

# Epidemiology of Male Mouth Cancer in India

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**Abstract:** Mouth cancer is a foremost health problem in many parts of the world, and significant geographical variations with an increase or decrease in incidence rate were reported in the Indian subcontinent and parts of Asia. Mouth cancer is the sixth most common cancer in the world and third most in India. In this review article we are focusing on epidemiology of Mouth cancer in males. Reports and data available from Indian national cancer registries show that the incidences of cancers are on increase in trend. Cancers such as Mouth, Breast, Prostate, thyroid, corpus uteri and kidney are showing significant rise in incidence rates. Mouth cancer is first leading cancer among males in nine PBCRs namely Barshi Rural, Barshi Expanded, Bhopal, Mumbai, Ahmedabad Rural district, Ahmedabad Urban district, Aurangabad, Nagpur and Pune and third rank among four namely Dibrugarh district, Kolkata, Kollam and Thiruvananthapuram. This data shows that most of the regions of India are affected with mouth cancer and that is increasing in trend. The cancer projection data shows that the number of incidences will be almost doubled by 2020. .

**Keywords:** Mouth cancer, Incidence, trend, CR, AAR, PBCRS

## 1. Introduction

Mouth cancer is a foremost health problem in many parts of the world, and significant geographical variations with increase or decrease in rate were reported in Indian Subcontinent and parts of Asia. It indicates that there is an increase in incidence rate of mouth cancer in developing countries [1]. Oral cancer is the sixth most common cancer in the world [2], and top three ranks in Indian subcontinent [3]. Age adjusted rates (AAR) of oral cancer in India are elevated, that is, 20 per 100,000 population and accounts for over 30% of all cancers in the country [4]. Oral cancer is diagnosed at later stages which result in less chance to defeat and extensive costs to the patients whom typically cannot afford this type of treatment because of these reasons it is having considerable public health importance in India [5].

## 2. Methods

Information for this review article was obtained from two sources. Percentage of relative proportion of mouth cancer burden in different cities of India and their respective crude rate (CR) and Age Adjusted Rate (AAR) per 100,000 populations was derived from three years report on 25 populated based cancer registries (PBCRs) : 2009-2011 by National Cancer Registry Program report commenced by Indian Council of Medical Research Bangalore in February 2013, across India including Bangalore, Barshi Rural and Expanded, Bhopal, Chennai, Delhi, Mumbai, Cachar district, Dibrugarh district, Kamrup Urban district, Manipur State, Mizoram State, Sikkim State, Ahmedabad Rural and Urban, Aurangabad, Kolkata, Kollam, Nagpur, Pune, Thiruvananthapuram, Meghalaya, Tripura State, Nagaland and Wardha [6].

Data for trends over time for mouth cancer and for estimating the projection of burden of mouth cancer was taken from National Cancer Registry Program report of Time Trend Cancer Incidence rate: 1982-2010 for 13 PBCRs including Bangalore, Bhopal, Chennai, Delhi, Mumbai, Barshi, Thiruvananthapuram, Dibrugarh district, Kamrup Urban district, Imphal West District, Ahmedabad Rural District and the states of Mizoram and Sikkim [7].

## 3. Burden of Mouth Cancer in Different Population Based Cancer Registries

The most recent PBCRs of different cities for the time period 2009-2011 shows that Mouth cancer was leading in most of the cities in male, female or both, in Bangalore, Barshi Rural and expanded, Bhopal, Chennai, Delhi, Mumbai, Cachar district, Dibrugarh district, Kamrup urban district, Sikkim state, Ahmedabad Rural and Urban district, Aurangabad, Kolkata, Kollam, Nagpur, Pune, Thiruvananthapuram, Meghalaya, East Khasi Hills and Wardha.

