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RESEARCH ARTICLE

Epidemiological Profile of Cancer Among Adolescents and Young Adults (15–39 Years) at a Tertiary Cancer Center in Belagavi, India: A Single Center Hospital- Based Study

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Abstract

Introduction: Cancer among adolescents and young adults (AYAs) represents a distinct clinical and epidemiological entity. The cancer spectrum in AYAs differs from that observed in children and older adults in terms of biological behaviour, treatment response, and survivorship outcomes. However, comprehensive data on the burden and distribution of cancer among AYAs in India remain limited. To identify the epidemiological profile, determine the most prevalent cancer types, and assess the association between selected sociodemographic and clinical characteristics and cancer categories in AYAs at a tertiary cancer center. **Materials and Methods:** This hospital-based cross-sectional study included 170 AYA patients aged 15–39 years who were diagnosed with cancer and registered at the Tertiary Cancer Center, Belagavi, between January 2025 and December 2025. Epidemiological, demographic, and clinical data were extracted from the patients' medical records and analyzed. Descriptive statistics were computed, and associations between categorical variables were assessed using the chi-square or Fisher exact test. **Results:** Out of all AYA cancer patients, nearly half of the patients (49.4%) belonged to the 35–39-year age group. Males constituted 54.7% of the cases (Male: Female = 1.21:1), with no significant association between age group and sex ($p = 0.938$). Head and neck cancers accounted for 44.7% of cases, followed by breast (17.6%), genitourinary (11.8%), and central nervous system (CNS) tumors (8.2%). Significant associations were noted between cancer category and sex ($p = 0.001$), addiction ($p = 0.01$), stage at diagnosis ($p = 0.004$), laterality ($p = 0.001$), treatment initiation ($p = 0.04$), physical activity ($p = 0.041$), and comorbidities ($p = 0.007$). **Conclusion:** Head and neck cancers were the predominant malignancy among AYAs in this cohort, particularly in males. Behavioural and clinical factors showed stronger associations with cancer category than sociodemographic characteristics. These findings highlight the need for region-specific prevention strategies, early detection initiatives, and age-focused multidisciplinary care models to improve outcomes in AYA cancer patients.

Keywords: Adolescent, Young adult, Cancer epidemiology, Head and neck cancer, India

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Introduction

Cancer is a major global public health concern and is a leading cause of mortality worldwide. AYAs represent a crucial subgroup within affected populations, characterized by specific cancer patterns and outcomes [1]. AYAs are defined by the National Cancer Institute as individuals aged 15–39 years and represent a unique population with distinct biological, epidemiological, and psychosocial characteristics [2, 3]. Globally, GLOBOCAN 2022 estimated over 1.3 million new AYA cancer cases, with India contributing substantially to this burden [4]. The age-standardized incidence of cancer among AYAs was highest in high Sociodemographic Index (SDI) countries (59.6 per 100,000 person-years), followed by high-middle SDI countries (53.2 per 100,000 person-years). In contrast, the highest age-standardized mortality rates were observed in low-middle SDI countries

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(14.2 per 100,000 person-years) and middle SDI countries (13.6 per 100,000 person-years) [5]. Cancer patterns among AYAs differ from those observed in pediatric and older adult populations [6, 7].

The spectrum of cancer types in this age group includes hematological malignancies like leukemia and lymphoma in younger AYAs, shifting towards epithelial tumors such as breast, thyroid and colorectal cancers in recent years [8, 9]. In India, registry-based studies have demonstrated a significant cancer burden in AYAs, with breast, cervical, and thyroid cancers predominating among females and head and neck cancers among males. However, hospital-based regional data remain limited [10]. Furthermore, the classification and management of cancers have traditionally been tailored to either pediatric or adult populations, leaving AYAs in a diagnostic and therapeutic dilemma [11]. Given the unique clinical challenges faced by AYAs, including diagnostic delays, fertility concerns, psychosocial impact, and survivorship issues, it is imperative to understand the regional epidemiological profile [12]. Therefore, this study aimed to identify the epidemiological profile, determine the most prevalent cancer types, and assess the association between selected sociodemographic and clinical characteristics and cancer categories among AYAs diagnosed at a tertiary cancer center.

