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ORIGINAL RESEARCH ARTICLE

Epidemiological Determinants of Common and Rare Cancers: A Hospital-Based Study in North India

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ABSTRACT

Background: Cancer remains a significant public health burden in India, with its incidence influenced by a complex interplay of sociodemographic and behavioral factors. Understanding these determinants is essential to tailor prevention and control strategies. The aim of the study is to identify the epidemiological determinants associated with common and rare cancers in patients attending a tertiary care center in North India.

Material and Methods: This hospital-based cross-sectional study was conducted among 400 histologically confirmed cancer patients between May 2023 and October 2024 at a tertiary care hospital in Bareilly, Uttar Pradesh. Data on sociodemographic variables, behavioral factors, and clinical history were collected using a pre-tested semi-structured schedule. Statistical analysis was performed using SPSS version 25. Chi-square test was applied to explore associations between independent variables and cancer type, with p <0.05 considered statistically significant.

Results: Significant associations were observed between cancer type and age (p = 0.000), gender (p = 0.000), occupation (p = 0.000), and socioeconomic status (p = 0.000). Common cancers were more prevalent in the 41 to 60 years age group and among females, while rare cancers were frequent in older males and individuals from lower socioeconomic classes. Behavioral factors such as tobacco smoking (p = 0.019), smokeless tobacco use (p = 0.007), and alcohol consumption (p = 0.019) were significantly associated with rare cancers. Although 73% of tobacco users noticed health warnings, 58.7% showed indifference, and only 15.7% reported quitting.
Conclusion: The study concludes that age, gender, occupation, and substance abuse are major determinants of cancer type. Awareness initiatives alone are insufficient; comprehensive prevention strategies must also address behavioral change, socioeconomic disparities, and targeted screening efforts.

Keywords: Cancer epidemiology, Sociodemographic factors, Behavioral risk factors, Tobacco use, Alcohol consumption, Common *vs*. rare cancers.

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INTRODUCTION

Cancer is a major public health concern globally and has emerged as one of the leading causes of morbidity and mortality, both in developed and developing countries. According to the GLOBOCAN 2020 estimates, nearly 19.3 million new cancer cases and 10 million cancer deaths occurred worldwide in 2020, with low- and middle-income countries bearing a significant portion of this burden.[1,2] In India, the cancer burden is steadily increasing due to demographic shifts, urbanization, lifestyle changes, and environmental exposures.[3,4]

Cancer is defined as a group of diseases characterized by the uncontrolled growth and spread of abnormal cells. If not detected and treated early, it can lead to death.[5] Common cancers refer to malignancies with high incidence rates in the population, such as breast, cervical, lung, colorectal, and oral cancers. These are often influenced by modifiable risk factors like tobacco use, diet, physical inactivity, and infections.[6,7] In contrast, rare cancers are defined as those with an incidence of fewer than six cases per 100,000 individuals per year. They include cancers such as medulloblastoma, Ewing sarcoma, gallbladder cancer, and submandibular gland tumors. These cancers often present diagnostic challenges and limited treatment protocols due to their rarity.[8,9] Understanding the epidemiological determinants—which include sociodemographic variables (age, gender, caste, occupation, residence), lifestyle factors (tobacco and alcohol use, diet, physical activity), and comorbidities—is crucial for formulating effective cancer prevention and control strategies.[10,11] Studies have also shown that socioeconomic status significantly influences both the incidence and stage of cancer at diagnosis, with individuals from disadvantaged backgrounds being more susceptible to late detection and poor outcomes.[12-14]

Despite advancements in diagnostics and treatment, many patients in India continue to face barriers in

cancer care due to delayed diagnosis, lack of awareness, and economic constraints.[15] Therefore, this study was undertaken to explore the epidemiological determinants of common and rare cancers among patients reporting to a tertiary care hospital in North India. The aim of the study is to identify the epidemiological determinants associated with common and rare cancers in patients attending a tertiary care center in North India.

MATERIAL AND METHODS

Study Design and Setting

A hospital-based cross-sectional study was conducted at the Cancer Treatment Centre of a tertiary care teaching hospital in Bareilly district, Uttar Pradesh, North India. The study was carried out over an 18-month period, from May 1, 2023, to October 31, 2024.

Study Population

The study population included patients of all ages and both sexes who had a confirmed diagnosis of cancer and reported for treatment at the tertiary care facility during the study period.

Patients with histologically/radiologically confirmed cancer of any anatomical site or stage. Individuals who provided written informed consent for participation were included and patients diagnosed with malignancy of unknown primary origin. Patients who did not consent to participate in the study.

