



Oral cancer mortality trends in Brazilian geographical regions from 1996-2001.

Loffredo, L.C.M.¹; Pinelli, C.¹; Vitussi, T.R.C.¹; Sundefeld, M.L.M.M.²; Campos, J.A.D.B.¹

¹Department of Social Dentistry, Araraquara Dental School, Universidade Estadual Paulista, UNESP, Araraquara, SP, Brazil.

²Department of Pediatric and Social Dentistry, Araçatuba Dental School, Universidade Estadual Paulista, UNESP, Araçatuba, SP, Brazil.

Recebido 19/10/06 / Aceito 07/02/07

ABSTRACT

The purpose of this study was to analyse the oral cancer mortality trends in Brazil by geographic region, age and sex, from 1996 to 2001. The Brazilian Ministry of Health database DATASUS and the Brazilian Institute of Geography and Statistics were used as the source of data. Oral cancer mortality rates per 100,000 population were estimated. Statistical analyses comprised estimates of oral cancer mortality rates, grouped according to the study variables, in 1996, 1997, 1998, 1999, 2000 and 2001; also, the three-year periods 1996-1998 and 1999-2001 were analysed, allowing the oral cancer mortality trends between these two periods to be calculated. For comparison, in each geographical region, the ratio between two death rates (related to period or sex) was calculated. In the period 1996-2001, a total of 25,972 deaths due to oral cancer were reported, giving a mortality rate of 2.67. The rates for the periods 1996-1998 and 1999-2001 were 2.53 and 2.73, respectively, showing a slight increase in the rate. There was a predominance of oral cancer in males with a male/female ratio of approximately 4. All regions exhibited an increase in mortality rates, with the exception of the Southeast region. From 1996 to 2001, the average mortality rates were 3.55 and 3.58 for the Southeast and South regions, and 1.94, 1.41, and 0.86 for the Mid-West, Northeast, and North regions, respectively. Over the age of 40, oral cancer mortality rates were seen to increase rapidly with age. Oral cancer mortality increased in all regions, except in the Southeast, and was considerably higher among males and older individuals.

Keywords: oral cancer; epidemiology; mortality; Brazil.

INTRODUCTION

Success in fighting cancer, as a public health concern, depends crucially on accurate knowledge of the extent of the disease, its distribution nationwide and worldwide and its mortality rate. Such basic epidemiological research is a fundamental basis of surveillance in cancer programs.

Oral cancer refers, mainly, to squamous cell carcinoma (Instituto Nacional do Câncer, 2002), which is a major threat to public health and has gained prominence due to the severity of the disease and its increasing prevalence in the latter half of the 20th century (Hindle & Nally, 1991). Sudbo (2004) comments that oral cancer is a devastating disease and that the mortality rates have not improved in the last few decades. O'Sullivan (2005) states that oral and pharyngeal cancer accounts for "over half a million new cases and 200,000 deaths worldwide per annum".

Oral cancer has one of the lowest survival rates, which could be improved if the malignant lesions could be identified and the disease treated at an early stage (Horowitz et al., 1996; Sundefeld et al., 2001; Kujan et al., 2005; McLeod et al., 2005). The main risk factors for oral cancer are tobacco smoking and alcohol consumption (Hindle & Nally, 1991; Instituto Nacional do Câncer, 2002).

According to the World Health Organization (WHO, 1984), oral cancer is one of the 10 most prevalent cancers in the world. Its geographical distribution shows highest incidence rates in South and Southeast Asia, while high incidences were reported in Brazil (WHO, 1984), in Singapore and in Hawaii among Caucasian inhabitants (Coleman et al., 1993). Among the European countries, France, Spain, Germany and Switzerland had the highest incidences (Franceschi et al., 2000). In USA, about 27,700 cases of oral and pharyngeal cancer are diagnosed each year, and about 7,200 Americans die from these cancers (Tomar et al., 2004). The oral and pharyngeal cancer mortality rate from 1988 to 1992 was 2.9 per 100,000 population, mortality in males (4.6) being more than twice that of females (1.7), and it reached 21.2 per 100,000 in people aged 85 and older (Swango, 1996). In Italy, interestingly, Tumino & Vicario (2004) found that oral cancer mortality rates decreased in both sexes, in the period 1986-1997, in the database of the Italian Network of Cancer Registries.

