RESEARCH COMMUNICATION

Oral Cancers in Mumbai, India: a Fifteen Years Perspective with Respect to Incidence Trend and Cumulative Risk

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Abstract

Objective: We estimated the time trends in the incidence and the risk of developing an oral cancer in Mumbai, Indian population using the data collected by the Bombay Population Based Cancer Registry during the 15 year period from 1986 to 2000.

Methods: A total of 9,670 oral cancers (8.2% of all neoplasms) were registered, of which 6577 were in males and 3093 in females (10.7% and 5.4% of the respective totals for the two genders) . For evaluation of the trend, we applied a linear regression model based on the logarithm of the observed incidence rates. The annual percentage changes were also computed for the incidence rates to evaluate the time trend.

Results: In males, a statistically significant decreasing trend in the overall age-adjusted incidence rates were observed during the period 1986 to 2000, with an yearly decrease of 1.70%. This decrease was significant for men above the age of 40, but for young adult men below the age of 40, there was no significant decrease, the level being stable. In females, the overall decreasing trend in the age-adjusted incidence rates of oral cancers was not significant, but in the age group 40-59, a significant decline was observed. The probability estimates indicated that one out of every 57 men and one out of every 95 women will contract any oral cancer at some time in their whole life and 97% of the chance is after he or she completes the age of 40.

Conclusion: The observed decreasing trend in oral cancers in Indian men may be attributed to a decrease in the usage of pan and tobacco. The high prevalence of the usage of smokeless tobacco among young adult men and women may explain the stable trend in oral cancer incidence in this group. These findings help to strengthen the association between tobacco use and oral cancer risk.

Key Words: oral cancer - incidence - trend - cumulative risk

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Introduction

The term 'oral' includes the lips and all intra-oral sites corresponding to the ICD9 codes 140 (lip), 141 (tongue), 143 (gum), 144 (floor of mouth) and 145 (other non-specific sites).Oral cancer is the sixth most common cancer in the world and is largely preventable (Parkin et al., 1988; Raubenheimer et al., 1989). It accounts for approximately 4% of all cancers and 2% of all cancer deaths world-wide (Boring et al., 1993). In India it is the commonest malignant neoplasm, accounting for 20-30% of all cancers (Nair et al., 1990). Southern India presents the highest oral cancer incidence rates among women worldwide, and the highest in India overall (Franceschi et al., 2000).

These very high incidence rates in Indian population reflect the continued prevalence of paan chewing in India, a habit which is equally common in both genders (IARC 1985). Besides paan chewing, the effects of tobacco use and alcohol drinking are clear risk factors for oral cancer in India and elsewhere have been described in several studies (WCRF/AICR 1997; Znaor et al., 2003; Balaram et al., 2002). In developed countries, over 90% of cancers of the oral cavity are caused by smoking and alcohol drinking (IARC 1986, 1988). Among Indian men, the attributable oral cancer risk due to smoking, alcohol and paan chewing is over 80% and among women in India, paan chewing alone explains almost all (over 90%) the oral cancer risk (Balaram et al., 2002).

The results of many studies (Macfarlane et al., 1992; Franchesci et al., 1994; Shiboski et al., 2000) suggest that

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head and neck cancer, particularly oral cancer, is increasing in young adults internationally.

In this study we provide the population-based incidence trend and cumulative risk of oral cancers in Mumbai, India using the oral cancer incidence data registered at Mumbai Cancer Registry from the year 1986 to 2000.

Materials and Methods

The Bombay Population Based Cancer Registry is the first Population Based Cancer Registry in India, established in 1963, as a unit of the Indian Cancer Society at Mumbai with the aim of obtaining reliable morbidity data on cancer from a precisely defined urban population (Greater Mumbai) (12 million inhabitants). The majority of hospitals in the city are maintained by the Municipal Corporation and the State Government, which are basically responsible for conducting public health and medical services in the city.

All malignant tumors including those where the pathologist may have merely suspected a malignant change are registered. Cancer cases where the death certificate is the only source of information, are also included. Patients in whom cancer has been ruled out or has not yet been diagnosed, are omitted from our register.