Materials and Methods

Study Design and Settings

This was a retrospective hospital record-based cross-sectional study conducted at a tertiary cancer center in Belagavi. In cases of missing or incomplete data, limited supplementary information was obtained through telephonic contact or follow-up visits with patients or caregivers.

Data Collection Period

January 1, 2025, to December 31, 2025.

Study Population

Patients aged 15–39 years who were diagnosed with cancer.

Sample Size

The sample size was calculated using the single population proportion formula.

$$n=(z^2\ pq)/d^2$$

Assuming a prevalence of 11.97% for AYAs cancers based on prior Indian studies, with a 95% confidence level (Z = 1.96) and 5% absolute precision [13]. The minimum required sample size was 162 participants. As this was a retrospective hospital record-based study, all eligible cases during the study period were included, yielding a final sample size of 170.

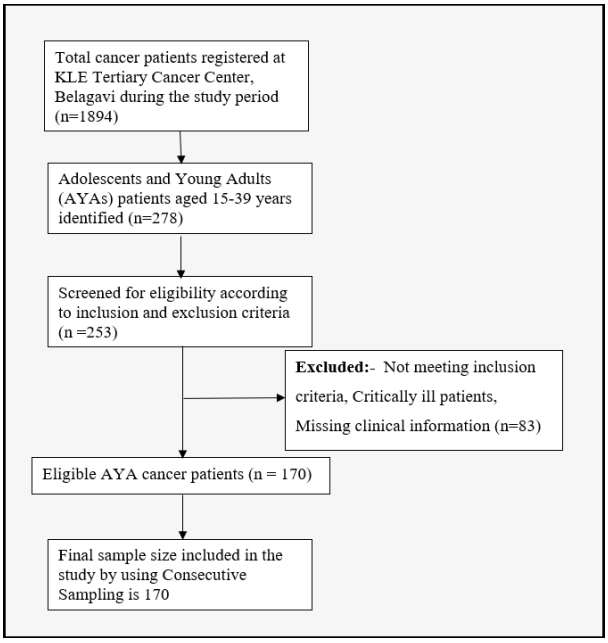


Figure 1. Flowchart Showing the Selection of Adolescent and Young Adult Cancer Patients Included in the Study

Sampling technique

Consecutive sampling was employed, wherein all eligible AYAs diagnosed with cancer and registered at the tertiary cancer center during the study period were included. All cases meeting the inclusion criteria were included to minimize the selection bias.

Inclusion and Exclusion Criteria

Patients aged 15–39 years who were registered during the study period were included in this study. Histologically confirmed malignancies were included wherever feasible. However, in certain situations where histopathological confirmation was not feasible (e.g., advanced-stage disease, inoperable tumors, or clinically evident malignancies), diagnosis was based on radiological findings supported by clinical evaluation, as per institutional protocols. This approach was adopted to avoid underrepresentation of advanced cancers and to better reflect real-world clinical practice in a tertiary care setting. Patients with non-malignant diagnoses were excluded from the study. In addition, critically ill patients with incomplete or insufficient clinical medical records were excluded due to the inability to obtain essential study variables. The selection process of the study participants is illustrated in Figure 1

Data Collection Procedure

Data were extracted from hospital medical records, including patient case sheets, oncology registry records, pathology reports, and electronic health records. The variables included demographic details, cancer stage, histopathology, treatment modality, comorbidities, and lifestyle factors. In cases where essential information was missing, patients or their caregivers were contacted through telephonic interviews or during follow-up visits to obtain the required details. This supplementary data

collection was limited to completing missing variables and did not involve any additional interventions. Verbal informed consent (and assent, where applicable for participants below 18 years) was obtained prior to such interactions. All data were handled confidentially in accordance with ethical guidelines.

Operational Definitions

The key variables used in this study were defined as follows to ensure consistency and reproducibility.

Addiction

Defined as self-reported current or past use of tobacco (smoking or smokeless) and/or alcohol consumption in any form.

Physical Activity

Categorized as "Yes" if the self-reported engagement in any regular moderate or vigorous physical activity (e.g., walking, exercise, occupational activity) for at least 30 minutes on most days of the week; otherwise categorized as "No."

Dietary Pattern

Classified as "Vegetarian" (no consumption of meat, fish, or eggs) or "Mixed diet" (includes both vegetarian and non-vegetarian food items), based on self-reporting.