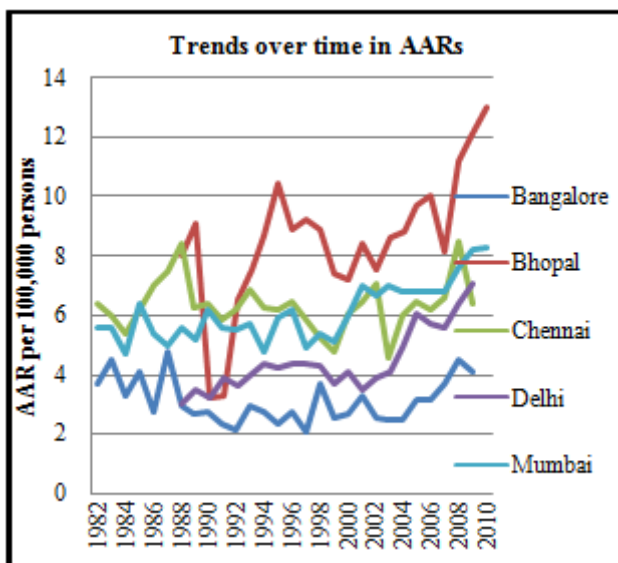
Mouth cancer is first leading cancer among males in nine PBCRs namely Barshi Rural, Barshi Expanded, Bhopal, Mumbai, Ahmedabad Rural district, Ahmedabad Urban district, Aurangabad, Nagpur and Pune and third rank among four namely Dibrugarh district, Kolkata, Kollam and Thiruvananthapuram (Table 1).

## 4. Trends over time for Mouth Cancer

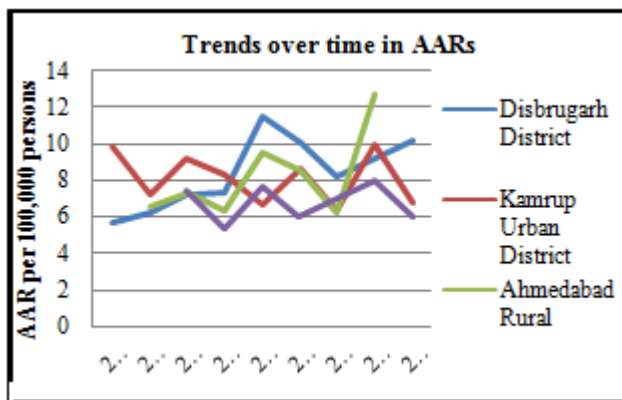
From the data received from "Times trends in cancer incidence rates from 1982-2010" shows that mouth cancer has statistically significant increase in incidence rate apart from Bangalore and Chennai (Figure 1 and 2).

**Table 1:** Table showing the relative proportion of mouth cancer Incidence, rank among the leading sites of all cancers, respective crude rate (CR) and Age Adjusted Rate (AAR) per 100,000 populations for different population based cancer registries in India

Sl. No	City	Relative proportion (%)	Rank	Respective crude rate (CR)	Age adjusted rate (AAR) per 100,000 population	Time period
1	Bangalore	3.9%	9 <sup>th</sup>		4.3	2008-2009
2	Barshi Rural	11.0%	1 <sup>st</sup>	5.3	6.5	2009-2010
3	Barshi Expanded	8.5%	1 <sup>st</sup>	3.1	3.5	2009
4	Bhopal	12.6%	1 <sup>st</sup>	9.1	5.4	2009-2010
5	Chennai	5.7%	5 <sup>th</sup>	6.2	6.4	2009
6	Delhi	5.8%	4 <sup>th</sup>	4.9	8.0	2008-2009
7	Mumbai	9.2%	1 <sup>st</sup>	6.5	8.2	2009-2010
8	Cachar district	3.8%	7 <sup>th</sup>		4.9	2009-2010
9	Dibrugarh district	9.0%	3 <sup>rd</sup>	6.3	9.2	2009-2011
10	Kamrup urban district	4.3%	7 <sup>th</sup>		7.7	2009-2011
11	Sikkim state	3.5%	8 <sup>th</sup>		2.7	2009-2011
12	Ahmedabad Rural district	13.9%	1 <sup>st</sup>	7.9	9.5	2009-2010
13	Ahmedabad Urban district	17.0%	1 <sup>st</sup>	14.9	17.1	2009-2010
14	Aurangabad	12.7%	1 <sup>st</sup>	4.8	7.0	2009-2010
15	Kolkata	6.8%	3 <sup>rd</sup>	6.9	6.2	2008-2009
16	Kollam	5.1%	3 <sup>rd</sup>	6.5	6.0	2009-2010
17	Nagpur	13.0%	1 <sup>st</sup>	10.6	11.6	2008-2009
18	Pune	10.2%	1 <sup>st</sup>	5.4	7.1	2009-2010
19	Thiruvananthapuram	5.3%	3 <sup>rd</sup>	7.6	7.0	2009-2011
20	Meghalaya	5.2%	5 <sup>th</sup>	4.2	8.1	2010-2011
21	East Khasi Hills Wardha	4.9%	6 <sup>th</sup>		10.3	2010-2011



