



## INCIDENCE AND RISK FACTORS OF MOST PREVALENT CANCERS IN INDIA

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### ABSTRACT

The incidence and mortality of any disorder in a country are of much importance in order to realize the impact that it creates among the population. A deadly disease like cancer has to be periodically accounted for its incidence in a population. Cancer which mainly arises due to a mutation at a gene level has found to impart a greater impact in India due to its increasing incidence and mortality in the recent years. This review accounts the incidence of major cancer types in India currently using the primary resources. In this regard the incidence, mortality, risk factors and future perspectives of major types of cancers namely lung cancer, breast, cervical and oral cancers have been discussed. The incidence of the above mentioned types of cancers has been compared with the worldwide incidence data and the importance of cancer genetic counseling has been emphasized.

**KEYWORDS:** incidence, mortality, genetic Counselling.

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## INTRODUCTION

Cancer is found to be one of the most important diseases in today's world. In India, cancer has taken the second place for most of the mortality rates next to cardiovascular diseases<sup>9</sup>. Cancer still stands as a very big threat to this world in spite of the advancements in the medical field in the diagnosis and treatment<sup>13</sup>. Different factors contribute to the etiology of cancer. The most common amongst them are genetics or the family history, life style of a person and environmental factors. Though somatic mutations are found to be the major cause for cancer, many germ line mutations also contribute to the predisposition of familial cancer in an individual. They may be single nucleotide substitutions, addition of nucleotides, insertion or deletion of smaller fragments of DNA. Apart from these changes, cells may acquire genetic changes from exogenous factors. Many viruses are known to be important exogenous factors for many types of cancers.<sup>22</sup> There are certain important genes in the human genome which have the function of controlling the cell cycle and the proliferation of cells. Mutations in any of these genes lead to their dysfunction and ultimately lead to the formation of cancer due to a disruption in the cell cycle. The evolution of a normal cell into a cancerous cell involves many diverse steps and different class of genes. The oncogenes are the altered forms of the normal genes; the genes involved in DNA repair and the onco-suppressor genes which have the property of preventing the cancer formation.<sup>6</sup> Major tumor

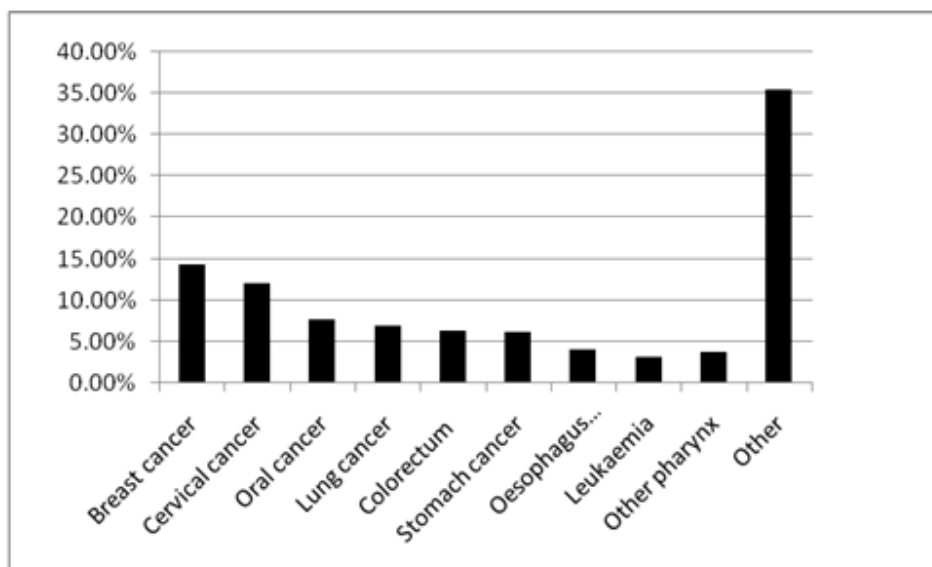
suppressor genes are: p53, retinoblastoma gene, BRCA1, BRCA2 etc. Any mutations in these genes will result in their malfunctioning and ultimately leads to cancer.