We utilize the coding system devised by the World Health Organization using code numbers 140-208 as published in the manual of the International Classification of Diseases, Injuries and Causes of Death (WHO 1997). We also utilize the International Classification of Diseases for Oncology (WHO 1976), (ICD-O) simultaneously, for coding the primary site.

During the 15 year period, 1986 to 2000, a total of 9,670 oral cancers (8.2% of all cancers) were registered by the Bombay Population Based Cancer Registry of which 6577 (10.7% of all male cancers) were males and 3093 (5.4% of all female cancers) were females. It has been shown that the data collected by Bombay Cancer Registry are complete and reliable (Yeole, 2001).

Population data was estimated from the 1981, 1991 and 2001 census reports (as on 1st March). The estimates for the years 1986 through 2000 (as on 1st July) was obtained by assuming a geometric rate of growth for each age group and sex. Since our definition of a resident differs from the criteria used in the population census, we have corrected our population estimates by eliminating all migrants whose duration of residence in Mumbai was less than one year.

Age adjusted rates were computed using world population as standard (Plummer, 1997). For evaluation of incidence trends we have used a linear regression analysis based on the logarithm of the observed incidence rates. Logarithmic transformation was preferred specifically because this facilitates the comparison of trends at varying incidence levels, that is where the trends at different ages are examined. A model that fits this data is the logarithm $Y=AB^x$ which represents a linear regression model, where 'Y' is the estimated incidence rate per 100,000 of the population and 'x' is the calendar year minus the initial year (1986) for the current data. 'A' therefore represents the estimated rate of the initial year and (B-1)*100 gives the average annual percentage change in the incidence rate, during the period.

The cumulative incidence rate is a summary measure of the experience of a population over a longer time span or age-interval. It is obtained by summing up the age-specific incidences for each year in the defined age-interval and then expressed as a percentage. Since age-specific incidence rates are usually computed for five year age intervals, the cumulative incidence rate between birth to 75+ years of age is, 5 times the sum of the age specific incidence rates calculated over five year age-groups. The cumulative incidence rate is a directly standardized incidence rate and is a good approximation to the actuarial or cumulative risk. Reason for interest in the cumulative incidence rate is that it has a useful probabilistic interpretation. Another advantage is that as a form of direct age standardization, the arbitrariness in choosing a standard population is removed. The probability of getting a specific cancer, expressed in terms of 'one in every n persons' is computed by reciprocating estimated cumulative incidence rate expressed as a percentage.

Results

During the 15 year period, 1986 to 2000, the crude and age adjusted incidence rates of oral cancers were 7.8 and 12.6 respectively for males and 4.4 and 7.3 respectively for females per 100,000 population. The age adjusted incidence rates of oral cancers at different age groups 00-39, 40-59 and 60+ were 1.0, 24.1 and 62.8 respectively for males and 0.6, 14.2 and 35.7 respectively for females per 100,000 population (Tables 1 and 2).

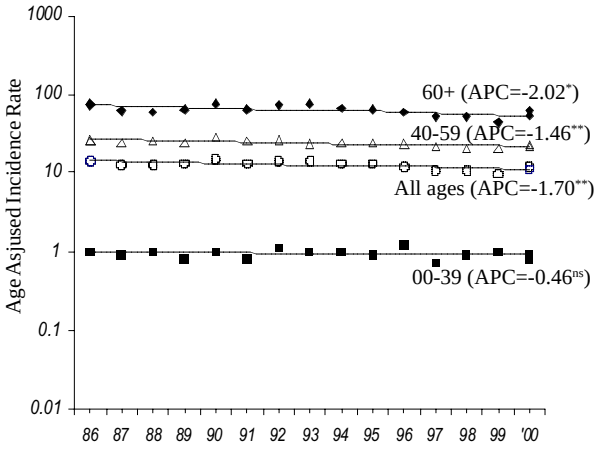
A statistically significant ($p<0.01$) decreasing trend in the overall age adjusted incidence rates of oral cancers were observed in males during the period 1986 to 2000, with an yearly decrease of 1.70%. This decrease was significant in males above the age of 40 but in young adults below the age of 40, there were no significant changes in trends in the crude and age adjusted incidence rates (Table 1 and Figure 1). In men, there were no increasing or decreasing trend in the overall crude incidence rates, but for men above the age of 40, there was a decreasing trend in the crude rates (Table 1). In females, there were no statistically significant increasing or decreasing trend in the over all crude and age adjusted incidence rates, but a decreasing trend is observed in the crude and age adjusted incidence rates in the age group 40-59. At all other age groups, 00-39 and 60+, the trends in the crude and age adjusted incidence rates were stable for females (Table 2 and Figure 2).

