

# Patterns of Neoplasm among the Tribal and Non-Tribal Communities in Wayanad District of Kerala, India: A Hospital Based Cross-Sectional Study

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DOI: 10.55489/njcm.150320243591

## ABSTRACT

**Background:** The burden of neoplasms coupled with the inaccessibility to health services has always been a public health concern among the tribal population. The objective of the study was to determine the patterns of neoplasm and its associated factors among the tribal and non-tribal communities attending a primary care hospital in Wayanad, Kerala.

**Methodology:** A record based cross-sectional study was conducted in a primary care hospital in Wayanad, Kerala. Data of patients who attended the hospital from January 2016 to December 2021 were collected from the procedure registry. The independent predictors of the community were identified using regression model (p value <0.05 was significant).

**Results:** Among the 650 study participants, majority (85.3%) were females. The mean ( $\pm$ SD) age was 41.62  $\pm$  15.26 years. Only 8.5% of the study participants had malignant lesions. Multivariable analysis revealed that the pre-malignant and malignant lesions were more among the tribals [AOR (95% CI) =3.31 (1.46-7.52)] with a female preponderance [AOR (95% CI) =1.99 (1.17-3.40)]. The other independent predictors of the community were neoplasms of gastrointestinal system [AOR (95% CI) =2.90 (1.04-8.04)] and age less than 20 years [AOR (95% CI) =2.42 (1.06-5.54)].

**Conclusion:** An increasing trend of malignancy and pre-malignancy is seen among the tribal communities.

**Keywords:** Indigenous population, Malignancy, Tumour, Trends

## ARTICLE INFO

**Financial Support:** None declared

**Conflict of Interest:** None declared

**Received:** 06-12-2023, **Accepted:** 05-02-2024, **Published:** 01-03-2024

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**How to cite this article:** Mohandas NV, George N, Vasudevan S, Dinesh A, Mohandas V, Kulothungan K, Rock Britto D, Muniyapillai T, Jeevagan A. Patterns of Neoplasm Among the Tribal and Non-Tribal Communities in Wayanad District of Kerala, India: A Hospital Based Cross-Sectional Study. Natl J Community Med 2024;15(3):192-198.  
DOI: 10.55489/njcm.150320243591

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www.njcmindia.com | pISSN09763325 | eISSN22296816 | Published by Medsci Publications

## INTRODUCTION

India has the second largest tribal population in the world after Africa.<sup>1,2</sup> Spread across 75 tribes, there are over 104 million tribal people who live in India which accounts for approximately 8.6% of the country's population.<sup>2</sup> These scheduled tribe groups tend to display high levels of unawareness and lack the capacity to aspire; consequently, their perceptions regarding health often do not adequately correspond to their real health needs.<sup>3</sup> Just like the indigenous populations in other countries, the Scheduled Tribes of India also have less opportunities to voice their concerns.<sup>4</sup>

According to the 2011 Indian Census data, Kerala has a Scheduled Tribe population of 4,84,839, accounting for approximately 1.5% of the total population of the state.<sup>2</sup> The majority of Kerala's Scheduled Tribes are found in the interior and hilly districts of Wayanad (31.2%), Idukki (11.5%) and Palakkad (10.1%).<sup>2</sup> Though Kerala has achieved outstanding progress in human development, its health status is a mixture of low overall mortality co-existing with considerable morbidity, mostly caused by diseases linked to underdevelopment, poverty and non-communicable diseases.<sup>5</sup>

Non-communicable diseases (NCDs) have surpassed communicable diseases in the global prevalence in the last decade.<sup>6</sup> NCDs contribute to more than 36 million deaths every year globally and 80% of these deaths occur in low and middle-income countries.<sup>7,8</sup> Kinra et al had demonstrated that NCD rates are steadily increasing even in the rural areas of India and had become the leading cause of death by 2010.<sup>7</sup> Kerala has the highest rates of NCD risk factors in India as reported by recent studies.<sup>9,10</sup>

Neoplasms are abnormal growths of tissue in the body which can be benign as well as malignant.<sup>11</sup> As per recent studies, one in nine people in India are likely to develop a malignancy in their lifetime and the incidence of malignancies are likely to increase by 12.8% in 2025 in comparison with 2020.<sup>12</sup> The average prevalence of cancers in Kerala state is the highest in the country.<sup>13</sup> The diagnosis of neoplasms including malignancies need to be done early so that the patients have the best chances of survival.<sup>14</sup> Effective screening strategies for neoplasms need to be implemented in order to improve the outcomes.<sup>15</sup> Inaccessibility to such services will increase the cost of treatment and lowers the chances of survival.<sup>16</sup>

