breast cancer has surpassed cervical cancer as the most common malignancy among Indian women, particularly in urban populations.[4] In contrast, thyroid and colorectal cancers have shown a rising trend in recent years, reflecting lifestyle transitions and improved diagnostic facilities.[5]

Histopathological examination remains the cornerstone of cancer diagnosis, offering critical insights into tumor type, grade, and biological behavior. Periodic assessment of institutional data provides useful information about site distribution and histological patterns and helps identify emerging trends and regional differences, which can inform prevention and control strategies.[6]

The present study analyzed the trends in site-specific cancers, histopathological subtypes, and demographic distribution over a five-year period at a tertiary care teaching hospital. Such data are crucial for developing region-specific cancer control measures

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and enhancing awareness programs.

Materials and Methods

Study Design and Setting: A retrospective, observational study was conducted in the Department of Pathology, Mahatma Gandhi Memorial (MGM) Hospital, Kakatiya Medical College, Warangal, Telangana, India, a tertiary care teaching hospital. The study covered five years from January 2020 to December 2024.

Study Population: All histopathologically confirmed malignant cases reported in the Department of Pathology during the study period were included. Patients of all ages and both sexes were eligible. Cases with inadequate biopsy material, inconclusive diagnosis, or incomplete demographic details were excluded.

Data Collection: Archival records, including histopathology requisition forms, case files, and pathology department registers, were reviewed. Demographic variables (age, sex), anatomical site of the tumor, and histopathological subtype were extracted and documented. Each case was cross-verified with the departmental records to avoid duplication.

Histopathological Examination: Tissue specimens were routinely fixed in 10% buffered formalin, processed, and embedded in paraffin blocks. Sections of 4–5 µm thickness were stained with hematoxylin and eosin (H&E) and examined by pathologists. Special stains and immunohistochemistry (IHC) were performed wherever necessary to confirm diagnosis or subtype categorization.

Data Analysis: The data were compiled and analyzed using Microsoft Excel and SPSS version 26. Descriptive statistics were applied to calculate frequencies and percentages. Year-wise distribution, site-specific trends, age and gender patterns, and histological subtypes were summarized in tables.

Ethical Considerations: The Institutional Ethics Committee, Kakatiya Medical College, Warangal, approved the study protocol. Patient confidentiality was maintained by anonymizing all identifying information. As this was a retrospective study on departmental records, the requirement for individual informed consent was waived.

Results

Over the five-year study period (2020–2024), 1,373 malignant cases were diagnosed. The annual case burden showed an increasing trend after 2021, with a peak in 2023 (481 cases) followed by a comparable load in 2024 (478 cases). The overall male-to-female ratio was approximately 0.9:1, with females contributing slightly more cases across the years [Table 1].

Table 1: Year-wise Distribution of Cancer Cases (2020–2024)

Year	Total Cases	Male (n)	Female (n)
2020	102	46	56
2021	143	71	72
2022	169	83	86
2023	481	231	250
2024	478	220	258
Total	1373	651	722

Analysis of site-specific distribution revealed that oral cavity cancers (27.5%) and breast cancers (21.5%) were the most frequent malignancies, together comprising nearly half of the total cases. Cervical cancer accounted for 8.0%, followed by colon (6.3%), laryngeal (6.0%), skin (5.9%), and thyroid cancers (3.5%). Gastrointestinal malignancies as a group—including stomach, esophagus, liver, gall bladder, pancreas, small intestine, appendix, and rectum constituted 3.8% of cases. Genitourinary cancers (prostate, bladder, kidney, testis, and penis) contributed 6.2%, while gynecological tumors of the ovary and uterus/endometrium formed 4.4%. Soft tissue sarcomas and melanomas represented 2.3%, and lymphoid malignancies, including lymphomas and metastatic nodes, accounted for 1.8%. Endocrine tumors other than thyroid were rare (0.2%), and miscellaneous or uncommon sites such as ocular, bone, and pediatric tumors comprised about 1.1% of the total burden [Table 2].