Sample Size and Sampling Technique

Institutional records indicated that approximately 3,500 patients attended the cancer outpatient department in the previous year. Using 10% of this figure and allowing for an additional 10% accounting for non-response, the minimum required sample size was calculated to be 385. To ensure statistical adequacy and account for rounding, a final sample of 400 patients was selected using consecutive sampling until the desired sample size was reached.

Anthropometric Assessment

Anthropometric data were collected using standardized techniques. Height was measured in centimeters using a wall-mounted stadiometer with the participant standing barefoot in the Frankfurt plane. Weight was recorded using a calibrated digital weighing scale with participants wearing light clothing. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2) to assess nutritional status.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of the host institution (Approval No: SRMS IMS/ECC/2023/58).

Statistical Analysis

Data were entered into Microsoft Excel 2020 and analyzed using IBM SPSS Statistics Version 25. Descriptive statistics were used to summarize the data: means and standard deviations for continuous variables and frequencies and percentages for categorical variables. The Chi-square test was employed to examine associations between categorical variables such as type of cancer and sociodemographic or behavioral factors. A *p-value* of < 0.05 was considered statistically significant.

RESULT

Table 1 shows that age was significantly associated with cancer type (p = 0.000). Common cancers were predominantly found in the 41 to 60 years group (58.27%), whereas rare cancers were more frequent in the older 61 to 80 years group (40.98%). This suggests that aging may be a contributing factor in the development of rare malignancies. Gender was also significantly associated (p = 0.000), with males accounting for a higher proportion of rare cancers (72.95%), while females were more affected by common cancers (54.32%). This may reflect gender-specific behavioral exposures and cancer types (e.g., higher prevalence of head and neck cancers in males). Occupation showed a strong association with cancer type (p = 0.000). Among those with rare cancers, skilled (16.39%) and professional occupations (12.30%) were m disadvantaged groups.

Among behavioral risk factors, smoking showed a statistically significant association with cancer type (p = 0.019). Former smokers made up 43.44% of rare cancer patients compared to 29.5% among common cancer patients. Although current smoking prevalence was similar (10.66 *vs.* 10.43%), a larger share of common cancer patients had never smoked (60.67%). Smokeless tobacco use also demonstrated a strong association (p = 0.007), with current users comprising 20.49% of rare cancer cases versus only 10.07% among common cancers. This supports the established link between smokeless tobacco and rare cancers such as those affecting the oral cavity and head and neck.

Alcohol consumption was another significant factor (p = 0.019). A higher proportion of rare cancer patients were current (7.38%) or former (46.72%) alcohol consumers compared to the common cancer group (2.88 and 37.77%, respectively), suggesting cumulative exposure contributes to carcinogenesis in rare cancer types. The association between family history of cancer and cancer type approached statistical significance (p = 0.051), with 15.10% of common cancer cases reporting a family history,

Table 1: Association between demographic, lifestyle, and behavioral factors and type of cancer (N = 400)

Variable	*Category*	*Common Cancer n (%)*	*Rare Cancer n (%)*	*p-value*
Age group (years)	0–20	3 (1.07)	1 (0.82)	0.000
	21–40	61 (21.94)	19 (15.57)	
	41–60	162 (58.27)	52 (42.62)	
	61–80	52 (18.70)	50 (40.98)	
Gender	Male	127 (45.68)	89 (72.95)	0.000
	Female	151 (54.32)	33 (27.05)	
Caste	General	62 (22.30)	22 (18.03)	0.601
	OBC	129 (46.40)	58 (47.54)	
	SC	87 (31.29)	42 (34.43)	
Religion	Hindu	198 (71.22)	95 (77.87)	0.139
	Muslim	64 (23.02)	25 (20.49)	
	Sikh	16 (5.76)	2 (1.64)	
Occupation	Unskilled	236 (84.89)	76 (62.30)	0.000
	Semi-skilled	6 (2.16)	11 (9.02)	
	Skilled	22 (7.91)	20 (16.39)	
	Professional	14 (5.04)	15 (12.30)	
Socioeconomic status	Upper/Upper-middle	12 (4.32)	3 (2.46)	0.000
	Middle	43 (15.45)	14 (11.48)	
	Lower-middle	172 (61.87)	46 (37.70)	
	Lower	51 (18.35)	59 (48.36)	
Smoking (Tobacco)	Current	29 (10.43)	13 (10.66)	0.019
	Former	82 (29.50)	53 (43.44)	
	Never	167 (60.67)	56 (45.90)	
Smokeless tobacco	Current	28 (10.07)	25 (20.49)	0.007
	Former	87 (31.29)	42 (34.43)	
	Never	163 (58.63)	55 (45.08)	
Alcohol consumption	Current	8 (2.88)	9 (7.38)	0.019
	Former	105 (37.77)	57 (46.72)	
	Never	165 (59.35)	56 (45.90)	
Family history of cancer	Yes	42 (15.10)	10 (8.10)	0.051
	No	236 (84.90)	112 (91.90)	
Pack-years (N = 178)	1–20	11 (8.33)	3 (7.87)	0.226
	21–40	13 (9.85)	4 (9.55)	
	>40	108 (81.82)	39 (82.58)	