There is increasing evidence that marginalized groups are more at risk of NCDs as they have limited access to health services, more exposed to harmful addictions like tobacco and unhealthy diet.<sup>9</sup> Tribal population in India have high rates of hypertension and other risk factors of NCD.<sup>17,18</sup> Recent studies have reported a high prevalence rate of precancerous oral lesions and a significant variation in the cancer patterns as well as the demographic parameters of the tribal population in Kerala.<sup>19-21</sup>

Majority of the studies on neoplasms among the tribals are focused only on specific neoplasms while there is very limited data on the demographic profile of different neoplasms which affect the tribal populations.

This study aimed to determine the patterns of neoplasm and its associated factors among the tribal as well as non-tribal communities attending a primary care hospital in Wayanad, Kerala.

## METHODOLOGY

A record based cross-sectional study was conducted in a primary care hospital in Wayanad district of Kerala. The hospital caters to approximately 50,000 patients per year and majority of the patients are from the tribal communities. Primary care as well as follow up is provided to each patient. Periodic specialist services (including Surgical and Gastro Medicine) for the diagnosis of neoplasms are also provided to the patients. Patients from different parts of Wayanad district utilize the services of the hospital. Institutional Ethical Committee (IEC) clearance was obtained before starting the study (IECHS/IRCHS/DSMCH/Cert/401B-Dhanalakshmi Srinivasan Medical College and Hospital-18/07/2023) and consent from the Administrative Medical Officer of the hospital was taken. The waiver of the patients' consent in this study was approved by the IEC.

**Sample Size:** The data of all patients who underwent Cytology or Histopathological Examination (HPE) at the primary care hospital from January 2016 to December 2021 was taken. A total of 650 patients were included in this study.

**Diagnostic Criteria:** All patients who underwent cytology or HPE in the hospital in view of suspicion of any form of neoplasm during the study period were included. 26 patients with incomplete records were excluded.

**Sampling Technique:** Universal sampling technique was used. The data was collected from the Histopathology and Cytology Registry of the hospital which included: a) Age and Gender b) Community to which the patient belonged (Tribal or Non-Tribal) as per the official list of scheduled tribes in Kerala issued by the Government of Kerala (census 1961-2011)<sup>22</sup> c) the year of diagnosis d) provisional diagnosis e) procedure performed i.e. Cytology (FNAC-Fine Needle Aspiration Cytology) and Histopathological Examination (HPE) f) Final report of the procedure (FNAC or HPE). The treatment modality received by the patient post diagnosis was not mentioned in the registry as tertiary management was not done at this hospital.

**Statistical Analysis:** The data collected was then entered in Microsoft Excel (Microsoft Corporation, Washington, USA), numerically coded and analysed

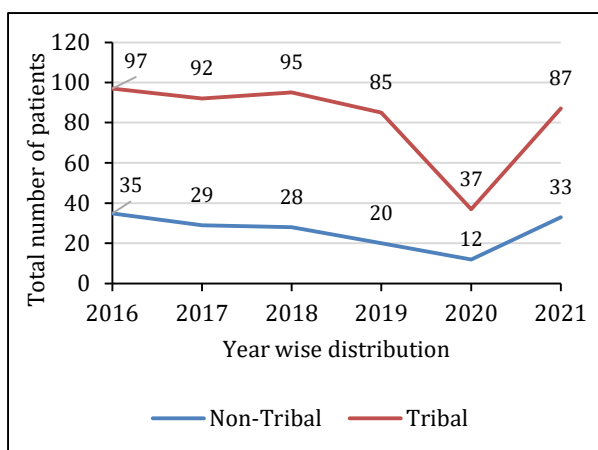
using IBM SPSS Statistics version 26 (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp). Descriptive statistics were expressed as frequencies and percentages. Regression model was used to find the independent predictors of tribal and non-tribal communities in terms of neoplasms taking a p-value <0.05 as significant. The Binomial Regression model was deemed fit using Hosmer and Lemeshow test ( $\chi^2 = 6.55$ ,  $p = 0.58$ ). The logistic regression model was statistically significant ( $\chi^2 = 48.76$ ,  $p = 0.001$ ) and explained 10.8% (Nagelkerke R Square) of the variance in patterns of neoplasm among the groups by correctly classifying 75.8% of the cases.