Table 2: Organ System-Wise Distribution of Malignancies (2020–2024, n = 1373)

Organ System / Site	Cases (n)
Oral cavity	378
Breast	295
Cervix	110
Colon	86
Skin	81
Thyroid	48
Larynx	83
Gastrointestinal (stomach, esophagus, liver, gall bladder, pancreas, small intestine, appendix, rectum)	52
Genitourinary (prostate, bladder, kidney, testis, penis)	85
Gynecological (ovary, uterus/endometrium)	60
Soft tissue & Melanoma	32
Lymphoid (lymphoma, metastatic nodes)	25
Endocrine (adrenal, others)	3
Miscellaneous / Rare (ocular, bone, pediatric, etc.)	15
Total	1373

Histopathological subtype analysis demonstrated a clear site-specific predominance. In breast cancers, invasive ductal carcinoma was the most frequent subtype, whereas lobular, mucinous, papillary, phyllodes, and other uncommon variants were less often encountered. Malignancies of the oral cavity were uniformly squamous cell carcinoma. Thyroid neoplasms were predominantly papillary carcinoma, with occasional follicular, medullary, and poorly differentiated variants. Cervical cancers were almost exclusively squamous cell carcinoma, with a minority of adenocarcinomas. Uterine malignancies were largely endometrioid adenocarcinomas, with less frequent squamous cell carcinoma, carcinosarcoma, and leiomyosarcoma.

Gastrointestinal cancers, including those of the colon and stomach, were primarily adenocarcinomas; poorly cohesive and signet-ring subtypes were noted in the stomach. Lung tumors showed a predominance of adenocarcinoma, followed by squamous cell carcinoma and small cell carcinoma, with large cell, carcinoid, and metastatic deposits documented less frequently. Skin tumors were dominated by squamous cell carcinoma, though basal cell carcinoma, melanoma, adenocarcinoma, porocarcinoma, and metastatic lesions were also reported.

Among gynecological malignancies, ovarian tumors were led by serous carcinoma, with mucinous, endometrioid, clear cell, granulosa cell tumor, teratoma, and microcystic stromal tumor also identified. Prostate cancers were largely adenocarcinomas. Bladder cancers were chiefly transitional cell carcinomas, with squamous and glandular variants observed occasionally. Renal tumors were most often clear cell renal cell carcinoma, with papillary and chromophobe types, along with Wilms tumor, comprising the remainder.

Soft tissue malignancies displayed wide heterogeneity, including liposarcoma, leiomyosarcoma, rhabdomyosarcoma, pleomorphic sarcoma, neurofibrosarcoma, desmoid tumor, dermatofibrosarcoma protuberans, and malignant peripheral nerve sheath tumors.

Metastatic carcinoma deposits dominated lymph node biopsies, but Hodgkin and non-Hodgkin lymphomas were also reported, with subtypes such as diffuse large B-cell, follicular, and Burkitt lymphoma.

Head and neck subsites showed predictable patterns: laryngeal cancers were overwhelmingly squamous cell carcinoma, with rare adenocarcinoma and sarcomatoid carcinoma; testicular malignancies were mainly seminomas, accompanied by yolk sac tumors, lymphomas, and metastatic deposits; penile tumors were consistently squamous cell carcinoma; salivary gland malignancies included mucoepidermoid carcinoma as the predominant type, followed by adenoid cystic, salivary duct, epithelial–myoepithelial carcinoma, and carcinoma ex pleomorphic adenoma.

Ocular and periocular tumors included squamous cell carcinoma, basal cell carcinoma, and sebaceous carcinoma. Nasal and paranasal tumors were represented by papillary adenocarcinoma, olfactory neuroblastoma, undifferentiated carcinoma, and mucoepidermoid carcinoma. Hepatic cancers were led by hepatocellular carcinoma, with cholangiocarcinoma and metastatic lesions also identified. Gall bladder tumors were consistently adenocarcinomas.