Considering the countries of Latin America and the Caribbean, an increasing incidence was observed in southeast South America and a decrease in other countries (Wünsch-Filho & Camargo, 2001). The highest Brazilian rates were in São Paulo city (25.3 and 4.9 per 100,000 among males and females, respectively), followed by Porto Alegre city (15.9 and 1.8 x 100,000 among males and females,

*Corresponding author: Leonor de Castro Monteiro Loffredo - Departamento de Odontologia Social - Faculdade de Odontologia de Araraquara - Universidade Estadual Paulista, UNESP - Rua Humaitá, 1680 - CEP: 14801-903 - Araraquara - SP, Brasil - Telefone: (16) 3301-6345 - E-mail: lloffred@foar.unesp.br

respectively), which are located in the Southeast and South regions, respectively (Wünsch-Filho, 2002). According to Franceschi et al. (2000), oral cancer rates in Brazil figure amongst the highest in the world. Considering the sex distribution in Brazil, "oral and pharynx cancer represents the fifth incidence of cancer among males and the seventh among females" (Wünsch-Filho, 2002).

Antunes et al. (2001) highlighted the stationary trend of oral cancer deaths in São Paulo city in the period 1980-1998, and found a female mortality rate of 0.79, and a male mortality rate of 3.6 per 100,000 population. In addition, in this period oral cancer was responsible for 2.16% of all cancer deaths. Mirra (1999) pointed to an incidence rate (in 100,000) in São Paulo, in 1993, of 2.4 for females and 9.3 for males.

In an assessment of oral cancer mortality and clinical stage at diagnosis, according to the results of a 5-year survival analysis of 371 patients, 18.1% of those diagnosed at clinical stage I died, compared with 65.4% of those diagnosed at stage IV (Leite & Koifman, 1998).

The study of mortality data has been hindered by underreporting, commonly seen in flawed death registers. Mello-Jorge et al. (2002) point out that, despite being flawed, the available government mortality data can be a valuable resource for epidemiological studies. Laurenti (1987) believes that a descriptive mortality study would be a source for further analyses, and Kligerman (2002) highlights the importance of knowing the distribution of malignant tumors, by geographical area and period, in epidemiological studies.

The purpose of this study was to analyse the oral cancer mortality trends in Brazilian geographical regions, by age and sex, from 1996 to 2001.

MATERIAL AND METHODS

Among the causes of death examined in this study, the mouth was taken as an underlying cause of death and they were classified as neoplasia of lips, oral cavity and pharynx, in accordance with the 10th Revision of the WHO International Classification of Diseases (Organização Mundial da Saúde, 1999).

Death rates due to oral cancer were estimated per 100,000 population in each Brazilian geographical region, according to sex and age, in the years from 1996 to 2001; no adjustment by age or sex was done because of the low probability of changes in their distribution in the 6-year study period.

Data from the Brazilian SUS (Unified Health System) dataprocessing department (DATASUS) and National Center for Epidemiology (CENEPI), both of the Ministry of Health (Brasil, 2006), were used to build the study database, which consisted of mortality information from 1996 to 2001. Population data were taken from those collected by the Brazilian Institute of Geography and Statistics (IBGE), according to region, sex and age (Brasil, 2006).