Yoga Practice

Defined as self-reported engagement in yoga activities (including asanas, pranayama, or meditation) at least once weekly; categorized as "Yes" or "No."

Comorbidities

Presence of any previously diagnosed chronic medical condition documented in the medical records or reported by the patient, including diabetes mellitus, hypertension, cardiovascular diseases, tuberculosis, HIV/AIDS, hepatitis B/C, asthma, or other chronic conditions.

Cancer Category

Refers to broader groupings of cancer types derived from ICD-10 codes for analytical purposes (e.g., head and neck, breast, genitourinary, CNS, gastrointestinal, hematological, bone and soft tissue, others).

Histopathological Type

Refers to the microscopic classification of tumors based on pathology reports (e.g., carcinoma, lymphoma, sarcoma, germ cell tumors, and CNS tumors).

Ethical Approval

Ethical approval was obtained from the Jawaharlal Nehru Medical College (JNMC) Institutional Ethics Committee (Ref. No. MDC/JNMCIEC/266). As the study primarily involved a retrospective review of hospital medical records, a waiver of informed consent was granted by the ethics committee for the extraction of anonymized patient data.

Statistical Analysis

Data were analyzed using SPSS version 29. Descriptive statistics were summarized as frequency and percentage. Associations between categorical variables were assessed using the chi-square test. Fisher's exact test was applied when the expected cell counts were less than 5 in >20% of the cells. Where necessary, categories with small frequencies were combined to ensure the validity of the statistical tests and to address issues related to small cell counts. All statistical tests were two-sided, and a p-value < 0.05 was considered statistically significant. The analysis was primarily exploratory and based on univariate methods.

Results

A total of 170 AYA cancer patients were included in the study. Of these, the majority were histologically confirmed (n = 123, 72.4%), while a substantial proportion were diagnosed based on radiological and clinical findings (n = 47, 27.6%), particularly in advanced or inoperable cases.

The socio-demographic and lifestyle characteristics of the participants are presented in Table 1. Males constituted a higher proportion (54.7%) than females (45.3%). The majority of the participants were Hindu (73.5%) and married (76.5%). Most of them belonged to the Belagavi district (62.9%) and resided in rural areas (55.3%) of Karnataka. Regarding education, the largest proportion had completed higher secondary education (34.7%). A considerable proportion were unemployed (35.9%) or engaged in skilled occupations (31.8%). More than half of the participants belonged to nuclear families (53.5%), and pucca houses were common among them (57.6%). In terms of clinical characteristics, most patients were diagnosed at Stage II (37.6%), followed by Stage III (28.8%), indicating presentation at moderately advanced stages. The most common cancer laterality was others (complete, ill-defined, and crossing midline) (41.2%), followed by left-sided involvement (32.9%). Most participants had no history of previous interventions (74.7%). Chemotherapy was the most frequently initiated treatment (37.6%), and the majority received treatment with curative intent (85.9%), with 74.1% completing treatment. Most participants reported no family history of cancer (81.8%). While 43.5% had no reported comorbidities, the remaining participants presented with diabetes (11.2%), hypertension (19.4%), or other specified conditions (25.9%), such as HIV/AIDS, hepatitis B/C, TB, asthma, allergy, and cardiovascular diseases. However, 61.8% of the participants reported addiction. The majority of the participants engaged in physical activity (84.1%), while 37.1% reported practicing yoga (Table 1).

Table 2 shows the distribution of cancer types among AYAs based on sex and the International Classification of Diseases, Tenth Revision (ICD-10 classification). The most common cancer category was head and neck malignancies, accounting for 44.7% of all cases, with a clear male predominance (55.7% vs. 30.1% in females). Within this broad head and neck category, buccal mucosa

was the most frequently affected subsite, followed by the thyroid and oral tongue. Breast cancer was the second most frequent malignancy overall (17.6%) and was observed exclusively in women (41.1%). Genitourinary cancers accounted for 11.7% of cases and were more common in females (19.2%) than in males (6.2%). Cancers of the central nervous system (CNS) accounted for 8.2% of cases, followed by hematological malignancies (5.8%) and gastrointestinal cancers (4.7%). Bone and soft tissue tumors and other malignancies each contributed 3.54% of the total cases and were observed only in males in this cohort.

