# Geographical Distribution of Cancer in Northern Kerala, India: A Retrospective Analysis

| Ratheesan.K | Dr.Saina Sunilkumar, |
|---|---|
| Lecturer in biostatistics, Malabar cancer centre | Lecturer in Dept. Of cancer registry and epidemiology |
| **Subhradev Sen** | **Dr.Satheesan.B** |
| Lecturer in Biostatistics, Malabar Cancer Centre | Prof. in dept. of Surgical Oncology, Malabar Cancer Centre |

**ABSTRACT** *Cancer is a major burden of disease worldwide. Each year, tens of millions of people are diagnosed with cancer around the world, and more than half of the patients eventually die from it. In many countries, cancer ranks the second most common cause of death following cardiovascular diseases. This study focused to analyze the geographic variation of cancer cases who were reported in a tertiary cancer centre in northern Kerala during the year 2011.A retrospective analysis was done based on the data collected from the Medical Record Division of the Centre. Among the patients from this area an average 36 % of the cases had smoking habits. 20 % cases were alcoholic. It was found that a significant association between Education level of the patients with their addiction habits. Variables identified as potential predictors of an advanced stage at diagnosis were sex and marital status.*

## Introduction

Globally, almost 12.7 million people were diagnosed with cancer in 2008 (excluding non-melanoma skin cancers) and 7.6 million people died from cancer [1]. Cancer was the third highest cause of death (following cardiovascular disease and infectious and parasitic diseases) [2].Usage of Tobacco ,alcohol ,ultraviolet exposure ,diet, genetics etc. are identified as the risk factor of cancer incidence [3].Cancer was estimated to be the greatest contributor to the burden of disease, causing 19% of the entire disease burden, and half of this was due to lung, colorectal, prostate and breast cancers [4].According to National Institute of Health and Family Welfare (NIHFW),In India it is estimated that there are 2 to 2.5 million cancer patients at any given point of time with about 0.7 million new cases coming every year and nearly half die every year. Two-third of the new cancers are presented in advance and incurable stage at the time of diagnosis. More than 60% of these affected patients are in the prime of their life between the ages of 35 and 65 years. With increasing life expectancy and changing life styles concomitant with development, the number of cancer cases will be almost three times the current number. The age adjusted incidence rate per 100,000 for all types in India in urban areas range from 106-130 for men and 100-140 for women but still lower than USA, UK and Japan rates. 50% of all male cancers are tobacco related and 25% in female (total 34% of all cancers are tobacco related). The geographic regions used for this analysis are Districts which cover North Kerala, India without gap or overlap.

## Methods and Materials:

It is a retrospective study based on the hospital based cancer registry (HBCR) data for the year 2011 in a tertiary cancer center in north Kerala, India. The three northern districts Kasaragod, Kannur and Kozhikode were included in the study. A semi-structured questionnaire was used to collect the information from patient's medical record about various characteristics under study. The study variables were age, sex, marital status, personal habits (smoking, alcohol consumption, pan chewing), district , tumor staging at diagnosis and education level of the patient. Staging is based on a combination of anatomical, pathological, operative, and clinical variables.

The association between qualitative variables was tested using chi-square test and Fisher's exact

Test. One way ANOVA was used to compare mean values in different districts. The relationship between predictor variables and disease staging at diagnosis was then examined by logistic regression. The collected data was entered and analyzed by using SPSS Version 20. P value of < 0.05 was considered significant.

## Result:

There were 2366 cancer patients were registered at a Tertiary Cancer Centre in north Kerala from the districts of Kannur, Kasaragod and Kozhikode during the year 2011 in which 1259 are males and 1107 are females. Of these, 1670 patients were from Kannur, 457 from Kozhikode and 239 from Kasaragod districts. The demographic characteristics, education level , religious belief, Tumor staging and other information were provided in Table 1. In all districts majority of patients were from Hindu communities and about 70 % of the patients in each district was poorly educated.

**Table 1.**

| Table 1. Distribution of Demographic Characteristics,Family History and Other Informations. | | |
|---|---|---|
| **Kannur** | **Kasaragod** | **Kozhikode** |
| Patients 1670 | Patients 239 | Patients 457 |
| **Sex** | **Sex** | **Sex** |
| Male 885(53%) | Male 134(56%) | Male 240(53%) |
| Female 785 (47%) | Female 105(44%) | Female 217(47%) |
| **Habits** | **Habits** | **Habits** |
| Smoking 561 (34%) | Smoking 96(40%) | Smoking 149(33%) |
| Alcohol 317 (19%) | Alcohol 60(25%) | Alcohol 71(16%) |
| Pan chewing 233 (14%) | Pan chewing 46(19%) | Pan chewing 74(16%) |
| **Staging** | **Staging** | **Staging** |
| I 146( 9%) | I 17(7%) | I 43(9%) |
| II 289( 17%) | II 36(15%) | II 80(18%) |
| III 638(38%) | III 87(36%) | III 178(39%) |
| IV 228(14%) | IV 44(18%) | IV 78(17%) |
| Unknown 369( 22%) | Unknown 55(23%) | Unknown 78(17%) |
| **Education** | **Education** | **Education** |
| Primary or less 1025(61%) | Primary or less 172(72%) | Primary or less 305(67%) |
| Middle or more 645(39%) | Middle or more 67(28%) | Middle or more 152(33%) |
| **Religion** | **Religion** | **Religion** |
| Hindu 1090(65%) | Hindu 176(74%) | Hindu 275(60%) |
| Muslim 423(25%) | Muslim 45(19%) | Muslim 162(35%) |
| Christian 155( 9%) | Christian 18(8%) | Christian 19(4%) |
| **Marital Status** | **Marital Status** | **Marital Status** |
| Unmarried 118(7%) | Unmarried 16(5%) | Unmarried 25(5%) |
| Married 1244 (74%) | Married 170(71%) | Married 346(76%) |
| Widowed 306(18%) | Widowed 51(21%) | Widowed 86 (19%) |