Statistical analyses comprised estimates of oral cancer mortality rates in the population groups under study

in 1996, 1997, 1998, 1999, 2000 and 2001; in addition, the rates for the three-year periods 1996-1998 and 1999-2001 were calculated, allowing the oral cancer mortality trend between these two periods to be analysed. To make this comparison, in each geographical region, the ratio between two rates (for two periods or sex groups) were calculated by point (R) and by 95% confidence interval (CI_{95%}) (Dever, 1988), as follows:

$$R = r_1 / r_2,$$

where:

R = ratio between two rates r_1 and r_2

r_1 = rate for Period 1 or sex A

r_2 = rate for Period 2 or sex B.

The 95% confidence interval (CI_{95%}) was defined as:

$$R \pm 1.96R \sqrt{\frac{1}{d_1} + \frac{1}{d_2}}$$

where:

d_1 = number of deaths in Period 1 or sex group A

d_2 = number of deaths in Period 2 or sex group B.

Within each geographical area, when the oral cancer mortality rate for the period 1999-2001 was compared to the rate for 1996-1998, for the purposes of this study an increasing trend occurred if $R > 1$ and its confidence interval did not include 1. There was a decreasing trend if $R < 1$, and its confidence interval did not include 1. When the confidence interval for R included 1, the trend was considered "stationary".

The results are displayed in Tables and Graphs.

RESULTS

In Brazil, in the period 1996-2001, 25,972 oral cancer deaths were registered, giving an oral cancer mortality rate of 2.67 per 100,000 population. The equivalent rates for the periods 1996-1998 and 1999-2001 were 2.53 and 2.73 per 100,000, respectively, leading to $R=1.08$ (CI_{95%}: 1.06-1.11), showing a slight increase in the rate in the second period, which was significant according to the confidence interval decision criteria.

Figure 1 displays the annual progression in the oral cancer mortality for each geographical region, over the 6-year study period.

An increasing tendency can be seen in oral cancer mortality rates in all regions, with the exception of the Southeast region. In the North, lower rates were found, but they increased appreciably in 1998, compared to the previous years. Improving registration of death certificates might explain that.

The oral cancer mortality rates for to the 3-year periods (1996-1998 and 1999-2001), in each geographical region, are collected in Table 1.

Oral cancer mortality

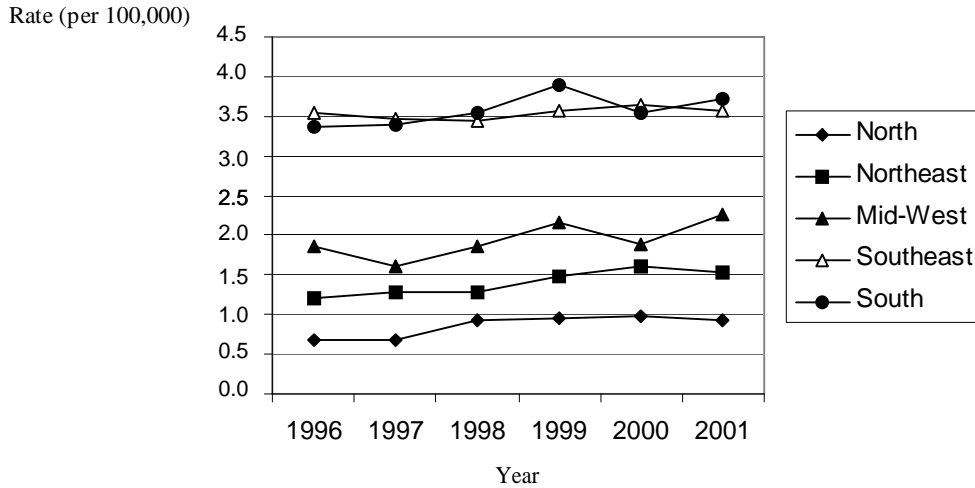


Figure 1. Yearly oral cancer mortality rates (per 100,000 population) for each geographical region. Brazil, 1996-2001.

Table 1 - Oral cancer mortality rates (per 100,000 population) for each geographical region and estimated interperiod ratio (R) with 95% confidence interval (95% CI). Brazil, 1996-1998 and 1999-2001.