The probability estimates indicated that one out of every 57 men and one out of every 95 women will contract any oral cancer at some time in their whole life, one out of every 79 men and one out of every 140 women will contract any oral cancer at some time after his or her 60's or 70's, one out of every 196 men and one out of every 333 women will

Table 1. Number of Incident Cases of Oral Cancers with Crude (CR) and Age Adjusted (AAR) Rates per 100,000 Population by Broad Age Group with Annual Percentage Changes in CR and AAR, 1986 to 2000, Males

	Age group											
	00-39			40-59			60+			Total (All ages)		
Year	N	CR	AAR	N	CR	AAR	N	CR	AAR	N	CR	AAR
1986	45	1.2	1.0	208	23.2	25.0	148	73.7	74.7	401	8.0	14.1
1987	40	1.0	0.9	204	22.4	24.0	127	62.2	61.3	371	7.3	12.4
1988	46	1.1	1.0	222	24.0	26.0	122	58.8	58.9	390	7.5	12.6
1989	40	1.0	0.8	217	23.1	24.8	133	63.1	64.3	390	7.4	12.9
1990	46	1.1	1.0	257	26.9	29.4	157	73.2	74.1	460	8.6	15.0
1991	41	1.0	0.8	229	23.6	25.6	137	62.9	63.1	407	7.5	12.9
1992	53	1.2	1.1	243	24.6	26.1	151	68.2	71.1	447	8.1	14.0
1993	51	1.2	1.0	218	21.7	23.0	166	73.7	76.6	435	7.7	14.0
1994	52	1.2	1.0	236	23.2	24.7	145	63.3	66.0	433	7.6	13.1
1995	50	1.1	0.9	247	23.1	24.5	185	64.4	64.9	482	8.3	12.9
1996	67	1.5	1.2	245	22.0	23.1	186	58.0	58.7	498	8.4	12.1
1997	41	0.9	0.7	234	20.6	21.5	178	52.3	52.6	453	7.5	10.8
1998	53	1.2	0.9	226	19.4	20.5	179	49.6	50.8	458	7.5	10.5
1999	60	1.3	1.0	235	19.8	20.9	165	43.1	44.0	460	7.4	9.9
2000	49	1.0	0.8	250	20.6	22.7	193	47.5	60.6	492	7.8	12.0
1986-2000	734	1.1	1.0	3471	22.4	24.1	2372	58.9	62.8	6577	7.8	12.6
APC		+0.36^{ns}	-0.46^{ns}		-1.32**	-1.46**		-2.68**	-2.02*		-0.06^{ns}	-1.70**

^{ns} -not significant, * _significant at the .05 level, ** _significant at the 0.01 level, *** _significant at the 0.001 level



^{ns} -not significant, * _significant at the .05 level, ** _significant at the 0.01 level, *** _significant at the 0.001 level

Figure 1. Trends in Age Adjusted Rates (AAR) of Oral Cancer Incidence at Different Age Groups and at All Ages with Corresponding Annual Percentage Changes, during 1986 to 2000, Males

contract this cancer at some time in his or her 40's or 50's and only one out of every 1985 men and one out of every 3411 women will get this cancer before his or her fourth decade of life. From the estimated cumulative incidence rate percentages for males, it has been evident that 1.86% of the male population will get any oral cancer at some time in their whole life and 1.29% out of this 1.86% who get any oral cancer belong to the age of more than 60 years, 0.52% will be in the age range 40-59 years and only 0.05% in the age 00-39 years. From the estimated cumulative incidence rate percentages for females, it has been evident that 1.08% of the female population will get any oral cancer at some time in their whole life and 0.74% out of this 1.08% who get any oral cancer belong to the age of more than 60 years, 0.31% will be in the age range 40-59 years and only 0.03% in the age 00-39 years (Tables 3 & 4).