The age- and sex-wise distribution of AYAs with cancer is shown in Table 3. Among the 170 participants, the highest proportion of cases was observed in the 35–39 year age group (49.41%), followed by the 30–34 year age group (25.29%), while the lowest proportion was observed in the 15–19 year age group (6.47%). Overall, males constituted a higher proportion of cases (54.71%) than females (45.29%), with a male-to-female ratio of 1:0.83. A male predominance was observed in most of the age groups. A progressive increase in the number of cancer cases was observed with advancing age. However, no statistically significant association was found between age group and sex distribution (chi-square test, p= 0.938) (Table 3).

Table 4 shows the association between selected variables and cancer category among AYAs with cancer. The analysis demonstrated a statistically significant association between cancer category and sex (p= 0.001), indicating variations in cancer distribution between men and women. Among the behavioral factors, addiction (tobacco/alcohol use) was significantly associated with cancer category (p= 0.01). Clinical variables, including stage at diagnosis (p= 0.004) and presence of comorbidities (p= 0.007), and among the lifestyle variables, physical activity (p = 0.041) were also significantly associated with the cancer category. In contrast, no significant

Table 1. Distribution of Study Participants According to Socio-demographic, Clinical and Lifestyle Characteristics (N = 170).

Variable		Frequency N (%)
Gender	Male	93 (54.7)
	Female	77 (45.3)
Religion	Hindu	125 (73.5)
	Muslim	20 (11.8)
	Christian	12 (7.1)
	Others	13 (7.6)
Marital Status	Married	130 (76.5)
	Unmarried	40 (23.5)
Regional Area	Belagavi	107 (62.9)
	Other than Belagavi	63 (37.1)
Residential Area	Urban	76 (44.7)
	Rural	94 (55.3)
Literacy Status	Illiterate	12 (7.1)
	Primary	24 (14.1)
	High School	48 (28.2)
	Higher secondary	59 (34.7)
	Graduate/ Post Graduate	27 (15.9)
Occupation	Unemployed	61 (35.9)
	Professional/Skilled workers	54 (31.8)
	Unskilled workers	14 (8.2)
	Industrial/Agriculture workers	34 (20.0)
	Others	7 (4.1)
Family income per capita	<1364	25(14.7)
	1364-2728	73(42.9)
	2729-4548	62(36.5)
	>9098	10(5.9)
Type of Family	Nuclear	91 (53.5)
	Joint	60 (35.3)
	Single parent	19 (11.2)
Type of House	Pacca	98 (57.6)
	Semi-Pucca	49 (28.8)
	Kattcha	23 (13.5)

Continued Table 1

Variable		Frequency N (%)
Stages at Diagnosis	Stage-I	33 (19.5)
	Stage-II	64 (37.6)
	Stage-III	49 (28.8)
	Stage-IV	24 (14.1)
Cancer laterality	Right	44 (25.9)
	Left	56 (32.9)
	Others ((complete, ill-defined and crossing midline)	70 (41.2)
Previous Intervention	Surgery	7 (4.1)
	Chemotherapy	13 (7.6)
	Radiation therapy	29 (17.1)
	No previous treatment	121 (71.2)
Treatment Initiated	Surgery	33 (19.4)
	Chemotherapy	64 (37.6)
	Radiation therapy	49 (28.8)
	Combine	24 (14.1)
Treatment Intent	Curative	146 (85.9)
	Palliative	24 (14.1)
Treatment Status	Active	44 (25.9)
	Complete	126 (74.1)
Family History of Cancer	No	139 (81.8)
	Yes	31 (18.2)
Comorbidities	Diabetes	19 (11.2)
	Hypertension	33 (19.4)
	*Others	44 (25.9)
	NA	74 (43.5)
Addiction	No	65 (38.2)
	Yes	105 (61.8)
Physical Activity	No	27 (15.9)
	Yes	143 (84.1)
Yoga Practice	No	107 (62.9)
	Yes	63 (37.1)

Others- HIV/AIDS, Hepatitis B/C, TB, Asthma, Allergy, Cardiovascular Diseases, History of Transfusion, etc.