There was a district wise variation on patient's alcoholic consumption, marital status, religious belief and education level with 5% significance level. It was observed that there exist a significant difference in the mean age of patients (P value <0.05) for different districts. More than half of the cases were diagnosed as stage III and stage IV in all the districts.

There was a statistical variation in the proportion of female patients in different districts who were diagnosed at an advanced stage of cancer. In Kannur and Kozhikode more than 55% female patients were diagnosed at advanced stages, whereas for Kasaragod it was only 50%. In Kannur and Kozhikode there were more than 70% male patients were diagnosed after the age of 55 years .In case of Kasaragod it was about 55%.It was also noticed that for all the three districts, older age was a potential risk factor for cancer.

The site wise distribution of top 9 cancer for all the districts were provided in Table 2. Breast and Lung was the leading sites of cancer from Kannur and Kasaragod, while Breast and mouth was the leading sites in case of Kozhikode district. Apart from small variation, the general trend of cancer was almost same for all the three districts.

**Table.2.**

| Table2. Site wise distribution of cancer in different districts | | | |
|---|---|---|---|
| Site | Kannur | Kozhikode | Kasaragod |
| Breast | 15% | 13% | 15% |
| Lung | 15% | 11% | 13% |
| Mouth | 5% | 12% | 10% |
| Tongue | 4% | 4% | 6% |
| Ovary | 4% | 3% | 5% |
| Rectum | 4% | 4% | 3% |
| Cervix Uteri | 4% | 5% | 3% |
| Thyroid | 2% | 4% | 2% |
| Corpus uteri | 2% | 2% | 0% |

Multiple Logistic Regression was applied to find out the relationship between suspected predictor variables(namely ,Alcohol consumption, Smoking habits, Sex, Marital Status and the district from which the patient came) and staging of cancer at diagnosis .Sex and marital status of the patient were found to be the potential risk factors in staging of cancer at diagnosis.

Chi-square test for independence was done to check the association between different variables. Table 3 provides the details of chi-square test for statistically significant cases.

**Table.3.**

| for independence | | Chi-square test | |
|---|---|---|---|
| Variable 1 | Variable 2 | Chi-square value | P-value |
| District | Alcohol consumption | 9.36 | P-value < 0.05 |
| District | Religion | 35.82 | P-value < 0.05 |
| District | Education | 12.7 | P-value < 0.05 |
| Education | Smoking habits | 10.7 | P-value < 0.05 |
| Education | Pan chewing habits | 28.9 | P-value < 0.05 |
| Education | Religion | 73.6 | P-value < 0.05 |
| Staging | Smoking habits | 12.5 | P-value < 0.05 |
| Staging | Sex | 38.8 | P-value < 0.05 |
| Staging | Marital status | 24.3 | P-value < 0.05 |

The above table shows that there was a district wise association in patient's alcohol consumption, religion and education status. Similarly there was a significant association between Education of the patients with their addiction habits and religious belief .

**Discussion:**
According to GLOBOCAN 2012, an estimated 14.1 million new cancer cases and 8.2 million

Cancer related deaths occurred in 2012, compared with 12.7 million and 7.6 million, respectively, in 2008. Prevalence estimates for 2012 show that there were 32.6 million people (over the age of 15 years) alive who had had a cancer diagnosed in the previous five years.

With significant improvement in treatment and prevention of cardiovascular diseases, cancer has or will soon become the number one killer in many parts of the world. As elderly people are most susceptible to cancer and population aging continues in many countries, cancer will remain a major health problem around the globe [5]. Kerala has roughly 35,000 new cancer cases every year (age-adjusted incidence), based on the cancer registry data. There are 913 male and 974 female cancer patients per million in Kerala. A total of 1, 00,000 cancer patients are in prevalence annually in the state. All living cells in the history have a chance of cancer occurrence. Studies have shown that 70 – 90% of cancers are environmental. The most important among the environmental exposures are lifestyle related factors. Dietary practices, reproductive and sexual practices and others account for up to 30% of cancers. Rightful changes in lifestyle can reduce mortality and morbidity [6].