**Figure 1:** Graph showing trends over time in AARs for five populations based cancer registries



**Figure 2:** Graph showing trends over time in AARs for four recent populations based registries

The PBCRs at Bangalore (-0.20%), Bhopal (2.97%), Chennai (-0.06%) Delhi (2.93%), Mumbai (1.35%) and Dibrugarh district (6.98%) have recorded a statistically significant increasing trend in incidence rate over time (Table 2 and 5).

**Table 2:** Table showing APC for different PBCRs

Sl No	PBCR	APC	Time period
1	Bhopal	2.97%	1988-2010
2	Delhi	2.93%	1988-2009
3	Mumbai	1.35%	1982-2010
4	Dibrugarh district	6.98%*	2003-2011

**4.1 Trend over time in AARs**

The age adjusted rate (AARs) for different PBCRs show a consistent increase over the time (1982-2010) in Bhopal, Delhi, Mumbai, Dibrugarh district and Ahmedabad Rural (Figure 1 and 2). The specified table shows that the actual values of the AARs for the PBCRs such as Bangalore, Bhopal, Chennai, Delhi, Mumbai, Dibrugarh district, Kamrup Urban district, Ahmedabad Rural and Thiruvananthapuram for each calendar year with statistical significance using slope (b) and p- value based on simple linear regression. Addition to this subsequent statistical significant of trends based on annual average AARs for three and five year grouping also provided. Table 3 and 4 shows the actual values of the PBCRs along with the recent ones (Kamrup Urban district and Thiruvananthapuram) for each year. For the recent PBCRs, the three year moving average is used because of the registry operation is not as yet sufficient to draw the three and five year trends like older PBCRs.

**Table 3:** Trends over time in AARs for five PBCRs

Year	Old PBCRs				
	Bangalore	Bhopal	Chennai	Delhi	Mumbai
1982	3.7		6.4		5.6
1983	4.5		6.0		5.6
1984	3.3		5.4		4.7
1985	4.1		6.2		6.4
1986	2.8		7.0		5.4
1987	4.8		7.5		5.0
1988	3.0	8.0	8.4	3.0	5.6
1989	2.7	9.1	6.3	3.5	5.2
1990	2.8	3.2	6.4	3.2	6.2
1991	2.4	3.3	5.9	3.9	5.6
1992	2.2	6.5	6.2	3.6	5.5
1993	3.0	7.5	6.9	4.0	5.7
1994	2.8	8.7	6.3	4.4	4.8
1995	2.4	10.4	6.2	4.2	5.9
1996	2.8	8.9	6.5	4.4	6.2
1997	2.1	9.2	5.9	4.4	4.9
1998	3.7	8.9	5.3	4.3	5.4
1999	2.6	7.4	4.8	3.7	5.1
2000	2.7	7.2	6.1	4.1	6.0
2001	3.3	8.4	6.5	3.5	7.0
2002	2.6	7.5	7.1	3.9	6.7
2003	2.5	8.6	4.6	4.1	7.0
2004	2.5	8.8	6	4.9	6.8
2005	3.2	9.7	6.5	6.1	6.8
2006	3.2	10	6.2	5.7	6.8
2007	3.7	8.1	6.6	5.6	6.8
2008	4.5	11.2	8.5	6.4	7.6
2009	4.1	12.1	6.4	7.1	8.2
2010		13.0			8.3
Slope (b)	-0.008	<b>0.217</b>	-0.003	0.137	<b>0.086</b>
p-value	0.692	<b>0.001</b>	0.921	0.000	<b>0.000</b>
3year trend slope (b)	-0.016	<b>0.236</b>	-0.008	0.130	0.086
p-value	0.567	<b>0.011</b>	0.773	0.013	0.000
5year trend slope (b)	0.007	0.256	0.008	0.160	<b>0.086</b>
p-value	0.851	0.058	0.779	0.041	<b>0.025</b>

