

# Trends and Patterns of Top Ten Common Cancers in Eastern India from 2014 to 2021: A Retrospective Hospital-based Cancer Registry Data Update

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## Abstract

**Background:** India is a vast and diverse country with existing variations in the frequency and distribution of cancers across its various parts. In regions lacking population-based cancer registries (PBCRs) in a vast country like India, hospital-based cancer registry (HBCR) data become an important source of information on the trends and patterns of a region. To determine the numerical trends of cases of the top ten cancer sites reporting to HBCR of a tertiary care cancer center in Bihar from 2014 to 2021. **Materials and Methods:** The details of all histopathologically confirmed cancer cases registered in the HBCR department of radiation oncology, State Cancer Institute, Indira Gandhi Institute of Medical Sciences, Patna, India between January 2014 and December 2021 were included in this retrospective observational study. All these cases were grouped site-wise and listed in descending order of the total number of cases reported in each group. Cross-tabulation with age and sex distribution was done. The frequency distribution of the top ten leading cancers for every consecutive calendar year was plotted in line diagrams for time trend analysis. Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) was used for analysis. Annual percent change (APC) was determined for the number of cases of all ten cancer sites using joinpoint regression analysis (Joinpoint Regression Software, Version 4.0.4—May 2013; Statistical Methodology and Applications Branch, Surveillance Research Program of the US National Cancer Institute; Bethesda, MD, USA). **Results:** Out of 32,057 total cancer cases registered between Jan 2014 and Dec 2021, 21,848 patients (68.2%) cases constituted the top ten cancers. The top ten cancers among both sexes were cancer gallbladder (n = 4204, 13.1%), head and neck (n = 3395, 10.6%), breast (n = 3392, 10.6%), lung (n = 2069, 6.5%), cervix (n = 2039, 6.4%), hematolymphoid (n = 1930, 6.0%), liver (n = 1572, 4.9%), stomach (n = 1116, 3.5%), ovary (n = 1103, 3.4%), and colon-rectum (n = 1028, 3.2%). Except for cervical and hematolymphoid cancers, the rest all showed a rising trend over consecutive years. **Conclusion:** Cancer of the gallbladder continues to be among the most common cancers in the region. Focused research in all aspects of this deadly disease is needed. Strengthening of prevention and screening programs for common cancers and upliftment of the existing infrastructure for diagnosis and treatment of cancer in the region are necessitated.

**Keywords:** Epidemiology, gallbladder neoplasms, head and neck neoplasms, incidence, registries, trends

## INTRODUCTION

According to Globocan 2020, India contributed 1,324,413 new cancer cases to the world in a year.<sup>[1]</sup> Known for diversity in its culture and geography, the Indian subcontinent also has varied distribution and frequency of various malignancies across its states. Population-based cancer registry (PBCR) and hospital-based cancer registry (HBCR) under the National Cancer Registry Programme (NCRP) are reliable sources of collecting data pertaining to cancer. Since its inception in year 1982, the coverage of cancer registries has continuously been growing, but PBCRs still cover only 10% population of the

country.<sup>[2,3]</sup> PBCRs are still scarce in a few regions of the country including eastern Indian states like Uttar Pradesh, Bihar, and West Bengal. Bihar got its first PBCR recently, however, HBCRs have been successfully running in this region well before that.

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An attempt was made to describe the cancer incidence, mortality, and disability-adjusted life years (DALY) of various states mainly based on PBCR, Sample Registration System, and Global Burden of Diseases analysis.<sup>[4]</sup> However, for a state like Bihar which lacked a PBCR until recently and still lacks mature data from it, HBCR data and its trends from a tertiary care cancer center become an important source of information for the policymakers to understand and identify the areas of concern.

This study aims to determine the numerical trends of cases of the top ten cancer sites reporting to HBCR of a tertiary care cancer center in Bihar from 2014 to 2021.