## RESULTS

The mean ( $\pm$ SD) age of the study participants was  $41.62 \pm 15.26$  years and most of them were females (85.1%). Majority (75.8%) of the patients were from the tribal communities. The age of the patients along with the gender and communities were studied. Majority of the patients were in the 21–40-year age group. (Table 1)

The trend of the number of patients utilizing the hospital services to undergo cytology and HPE are given in Figure 1. The number of patients drastically reduced in 2020-2021 which can be attributed to hospital services being diverted to COVID-19 patients during the COVID-19 lockdown enforced in March, 2020. The total number of patients attended to during the years 2016, 2017, 2018, 2019, 2020 and 2021 were 132, 121, 123, 105, 49 and 120 respectively. (Figure 1)

Majority of the patients (88.4%) had benign neoplasms, followed by malignant (8.5%) and pre-malignant lesions (3.1%). The most common test done for neoplasm detection was cytology (72.3%) and thyroid was the most common organ affected by neoplasm (64%).



**Figure 1: Tribal and Non-Tribal Communities utilizing the hospital services to undergo Cytology and HPE (from 2016-2021)**

However, the most common organ system involved in pre-malignancy and malignancy was the gastrointestinal tract (45.3%). The remaining details are given in Table 2.

**Table 1: Distribution of study participants according to socio demographic variables (n=650)**

Variables	Cases (%)
<b>Age (years)</b>	
<20	65 (10)
21-40	268 (41.2)
41-60	237 (36.5)
>60	80 (12.3)
<b>Gender</b>	
Male	97 (14.9)
Female	553 (85.1)
<b>Community</b>	
Non-Tribal	157 (24.2)
Tribal	493 (75.8)
<b>Year wise distribution</b>	
2016-2017	253 (38.9)
2018-2019	228 (35.1)
2020-2021	169 (26)

**Table 2: Distribution of patterns of neoplasm among the Tribal and Non-Tribal communities**

Variables	Cases (%)
<b>Type of Neoplasm</b>	
Benign	575 (88.4)
Pre-Malignant	20 (3.1)
Malignant	55 (8.5)
<b>Neoplasm affected organ systems of body (n=650)</b>	
Thyroid	416 (64)
Breast	52 (8)
GIT*	68 (10.5)
Skin	56 (8.6)
Lymphatic	39 (6)
Musculoskeletal	10 (1.5)
Neurological	6 (0.9)
Respiratory	3 (0.4)
<b>Only malignancy and pre-malignancy affected organ systems of body (n=75) §</b>	
Thyroid	9 (12)
Breast	16 (21.3)
GIT*	34 (45.3)
Skin	9 (12)
Lymphatic	6 (8)
Respiratory	1 (1.3)
<b>Tests done</b>	
Cytology	470 (72.3)
HPE†	180 (27.7)
<b>Procedure done</b>	
FNAC‡	470 (72.3)
Incision Biopsy	70 (10.8)
Excision Biopsy	110 (16.9)

\*GIT- Gastrointestinal Tract (including Oral and Oesophageal neoplasms)

†HPE- Histopathological Examination

‡FNAC- Fine Needle Aspiration Cytology

§ Includes only those organ systems affected by malignant and pre-malignant lesions (Benign lesions are not included)

**Table 3: Independent predictors based on Tribal and Non-Tribal communities**

Variable	Communities		Unadjusted OR (95% CI)	Adjusted OR (95% CI)
	Non-Tribal (%)	Tribal (%)		
<b>Year wise distribution</b>				
2016-2017	64 (25.3)	189 (74.7)	1	1
2018-2019	48 (21.1)	180 (78.9)	1.27 (0.82-1.94)	1.231 (0.78-1.92)
2020-2021	45 (26.6)	124 (73.4)	0.93 (0.59-1.45)	0.95 (0.59-1.53)
<b>Gender</b>				
Male	35 (36.1)	62 (63.9)	1	1
Female	122 (22.1)	431 (77.9)	<b>1.99 (1.25-3.16)*</b>	<b>1.99 (1.17-3.40)*</b>
<b>Age (years)</b>				
<20	13 (20)	52 (80)	1.61 (0.74-3.51)	<b>2.42 (1.06-5.54)*</b>
21-40	57 (21.3)	211 (78.7)	1.49 (0.84-2.63)	1.65 (0.89-3.04)
41-60	64 (27)	173 (73)	1.09 (0.62-1.91)	1.14 (0.62-2.08)
>60	23 (28.7)	57 (71.3)	1	1
<b>Tests done</b>				
Cytology	109 (23.2)	361 (76.8)	1.20 (0.81-1.78)	0.83 (0.56-1.23)
HPE†	48 (26.7)	132 (73.3)	1	1
<b>Neoplasm affected organ systems of body</b>				
Thyroid	88 (21.2)	328 (78.8)	1.81 (1.01-3.29)	1.55 (0.81-2.96)
Breast	21 (40.4)	31 (59.6)	0.71 (0.33-1.56)	0.43 (0.18-1.01)
GIT‡	7 (10.3)	61 (89.7)	<b>4.24 (1.63-11.03)*</b>	<b>2.90 (1.04-8.04)*</b>
Skin	22 (39.3)	34 (60.7)	0.75 (0.35-1.62)	0.73 (0.32-1.63)
Others§	19 (32.8)	39 (67.2)	1	1
<b>Type of Neoplasm</b>				
Benign	145 (25.2)	430 (74.8)	1	1
Pre-Malignant and Malignant	12 (16)	63 (84)	<b>1.77 (0.92-3.37)*</b>	<b>3.31 (1.46-7.52)*</b>