Discussion

A significant decreasing trend in the overall crude and age-adjusted incidence rates of oral cancers were observed in Mumbai males. This decrease was significant for men above the age of 40, but for young adult men below the age of 40, there was no significant decrease or increase in trend but was stable. In females, there were no significant increase or decrease in trend in the over all crude and age adjusted incidence rates. But in females, a decreasing trend is observed in the crude and age adjusted incidence rates in the age group 40-59 and at all other age groups, 00-39 and 60+, the trends in the crude and age adjusted incidence rates were stable for females.

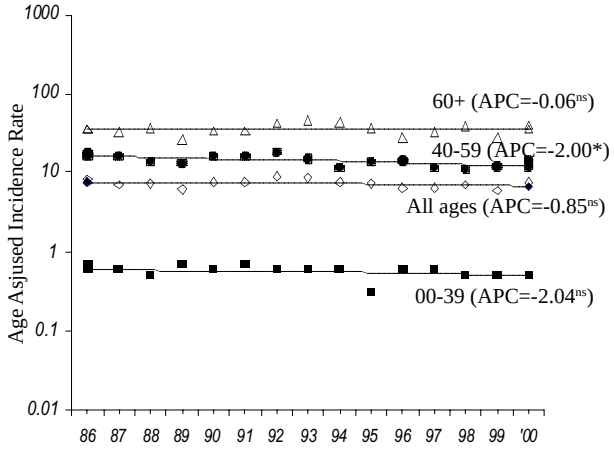
The results of many studies (Macfarlane et al., 1992; Franchesci et al., 1994; Shiboski et al., 2000) suggest that head and neck cancer, particularly oral cancer, is increasing in young adults internationally. After a steady decline since the turn of the 20th century oral cancer incidence rates in the UK and US are now rising particularly in women (Hindle et al., 1996).

In our study, we observed a decline in trend in males and no change in the trend in females in the overall age adjusted incidence rates of oral cancers. A possible reason

Table 2. Number of Incident Cases of Oral Cancers with Crude (CR) and Age Adjusted (AAR) Rates per 100,000 Population by Broad Age Group with Annual Percentage Changes for CR and AAR, 1986 to 2000, Females

	Age group											
	00-39			40-59			60+			Total (All ages)		
Year	N	CR	AAR	N	CR	AAR	N	CR	AAR	N	CR	AAR
1986	23	0.7	0.7	92	15.5	17.3	68	35.4	36.0	183	4.6	8.1
1987	19	0.6	0.6	91	15.0	15.8	63	32.1	32.1	173	4.2	7.2
1988	17	0.5	0.5	82	13.2	13.9	76	37.9	36.7	175	4.2	7.3
1989	24	0.7	0.7	78	12.3	13.1	55	26.8	27.0	157	3.7	6.2
1990	20	0.6	0.6	97	14.9	16.1	72	34.3	34.7	189	4.3	7.6
1991	24	0.7	0.7	95	14.3	15.8	74	34.5	34.3	193	4.3	7.5
1992	23	0.6	0.6	111	16.4	18.0	94	42.8	42.7	228	5.0	8.9
1993	24	0.6	0.6	97	14.0	14.8	101	45.0	45.2	222	4.8	8.5
1994	21	0.5	0.6	77	10.9	11.5	102	44.4	44.6	200	4.2	7.7
1995	14	0.4	0.3	102	13.1	13.9	99	36.6	37.0	215	4.4	7.2
1996	27	0.7	0.6	114	13.8	14.4	81	27.8	28.0	222	4.5	6.5
1997	30	0.8	0.6	96	11.2	11.6	96	31.4	32.1	222	4.4	6.4
1998	24	0.6	0.5	96	10.8	11.1	119	37.1	38.4	239	4.6	6.9
1999	25	0.6	0.5	109	11.8	12.1	91	27.0	27.2	225	4.2	5.9
2000	25	0.6	0.5	112	11.7	14.2	112	31.6	39.7	249	4.6	7.7
1986-2000	340	0.6	0.6	1449	13.1	14.2	1303	34.5	35.7	3092	4.4	7.3
APC		-0.17^{ns}	-2.04^{ns}		-1.98**	-2.00*		-0.63^{ns}	-0.06^{ns}		+0.41^{ns}	-0.85^{ns}