High incidence of lung cancer among males in these districts could be due to high level consumption of tobacco and alcohol. According to the report of Hospital Based Registry for the year 2010, more than 90 % lung cancer patients were smokers[7]. The prevalence of smoking and alcohol consumption among females was very low compared to males in these areas but chewing of betel and tobacco was not very less in old aged women. As per the cancer registry report of the concerned centre in 2010, lung cancer stood first among males with 38% of all tobacco related cancers (HBCR, 2010). Here we can see that approximately 36% of the overall patients had the habit of smoking . Patients from Kasaragod district around 40% had the habit of smoking. Based on the 2011 registration of the centre it was found that 10% female lung cancer patients were passive smokers [7]. According to American Cancer Society passive smoke has been linked to lung cancer. There were also some evidences suggesting it might be linked to lymphoma, leukemia, and brain tumors in children, and cancers of the larynx (voice box), pharynx (throat), nasal sinuses, brain, bladder, rectum, stomach, and breast in adults.

About 19% of tobacco consumption in India is in the form of cigarettes, while 53% is smoked as *bidis*, the rest is used mainly in smokeless form. *Bidis* tend to be smoked mainly by lower economic classes and have a level of social acceptance in different cultures [8].  In north Kerala there are plenty of *bidi* workers and *bidi* manufacturing villages. The availability and consumption of *bidi* is more in these areas. That is also may be a possible reason of high rate of tobacco related cancers in this area.

It is an important fact which is statistically proved was the association between education level and the addiction habits. In both smoking as well as alcoholic consumption was well associated with their education. Now the government started implementing schemes like ASHWAS for cancer screening and offer free treatment for the positive cases. According to the data for our study centre, most of the patients were coolie workers or farmers and they hadn't attended any cancer awareness camps. Lack of awareness compel them to neglect the initial problems or symptoms faced, resulting advanced stage diagnosis at the end. As the majority of the cases reported at the centre were in the advanced stage of cancer, it is essential to arrange cancer awareness camps and premalignant screening in the interior parts of these districts where people are less educated or coming from backward socio-economic status.

Moreover, studies have shown that there exist a positive association between red meat intake specifically and cancers of the esophagus and liver, and a borderline significant positive association for laryngeal cancer [11]. Out of the 33 million people in Kerala, Christians and Muslims together constitute around 47 percent and most of the meat eaters are from these communities [12]. There is culture and area wise variations in food habit of people in different parts of Kerala as well. A detailed study has to be formulated for getting concrete ideas in these respects.

In this study the factors identified as potential predictors of an advanced stage at diagnosis were sex and marital status. One of the previous study identified that gender remained a significant predictor of the total number of modifiable cancer risk factors; such that male gender was associated with having fewer risk factors relative to individuals of female gender [13].Further advanced research is required to identify the sex wise risk factor of the disease.

One limitation of this study is that it is solely based on Hospital based registry data. In North Kerala this centre is the only cancer hospital under the Government of Kerala. More than 90% patients are receiving free treatment schemes like *Karunya, Arogya insurance* etc. So the data analysed for this study caters most of the cancer patients from the mentioned districts. As Kasaragod is the northern most districts of Kerala, the chance of patient moving to the adjacent state, Karnataka, is also high. Before getting a report of Population Based Cancer Registry of this area we can use this data to identify and understand the trend of cancer in this districts.

### References

1.  Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM: GLOBOCAN 2008,Cancer Incidence and Mortality Worldwide: IARC CancerBase No 10 [Internet] Lyon, France: International Agency for Research on Cancer; 2010.

2.  Health statistics and informatics Department WHO: The Global Burden of Disease: updated projections Geneva: WHO 2008.

3.  World Cancer Research Fund, American Institute for Cancer Research: Policy and Action for Cancer Prevention Food, Nutrition, and Physical Activity: a Global Perspective Washington DC: AICR; 2009.

4.  Australian Institute of Health and Welfare, Australasian Association of Cancer Registries: Cancer in Australia: an overview, 2010 Canberra: AIHW;2010.

5.  Xiaomei Ma and Herbert Yu, 'Global Burden of Cancer',Yale J Biol Med. 2006 December;  79(3-4): 85–94.

6.  'Cancer Kerala' ,care foundation (http://carecalicut.org/cancer-facts/cancer-in-kerala.html)

7.  Lung Cancer in Malabar Cancer Center in Kerala - A Descriptive Analysis Binukumar Bhaskarapillai et al,  Asian Pacific Journal of Cancer Prevention, Vol 13, 2012

8.  Prakash C. Gupta,Samira Asma,'Bidi Smoking and Public Health', Published by the Ministry   of   Health and Family Welfare,India,2008

9.  Sarin R (2005). Indian national cancer control programme: setting sight on shifting targets. J   Cancer Res Therapeutics, 1, 240-8.

10. Thun MJ, Henley SJ, Calle EE (2002). Tobacco use and cancer: an epidemiologic perspective  for geneticists. Oncogene, 21, 7307-25.

11. A Prospective Study of Red and Processed Meat Intake in Relation to Cancer Risk Amanda  J. Cross et al. PLoS Medic,2007

12. Socioeconomic Status, Negative Affect, and Modifiable Cancer Risk Factors in African

13. American Smokers ,Darla E. Kendzor et al. Cancer Epidemiol Biomarkers Prev. 2008 17(10):  2546–2554.