\*p value <0.05 is significant

†HPE-Histopathological Examination

‡GIT- Gastrointestinal Tract (including Oral and Oesophageal neoplasms)

§Others-Lymphatic, Musculoskeletal, Neurological and Respiratory systems

**Table 4: Characteristics of the study participants based on gender**

Variable	Gender		Unadjusted OR (95% CI)	Adjusted OR (95% CI)
	Males (%)	Females (%)		
<b>Year wise distribution</b>				
2016-2017	44 (17.4)	209 (82.6)	1	1
2018-2019	27 (11.8)	201 (88.2)	1.56 (0.93-2.62)	1.74 (0.97-3.12)
2020-2021	26 (15.4)	143 (84.6)	1.15 (0.68-1.96)	<b>1.86 (1.01-3.43)*</b>
<b>Category</b>				
Tribal	62 (12.6)	431 (87.4)	<b>1.99 (1.25-3.16)*</b>	<b>2.07 (1.21-3.54)*</b>
Non-Tribal	35 (22.3)	122 (77.7)	1	1
<b>Age (years)</b>				
<20	14 (21.5)	51 (78.5)	0.98 (0.44-2.18)	0.63 (0.25-1.59)
21-40	29 (10.8)	239 (89.2)	<b>2.22 (1.15-4.30)*</b>	1.16 (0.54-2.47)
41-60	37 (15.6)	200 (84.4)	1.45 (0.76-2.76)	0.86 (0.42-1.76)
>60	17 (21.3)	63 (78.8)	1	1
<b>Tests done</b>				
Cytology	39 (8.3)	431 (91.7)	<b>5.25 (3.34-8.26)*</b>	2.01 (0.97-4.12)
HPE†	58 (32.2)	122 (67.8)	1	1
<b>Neoplasm affected organ systems of body (n=650)</b>				
Thyroid	30 (7.2)	386 (92.8)	<b>7.86 (4.11-15.02)*</b>	<b>4.93 (2.21-11.02)*</b>
Breast	2(3.8)	50 (96.2)	<b>15.27 (3.37-69.13)*</b>	<b>15.26 (3.28-70.82)*</b>
GIT‡	20 (29.4)	48 (70.6)	1.46 (0.69-3.08)	1.36 (0.59-3.14)
Skin	23 (41.1)	33 (58.9)	0.87 (0.41-1.85)	0.95 (0.42-2.14)
Others§	22 (37.9)	36 (62.1)	1	1
<b>Type of Neoplasm</b>				
Benign	81 (14.1)	494 (85.9)	1	1
Pre-Malignant and Malignant	16 (21.3)	59 (78.7)	0.60 (0.33-1.10)	1.04 (0.49-2.22)

\*p value <0.05 is significant

†HPE-Histopathological Examination

‡GIT- Gastrointestinal Tract (including Oral and Oesophageal neoplasms)

§Others-Lymphatic, Musculoskeletal, Neurological, Respiratory systems

The sociodemographic details including age of the patients, category of patients and year wise distribution was compared with the tribal and non-tribal communities. Tribal communities had 3.31 times odds of developing pre-malignant and malignant lesions. There is a female preponderance among the tribal population utilizing the services of the hospital [AOR (95% CI) =1.99 (1.17-3.40)]. Tribal youths <20 years have 2.42 times odds of having a neoplasm and gastrointestinal system had 2.90 times odds of having a neoplasm among tribes as compared to other systems in the body. (Table 3)