versus only 8.10% of rare cancer cases. Although not conclusive, this may reflect the genetic predisposition, particularly to common cancers such as breast or colorectal cancer. Lastly, no significant association was observed for caste ($p = 0.601$), religion ($p = 0.139$), or pack-years of smoking ($p = 0.226$).

Figure 1 represents tobacco awareness of health warning labels on tobacco products and their behavioral response to them. Among the 230 patients who consumed tobacco, 73% acknowledged noticing the warning labels, while 27% reported not noticing them. Even though this considerable level of awareness, the behavioral impact was limited. The majority (58.7%) of those who noticed the warnings responded with indifference. Only 25.7%

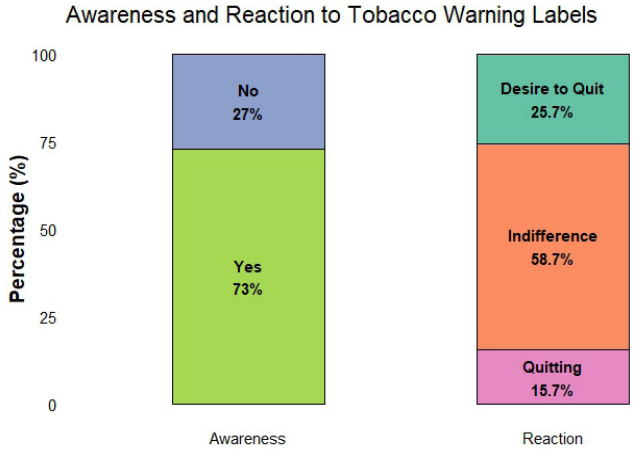

Figure 1: Awareness and reaction to tobacco warning labels

expressed a desire to quit, and a mere 15.7% reported actual quitting behavior.

DISCUSSION

This study investigated the epidemiological determinants of common and rare cancers among patients attending a tertiary care hospital in North India. The findings reveal significant associations between cancer type and demographic, occupational, socioeconomic, and behavioral factors. Age was a significant determinant, with common cancers being more prevalent among individuals aged 41 to 60 years ($p = 0.000$), consistent with previous research showing that cancer incidence increases with age due to cumulative exposure to environmental risk factors and biological aging processes.[7] In contrast, rare cancers were more frequent in older patients (>60 years), potentially due to delayed manifestations of exposures, reduced immune surveillance, and diagnostic delays.[3]

Gender differences were also pronounced ($p = 0.000$), with rare cancers significantly more common in males. This may be attributed to the higher prevalence of modifiable risk factors such as tobacco and alcohol use among men.[6,11] Common cancers like breast and cervical cancer were more common in females, aligning with national data trends in India.[8]

A significant association was observed between occupation and cancer type ($p = 0.000$). Unskilled laborers were more likely to develop common cancers, while rare cancers were observed more frequently among skilled and professional workers. Occupational exposures to carcinogens and stress, combined with varying access to healthcare, could explain these trends.[6] Similarly, socioeconomic status showed a significant association ($p = 0.000$), with rare cancers more prevalent in the lower class. Limited access to healthcare, delayed screening, and higher environmental exposures may contribute to this disparity.[5,6]

Substance abuse was a major behavioral determinant. Both smoked and smokeless tobacco use showed strong associations with cancer type (p = 0.019 and 0.007, respectively), with rare cancers more prevalent among current and former users. This supports global evidence on the carcinogenic effects of nicotine and nitrosamines in head and neck, esophageal, and lung cancers.[6,11] Alcohol intake was also significantly associated with rare cancers ($p = 0.019$), reinforcing the synergistic effect of alcohol and tobacco in increasing cancer risk.[11]

Although family history did not reach statistical significance (p = 0.051), common cancers were more frequently reported among patients with a positive family history. This reflects known genetic susceptibilities in hereditary cancer syndromes.[16] In contrast, rare cancers appeared to have a more environmental or occupational etiology. Although 73% of tobacco users noticed warning labels, only 15.65% quit tobacco and 58.7% remained indifferent. This disconnect between awareness and behavior change mirrors other studies showing that addiction, low health literacy, and poor risk perception limit the impact of warning labels.[17] Treatment patterns showed that radiotherapy was the most common modality, followed by post-operative therapies and combined chemotherapy, indicating improved access to multidisciplinary cancer care.[15] Despite a low recurrence rate (4.75%), long-term follow-up remains crucial for monitoring disease progression and treatment efficacy. Overall, the study reinforces that cancer prevention and control efforts must move beyond clinical intervention strategies and should include targeted education, behavioral interventions for cessation, health equity promotion, and improved communication of risk, especially in vulnerable populations.