### **2) Cancer scenario in India**

Many reports have shown that there is an increase in the number of cancer cases in India every year. This increment in the incidence of cancer in India may be attributed to poor living standards, and due to inadequate medical facilities.<sup>2,25</sup> It has been observed that every year there are around 8,00,000 new cancer cases diagnosed in India in 5,50,000 deaths among them.<sup>17</sup> According to Ali Imran et al., 2011, in India the number of cancer patients in 2004 was found to be around 8,00,000; and in 2009 it was 9, 62,832 and in 2010 it was estimated to be 9, 79,786. This steady increase in cancer incidence in India is remarkable. The different types of cancers encountered every year in India are, cancers of lung, breast, stomach, gall bladder, cervix and oral.<sup>2</sup>

### **3) Most prevalent cancers in India**

As described by Globocan 2012 (IARC) data the most common cancers prevalent in India among both the sexes are, breast, cervix, lip or oral cavity, lung, colorectal, stomach, esophagus, pharynx and leukemia. This review deals with the four most common types of cancers namely, Lung, breast, oral and cervical cancers. The distribution of different types of cancers in India is represented in figure 1.



**Figure 1**  
**Distribution of different types of cancers in India (Globocan 2012).**

### 3.1) Lung cancer

Lung cancer is known to be the most common cause of cancer deaths in India. Though it was less in the past few years, currently lung cancer has become one of the most predominant cancers found in our country<sup>4</sup>. Reports say that lung cancer is found to be the common reason for cancer deaths in both developed and developing countries.<sup>11</sup> According to Globocan 2008 (IARC) report the number of lung cancer cases and number of lung cancer deaths in India were estimated to be around 58,000 and 51,000 respectively. And Globocan 2012 (IARC) has estimated the number of lung cancer cases and deaths to be 70,000 and 64,000 respectively. This increase in the incidence and death rate of lung cancer is quite notable. Behera 2012 reported that in 2001, 75-80 % of lung cancer cases were non-small cell lung cancers and small cell lung cancers accounted for 20 % of all cancer cases. The major causes for lung cancer can be mainly attributed to environmental factors and life style of an individual. Smoking is one of the major causative factors of lung cancers. The risk increases with increase in the duration and amount of smoking.<sup>3</sup> Passive smokers have also been found to suffer from lung cancer because of the exposure to carcinogens. Other factors such as, exposure to mutagens namely,

asbestos, arsenic, chloromethyl, ethers, mustard gas and exposure to environmental pollutants also accounts for higher rates of lung cancer risk.<sup>22</sup> Looking on to the future perspectives, Globocan 2012 (IARC) reported the incidence of lung cancer in India by 2015 may turn up to 76,599 and in 2020 it would turn up to 88,831.

### 3.2) Breast cancer

Breast cancer is found to be predominant in both developed and in developing countries. It is reported to be the second most common cancers worldwide. The incidence of breast cancer in India is relatively less but it is of greater importance because the frequency is found to be in an increasing trend in the recent years.<sup>10,9</sup> Due to lack of awareness, most of the breast cancer cases have been diagnosed in the advanced stages and this has led to an increasing mortality in breast cancer cases. Globocan 2012 (IARC) has estimated that in 2012 among 16, 77,000 of world breast cancer cases, Indian cases are 1, 45,000 and among which the number of deaths are 70,000. Murthy et al., 2007 reported that the rise in incidence of breast cancer in India is 0.5-2% per annum and most of the patients have been observed to be less than 60 years of age. Occurrence of breast cancer has been witnessed to be more in

younger Indian women.<sup>16</sup> And the younger aged patients have been reported to be associated with larger tumour size, higher rates of metastasis and poorer survival rates.<sup>19,14</sup> On analyzing the etiology of breast cancer the lifestyle of a person is found to play an important role. The factors may be- increasing urbanization, inducing more stress in employed women; food habits coupled with lack of proper physical activity and the to the lack of proper breast feeding have been attributed to the premenopausal breast cancers.<sup>15</sup> Meshrametal., 2009 reported that lack of or less breast feeding causes an increase in the risk of breast cancer. It has also been reported that the breast cancer risk decreases with increase in the duration of breast feeding.<sup>15</sup> The online analysis prediction tool of Globocan 2012 reveals that the estimated number of breast cancer cases in India in 2012 was found to be 1, 44,937, in 2015 it is expected to be 1, 55,863 and in 2020 it will be 1, 74,706. This increasing trend of breast cancer incidence would be quite challenging for the near future in India.