^{ns} -not significant, * _significant at the .05 level, ** _significant at the 0.01 level, *** _significant at the 0.001 level



^{ns} -not significant, * _significant at the .05 level, ** _significant at the 0.01 level, *** _significant at the 0.001 level

Figure 2. Trends in Age Adjusted Rates (AAR) of Oral Cancer Incidence at Different Age Groups and at All Ages with Corresponding Annual Percentage Changes, during 1986 to 2000, Females

for this may be a decline in trend in the tobacco consumption habit of the urban household. In India, National Sample Survey Organization (NSSO) collects data on the prevalence of tobacco use. The National Sample Survey data on tobacco consumption in India from the year 1987-88 to 1999-00 showed that tobacco (bidi, cigarette and pan) consumption habit of the urban household is showing a declining trend on the whole, while that of the rural household is showing a substitution between various tobacco products (NSSO 1998, 2000). The National Sample Survey data on the prevalence of tobacco use among different socioeconomic group showed that in the age groups 15-24 and 60+, the prevalence of smokeless tobacco consumption is more among females than among the males and in urban males in the agegroup 10-24, the prevalence of smokeless tobacco consumption is more than smoking (Gupta et al., 2002). This may explain the stability in the trend in the incidence of oral cancer among females belonging to these age groups and in young adult men below the age of 40.

In a recent case control study conducted in Indian men, it is observed that tobacco chewing emerged as the strongest risk factor for oral cancer, with the highest risk for chewing products containing tobacco (Znaor et al., 2003). In an earlier study conducted in southern India, it is observed that among men, 35% of oral cancer is attributable to the combination of smoking and alcohol drinking and 49% to pan-tobacco chewing. Among women, chewing and poor oral hygiene explained 95% of oral cancer (Balaram et al., 2002).

In our study, it is estimated that one out of every 57 men and one out of every 95 women will contract any oral cancer at some time in their whole life and 97% of the chances are after he or she completes the age of 40.

As per the Bombay Population Based Cancer Registry data from 1986 to 2000, it has been observed that oral cancers accounts 8.2% of all cancers (10.7% of all male cancers and 5.4% of all female cancers). The age-adjusted incidence rates of oral cancers in males (12.6 per 100,000) were almost double of that in females (7.4 per 100,000). This may be attributed to a higher proportion of tobacco users in the male population than in the female population. In India an estimated 65% of all men and 33% of all women use some form of tobacco (Shimkhada et al. 2003). Among the many

Table 3. Cumulative Incidence Rate Percent (CIRP) and Life Time Risk Expressed as 'one in every 'n' Persons' (LTR), at Different Age Groups and for All Ages for Oral Cancers, 1986 to 2000, Males

Year	Age group							
	00-39		40-59		60+		Total (All ages)	
	CIRP	LTR	CIRP	LTR	CIRP	LTR	CIRP	LTR
1986	0.05	1839	0.54	185	1.55	65	2.14	54
1987	0.05	2084	0.52	193	1.22	82	1.79	66
1988	0.06	1798	0.56	179	1.17	85	1.79	56
1989	0.05	2218	0.53	189	1.31	76	1.89	53
1990	0.05	1909	0.64	156	1.51	66	2.2	46
1991	0.05	2193	0.56	180	1.27	79	1.88	54
1992	0.06	1685	0.55	181	1.57	64	2.18	46
1993	0.06	1757	0.49	205	1.64	61	2.19	46
1994	0.06	1764	0.53	190	1.40	72	1.99	51
1995	0.05	1997	0.52	193	1.29	77	1.86	54
1996	0.06	1589	0.48	207	1.20	84	1.74	57
1997	0.04	2650	0.44	225	1.03	97	1.51	66
1998	0.05	2102	0.43	232	1.07	93	1.55	64
1999	0.05	1886	0.45	224	0.93	108	1.43	70
2000	0.04	2297	0.50	202	1.22	82	1.76	67
1986-2000	0.05	1985	0.52	196	1.29	79	1.86	57

Table 4. Cumulative Incidence Rate Percent (CIRP) and Life Time Risk Expressed as 'one in every 'n' Persons' (LTR), at Different Age Groups and for all Ages for Oral Cancers, 1986 to 2000, Females