## MATERIALS AND METHODS

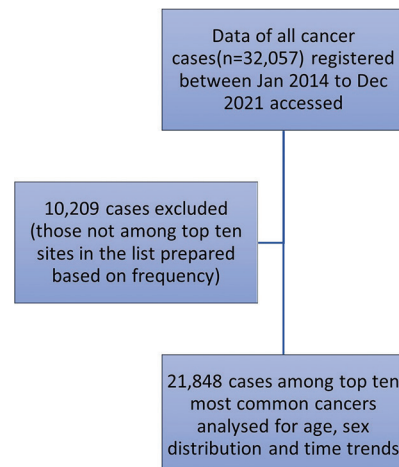
- a. Study design: Retrospective observational
- b. Setting: The study took place in the department of radiation oncology of department of radiation oncology, State Cancer Institute, Indira Gandhi Institute of Medical Sciences, Patna, India. The institute has its own HBCR that registers all new histopathologically proven cancers reporting to its various clinical departments. HBCR is an Indian Council of Medical Research -The National Centre for Disease Informatics and Research (ICMR-NCDIR), Bengaluru, India project that established a nationwide database of cancer through the NCRP. Approval from the Institutional Ethics Committee along with a waiver of informed consent was obtained. The study was conducted according to ethical guidelines established by the Declaration of Helsinki, and other guidelines like Good Clinical Practice Guidelines and those established by the ICMR.
- c. Participants: The details of all histopathologically confirmed cancer cases registered in the HBCR between January 2014 and December 2021 were included.
- d. Study size and variables: The study size included all cancer patients registered in the HBCR during the study period. The data was stratified based on the primary site of the tumor and the total numbers were noted year-wise. The age and sex distribution of these patients were noted.
- e. Objectives:
  - i. Primary: To determine the trends of the number of cases of the top ten cancer sites reporting to HBCR from the year 2014 to 2021.
  - ii. Secondary: To describe the demographic details (in terms of age and sex distribution) of all cases of the top ten malignancies reporting to HBCR from 2014 to 2021.
- f. Study methodology and statistical analysis: There was no sample size calculation done for the study. The details of all new cancer cases registered for consecutive years from 2014 to 2021 were extracted from the HBCR of the institute. All these cases were grouped site-wise and listed in descending order of

the total number of cases reported in each group. Cross-tabulation with age and sex distribution was done. The frequency distribution of the top ten leading cancers for every consecutive calendar year was plotted in line diagrams for time trend analysis. The percentage of each cancer was calculated with the denominator being the total number of all registered cases. The statistical analysis was performed using Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). Annual percent change (APC) was determined for the number of cases of all ten cancer sites using joinpoint regression analysis (Joinpoint Regression Software, Version 4.0.4—May 2013; Statistical Methodology and Applications Branch, Surveillance Research Program of the US National Cancer Institute; Bethesda, MD, USA) and analyzed for the upward or downward trend of the disease over consecutive calendar years. A *P* value of 0.05 was considered significant for all analyses.

APC is a way to characterize trends in cancer rates over time. Assuming constant change due to linearity on the log scale, APC can be equivalently defined as transformations of either (a) the slope of the line that runs through the log of each rate, (b) the ratio of the last rate to the first rate in the series, or (c) the geometric mean of the proportional changes in the rates over the series.<sup>[5]</sup>