Table 2. Distribution of Cancer Cases by Cancer Category and Sex According to ICD-10 Classification

Cancer category	ICD-10 Code	Male n (%)	Female n (%)	Total (%)
Head & Neck	C00-C14, C30-C32, C77-C80	54 (55.7)	22 (30.1)	76 (44.70)
CNS	C70-C72	9 (9.3)	5 (6.8)	14 (8.23)
Breast Cancer	C50	0 (0.0)	30 (41.1)	30 (17.64)
Hematological	C81-C96	6 (6.2)	4 (5.5)	10 (5.89)
Genitourinary	C64-C68	6 (6.2)	14 (19.2)	20 (11.76)
Gastrointestinal	C15-C26	6 (6.2)	2 (2.7)	8 (4.7)
Bone & Tissue Tumor	C40-C41	6 (6.2)	0 (0.0)	6 (3.54)
Other	C73-C80	6 (6.2)	0 (0.0)	6 (3.54)
Total		97 (57.06)	73 (42.94)	170 (100)

*ICD-10, International Classification Diseases-10.

association was found between cancer category and age group (p= 0.231), body mass index (p= 0.814), occupation (p= 0.311), and family income per capita (p= 0.425). However, treatment intent (p= 0.68) and family history of cancer (p= 0.138) were not significantly associated. These findings suggest that clinical presentation and behavioral factors play a more important role in the variation in cancer sites than sociodemographic characteristics in this study population (Table 4).

The distribution of cancer cases according to histopathological type among AYAs is shown in Figure 2. Carcinoma was the most common histopathological type, accounting for (72%). CNS tumors constituted (8%), while lymphoma and other unspecified malignancies each accounted for (7%) cases. Sarcomas (4%) and germ cell tumors (3%) were less frequently observed than other tumor types. Overall, carcinoma was the predominant histopathological diagnosis among AYA with cancer. (Figure. 2)

Discussion

The science of AYA cancer is evolving, and there is limited knowledge regarding the epidemiology, biology, genetics, and therapeutics of cancer in AYA patients in developing countries [13]. Furthermore, this study uniquely applies the new classification system proposed by Barr et al. (2020) for AYAs, which aims to provide a more refined understanding of cancer patterns in this age group compared to previous systems (Birch et al., 2006) [14, 15]. Our study findings showed that the most common type of malignancy observed was head and neck cancer (44.7%). Breast cancer (17.6%) was the second most common, followed by genitourinary cancer (11.8). This result is consistent with the study by Kakkar et al [16]. Our observations align with previous Indian studies demonstrating a predominance of epithelial malignancies [11]. In terms of histopathological characteristics, carcinoma constituted the predominant tumor type in this study, which is consistent with the observed distribution of epithelial malignancies. Other tumor types such as lymphomas, sarcomas, germ cell tumors, and CNS tumors were less frequent. However, further subclassification of tumor subtypes was limited due to the nature of available records, and more detailed molecular or histological characterization would provide additional insights into disease patterns among AYAs. However, the relatively higher proportion of head and neck cancers observed in this study should be interpreted with caution. This may be partly explained by referral bias inherent to the hospital-based study design, as tertiary oncology centers often receive a disproportionate number of advanced or site-specific cancer cases. Additionally, the higher burden of tobacco-related cancers in Belagavi and surrounding regions may have contributed to this distribution. Therefore, these findings may not be fully generalizable to the broader population. The predominance of breast cancer among female AYAs in this cohort aligns with broader trends often attributed to factors such as hormonal influences, delayed childbearing, and changing reproductive patterns, as observed in the literature.

Age-wise distribution revealed a progressive increase in cancer cases from the 15–19-year age group onward, with the highest proportion observed in the 35–39-year age group (49.41%). A similar pattern was documented in an earlier study by Kakkar et al [16]. The increasing

Table 3. Age-wise and Gender-wise Distribution of AYAs Cancer Patients (N = 170)

Age Group	Male n (%)	Female n (%)	Total n (%)	M:F	Chi- Square/Fisher's p-Value
15-19	5 (2.94)	6 (3.53)	11 (6.47)	0.83:1	0.938
20-24	8 (4.71)	6 (3.53)	14 (8.24)	1.33:1	
25-29	9 (5.29)	9 (5.29)	18 (10.59)	01:01	
30-34	23 (13.53)	20 (11.76)	43 (25.29)	1.15:1	
35-39	48 (28.24)	36 (21.18)	84 (49.41)	1.33:1	
Total	93 (54.71)	77 (45.29)	170 (100)	1.21:1	

Note- p-value is computed using chi-square/Fisher's exact test (* indicates Statistical significance with p-value < 0.05)

Table 4. Association of Socio-demographic and Clinical Characteristics with Cancer Categories Among AYAs (N = 170).