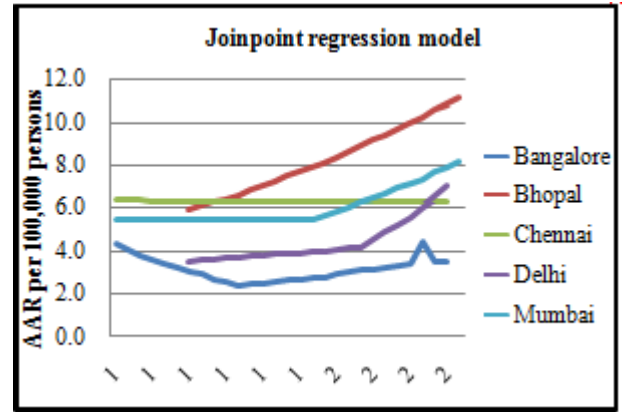
Bold represents significant slope values ( $p < 0.05$ ).

**Table 4:** Trends over time in AARs for new PBCRs

Year	Disbrugarh District	Kamrup Urban District	Ahmedabad Rural	Thiruvananthapuram
2003	5.7	9.9		
2004	6.3	7.2	6.5	
2005	7.2	9.2	7.3	7.4
2006	7.3	8.3	6.3	5.3
2007	11.5	6.6	9.5	7.7
2008	10.1	8.6	8.5	6.0
2009	8.2	6.3	6.2	7.0
2010	9.2	10	12.7	8.0
2011	10.2	6.8		6.0
Slope(b)	<b>0.526</b>	-0.157	0.662	0.013
p-value	<b>0.023</b>	0.450	0.150	0.924
3 year Moving average slope (b)	<b>0.507</b>	-0.138	<b>0.524</b>	0.102
p-value	<b>0.030</b>	0.170	<b>0.015</b>	0.316

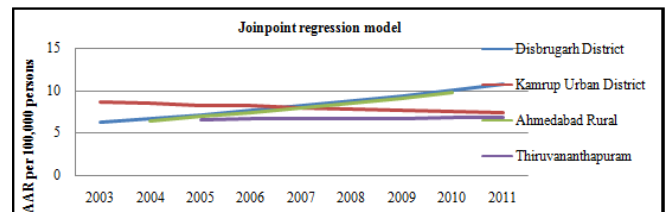
**4.2 Trends over time based on value of joinpoint AARs with Annual Percentage Change (APC)**

In Table 5 and 6 the Joinpoint Regression Data for the same PBCRs are given along with the Annual Percentage Change (APC) and statistical significance. The graphical representations of joinpoint for same PBCRS have been illustrated (Figure 3 and 4).



**Figure 3:** Graph showing trends over time in AARs for joinpoint regression model for five populations based cancer registries

Among all the PBCRs data shown in the tables Dibrugarh district (6.98%) has the highest rate of significant APC is followed by Bhopal (2.97), Delhi (2.93) and Mumbai (1.35)(Table 4 and Table 5)



**Figure 4:** Graph showing trends over time in AARs for joinpoint regression model for four recent populations based cancer registries