The study participants were studied based on the gender distribution. Statistically significant associations were present for the 2020-2021 period, tribal category as well as the organ systems involved in neoplasms especially Thyroid and Breast. (Table 4)

## DISCUSSION

This study presents a comprehensive overview regarding the trends and patterns of neoplasm among the tribal and non-tribal communities of Wayanad district in Kerala. The study concludes that majority (88.4%) of the neoplasms are benign; however, the tribal communities had 3.31 times odds of developing premalignant and malignant lesions as compared to the non-tribal population. A similar result was obtained in a study by Kerketta et al in 2023 which concluded that breast cancer was 2.37 times more significantly associated with the tribals as compared to the non-tribals.<sup>23</sup> Recent studies on the tribal population in India have reported that NCD related deaths have surpassed deaths due to infectious diseases.<sup>24,25</sup> This may be attributed to the early epidemiologic transition in this population as mentioned in the tribal health report submitted to the Government of India by Dr Abhay Bang et al.<sup>26</sup>

This study concludes that the most common neoplasm seen is in the Thyroid (64%) followed by GIT (10.5%). Populations residing in hilly areas of the country are usually considered to be high risk groups for thyroid disorders<sup>27,28</sup> and that is consistent with the findings of this study as well. The age group <20 years have 2.42 times odds of developing a neoplasm which is statistically significant in this study. This may be attributed to the rising trend of smoking and tobacco chewing among young Indians.<sup>29</sup> In India, 8.3% of women and 27.4% of men in the 15–24 age range use tobacco in any form, according to the Global Adult Tobacco Survey 2009–2010.<sup>30</sup> Recent studies indicate that adolescent females are more prone to thyroid disorders.<sup>31,32</sup> The study conducted by Ganie et al in 2020 among the tribal population of Kashmir valley report similar findings.<sup>33</sup> A similar study conducted in Delhi in 2021 by Randeep Singh et al have comparable results but it was not done among tribal population.<sup>34</sup> This consistent pattern may be related to the ongoing rise in thyroid disorders including neoplasms in the past decade

throughout India as reported by regional surveys, the reasons for which vary from increase in autoimmunity to rapid iodination and obesity.<sup>35</sup>

An increasing trend in neoplasms have been noted over the years in this study and although it was not statistically significant, this finding was consistent with various studies done from the report of the National Cancer Registry Programme (2012-2016) which states that the increasing trend will continue till 2026.<sup>36</sup> It is estimated that the total number of new cases in males will be increased from 0.589 million in 2011 to 0.934 million by the year 2026.<sup>36</sup> This may be due to numerous factors such as unhealthy lifestyle practises and dietary habits, extreme poverty, poor hygiene, lack of awareness and intricate social dynamics.<sup>37</sup> The reduction in the number of neoplasms diagnosed during the 2020-2021 period in this study compared to the previous years is probably due to the COVID-19 lockdown which was enforced in March, 2020 during which the specialist and diagnostic services were geared towards COVID-19 patients.

The gender wise distribution of neoplasms shows a statistically significant female preponderance. Recent studies do indicate the increasing trend of malignancies among the female population in India.<sup>38,39</sup> This can be due to the changing lifestyles of tribal women, their low awareness regarding the disease as well as their reluctance to seek treatment in the early stage of the disease owing to social norms. However, this also signifies that the pattern of utilization of healthcare services among the tribal as well as non-tribal women has improved as majority of the patients in this study were women. The study conducted by Islary et al among different tribal communities in India show similar findings.<sup>40</sup>

A recent study by Ramachandra et al conducted among the tribal population in Andhra Pradesh concluded that the incidence of oral cancer among the tribal youths is on the rise which can be attributed to the consumption of increased amounts of tobacco and alcohol.<sup>41</sup> This is consistent with the results found in this study which shows that tribal populations have 2.90 times odds of developing GIT neoplasms (majority of which includes oral and oesophageal neoplasms) as compared to the non-tribal population.