Variables		Cancer Category									Chi- Square/ Fisher's p-Value
		Head & Neck n (%)	CNS n (%)	Breast Cancer n (%)	Hematological n (%)	Genitourinary n (%)	Gastrointestinal n (%)	Bone & Tissue Tumor n (%)	Other n (%)	Total (100%)	
Gender	Male	54 (58.1)	9 (9.7)	0 (0.0)	6 (6.5)	6 (6.5)	6 (6.5)	6 (6.5)	6 (6.5)	93	<0.001**
	Female	22 (28.6)	5 (6.5)	30 (39.0)	4 (5.2)	14 (18.2)	2 (2.6)	0 (0.0)	0 (0.0)	77	
Age Distribution	15-19	6 (54.5)	2 (18.2)	0 (0.0)	1(9.1)	0 (0.0)	1 (9.1)	0 (0.0)	1 (9.1)	11	0.231
	20-24	5 (35.7)	2 (14.3)	3 (21.4)	1 (7.1)	0 (0.0)	1 (7.1)	0 (0.0)	2 (14)	14	
	25-29	5 (27.8)	1 (5.6)	2 (11.1)	3 (16.7)	5 (27.8)	1 (5.6)	0 (0.0)	1 (5.6)	18	
	30-34	20 (46.5)	5 (11.6)	6 (14.0)	1 (2.3)	6 (14.0)	1 (2.3)	3 (7.0)	1 (2.3)	43	
	35-39	40 (47.6)	4 (4.8)	19 (22.6)	4 (4.8)	9 (10.7)	4 (4.8)	3 (3.6)	1 (1.2)	84	
Body Mass Index (BMI)	Underweight	13 (54.2)	0 (0.0)	4 (16.7)	0 (0.0)	4 (16.7)	2 (8.3)	0 (0.0)	1 (4.2)	24	0.814
	Normal weight	47 (45.6)	11 (10.7)	15 (14.6)	8 (7.8)	10 (9.7)	5 (4.9)	4 (3.9)	3 (2.9)	103	
	Overweight	14 (38.9)	2 (5.6)	8 (22.2)	2 (5.6)	5 (13.9)	1 (2.8)	2 (5.6)	2 (5.6)	36	
	Obese	2 (28.6)	1 (14.3)	3 (42.9)	0 (0.0)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	7	
Occupation	Unemployed	21 (34.4)	3 (4.9)	18 (29.5)	4 (6.6)	10 (16.4)	3 (4.9)	1 (1.6)	1 (1.6)	61	0.311
	Manual Labor	41 (51.9)	9 (11.4)	8 (10.1)	4 (5.1)	7 (8.9)	3 (3.8)	4 (5.1)	3 (3.8)	79	
	Professional	9 (39.1)	1 (4.3)	4 (17.4)	2 (8.7)	3 (13.0)	2 (8.7)	1 (4.3)	1 (4.3)	23	
	Others	4 (57.1)	1 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (28)	7	
Family income per capita	<1364	14 (56.0)	1 (4.0)	5 (20.0)	1 (4.0)	1 (4.0)	1 (4.0)	2 (8.0)	0 (0.0)	25	0.425