Less common sites showed distinct patterns: small intestine and ileal tumors comprised adenocarcinoma, neuroendocrine tumors, and gastrointestinal stromal tumors; appendiceal malignancies included neuroendocrine tumors and low-grade mucinous neoplasms; adrenal cancers were adrenocortical carcinomas; bone tumors included giant cell tumor and chondrosarcoma; ampullary and esophageal malignancies were uniformly adenocarcinomas.

These findings emphasize the organ-specific distribution of histological subtypes across malignancies, with adenocarcinoma, squamous cell carcinoma, and sarcomas emerging as the dominant categories depending on anatomical site [Table 3].

Table 3: Major Histological Subtypes of Common Malignancies in our study

Cancer Site	Dominant Subtype	Other Subtypes (brief)
Breast	Invasive ductal carcinoma- 272	Lobular-3, mucinous-9, papillary-4, cribriform-2, phyllodes-2, intraductal-1, inflammatory – 2 , squamous cell carcinoma-1, (24)
Oral cavity	Squamous cell carcinoma- 318	–
Thyroid	Papillary carcinoma - 46	Follicular-2, medullary-2, poorly differentiated carcinoma-1 (5)
Cervix	Squamous cell carcinoma - 106	Adenocarcinoma - 4
Uterus	Endometrioid adenocarcinoma - 23	Squamous cell carcinoma-1, carcinosarcoma-1, low grade sarcoma- 1 (3)
Colon	Adenocarcinoma - 86	-
Stomach	Adenocarcinoma - 19	Poorly cohesive carcinoma-1
Lung	Adenocarcinoma- 4	Squamous cell carcinoma-6, metastatic deposits-1, pleural fluid for malignant cells-8, lymphoma-1 (16)
Skin	Squamous cell carcinoma - 51	Basal cell carcinoma-16, melanoma-7, adenocarcinoma-2, porocarcinoma-2, metastatic deposits-1 (28)
Ovary	Serous carcinoma- 16	Mucinous-7, granulosa cell tumor-2,teratoma-1, microcystic stromal tumor- 1 (11)
Prostate	Adenocarcinoma- 13	–
Urinary bladder	Transitional cell carcinoma -25	Squamous cell carcinoma-3
Kidney	Renal cell carcinoma (clear cell)- 2	Wilms tumor- 1
Soft tissue	Sarcomas (heterogeneous)- 18	Liposarcoma-4, rhabdomyosarcoma-1, pleomorphic sarcoma-3, neurofibrosarcoma-1,malignant fibrous histiocytoma -2,desmoid tumor-1, dermatofibrosarcoma protuberans-4, malignant peripheral nerve sheath tumor – 2 (18)
Lymph node	Metastatic carcinoma deposits - 18	Non-Hodgkin lymphoma (DLBCL, follicular, Burkitt)-6, Hodgkin lymphoma- 3 (9)
Larynx	Squamous cell carcinoma - 82	Adenocarcinoma-1

Testis	Seminoma - 11	Yolk sac tumor-3, Non-Hodgkin lymphoma-5, metastatic deposits- 1 (9)
Penis	Squamous cell carcinoma- 22	–
Salivary gland	Mucoepidermoid carcinoma- 4	Adenoid cystic carcinoma-1, salivary duct carcinoma-3, epithelial-myoepithelial-carcinoma-1, carcinoma ex pleomorphic adenoma – 1 (6)
Eye/Periocular	Squamous cell carcinoma -3	Basal cell carcinoma-1, sebaceous carcinoma- 1 (2)
Nasal/Paranasal	Papillary adenocarcinoma- 1	Olfactory neuroblastoma-1,undifferentiated carcinoma-1, mucoepidermoid carcinoma- 1 (3)
Liver	Hepatocellular carcinoma - 6	Cholangiocarcinoma-2, metastatic deposits-8 (10)
Gall bladder	Adenocarcinoma - 4	–
Small intestine/Ileum	Adenocarcinoma - 3	Neuroendocrine tumor-3, gastrointestinal stromal tumor (GIST)- 2 (5)
Appendix	Neuroendocrine tumor - 2	Low-grade mucinous neoplasm-1
Adrenal	Adrenocortical carcinoma-1	–
Bone	Giant cell tumor - 2	Chondrosarcoma- 1
Ampullary	Adenocarcinoma - 2	–
Esophagus	Adenocarcinoma -1	–
Pancreas	Adenocarcinoma - 2	-