**Table 5:** Trends over time based on value of joinpoint AARs with annual percentage change

Year	Bangalore JP1	Bhopal JP0	Chennai JP0	Delhi JP1	Mumbai JP1
1982	4.3		6.4		5.5
1983	4.0		6.4		5.5
1984	3.8		6.4		5.5
1985	3.6		6.3		5.5
1986	3.4		6.3		5.5
1987	3.2		6.3		5.5
1988	3.0	5.9	6.3	3.5	5.5
1989	2.9	6.1	6.3	3.6	5.5
1990	2.7	6.3	6.3	3.6	5.5
1991	2.6	6.4	6.3	3.7	5.5
1992	<b>2.4</b>	6.6	6.3	3.7	5.5
1993	2.5	6.8	6.3	3.8	5.5
1994	2.5	7.0	6.3	3.8	5.5
1995	2.6	7.2	6.3	3.9	5.5
1996	2.7	7.5	6.3	3.9	5.5
1997	2.7	7.7	6.3	3.9	5.5
1998	2.8	7.9	6.3	4.0	<b>5.5</b>
1999	2.8	8.1	6.3	4.0	5.7
2000	2.9	8.4	6.3	4.1	5.9
2001	3.0	8.6	6.3	4.2	6.1
2002	3.1	8.9	6.3	<b>4.2</b>	6.3
2003	3.1	9.2	6.3	4.5	6.5
2004	3.2	9.4	6.3	4.9	6.7
2005	3.3	9.7	6.3	5.2	7.0
2006	3.4	10.0	6.3	5.6	7.2
2007	4.4	10.3	6.3	6.1	7.4

2008	3.5	10.6	6.3	6.5	7.7
2009	3.5	10.9	6.3	7.0	7.9
2010		11.2			8.2
APC0	-0.20	<b>2.97*</b>	-0.06	<b>2.93*</b>	<b>1.35*</b>
APC1	<b>-5.56*</b>	-	-	1.26	0.08
APC2	<b>2.39*</b>	-	-	<b>7.61*</b>	<b>3.31*</b>

Values of years where a shift in trend observed is highlighted;

\*represents significant APC values (p<0.05)

**Table 6:** Trends over time based on the value of jointpoint AARs with annual percentage change for four recent PBCs.

Year	Disbrugarh District	Kamrup Urban District	Ahmedabad Rural	Thiruvana nthapuram
	JP0	JP0	JP0	JP1
2003	6.3	8.7	6.4	6.6
2004	6.7	8.5	6.9	6.7
2005	7.2	8.3	7.4	6.7
2006	7.7	8.2	7.9	6.7
2007	8.2	8.0	8.5	6.7
2008	8.8	7.8	9.1	6.8
2009	9.4	7.7	9.8	6.8
2010	10.1	7.5		
2011	10.8	7.4		
APC0	<b>6.98*</b>	-2.04	7.4	0.35
APC1	-	-	-	-
APC2	-	-	-	-

Values of years where a shift in trend observed is highlighted; \* represents significant APC values (p<0.05)

## 5. Projection of Burden of Mouth Cancer

Projections of the number of cancer cases by place and type are valuable to plan control actions and in anticipating the demand of cancer services such as health care services and allocation of funds and resources, that would help to include both diagnostic and treatment facilities. Projection of cancer means a systematic way of prediction of the number of cancer cases for a specific period of time [7]. The given table 7 shows the number of projected cases of male mouth cancer for selected time periods for India.

**Table 7:** Projected case of mouth cancer for selected time periods (2013, 2014, 2015 and 2020)

ICD-10	Site Name	2013	2014	2015	2020
C03-C06	Mouth	45669	48430	51362	68977

## 6. Conclusion

We have received the epidemiology of mouth cancer across different PBCRs in India. Mouth cancer is the sixth most common cancer in the world and third most in India. Mouth cancer is first leading cancer among males in nine PBCRs namely Barshi Rural, Barshi Expanded, Bhopal, Mumbai, Ahmedabad rural district, Ahmedabad Urban district, Aurangabad, Nagpur and Pune and third rank among four namely Dibrugarh district, Kolkata, Kollam and Thiruvananthapuram. This data shows that most of the regions of India are affected by mouth cancer and that is increasing in trend. The cancer projection data shows that the number of incidences will be almost doubled by 2020.

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