	1364-2728	27 (37.0)	11 (15.1)	11 (15.1)	6 (8.2)	10 (13.7)	3 (4.1)	2 (2.7)	3 (4.1)	73	
	2729-4548	32 (51.6)	2 (3.2)	11 (17.7)	3 (4.8)	7 (11.3)	4 (6.5)	1 (1.6)	2 (3.2)	62	
	>9098	3 (30.0)	0 (0.0)	3 (30.0)	0 (0.0)	2 (20.0)	0 (0.0)	1 (10)	1 (10)	10	
Addiction (Tobacco/ Alcohol)	No	19 (29.2)	8 (12.3)	16 (24.6)	7 (10.8)	10 (15.4)	3 (4.6)	1 (1.5)	1 (1.5)	65	0.01*
	Yes	57 (54.3)	6 (5.7)	14 (13.3)	3 (2.9)	10 (9.5)	5 (4.8)	5 (4.8)	5 (4.8)	105	
Stages at Diagnosis	Stage-I	8 (24.2)	1 (3.0)	5 (15.2)	3 (9.1)	10 (30.3)	3 (9.1)	2 (6.1)	1 (3.0)	33	0.004**
	Stage-II	31 (48.4)	9 (14.1)	12 (18.8)	2 (3.1)	8 (12.5)	2 (3.1)	0 (0.0)	0 (0.0)	64	
	Stage-III	21 (42.9)	4 (8.2)	11 (22.4)	4 (8.2)	1 (2.0)	3 (6.1)	2 (4.1)	3 (6.1)	49	
	Stage-IV	16 (66.7)	0 (0.0)	2 (8.3)	1 (4.2)	1 (4.2)	0 (0.0)	2 (8.3)	2 (8.3)	24	
Treatment Intent	Curative	60 (41.1)	14 (9.6)	28 (19.2)	9 (6.2)	19 (13.0)	8 (5.5)	4 (2.7)	4 (2.7)	146	0.68
	Palliative	16 (66.7)	0 (0.0)	2 (8.3)	1 (4.2)	1 (4.2)	0 (0.0)	2 (8.3)	2 (8.3)	24	
Family History of Cancer	No	62 (44.6)	14 (10.1)	24 (17.3)	7 (5.0)	17 (12.2)	4 (2.9)	5 (3.6)	6 (4.3)	139	0.138
	Yes	14 (45.2)	0 (0.0)	6 (19.4)	3 (9.7)	3 (9.7)	4 (12.9)	1 (3.2)	0 (0.0)	31	
Comorbidities	Diabetes	13 (68.4)	1 (5.3)	2 (10.5)	1 (5.3)	2 (10.5)	0 (0.0)	0 (0.0)	0 (0.0)	19	0.007**
	Hypertension	8 (22.9)	6 (17.1)	9 (25.7)	1 (2.9)	5 (14.3)	2 (5.7)	2 (5.7)	2 (5.7)	35	
	Others	28 (66.7)	1 (2.4)	4 (9.5)	3 (7.1)	2 (4.8)	1 (2.4)	1 (2.4)	2 (4.8)	42	
	NA	27 (36.5)	6 (8.1)	15 (20.3)	5 (6.8)	8 (10.8)	5 (6.8)	4 (5.4)	4 (5.4)	74	
Physical Activity	No	8 (29.6)	4 (14.8)	5 (18.5)	5 (18.5)	4 (14.8)	1 (3.7)	0 (0.0)	0 (0.0)	27	0.041*
	Yes	68 (47.6)	10 (7.0)	25 (17.5)	5 (3.5)	16 (11.2)	7 (4.9)	6 (4.2)	6 (4.2)	143	