Age-wise distribution showed that most malignancies occurred in the 41–70 year age group, comprising more than 70% of all cases. The peak incidence was noted in the 51–60 year bracket (n=254), followed by 61–70 years (n=245). Cancers in younger patients (<30 years) were uncommon, contributing less than 5% of the total. Gender analysis revealed a higher proportion of breast and cervical cancers among women, whereas oral cavity, laryngeal, and prostate cancers were more common among men. In the <20 years age group, testicular tumors and lymphomas predominated, while in older adults (>70 years), skin cancers, colorectal cancers, and prostate malignancies were more frequent [Table 4, Figure 1].

Table 4: Age- and Gender-Wise Distribution of Malignancy Cases (2020–2024, n=1373)

Age Group (years)	Cases (n)	Male (%)	Female (%)	Commonest Sites
<20	16	~60%	~40%	Testis, lymphoma
21–30	35	~45%	~55%	Thyroid, ovary
31–40	98	~35%	~65%	Breast, cervix, thyroid
41–50	193	~40%	~60%	Breast, oral cavity, cervix
51–60	254	~55%	~45%	Oral cavity, breast, cervix
61–70	245	~55%	~45%	Oral cavity, breast, larynx, colon
71–80	104	~60%	~40%	Skin, prostate, cervix
81–90	27	~50%	~50%	Breast, colon, skin
Total	972 (M+F known)	–	–	–

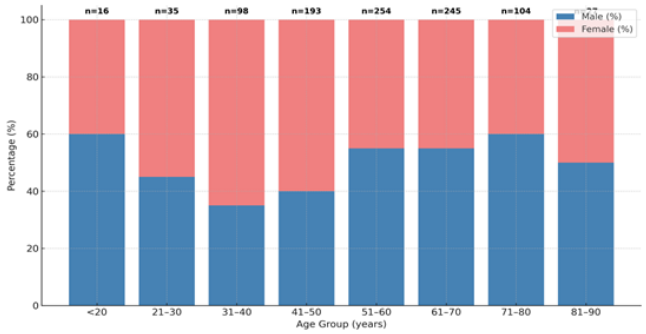

Figure 1: Age and Gender Wise Distribution of Malignancy Cases (2020 to 2024)

Discussion

This five-year retrospective analysis provides an institutional overview of malignancy trends. Between 2020 and 2024, 1,373 cases were reported, with a slight female predominance (52.6%). The annual case load peaked in 2023, which may be attributable to increased healthcare access, improved diagnostic awareness, and post-pandemic resumption of hospital services.

Site-Specific Trends: Oral cavity and breast cancers together constituted nearly half of the total malignancies, reflecting the dual impact of lifestyle-related and gender-specific tumors. Oral cavity cancers (27.5%) remained the leading site, consistent with regional data where tobacco chewing, smoking, and alcohol use are major contributors in South Asia.[7] Breast cancer (21.5%) was the most frequent malignancy among women, confirming its growing burden across diverse populations, in line with reports from Turkey and other middle-income countries.[8] Cervical cancer accounted for 8.0% of the female cancer burden, highlighting persistent deficiencies in screening and HPV vaccination uptake, despite its global downward trend. Colorectal cancers (6.3%) and thyroid malignancies (3.5%) demonstrated a rising trajectory, likely driven by lifestyle changes, dietary factors, and improved diagnostic surveillance. Genitourinary, gynecological (ovary and uterus), lymphoid, and soft tissue tumors collectively contributed a smaller yet clinically relevant proportion, reinforcing the heterogeneity of cancer distribution in tertiary care registries.