### 3.3) Oral cancer

Due to many unhealthy lifestyles such as chewing tobacco and smoking, oral cancer has taken up a greater part of many other cancers found in India. Reports say that oral cancer takes up to 30% of cancer deaths every year in India.<sup>21</sup> Like any other cancer, oral cancer also has an increased rate of mortality. This is mainly because of the delayed diagnosis; primarily because of the patients' ignorance about the disease and its earlier symptoms. According to a study conducted by Shenoietal., 2012, in central Indian population (sample size=201) with OSCC (Oral Squamous Cell Carcinoma) from January 2008 to September 2010, the major site of tumour in oral cancer patients were found to be in mandibular alveolar region. And by looking on to the lifestyle as an important inclusion criteria of patients, most of them were found to be using tobacco for a longer period of time. Majority of them were found to be presented with tumour in stage III. Oral cancer is a type of Head and Neck Cancer (HNC). The squamous cell carcinoma usually arises due to genomic

instability and mutations which affects the cell cycle regulation also stands as a major cause for it. The predicted number of oral cancer in India by 2015 is 83357 and by 2020 it is expected to be 94903. (GLOBOCAN 2012-IARC).

### 3.4) Cervical cancer

Like the earlier discussed cancers, cervical cancer is also a common type of cancer in Indian population. According to Globocan 2012 in about 5, 28,000 cases of cervical cancer in the world, there were about 1,23,000 cases recorded in India and among which the number of deaths were 67,000. The risk factors of cervical neoplasia are many. The most important among them is the infection by an oncogenic virus called HPV (Human Papiloma Virus) and other risk factors include sexual intercourse at an early age, multiple sex partners, long term usage of oral contraceptives, use of tobacco, infection with *Clamydiatrachamatitis* and micronutrients deficiency.<sup>24</sup> In a developing country like India the poor economic condition and low standard of living stands as the major reason for more people becoming susceptible to cervical cancer. The different types of oncogenic HPV which causes cervical cancer are HPV types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59 and 68.<sup>7</sup> Screening of asymptomatic women is possible with a variety of tests namely Papanicolaou (Pap) smears, VIA (visual inspection with acetic acid), molecular biology based techniques like PCR to identify HPV genome in patients' sample.<sup>23</sup> The Globocan 2012 prediction tool reveals an estimation of about 1,32,314 cases of cervical cancer in India by 2015 and 1,48,624 cases of cervical cancer by 2020. This increase in the incidence of cervical cancer is impossible to manage properly without organizing proper screening programs especially in the rural areas.

## DISCUSSION

Cancer being a deadly disease worldwide has always found to be in an increasing rate in almost all the countries. Both the developed as well as the developing countries are facing the

burden of cancer in today's world. The Globocan 2012 reported that the cancer prevalence worldwide is 1, 40, and 90,000. In 2012, the total incidence of all types of cancers in India was accounted to be 12, 58,350. And the risk of cancer incidence before 75 years of age is 10.1%. (GLOBOCAN 2012 IARC) In current scenario it is obvious to see the

incidence of cancer in younger population. The incidence of four major types of cancer (namely lung cancer, breast cancer, cervical cancer and oral cancer) in India as well as worldwide with their mortality rates and the expected number of cancer cases in the year 2015 and 2020 is presented in Table 1.