Note- p-value is computed using chi-square/Fisher's exact test (*indicates Statistical significance with p-value < 0.05).

incidence with advancing age within the AYA spectrum may reflect cumulative exposure to carcinogenic factors, hormonal influences, and improved diagnostic detection among older AYAs. The number of cancers in the age group 15-19 years was slightly higher in females; however, as the years progressed, the number of cancers in females increased significantly up to the age group of 35-39 years in the present study. These findings are consistent with the study conducted in Karnataka by Rashmi et al [17]. the overall male-to-female ratio in our study was 1.21:1, indicating a modest male predominance, it is closer to the study conducted by Singh et al and Sharma et al [20, 21]. Gender-specific patterns were evident, the head and neck cancer predominated among males, while breast cancer was the leading malignancy among females. These findings reinforce the importance of gender-sensitive screening and preventive strategies in this regard. Overall, our observation highlights clear gender differences in cancer distribution among AYA patients and is comparable to observations reported by Guleria et al. and Kalyani et al [18, 19].

The cancer pattern observed among AYAs in the present study highlights the impact of regional lifestyle, cultural, and environmental factors and corresponds with

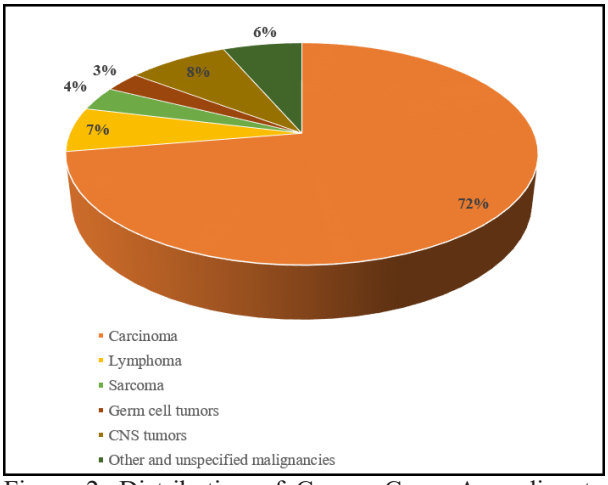


Figure 2. Distribution of Cancer Cases According to Histopathological Type Among AYAs Patients (N = 170).

trends reported at the national and global levels. Notable patterns were observed across gender, residence, literacy, occupation, family type, cancer stage, and treatment modalities, with males and rural residents emerging as the most prevalent categories, alongside advanced stage IV disease and surgery as the leading treatment modalities. These align closely with the Varanasi Population-Based Cancer Registry (PBCR) findings (2017-2019) by Khanna et al [22]. The present study also explored the association between selected variables and cancer categories. The analysis revealed a statistically significant relationship between gender and cancer category, reflecting sex-based differences in AYA cancer patterns, likely due to biological, hormonal, and behavioural factors; however, this association should be interpreted cautiously in the absence of multivariable adjustment. Similar gender-related differences in cancer patterns have been reported in earlier epidemiological studies of AYA cancers [2]. A history of addiction, particularly tobacco and alcohol consumption, showed a significant association with cancer type in the present study. These findings are consistent with global evidence demonstrating that tobacco use is one of the most important risk factors for the development of head and neck cancers and several other malignancies [17, 18]. The stage at diagnosis varied across cancer categories, suggesting differences in clinical presentation and healthcare-seeking behaviour, while the treatment initiation modality reflected site-specific protocols. These variations likely reflect differences in disease progression, tumor biology, and clinical management strategies among various cancer types. Comorbidities and physical activity were associated with the type of cancer. Similar findings have been reported in other hospital-based studies, suggesting that biological mechanisms, genetic susceptibility, and disease-specific characteristics may play a more substantial role in determining cancer patterns among AYAs [3, 13]. Overall, the findings of the present study provide important region-specific insights into the epidemiological and clinical characteristics of cancers affecting adolescents and young adults and may support the development of targeted prevention and management strategies in tertiary oncology centers. Given the cross-sectional nature of the study, causal inferences cannot be established, and the observed findings should be interpreted as associations rather than causal relationships. Additionally, considering multiple statistical comparisons, the possibility of type I error cannot be excluded, and the findings should be interpreted cautiously.

Limitation

The present study had some limitations, including a relatively small sample size and a single-center hospital-based study design, which limits the generalizability of the findings, as the results may not be representative of the broader population. Additionally, the exclusion of critically ill patients with incomplete medical records may have introduced selection bias, potentially leading to underrepresentation of patients with advanced disease or poor prognosis. The analysis was limited to univariate methods, and multivariable analysis was not performed to adjust for potential confounding factors; therefore, the observed associations should be interpreted with caution. Furthermore, the lack of population-based denominators limits the ability to estimate incidence rates and restricts broader epidemiological interpretation of the findings.

In conclusion, adolescents and young adults represent a distinct oncological population that requires tailored care strategies. Head and neck cancer was the most prevalent malignancy in this cohort, particularly among men. A significant proportion of patients presented with advanced-stage disease, indicating potential delays in diagnosis and highlighting the need for improved awareness and early detection strategies. Behavioural exposures and clinical characteristics were significantly associated with cancer distribution. Strengthening prevention programs, early detection initiatives, and AYA-specific multidisciplinary care models is essential for improving outcomes in this age group.

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Conflict of interest

The authors declare no conflict of interest.

CTRI Registration
Not Applicable

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