Year	Age group							
	00-39		40-59		60+		Total (All ages)	
	CIRP	LTR	CIRP	LTR	CIRP	LTR	CIRP	LTR
1986	0.04	2682	0.40	255	0.78	129	1.22	83
1987	0.03	3441	0.34	298	0.59	169	0.96	105
1988	0.03	3565	0.30	339	0.74	136	1.07	94
1989	0.04	2840	0.28	358	0.56	178	0.88	114
1990	0.03	3146	0.35	290	0.75	133	1.13	89
1991	0.03	2909	0.35	286	0.69	145	1.07	93
1992	0.03	2964	0.40	251	0.86	117	1.29	77
1993	0.03	2900	0.31	320	0.92	109	1.26	79
1994	0.03	3435	0.25	407	0.92	109	1.20	84
1995	0.02	5887	0.30	330	0.78	129	1.10	91
1996	0.03	3154	0.31	320	0.58	174	0.92	109
1997	0.03	3015	0.25	404	0.64	156	0.92	109
1998	0.03	3885	0.23	432	0.82	123	1.08	93
1999	0.03	3859	0.26	385	0.56	178	0.85	118
2000	0.03	3489	0.31	326	0.86	116	1.20	84
1986-2000	0.03	3411	0.31	333	0.74	140	1.08	95

million tobacco users in India 48% of them use bidis, 38% use different chewing items and the rest 14% are cigarette smokers (Sundaram, 2003).

Incidence rates show marked geographic variation with the Bas-Rhin region in France having the highest recorded incidence of oral cancers in the world (Park et al., 1998; Johnson et al., 1991). Ninety five percent of patients with oral cancer are over 40 years of age at diagnosis (Park et al., 1998).

Worldwide oral cancers are estimated to be the sixth most common cancer, prevalence being highest in India (Boyle et al., 1992). An increase in incidence has also been reported in central and eastern Europe, especially among younger men (Macfarlane et al., 1994). Mortality remains high and although the prognosis for cancer of the lip is good, the prognosis for intra-oral squamous cell carcinoma remains poor (Hindle et al., 1996). There is little convincing evidence that mouthwash use, poor oral hygiene, or oral infections of viral origin play an important role in the aetiology (Johnson et al., 1991; McKaig et al., 1998). Consuming fruits and vegetables may have a protective effect. It has been suggested that lichen planus and oral submucosal fibrosis

are associated with an increased risk of intra-oral malignancy. Wide variations in the malignant potential of these lesions have been reported. There is a slight familial risk for oral cancer which may be related to the similar exposures to tobacco and alcohol which occur among family members (Goldstein et al., 1994).

Suspected etiologic agents that may account for oral cancer in young adults include smokeless tobacco (Mattson et al., 1989; Sankaranarayanan et al., 1989), various forms of drug abuse (Endicott et al., 1993), virus (Das et al., 1993), and host susceptibility factors (Schantz et a., 1989). However, no clear evidence exists to support the significance of any single determinant, including the role of tobacco (Schantz et al., 1988). Tobacco use has taken epidemic dimensions among children and young adults in India. This may reflect in a high burden of disease for the country in future.

Primary prevention will be the best effective method to prevent this cancer. Primary prevention involves stopping the use of tobacco. Regression of premalignant lesions has been reported in former smokers (Gupta et al., 1992; Gupta et al., 1995). In the Indian subcontinent and in areas with large populations of Asian migrants, reducing the use of betel quid may also be beneficial. The prevalence of betel quid use remains high in immigrant populations in the United Kingdom (Ahmed et al., 1997).

Public campaigns are necessary, however, to make patients aware of oral cancer; patients often delay seeking professional advice early (Dimitroulis et al., 1992; Jovanovic et al., 1992). The 1992 US National Health Interview Survey showed that the 15% of adults who had had an oral examination were likely to be better educated about and more aware of the risks of oral cancer than those who had not had such an examination (Horowitz et al., 1996).

Early identification of premalignant lesions and small oral cancers will allow patients to be treated earlier. Screening for oral cancer is simple and it does not require any laboratory support. Public health authorities should be encouraged to screen patients opportunistically especially if patients are males, smokers, and over 40 years old.

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