## RESULTS

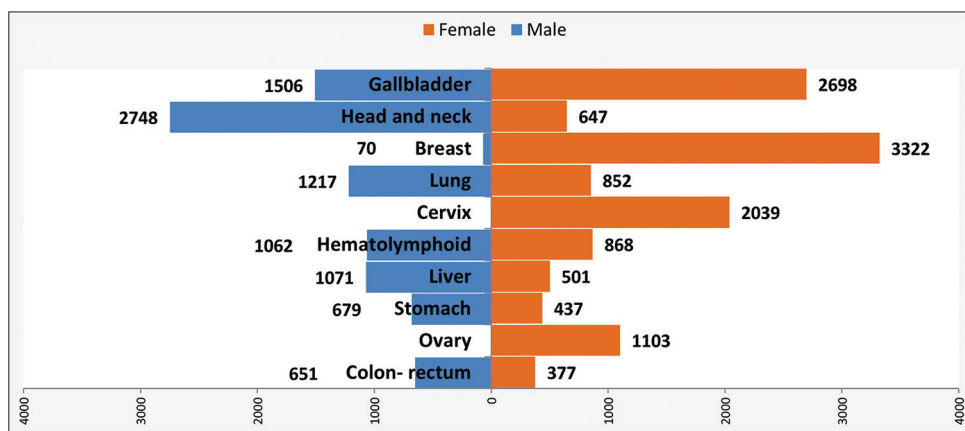
A total of 32,057 cancer patients were registered in the HBCR between January 2014 and December 2021. Out of these, 21,848 patients (68.2%) constituted the top ten cancer sites [Figure 1]. The top ten cancers among both sexes were cancer gallbladder (*n* = 4204, 13.1%), head and neck (*n* = 3395, 10.6%), breast (*n* = 3392, 10.6%), lung (*n* = 2069, 6.5%), cervix (*n* = 2039, 6.4%), hematology (lymphoid) (*n* = 1930, 6.0%), liver (*n* = 1572, 4.9%), stomach (*n* = 1116, 3.5%), ovary (*n* = 1103, 3.4%), and colon-rectum (*n* = 1028, 3.2%) [Table 1, Figure 2].



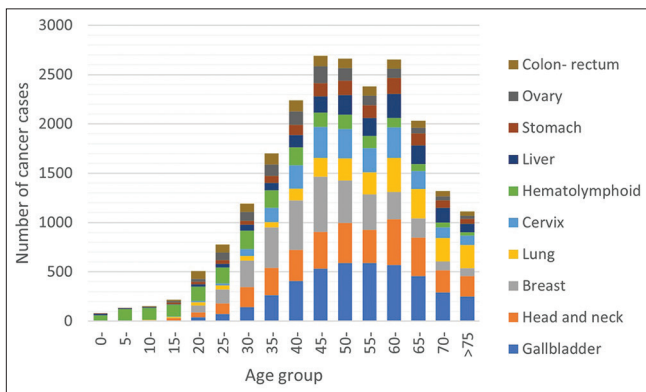
**Figure 1:** Patient flow diagram of the study

**Table 1: Top ten common cancers registered between January 2014 and December 2021 in the Hospital-Based Cancer Registry**

Rank	Cancer	n								Total [n(%)]	Median age in years (range)	Male: female
		2014	2015	2016	2017	2018	2019	2020	2021			
1	Gallbladder	370	506	619	911	711	273	383	431	4204 (13.1)	55 (13-93)	0.55
2	Head and neck	345	465	483	678	446	188	389	401	3395 (10.6)	53 (11-85)	4.2
3	Breast	303	413	435	592	476	220	441	512	3392 (10.6)	46 (12-86)	0.02
4	Lung	144	200	285	414	376	128	269	253	2069 (6.5)	50 (9-90)	1.4
5	Cervix	239	289	261	412	320	96	204	218	2039 (6.4)	51 (17-90)	-
6	Hemato-lymphoid	135	149	164	337	375	158	292	320	1930 (6.0)	38 (0-86)	1.2
7	Liver	117	150	153	307	228	100	256	261	1572 (4.9)	55 (0-92)	2.1
8	Stomach	99	97	134	185	150	67	196	188	1116 (3.5)	53 (10-87)	1.5
9	Ovary	69	97	135	206	189	64	147	196	1103 (3.4)	45 (7-85)	-
10	Colon-rectum	92	119	157	179	163	60	117	141	1028 (3.2)	49 (12-92)	1.7



**Figure 2:** Distribution of various cancers based on gender



**Figure 3:** Distribution of various cancers among different age groups

The median age of presentation among all cancer patients was 49.5 years (Range: 0-93 years). The distribution of various cancers according to age groups is shown in Figure 3. Except for the earlier age of presentation in hematolymphoid malignancies (median age: 38 years; range: 0-86 years), the median age of all other cancers was reported in the fifth or sixth decades of life [Table 1].

