RESEARCH COMMUNICATION

Trends of Head and Neck Cancers in Urban and Rural India

J Kalavathy Elango[1,2], P Gangadharan[2]*, S Sumithra[3], MA Kuriakose[1]

Abstract

Background:The sub-site predilection of head and neck squamous cell carcinoma (HNSCC) reflects the risk profile of a community and there are suggestions that these are changing over time. Objective: To determine the change in head and neck cancer in rural and urban populations in India. Methods: Cancer registry data of an urban and a rural population were reviewed over a period of 13 and 11 years, respectively. Age adjusted rates (AAR) and age specific incidence rates were used for data analysis. Results: Oral cancers formed the majority of the head and neck cancers with a predilection for tongue, except in rural males, in whom the pharynx was the predominant sub-site. Overall there was a reduction in the incidence of HNSCC, which was more pronounced in urban females and rural males (p< .001). Among the sub-sites, oral cavity cancers showed a decreasing trend in urban females (p< .01) and rural males (p< .01). However, the trend was towards increase of incidence of tongue cancers. Pharyngeal cancer showed reduction in urban females (p< .01), whereas it increased in rural females. The recent increase in incidence of young adults with HNSCC reported in developed countries was not observed. Conclusions: Overall, incidence of HNSCC is reducing. This may be attributed to the decreased prevalence of tobacco use.The increase in incidence of tongue cancer may suggest factors other than tobacco and alcohol in its genesis.

Key Words: Head and neck cancer - epidemiology - urban and rural India - trends - tobacco

Asian Pac J Cancer Prev, **7**, 108-112

Introduction

Head and neck squamous cell carcinoma (HNSCC), which constitutes the upper aerodigestive tract carcinomas (ICD-9 141,143-146,148,149,161), has a distinct geographical predilection. The age-adjusted rates of head and neck cancers are highest in countries like France, India, Brazil, and USA (blacks). Among females the age-adjusted rates of India are the highest in the world (Sankaranarayanan et al., 1998; Parkin et al., 1997;2002). The age adjusted rates of head and neck cancers range from 45 in France to 5 in places like Costa Rica, Kuwait and Japan.There is also a distinct site predilection in different countries. In India,the oral cavity is the predominant site, whereas pharynx is the common site in France.(Coleman et al., 1993). The difference in disease predilection may be a reflection of the prevailing risk habits of the population (Sankaranarayanan et al., 1998; Menvielle et al., 2004). The common risk factors for HNSCC are tobacco habits of smoking or chewing with pan and alcohol (Hashibe et al., 2000; Iype et al., 2001; Balaram et al., 2002). Cancers of the tongue as well as buccal mucosa have been noted to be quiet common in India, attributed to the local custom of chewing pan, betel leaf with tobacco (Thomas et al., 2003). Smoking is the most common form of tobacco consumption in urban male population in India whereas in rural population, chewing tobacco is more common (National Sample Survey Organization, 1998). There is evidence to suggest that the tobacco habit is changing over time and our hypothesis was that changes in risk habits and urbanization may cause alterations in the patterns of HNSCC, like the age of onset and sub-site predilection. To test this hypothesis we conducted an in-depth analysis of cancer registry data for one urban and one rural population in India. The results demonstrated a reduction overall in the incidence of head and neck cancers in both urban and rural populations, associated with alteration in the sub-site predilection.

Materials and Methods

In this study we analyzed the data from urban (Chennai-1986-98) and rural (Barshi-1988-98) cancer registries, which are monitored by theNational Cancer Registry Programme of the Indian Council of Medical Research (ICMR) s these cancer registry data. Barshi registry, the first rural registry in India covers a total population of around 0.4 million in 346 villages spread over 3713 sq.km. in Solapur district of Maharashtra. Chennai registry, caters to an area of 170sq.km

1 Head and Neck Institute, 2 Cancer Registry, 3 Department of Community Medicine, Amrita Institute of Medical Sciences & Research Center (Deemed University) Cochin, Kerala, India-682026 For contact: P Gangadharan Tel: +91-484-280 1234, extn: 3006 Fax: +91-484-280 2020 e-mail: gangadharanp@aimshospital.org

Table 1. Sub-site Distribution of HNSSCs

Site	Urban								Rural							
	Male		Female		Young male		Young female		Male		Female		Young male		Young female	
	no:	%	no:	%	no:	%	no:	%	no:	%	no:	%	no:	%	no:	%
Tongue	1019	21%	298	14%	123	22%	47	13%	44	16%	12	23%	6	15%	4	29%
Oral cavity	1252	26%	1175	57%	140	25%	181	48%	59	22%	21	40%	15	39%	2	14%
Larynx	863	18%	104	5%	100	18%	24	6%	43	16%	5	9%	5	13%	3	21%
Pharynx	1643	34%	503	24%	198	35%	122	33%	126	46%	15	28%	13	33%	5	36%

and covers an urban population of 4.2 million.