This study reported that majority of the malignant lesions (45.3%) are in the GIT followed by breast (21.3%) which is consistent with the findings of recent studies done in India.<sup>23,42</sup> The rise in GIT malignancies may be attributed to the dietary practices which favour spicy, preserved food coupled with smoking and alcohol intake.<sup>43</sup> The traditional dietary habits of the tribal population is shifting mostly due to the government regulations for wildlife protection which prohibits them from using the forest's resources.<sup>44</sup> Recent studies state that nearly 60% of the breast cancer cases in India are diagnosed only in the advanced stage of the disease as women prefer to



overlook the early symptoms.<sup>45,46</sup> Limited awareness about cancer coupled with the paucity of healthcare facilities, out-of-pocket expenses, faith in traditional healers and misconceptions are the main barriers for tribal women to prioritize their health over other demands.<sup>47</sup> Reports from recent studies indicate that Breast self-examination (BSE) is not a very common practise among women, particularly in rural India.<sup>48,49</sup>

There are a few limitations in this study. The data from 2016 to 2021 was taken from the Histopathology and Cytology Registry of the Hospital where only limited amount of information is available. Data regarding socio-economic status, education, occupation, risk factors, onset and the profile of diagnosis about disease was not available in the registry. Data from only a single hospital was taken into consideration. The neoplasm diagnostic services were partially suspended at the hospital during the COVID-19 lockdown which led to a reduction in the number of neoplasms diagnosed during 2020-2021 period.

Neoplasms being multifactorial in nature cannot have a one-size-fits all solution. Hence, the government should spearhead health awareness, early detection as well as screening programmes in order to improve the health literacy of this community for effective identification of neoplasms. Schemes for the diagnosis, treatment and follow up care of tribal patients suffering from various neoplasms also need to be undertaken by the government. A follow up multi-centric longitudinal study is needed to further analyse the increasing trends of neoplasm in the tribal community in detail.

## CONCLUSION

This study has concluded that there is an increasing trend of pre-malignancy and malignancy among the tribal communities with the most common system involved being gastrointestinal (including oral and oesophageal neoplasms). The number of neoplasms in the younger age groups are on the rise and a female preponderance among the tribals was noted in the study. The increasing trends of neoplasms among the tribals should be given an urgent focus with a note on the screening facilities and existing diagnostic/treatment facilities among the populations.

## ACKNOWLEDGEMENT

The authors would like to thank Dr Ajitha Kumari, Medical Officer of Amrita Kripa Charitable Hospital along with all the staff members of the hospital and Dr Aswathy Sreedevi, Head of the Department of Community Medicine, Amrita Institute of Medical Sciences, Kochi for extending their valuable support during the conduct of this study.

## REFERENCES

- Scaria R, Sumesh K, Irfan T. Multi-dimensional Poverty Index (MPI) status of tribes in Attappady Block, Palakkad District, Kerala. *Asian Journal of Management Research*. 2013; 4(2): 232-240.
- Morbidity Pattern of Tribes in Kerala [Internet]. [cited 2024 Feb 4]. Available from: <https://www.iosrjournals.org/iosr-jhss/papers/Vol.%2021%20Issue4/Version-3/C0214033036.pdf>
- Dey SM, D. V. N, D. V. N, Jude M, Jude M. Assessment of periodontal health status among Koraga tribes residing in Mangalore taluk: a cross sectional study. *Int J Res Med Sci*. 2017 Aug 26;5(9):3980.
- Tripura B. Decolonizing ethnography and Tribes in India: Toward an alternative methodology. *Frontiers in Political Science*. 2023;5.
- Paving the way to achieving the United Nations Sustainable Development Goals for women from Indigenous communities: lessons from Attappady, India | Discover Sustainability [Internet]. [cited 2023 Sep 6]. Available from: <https://link.springer.com/article/10.1007/s43621-021-00009-y>
- Dandona L, Dandona R, Kumar GA, Shukla DK, Paul VK, Balakrishnan K, et al. Nations within a nation: variations in epidemiological transition across the states of India, 1990–2016 in the Global Burden of Disease Study. *The Lancet*. 2017 Dec 2;390(10111):2437–60.
- Kinra S, Bowen LJ, Lyngdoh T, Prabhakaran D, Reddy KS, Ramakrishnan L, et al. Sociodemographic patterning of non-communicable disease risk factors in rural India: a cross sectional study. *BMJ*. 2010 Sep 27;341:c4974.
- Sajeev P, Soman B. Prevalence of noncommunicable disease risk factors among the Kani tribe in Thiruvananthapuram district, Kerala. *Indian Heart J*. 2018;70(5):598–603.
- Thankappan KR, Shah B, Mathur P, Sarma PS, Srinivas G, Mini GK, et al. Risk factor profile for chronic non-communicable diseases: results of a community-based study in Kerala, India. *Indian J Med Res*. 2010 Jan;131:53–63.
- Sarma PS, Sadanandan R, Thulaseedharan JV, Soman B, Srinivasan K, Varma RP, et al. Prevalence of risk factors of non-communicable diseases in Kerala, India: results of a cross-sectional study. *BMJ Open*. 2019 Nov;9(11):e027880.
- Malignant Neoplasm: What It Is, Types & Factors [Internet]. [cited 2024 Feb 3]. Available from: <https://my.clevelandclinic.org/health/diseases/22319-malignant-neoplasm>
- Sathishkumar K, Chaturvedi M, Das P, Stephen S, Mathur P. Cancer incidence estimates for 2022 & projection for 2025: Result from National Cancer Registry Programme, India. *Indian J Med Res*. 2022;156(4–5):598–607.
- NCD- Non Communicable Diseases Control Programme – National Health Mission [Internet]. [cited 2023 Nov 17]. Available from: <https://arogyakeralam.gov.in/2020/03/23/ncd-non-communicable-diseases-control-programme/>
- Baba AI, Cătoi C. CANCER DIAGNOSIS. In: *Comparative Oncology*. The Publishing House of the Romanian Academy; 2007.
- Promoting cancer early diagnosis [Internet]. [cited 2023 Nov 16]. Available from: <https://www.who.int/activities/promoting-cancer-early-diagnosis>
- Loud J, Murphy J. Cancer screening and early detection in the 21st century. *Semin Oncol Nurs*. 2017 May;33(2):121–8.
- Muthanandam S, Babu BV, Muthu J, Rajaram S, Sundharam BS, Kishore M. Burden of oral precancer and cancer among an indigenous tribal population of South India – An evaluative study. *Indian Journal of Dental Research*. 2022 Jul 1;33(3):253.
- Azeez K, Ismail I. Blood pressure pattern and hypertension rates among selected tribal population of Kerala. *National*