The most common cancers among males and females have been shown in Supplementary Figures 1 and 2. There

was a female predilection with a male-to-female ratio of 0.55 among cancer gallbladder patients. On the contrary, head and neck cancers, lung, hematolymphoid, liver, stomach, and colorectum showed a male predisposition [Table 1, Figure 2].

The cancers showing declining trends in the number of cases over consecutive years were cancer cervix (APC = -0.271, Confidence Interval: -0.582-0.029, p- 0.071) and hematolymphoid malignancies (APC = -0.262, Confidence Interval: -0.563-0.024, p- 0.073). Rest all showed an upward rising trend [Figure 4, Table 2].

## DISCUSSION

The present study reports cancer gallbladder (n = 4204, 13.1%) to be the most common cancer registered between 2014 and 2021 in the registry. However, upon stratification based on sex, it was placed second after head and neck cancer in males and after breast cancer in females.

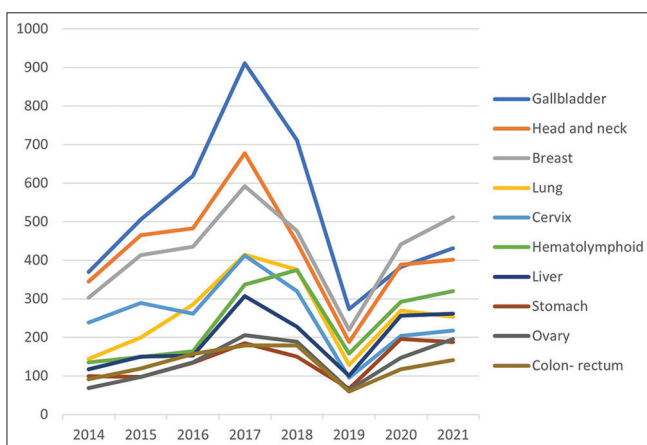
### Gallbladder cancer

It shows a rising trend with an annual percentage change of 2.80 (Confidence Interval: -0.095 to 5.786, p-0.056). A preliminary analysis earlier had also revealed similar findings.<sup>[6]</sup> In contrast, the Indian factsheet shows only 1.5%

**Table 2: Annual Percentage Change (APC) in the total number of cases of the top ten cancers registered in the Hospital-Based Cancer Registry (HBCR) from 2014 to 2021**

Rank	Cancer site	Annual Percentage Change (%)	95% Confidence Interval	P
1	Gallbladder	2.801	-0.095-5.786	0.054
2	Head and neck	3.012	0.980-5.181	0.006*
3	Breast	2.402	2.217-3.157	<0.001*
4	Lung	2.523	0.774-4.308	0.006*
5	Cervix	-0.271	-0.582-0.029	0.071
6	Hematolymphoid	-0.262	-0.563-0.024	0.073
7	Liver	1.867	1.401-2.321	<0.001*
8	Stomach	1.156	0.878-1.437	<0.001*
9	Ovary	2.412	0.763-4.201	0.006*
10	Colon-rectum	1.862	1.443-2.411	<0.01*

\*Indicates significant  $P < 0.05$



**Figure 4:** Time trends of the top ten cancers at the Hospital-Based Cancer Registry (HBCR)

new cases of cancer gallbladder among the total incident cases annually, pushing it to the 20<sup>th</sup> position.<sup>[1]</sup> The disease also appears in the top ten list of Delhi, West Bengal, and Assam PBCRs.<sup>[2]</sup> The exact cause of the high incidence of cancer gallbladder in the region is unclear; however, cholesterol gallstones,<sup>[7]</sup> mustard oil consumption,<sup>[8]</sup> heavy metals,<sup>[9]</sup> etc., have been reported to have an association with the disease. Gallstones associated with chronic cholecystitis have a 34-fold increased risk of getting the disease.<sup>[7]</sup> A greater preponderance among females (M: F =0.55) was noted in our study, which is in line with other studies.<sup>[10,11]</sup> Various reasons indicating exposure to estrogen and progesterone have been suggested including early age of marriage and children in India.<sup>[12]</sup> The presence of estrogen and progesterone receptors in gallbladder mucosa may cause stasis that increases the exposure to toxins of the bile and gallstone formation. A familial relative risk of 3.15 has been reported.<sup>[13]</sup> Such a high incidence of the disease in the region coupled with a grim prognosis may warrant screening measures to diagnose it early, especially in high-risk cases.<sup>[14]</sup> Awareness and education on prompt addressal of gallstones may be helpful.<sup>[15,16]</sup> More focused research on all aspects of this disease management is urgently required.