In this study we used the age adjusted incidence rate (AAR) and the age specific incidence rate (ASpR) for analyzing trends. ASpR refers to the rate obtained by dividing the total number of cancer cases by the corresponding estimated population in that age group and sex/ site/ geographic area/ time period and multiplying by 100,000. As age increases, the incidence of cancers also increases, therefore with an increase in the median age of a population the cancer incidence also increases in the community. In order to make the rates comparable between different populations, the age specific incidence rates are adjusted to the five-year age distribution of the world standard population (Plummer,WHEN?) to obtain the AARs. Age adjusted rates are calculated for all age groups as well as for the young (20-44 years) age groups in this study. A model that fits the data is linear regression analysis estimated by the method of Least Squares through SPSS package and the regression equation is stated as $Y = mX + b$, where Y is the outcome or the dependent variable- the age adjusted rate, X is the independent variable- year of diagnosis, m is the annual percentage change, b is the Y-intercept. Few variables violated the assumption of normality for which square root transformation technique was used.

Cumulative risk (Cu R) refers to the probability that the person will develop a particular cancer during a certain age period in the absence of any other cause of death. The Cumulative Rate is an approximation of the cumulative risk. It is obtained by adding the annual age-specific incidence rates for each five-year age interval (for whatever age group is to be used to calculate the cumulative risk) multiplied by 5 (representing the five year age interval) times 100 divided by 100,000.

The cumulative incidence rate has a useful probabilistic interpretation. This also removes the arbitrariness of choosing a standard population. The confidence intervals are calculated using the formula [Cumulative Incidence Rate Percentage (CIRP) +/- (1.96X Standard Error of CIRP]. The probability of getting a specific cancer, expressed in terms of one in every so many persons was computed by reciprocating estimated cumulative incidence rate expressed as a percentage.

Results

The urban registry recorded a total of 6,857 head and neck cancers during the time period 1986 to 1998, out of which 4,777 were in males (23% of all male cancers), and 2,080 were in females (9% of female cancers). In the rural registry, a total of 325 head and neck cancers were registered during the time period 1988 to 1998, out of which 272 were in males (28% of all male cancers) and 53 were in females (5% of all female cancers). The overall male: female ratio of head and neck cancers in urban population was 2:1 and in the rural population was 5:1.

To investigate whether there was any change in the incidence of head and neck cancers in the young adults the AARs for the age group 20-44 years were analyzed. In the urban population, among males, 12% of the total head and neck cancers were from younger age group (20-44 years) and among females it was 18%. In the rural population, the contribution of young males was 14.5% and for young females was 26%. Among young adults, the male: female ratio in urban population was 1.5:1 and in rural population it was 3:1. In contrast in patients over 45 years old the male: female ratio was 2.5:1 in the urban and 6:1 in the rural community.

The sub-site distribution of all head and neck cancers is given in Table1. Oral cavity including tongue was the predominant site in the urban and rural population except in rural males, where the pharynx was the predominant site. The age specific incidence rates of head and neck cancers showed the peak incidence in 70-74 years in both urban and rural populations (see Figure 1).