- Journal of Physiology, Pharmacy and Pharmacology. 2017 Jan 1;7:1.
19. EBSCOhost | 127250966 | Cancer Patterns, Risk Habits, Treatment, And Follow Up Rate Of Tribals At A Tertiary Cancer Care Centre In Northern Kerala, India -A Retrospective Analysis.
  20. Palliyal SA. Oral health disparities among privileged and underprivileged tribes of south India - A study on precancerous oral lesions prevalence. *Annals of Oncology*. 2019 Nov 1;30:ix104-5.
  21. Rajkuwar A, Verma A, Vijayapandian H, Kumar P, Dheeraj M, Vincent V. Prevalence of Tobacco Use and Oral Mucosal Lesions among Nicobarese Tribal Population in Andaman and Nicobar Islands. *J Contemp Dent Pract*. 2021 Sep 1;22(9):975-8.
  22. ST\_Census.pdf [Internet]. [cited 2024 Feb 2]. Available from: [https://repository.tribal.gov.in/bitstream/123456789/75207/1/ST\\_Census.pdf](https://repository.tribal.gov.in/bitstream/123456789/75207/1/ST_Census.pdf)
  23. Kerketta ZH, Kujur A, Kumari N, Sagar V, Pushpa F. A Cross-Sectional Study on the Epidemiology of Newly Diagnosed Breast Cancer Patients Attending Tertiary Care Hospitals in a Tribal Preponderant State of India: Regression Analysis. *Cureus*. 15(6):e40489.
  24. Kaur P, Borah PK, Uike PV, Mohapatra PK, Das NK, Gaigaware P, et al. Non-communicable diseases as a major contributor to deaths in 12 tribal districts in India. *Indian J Med Res*. 2022 Aug;156(2):250-9.
  25. Dawa N, Narain JP. Noncommunicable diseases among tribal populations in India: A case of double jeopardy. *International Journal of Noncommunicable Diseases*. 2023 Mar;8(1):1.
  26. From the Desk of Chairman – Tribal Health Report, India [Internet]. [cited 2024 Feb 4]. Available from: <https://tribalhealthreport.in/preface/>
  27. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. *Indian J Endocrinol Metab*. 2011 Jul;15(Suppl2):S78-81.
  28. Yadav K, Pandav CS. National Iodine Deficiency Disorders Control Programme: Current status & future strategy. *Indian J Med Res*. 2018 Nov;148(5):503-10.
  29. Kakkar N, Gupta A, Sharma NK, Agarwal P, Kaur J. Adolescents and young adults: A study of distribution of cancer at ages 15-39 years in a tertiary care hospital from North India: Epidemiological considerations. *South Asian J Cancer*. 2017;6(4):180-2.
  30. Global-Adult-Tobacco-Survey-India-2009-2010-Report.pdf [Internet]. [cited 2024 Feb 4]. Available from: <https://ntcp.mohfw.gov.in/assets/document/surveys-reports-publications/Global-Adult-Tobacco-Survey-India-2009-2010-Report.pdf>
  31. Sayanna S, Shankar MU, Babu KR. Incidence of thyroid diseases in a tertiary hospital: a retrospective study. *International Surgery Journal*. 2019 Mar 26;6(4):1254-8.
  32. Pamidimarri G. Thyroid Dysfunctions in Tribal Women of the Bastar Region of Chattisgarh, India. 2020 May 13;
  33. Ganie MA, Charoo BA, Sahar T, Bhat MH, Ali SA, Niyaz M, et al. Thyroid Function, Urinary Iodine, and Thyroid Antibody Status Among the Tribal Population of Kashmir Valley: Data From Endemic Zone of a Sub-Himalayan Region. *Frontiers in Public Health*. 2020;8.