CONCLUSION

This study concludes that the common cancers were more prevalent among individuals aged 41 to 60 years, females, and those belonging to the lower-middle socioeconomic class. In comparison, rare cancers were more frequently observed in older age groups (61–80 years), males, unskilled occupations, and those from lower economic strata. Substance abuse emerged as a major modifiable risk factor, with smoking and smokeless tobacco, as well as alcohol consumption, showing strong associations with rare cancers. High cumulative tobacco exposure was observed across both cancer categories without a statistically significant difference. These findings highlight the need for targeted public health strategies, particularly in rural and low-income populations, to reduce behavioral risk factors such as tobacco and alcohol use, promote early cancer screening, and address occupational and environmental exposures.

REFERENCES

1. Popat K, McQueen K, Feeley TW. The global burden of cancer. *Best Pract Res Clin Anaesthesiol*. 2013;27(4):399–408.
2. Mulryan C. Understanding cancer: the basics. *Br J Healthc Assist*. 2010;4(6):266–9.
3. Ali S, Tanveer A, Hussain A, Rehman SU. Identification of Cancer Disease Using Image Processing Approaches. *Int J Intell Inf Syst*. 2020;9(2):6–15.
4. Deo SVS, Sharma J, Kumar S. GLOBOCAN 2020 Report on Global Cancer Burden: Challenges and Opportunities for Surgical Oncologists. *Ann Surg Oncol*. 2022;29(11):6497–6500.
5. Sharma R. An examination of colorectal cancer burden by socioeconomic status: evidence from GLOBOCAN 2018. *EPMA J*. 2020;11(1):95–117.

6. Nagaraju V, Pandit N, Narasimaiah L, Rajanna MM. Study of incidence and pattern of cancers among patients attending to tertiary care hospital Mandya Institute of Medical Sciences, Mandya, Karnataka, India. *Int Surg J*. 2016;3(2):505–8.
7. Rawla P. Epidemiology of Prostate Cancer. *World J Oncol*. 2019;10(2):63–89.
8. Dhillon PK, Mathur P, Nandakumar A, Fitzmaurice C, Kumar GA, Mehrotra R, et al. The burden of cancers and their variations across the states of India: the Global Burden of Disease Study 1990–2016. *Lancet Oncol*. 2018;19(10):1289–1306.
9. Fine P. Another defining moment for epidemiology. *The Lancet*. 2015;385(9965):319–20.
10. Molina JR, Yang P, Cassivi SD, Schild SE, Adjei AA. Non-small cell lung cancer: epidemiology, risk factors, treatment, and survivorship. *Mayo Clin Proc*. 2008;83(5):584–94.
11. Rumgay H, Murphy N, Ferrari P, Soerjomataram I. Alcohol and cancer: epidemiology and biological mechanisms. *Nutrients*. 2021;13(9):3173.
12. Greenwald P, Dunn BK. Landmarks in the history of cancer epidemiology. *Cancer Res*. 2009;69(6):2151–62.
13. Torres AZ, Phelan-Emrick D, Castillo-Salgado C. Evaluating neighborhood correlates and geospatial distribution of breast, cervical, and colorectal cancer incidence. *Front Oncol*. 2018;8:386153.
14. Sharma R. An examination of colorectal cancer burden by socioeconomic status: evidence from GLOBOCAN 2018. *EPMA J*. 2020;11(1):95–117.
15. Singh NP, Kathuria D, Aggarwal NP, Gupta AK, Kaur G. Acute kidney injury in intensive care unit: a clinical and outcome study. *Indian J Med Spec*. 2021;12(3):132–6.
16. Yurgelun MB, Kulke MH, Fuchs CS, Allen BA, Uno H, Hornick JL, et al. Cancer susceptibility gene mutations in individuals with colorectal cancer. *J Clin Oncol*. 2017;35(10):1086–95.
17. Ward E, Jemal A, Cokkinides V, Singh GK, Cardinez C, Ghafoor A, et al. Cancer disparities by race/ethnicity and socioeconomic status. *CA Cancer J Clin*. 2004;54(2):78–93.