Cancer type	Worldwide prevalence	Incidence in India (2012)	Mortality in India (2012)	Prediction of Incidence In India	
				2015	2020
Lung cancer	1825000	77003	52067	76599	88831
Breast cancer	1677000	144937	70218	155863	174706
Cervical cancer	528000	122844	67477	132314	148624
Oral cancer	140900	77003	52067	83357	94903

**Table 1**  
**Prevalence of different types of cancer in India (Globocan 2012).**

On observing the number of cancer patients in each cancer types a considerable percentage of cancer incidences in Indian population could be witnessed. The above data shows that, the percentage of lung cancer incidence in India in 2012 among the worldwide incidence is 4.219%, and the breast cancer in India from worldwide incidence is 4.187%; while cervical cancer accounts for 23.265%and oral cancer accounts for 5.65%.In a developing country like India the higher rates of cancer prevalence and deaths is a very big drawback since it incurs stress over human kind and it directly explains the standard of living of the people and the country's medical facilities. The incidence of any disease or disorder can be reduced by understanding its root cause at a closer range. The lack of knowledge about cancer and its risk factors stands as the major reason for the higher morbidity and mortality rates of cancer in India. In particular, cancers such as breast

cancer and cervical cancer are more commonly prevalent in women from rural areas. Proper screening programs have to be organized in every part of the country to diagnose the cancer at an early stage. Awareness program among the public about the use of various carcinogens such as tobacco may help them realize the risk of cancer. The common public should be made aware of various new diagnostic facilities which are introduced to detect cancer at the earliest possible.

**Cancer genetic counseling**

In a practical perspective genetic counseling is essential for public to reduce their fear and ambiguity in taking up the radiation therapy and chemotherapy. Only an accomplished genetic counselor can make a patient better understand the underlying cause of a particular type of cancer. The probability of a particular cancer to be inherited to the

forthcoming generation can also be effectively made clear by a genetic counselor so that the later generations can be screened for cancer at the earliest.

### **Life style**

Though genetics stand as the major reason behind it, cancer and the mutations which lead to cancer are most commonly due to the lifestyle of a particular individual. The current lifestyle of any common man is prone to subject an individual to more oxidative stress, which stands as a hidden reason for cancer development. Experts say that a diet with poor nutrients and antioxidants are the most common etiological factors of cancer. Constant exposure to mutagens triggers genomic instability and makes an individual more susceptible to cancer.

### **Cancer treatment**

Cancer patients who receive radiation therapy are also prone to develop secondary tumors because of the DNA damage induced by the radiations. Kojaretal, 2002 have reported in a study about the DNA damage induced by radiation therapy in cancer patients. It has been reported that there is a significant amount of DNA damage induced by different combinations of radiation therapy and these may induce a secondary tumour in cancer patients. The study method used to detect DNA damage was alkaline comet assay. And it has also been reported that, a periodic review of oxidative stress and DNA damage induced by radiation therapy in cancer patients is essential to prevent or diagnose the development of secondary tumours. Thus it is very important to regularly check the reactive oxidative stress induced by radiation therapy in cancer patients. Hence, proper genetic counseling given to cancer patients who may cover all the above mentioned aspects would help to improve the lifestyle of cancer patients.<sup>22</sup>

### **Biomarkers**

Cancer biomarkers are essential for proper diagnosis of any type of cancer. The detection of precancerous state of an individual can be screened with the help of cancer biomarkers. Biomarkers of cancer include a wide range of biochemical entities, such as nucleic acids, proteins, sugars, lipids, and small metabolites, cytogenetic and cytokinetic parameters as well as whole tumour cells found in the body fluid. Biomarkers not only help to diagnose a particular disease, but it also helps to decide a particular type of treatment for an individual effectively.<sup>5</sup> Different assays are helpful in detecting the genomic instability of cancerous and precancerous states. George Alex, et al 2014 has studied the genomic instability of 72 cases of Head and Neck Carcinoma. The techniques used in the study were, CA (Chromosomal Aberration) assay to estimate chromosome instability and CBMN (Cytokinesis Block Micronucleus Cytome) assay to study nuclear level anomalies. This study has reported a higher rate of spontaneous chromosome aberrations, chromatid type aberrations, dicentric chromosomes and chromosome aneuploidy in cultured lymphocytes of HNC cases when compared to controls. This study thus indicates that biomarkers are effective in predicting the malignancy of solid tumours at an early stage.<sup>8</sup>

### **CONCLUSION**

This review discusses about the incidence, mortality and risk factors of the four major types of cancers prevalent in India. This review has been presented with the perspective that a periodic assessment of lifestyle diseases like cancer is essential to understand the status of its prevalence in our country better and would help to manage the disease in an effective manner.

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