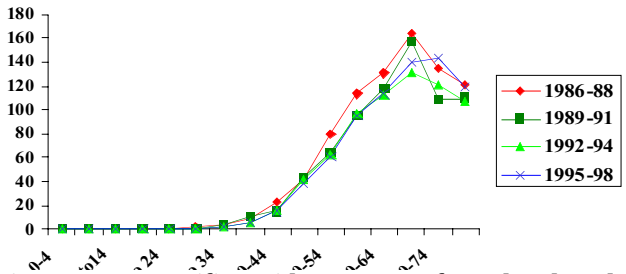

Figure1. Age Specific Incidence Rates of Head and Neck Cancers

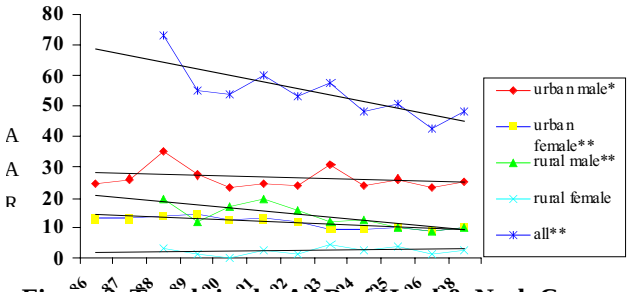

Figure 2. Trends in the AAR of Head & Neck Cancers

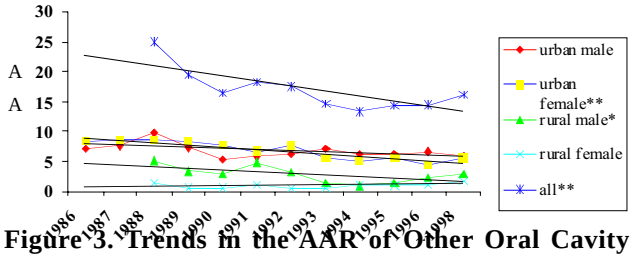

Figure 3. Trends in the AAR of Other Oral Cavity Cancers

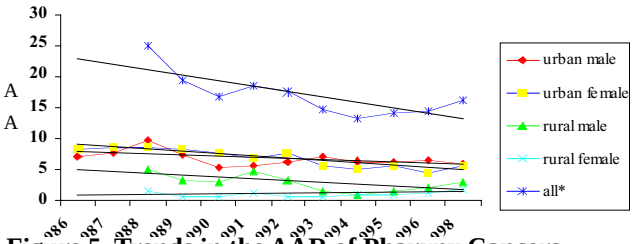

Figure 5. Trends in the AAR of Pharynx Cancers

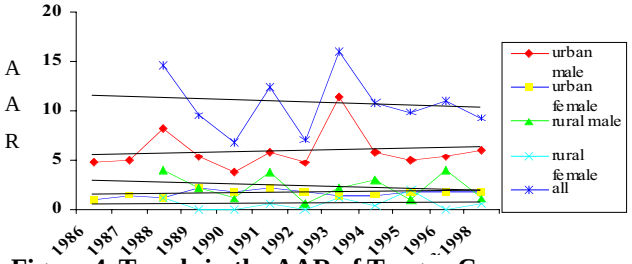

Figure 4. Trends in the AAR of Tongue Cancers

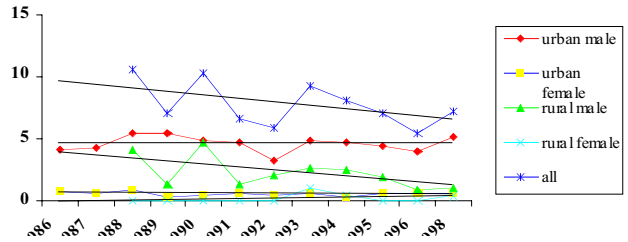

Figure 6. Trends in the AAR of Larynx Cancers

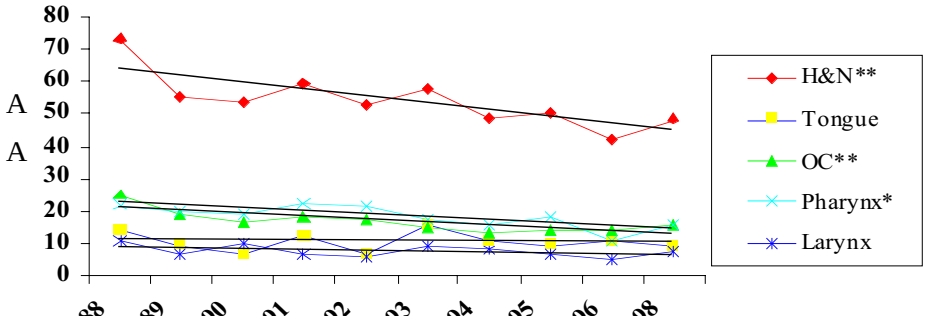

Figure 7. Trends in AAR of Head and Neck and All Sub-sites, Urban & Rural, Males & Females

Figure 2 demonstrates the trends in the AAR of head and neck cancers. Overall there was a reduction in the AAR of head and neck cancers in both urban and rural population and this reduction was statistically significant (p=0.01). However among rural females the AAR of Head and Neck squamous cell carcinoma had increased during the study period though this change had not reached statistical significance.

In Figure 3 the trends of other oral cavity cancers (oral cavity cancers other than tongue) are shown. There was a reduction in the incidence in the urban females (p=0.01). In the rural population, a reduction in the incidence was seen among males (p=0.01), whereas a steady increase was found among females, which was not statistically significant.

For the tongue cancers, there was an overall increase in the incidence in the urban community as well as in rural females. A decreased incidence of tongue cancer was seen in rural males (Figure 4), but not statistically significant.