### Head and neck cancer

A high incidence of head and neck malignancies (n = 3395, 10.6%) in our registry, especially among males may be due to the high prevalence of tobacco use in the region.<sup>[17-19]</sup> Despite being tobacco-related cancer that may be prevented to a great extent,<sup>[20]</sup> the rising trend in the number of cases (APC of 3.0. Confidence interval: 0.980 to 5.181, p-0.006) over consecutive years in the region is a great cause of concern. With the knowledge of the fact that tobacco is an important cause of this most common cancer among males in the region, strict measures of tobacco control programs are needed. Specific measures of primary prevention may include imposing a complete ban on all sorts of tobacco, health education to adolescents in schools and colleges, etc. Tobacco de-addiction centers may have an important role to play in the prevention of this disease. Another important tobacco-related malignancy that stood at fourth position in the registry was lung cancer (n = 2069, 6.5%), and holds the same position in the national list as well.<sup>[1]</sup>

### Cancer breast and cancer cervix

Breast cancer (n = 3392, 10.6%) has been the most common cancer among females since the inception of the registry and is showing significantly rising trends (APC = 2.4, Confidence Interval: 2.217 to 3.157,  $P < 0.001$ ) in number of cases in the region. In fact, the disease outnumbered cancer gallbladder in the last couple of years of the study period. On the contrary, cervical cancer (n = 2039, 6.4%) is showing a decline in numbers (APC = -0.07, Confidence Interval: -0.582 to 0.029, p- 0.07) over time. The rise in breast cancer and decline in cervical cancers are reported from most other registries of India, however, the rate of decline in numbers of cervical cancer (in terms of APC) is noted to be much lower than in other registries.<sup>[3,21]</sup> This may be attributed to the adoption of an urban lifestyle including dietary changes, late age of marriage and children, lack of breastfeeding, etc., The possible causes of the decline of the cancer cervix may be improved hygiene, socioeconomic changes, adoption of a Western lifestyle, detection of pre-cancerous lesions, etc.<sup>[21,22]</sup> It may be early to give credit to the human



papillomavirus (HPV) vaccination which began only in the last decade,<sup>[23,24]</sup> for a disease like cancer cervix with such a long latency period. Realizing the high prevalence of preventable cancers, the National Programme for Non-Communicable Diseases (NP-NCD) initiated a national prevention and screening program for breast, cervical, and oral cancers along with diabetes and hypertension.<sup>[25,26]</sup> The NP-NCD erstwhile NPCDCS (National Programme for Control and Prevention of Cancer, Diabetes, Cardiovascular Diseases, and Stroke) supports for strengthening of cancer care centers in a state from district level to state cancer institutes.

Remaining all cancers of liver (n = 1572, 4.9%), stomach (n = 1116, 3.5%), ovary (n = 1103, 3.4%), and colorectum (n = 1028, 3.2%)<sup>[27,28]</sup> except hematomolymphoid (n = 1930, 6.0%) that were in the top ten list showed an overall increasing trend in the number of cases over years. The other prominent cancers noted in the registry were kidney (n = 612, 1.9%), brain (n = 543, 1.7%), and prostate (n = 467, 1.5%).

The state of Bihar lacked a PBCR till recent years. PBCR provides cancer statistics in a defined population and becomes the basis for assessing and controlling the impact of the disease on the community. Trend analysis of a disease helps evaluate primary as well as secondary prevention measures. HBCR on the other hand is a source of information to the hospital administration regarding patient care in a hospital.<sup>[29]</sup> In the absence of a PBCR, HBCRs become important in understanding the trends in cancer incidence of the geographical region. The present study is reporting the data from the largest cancer patient cohort by far from the region.