Histopathological Patterns: Clear site-specific histological predominance was observed. Squamous cell carcinoma was the uniform pattern in the oral cavity, cervix, larynx, skin, penis, and ocular/periocular sites. In breast cancer, invasive ductal carcinoma overwhelmingly dominates, with lobular, mucinous, papillary, and phyllodes tumors forming the minority. Thyroid cancers were largely papillary carcinoma, with follicular, medullary, and poorly differentiated variants also identified, consistent with global trends of rising differentiated thyroid cancers.[9] Gastrointestinal cancers, including colon and stomach,

were predominantly adenocarcinomas, with poorly cohesive and signet-ring types also observed. Lung malignancies were mostly adenocarcinoma, followed by squamous and small cell carcinoma, with occasional large cell and carcinoid tumors.

Gynecological cancers showed expected trends: ovarian tumors were predominantly serous carcinoma, with mucinous, endometrioid, clear cell, and germ cell variants also encountered, while uterine malignancies were chiefly endometrioid adenocarcinoma with carcinosarcoma and leiomyosarcoma as less common subtypes. Prostate cancers were primarily adenocarcinoma, whereas bladder cancers were dominated by transitional cell carcinoma, with rare squamous and glandular forms. Renal cancers were mainly clear cell renal cell carcinoma, with papillary and chromophobe types, along with Wilms' tumor. Soft tissue sarcomas were heterogeneous, comprising liposarcoma, leiomyosarcoma, rhabdomyosarcoma, pleomorphic sarcoma, and desmoid tumors. Lymph node biopsies were frequently positive for metastatic carcinoma deposits. At the same time, though less common, lymphomas included both Hodgkin and non-Hodgkin variants such as diffuse large B-cell, follicular, and Burkitt lymphoma.[10]

Demographic Distribution: Most cancers occurred between 41 and 70 years, accounting for over 70% of cases, in line with the well-documented age-dependent nature of cancer. Younger patients (<20 years) predominantly presented with lymphomas and testicular tumors, while the elderly (>70 years) had higher rates of prostate, skin, and colorectal cancers, paralleling international reports of age- and site-specific cancer patterns.[11]

Comparison with Literature: The findings broadly mirror Indian tertiary hospital audits, with oral cavity and breast cancers consistently ranking highest. However, global cancer profiles vary considerably, with gastric and esophageal cancers occupying a more prominent position in countries such as Japan and the United States.[11,12] These contrasts reflect dietary, lifestyle, and environmental influences, underscoring the need for regionally tailored cancer control strategies.

Implications: The predominance of preventable cancers, particularly those linked to tobacco, underscores the urgent need for strengthened cessation programs and targeted screening. Enhanced awareness campaigns for breast and cervical cancers could improve early detection. Institutional audits such as the present study are critical for refining local cancer policies, guiding health resource allocation, and identifying priority areas for intervention.

Limitations: As a single-center retrospective study, the findings may not fully reflect population-level cancer trends. Lack of staging and survival data limits clinical extrapolation. Nevertheless, the study contributes important regional evidence, complementing broader population-based research from Europe, Asia, and North America.

Conclusion

This five-year retrospective analysis revealed that oral cavity and breast cancers together accounted for nearly half of all malignancies, underscoring the combined impact of lifestyle-related exposures and gender-specific risks. Cervical, colorectal, thyroid, laryngeal, and skin cancers also contributed substantially, while gastrointestinal, genitourinary, gynecological, lymphoid, and soft tissue tumors enriched the overall cancer spectrum. Histopathological evaluation demonstrated clear site-specific predominance, with squamous cell carcinoma consistently dominating head-and-neck, cervical, cutaneous, and penile sites, and invasive ductal carcinoma leading breast malignancies. Adenocarcinomas were the principal subtype in gastrointestinal, prostatic, and endometrial tumors, while papillary carcinoma was the most frequent thyroid malignancy. Most cases clustered in the 41–70 year age group, confirming their mid- to late-adult onset. These findings highlight the urgent need for regionally adapted preventive measures, comprehensive tobacco and alcohol cessation programs, and strengthened screening initiatives—particularly for breast, cervical, and colorectal cancers—to reduce the disease burden and facilitate earlier detection.

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Conflicts of interest

There are no conflicts of interest.

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