The pharyngeal cancers showed a decrease in incidence in the urban population and rural males (Figure 5). However there was an increase among rural females. These changes were not statistically significant.Similar changes were observed in laryngeal cancers (Figure 6).

Analysis of the AAR in urban young adults showed a decreased incidence of all cancers except that of tongue in females. Among these changes the reduction in the incidence of head and neck cancers (p=0.001), other oral cavity (p=0.001) and pharyngeal cancers (p=0.01) among females were statistically significant.

Analysis of the AAR in rural young adults showed a trend towards reduction in the incidence of head and neck cancers, especially that of tongue and larynx and an increase

Table 2. Probability Estimates for the Sub-sites

Site	Life time risk				Cumulative Incidence Rate Percent			
	Urban		Rural		Urban		Rural	
	M	F	M	F	M	F	M	F
Head & neck	27	64	54	494	4.0% (3.43-4.04)	1.6% (1.44-1.72)	2.0% (1.57-2.45)	0.34% (0.20-0.46)
Tongue	136	458	459	1250	0.8% (0.66-0.86)	0.23% (0.20-0.26)	0.33% (0.19-0.48)	0.07% (0.01-0.14)
Oral cavity	102	111	422	1068	1.0% (0.90-1.10)	0.94% (0.82-1.07)	0.33% (0.21-0.52)	0.12% (0.08-0.16)
Larynx	150	1386	-*	-*	0.69% (0.61-0.77)	0.08% (0.06-0.09)	0.24% (0.21-0.45)	0.003% (-.012-.07)
Pharynx	80	313	130	1304	1.27% (1.15-1.41)	0.30% (0.29-0.39)	0.97% (0.68-1.26)	0.11% (0.055-0.17)

*- Not sufficient cases for reliable estimation CIRP 95% Confidence Intervals are given in brackets

in the incidence of other oral cavity,and pharynx among males. Among rural females there was a trend towards increase in incidence of all head and neck cancers except that of pharynx. The overall trends in the AAR of head and neck cancers in different sub sites are given in Figure 7.

The probability estimates showed that among urban, one out of every 27men and one out of every 64 women would contract head and neck cancer in their life span (Table 2). Estimation of the cumulative incidence rate percentage showed that 3.7% of the urban male population will develop head and neck cancer in their life span; out of this 0.2% belongs to 20-44 years age group. Of the urban female population 1.6% will develop head and neck cancer in their life span; out of this 0.13% belong to the younger age group. Among rural population, one out of every 54 men and one out of every 494 women would contract head and neck cancers in their lifespan. Estimation of the cumulative incidence rate percentage showed that 2% of the rural male population will develop head and neck cancer in their life span; out of this 0.2 % belongs to 20-44 years age group. Of the rural female population 0.3% will develop head and neck cancer in their life span; out of this 0.1 % belong to the younger age group. The probability estimates of the sub sites are also given in Table 2.

Discussion

The results suggest that there is an overall reduction in the incidence of head and neck cancers in both urban and rural community. This is more pronounced in the urban community, probably due to the reduction in the use of tobacco in that population. This reduction has not happened in rural women emphasizing the need to target that population for health education.

There is strong epidemiological evidence to link tobacco habits with the occurrence of head and neck cancers. A wide variety of tobacco habits like smoking, chewing, snuffing, using burnt tobacco as powder or paste are prevalent in India, which is more so in the rural population than in their urban counterparts (National Sample Survey Organization, 1998). Among them, bidi smoking, tobacco chewing and cigarette smoking, in that order, account for a large majority of head and neck cancers (Sanghvi et al., 1989). Smoking is most common form of tobacco consumption among males and chewing among females (National Sample Survey Organization, 1998). Tobacco related cancers (TRC) account for nearly 48.2% of all cancers in Indian men and 20.1% in women (Gajalakshmi and Shanta, 1996). Other than tobacco, alcohol abuse and viral infection have been implicated in head and neck carcinogenesis.

National Sample Survey Organization (NSSO) data from India has shown that the tobacco consumption has decreased in both urban and rural males and females over the period 1987-88 to 1993-94. Contrary to the popular belief that the tobacco consumption is increasing, this data shows that it has decreased in all sectors. Possibly the decreased consumption could account for the decrease in head and neck cancers, especially that of oral cavity. Though there is a decreasing trend, the incidence of oral cavity cancers in India, is still one of the highest in the world (Franceschi et al., 2000). The possible reasons could be the easy availability of tobacco products and the lack of awareness in the community.