A nationwide study based on various sources including PBCR data depicted Bihar to have the least cancer incidence over a span of 26 years. Although the cancer crude incidence rose in the state from 44.9 (1990) to 53.9 (2016) new cases per 1,00,000 population, it continued to be the lowest in the country (81.2 in 2016).<sup>[4]</sup> The reliability of the results in the earlier study may be questioned due to limited representative data from the region. Nevertheless, despite the calculated lowest incidence, the state lacks adequate facilities for cancer diagnosis and treatment. There is a huge deficit in human resources as well as equipment for radiation therapy in the state. In a projection study for the year 2016, with 109,649 new cases, the state of Bihar required more than 100 telecobalt machines,<sup>[30]</sup> however, even in 2022, the actual number still is below ten, that too limited to the urban areas. The development of more comprehensive cancer care centers is required in the state that provides care to the rural population as well. The gap in radiotherapy facilities needs and availability in India is far too wide.<sup>[31]</sup>

The limitations of our study are, firstly, it lacks population-based data. Inherent selection bias due to hospital-based studies may not be ruled out. However, being a tertiary care State Cancer Institute, it may provide a fair idea about the trends of the entire region. Secondly, a dip in the number of cases that occurred due to operation disruptions of our HBCR at the institute level in 2019 and due to the coronavirus 2019 pandemic in 2020.

## CONCLUSION

Cancer Gallbladder continues to lead among all cancer sites over the years since the inception of our HBCR. Tobacco-related malignancies including head and neck and lung cancers are showing a rising trend which calls for urgent action by imposing a complete ban on all forms of tobacco. Breast cancers are on the rise too unlike cervical cancers which are on a constant decline. Measures of proper implementation of cancer prevention, awareness, and screening programs, and attention to adequate infrastructure and manpower for early access to diagnosis and treatment are need of the hour. Research activities focused on gallbladder cancer causation and treatment are urgently required.

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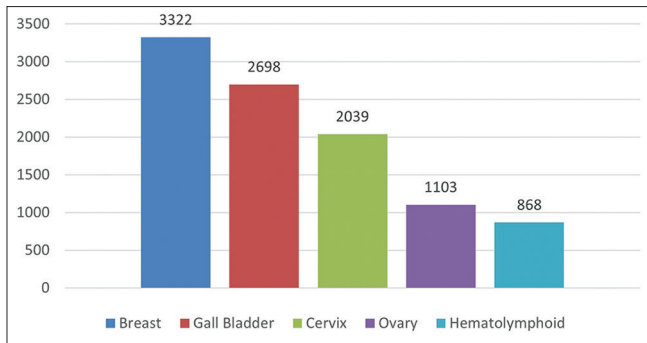
## Conflicts of interest

The results were presented at annual conference of Association of Radiation oncologists of India (AROICON) 2022 New Delhi.

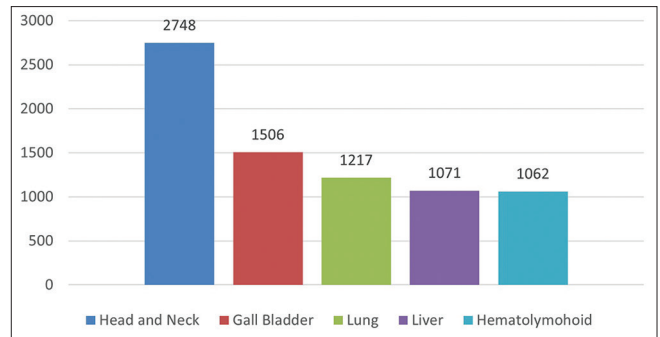
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**Supplementary Figure 1:** Top five female malignancies in HBCR of SCI, Bihar(2014 to 2021)



**Supplementary Figure 2:** Top five male malignancies in HBCR of SCI, Bihar(2014 to 2021)