  34. Singh R, Shirali R, Chatterjee S, Adhana A, Arora RS. Epidemiology of cancers among adolescents and young adults from a tertiary cancer center in Delhi. *Indian Journal of Medical and Paediatric Oncology*. 2016 Apr;37(02):90-4.
  35. Menon AS. Rising prevalence of Thyroid disorders in India - The time to act is now. *Thyroid Research and Practice*. 2020 Dec;17(3):99.
  36. D'Souza NDR, Murthy NS, Aras RY. Projection of cancer incident cases for India -till 2026. *Asian Pac J Cancer Prev*. 2013; 14(7):4379-86.
  37. Pal SK. Increasing cancer incidence in India: What can be done. 2024 Feb 4;
  38. Jain Y, Kataria R, Patil S, Kadam S, Kataria A, Jain R, et al. Burden & pattern of illnesses among the tribal communities in central India: a report from a community health programme. *Indian J Med Res*. 2015 May;141(5):663-72.
  39. tribal\_health.pdf [Internet]. [cited 2023 Nov 9]. Available from: [https://aiggpa.mp.gov.in/uploads/project/tribal\\_health.pdf](https://aiggpa.mp.gov.in/uploads/project/tribal_health.pdf)
  40. Islary J. Health and Health Seeking Behaviour Among Tribal Communities in India: A Socio-Cultural Perspective. Rochester, NY; 2014.
  41. Ramachandra NB. Carcinogenic Habits of Tribals is It Inherited or Acquired, which Causes Oral Cavity Cancer: A Survey Report from Upper Northern Tribal Area of Andhra Pradesh (India). *International Journal of Head and Neck Surgery*. 2012 Apr 1;1(3):147-52.
  42. Muthanandam S, Babu BV, Muthu J, Rajaram S, Sundharam BS, Kishore M. Burden of oral precancer and cancer among an indigenous tribal population of South India - An evaluative study. *Indian J Dent Res*. 2022;33(3):253-7.
  43. Vasudevan S, Mehta A. Colorectal cancer in young Indians: Alarm bells are ringing. *Cancer Research, Statistics, and Treatment*. 2022 Dec;5(4):777.
  44. When tribals are forced to change food habit [Internet]. [cited 2024 Feb 4]. Available from: <https://www.downtoearth.org.in/blog/food/when-tribals-are-forced-to-change-food-habit-56080>
  45. Mehrotra R, Yadav K. Breast cancer in India: Present scenario and the challenges ahead. *World J Clin Oncol*. 2022 Mar 24;13(3):209-18.
  46. Gogia A, Deo S, Sharma D, Mathur S. Breast cancer: The Indian scenario. *JCO*. 2020 May 20;38(15\_suppl):e12567-e12567.
  47. Birje S, Patil AD, Munne KR, Chavan V, Joshi BN, Akula A, et al. Enablers & challenges of tribal women & health system for implementation of screening of non-communicable diseases & common cancers: A mixed-methods study in Palghar district of Maharashtra, India. *Indian J Med Res*. 2022 Aug; 156(2): 319-29.
  48. Chaturvedi M, Vaitheeswaran K, Satishkumar K, Das P, Stephen S, Nandakumar A. Time Trends in Breast Cancer Among Indian Women Population: An Analysis of Population Based Cancer Registry Data. *Indian J Surg Oncol*. 2015 Dec 1; 6(4): 427-34.
  49. Kumarasamy H, Veerakumar AM, Subhathra S, Suga Y, Murugaraj R. Determinants of Awareness and Practice of Breast Self Examination Among Rural Women in Trichy, Tamil Nadu. *J Midlife Health*. 2017;8(2):84-8.