The sub-site predilection table shows that the reduction in incidence is obvious in tumors where tobacco is the primary risk factor such as `other oral cavity,(chewing of tobacco) and larynx (smoking). Similar trends were observed in other parts of India (Coleman et al., 1993; Sunny et al., 2004). The decreasing trend may be attributable to a decrease in the usage of pan and tobacco. It is interesting to note that although there is a decrease in `other oral cavity,Ä cancers, the AAR of tongue is increasing. This may suggest that risk factor for tongue cancers may be different from that of other head and neck sub-sites.

There are reports from Europe and United State of America to suggest that head and neck cancers are increasing among young, particularly in tongue (Schantz and Yu, 2000; Llewellyn et al., 2004). This finding was not observed in our study.

References

Balaram, P., et al (2002). Oral cancer in southern India: the influence of smoking, drinking, paan-chewing and oral hygiene. *Int J Cancer*, **98**, 440-5.

Franchesci S, Levi F, Lucchini F (1994). Trends in cancer mortality in young adults in Europe, 1955-1989. *Eur J Cancer*, **30A**, 2096-118.

Franceschi S, Bidoli E, Herrero R, Munoz N (2000). Comparison of cancers of the oral cavity and pharynx worldwide: etiological clues. *Oral Oncol*, **36**, 106-15.

Gajalakshmi CK, Shanta V (1996). Tobacco-related cancers in Madras, India. *Eur J Cancer Prev*, **5**, 63-8.

Hashibe M, Mathew B, Kuruvilla B, et al (2000). Chewing tobacco, alcohol, and the risk of erythroplakia. *Cancer Epidemiol Biomarkers Prev*, **9**, 637-8.

Iype EM, Pandey M, Mathew A, et al (2001). Oral cancer among patients under the age of 35 years. *J Postgraduate Med*, **47**, 171-6.

Llewellyn CD, Johnson, W, Warnakulasuriya, A (2001). Risk factors for squamous cell carcinoma of the oral cavity in young people--a comprehensive literature review. *Oral Oncol*, **37**, 401-18.

Llewellyn CD, Linklates K, Bell J, Johnson NW, Warnakulasurya A (2004). An analysis of risk factors for oral cancer in young people: a case-control study. *Oral Oncol*, **40**, 304-13.

Macfarlane G J, Boyle P, Scully C (1992). Oral cancer in Scotland: changing incidence and mortality. *BMJ*, **305**,1121-3.

Menvielle G, Goldberg P, Bugel I, Leclerc A (2004). Smoking, alcohol drinking and cancer risk for various sites of the larynx and hypopharynx. A case-control study in France. *Eur J Cancer Prev*, **13**, 165-72.

Michel P, Coleman JE, Damiecki P, Arslan A, Renard H (1993). Trends in Cancer incidence and mortality. IARC Scientific Publications No. 121 Lyon, IARC.

National Sample Survey Organization (1998). NSS 50th Round(1993-1994), A note on the consumption of tobacco in

India. Sarvekshana, (21): p 69.
Parkin DM, Laara E, Muir C (1998). Estimates of the worldwide frequency of sixteen major cancers. *Int J Cancer*, **41**, 184-97.
Parkin DM, Whelan SL, Ferlay J, Raymond, L, Young, J., eds (1997). Cancer Incidence in Five Continents Vol. VII. IARC Scientific Publications No. 143 Lyon, IARC.
Parkin DM, Whelan, SL, Ferlay J, Teppo L, Thomas DB eds (2002). Cancer Incidence in Five ContinentsVol. VIII. IARC Scientific Publications No. 155 Lyon, IARC.
Plummer, M (1997). Age standardization. In: Parkin D et al., eds. Cancer Incidence on Five Continents Vol. VII. Lyon, International Agency for Research on Cancer. IARC Scientific Publications, No.143: p. 66-68.
Sanghvi LD, Rao N, Joshi S (1989). Epidemiology of head and neck cancers. *Semin Surg Oncol*, **5**, 305-9.
Sankaranarayanan R, Masuyer E, Swaminathan R, Ferlay J, Whelan S (1998). Head and neck cancer: a global perspective on epidemiology and prognosis. *Anticancer Res*, **18**, 4779-86.
Schantz SP, Yu GP (2002). Head & neck cancer trends in young Americans (1973 – 1997) with a special analysis for tongue cancer. *Arch Otolaryngol Head Neck Surg*, **128**, 268-74.
Sunny L, Yeole BB , Hakama M, et al (2004). Oral cancers in Mumbai, India: a fifteen years perspective with respect to incidence trend and cumulative risk. *Asian Pac J Cancer Prev*, **5**, 294 – 300.
Thomas G, Hashibe M, Jacob BJ, et al (2003). Risk factors for multiple oral premalignant lesions. *Int J Cancer*, **107**, 285-91.