Period	North	Northeast	Southeast	South	Mid-West
1996-1998	0.76	1.26	3.49	3.44	1.77
1999-2001	0.95	1.55	3.60	3.72	2.11
R	1.25	1.23	1.03	1.08	1.19
(95% CI)	(1.05-1.45)	(1.18-1.31)	(1-1.06)	(1.06-1.1)	(1.06-1.32)

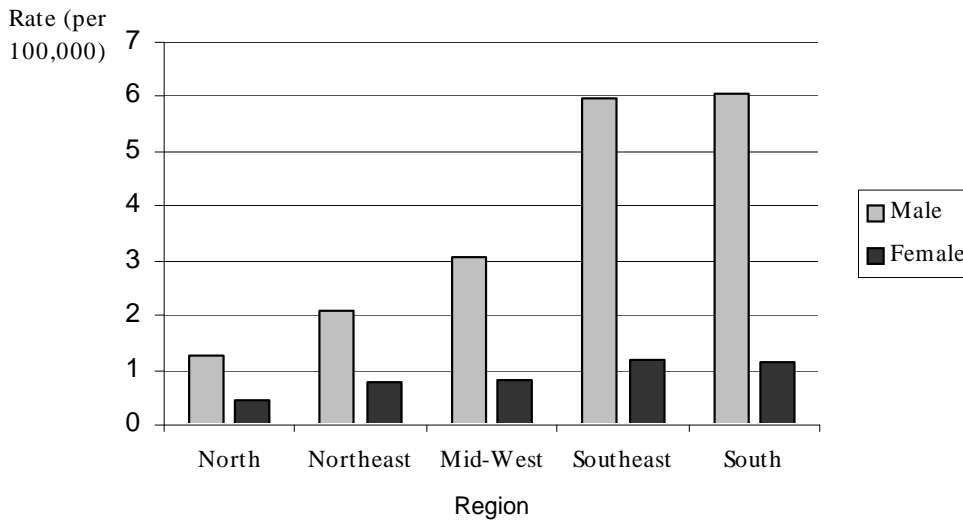


Figure 2. Mean oral cancer mortality rates (per 100,000 population) for each geographical region and sex. Brazil, 1996-2001.

The high incidences of oral cancer death observed in both Southeast and South regions remained fairly steady. In the Southeast region, with $R=1.03$ ($CI_{95\%}: 1-1.06$), the trend was stationary, whereas $R=1.08$ ($CI_{95\%}: 1.06-1.1$) in the South, pointing to a slight increase.

In the North, Northeast and Mid-West regions, rates were higher in the period 1999-2001 relative to 1996-1998, leading to $R=1.25$ ($CI_{95\%}: 1.05-1.45$), $R=1.23$ ($CI_{95\%}: 1.18-1.31$) and $R=1.19$ ($CI_{95\%}: 1.06-1.32$), respectively.

With regard to sex, the mean oral cancer mortality rates were 4.33 per 100,000 for males and 0.99 per 100,000 females, leading to an intersex $R=4.37$ ($CI_{95\%}: 4.23-4.51$), showing a highly significant difference between the sexes, over the whole study period. High mortality rates among males were observed in all geographical regions, although this difference varied from one region to another, as can be seen in Figure 2.

The results show, in the male sex, highest oral cancer

mortality rates in the South (6.06 per 100,000) and Southeast regions (5.98 per 100,000), while in the other regions, the rates were 3.08, 2.08, and 1.26 per 100,000 in the Mid-West, Northeast and North, respectively, throughout the 6-year study period, with male/female ratios of approximately 5 in the South and Southeast regions, and approximately 3 in the Mid-West, North and Northeast regions.

Considering the periods 1996-1998 and 1999-2001, the oral cancer mortality rates in Brazil for each sex are shown in Table 2.

Table 2 - Oral cancer mortality rates (per 100,000 population) for each sex. Brazil, 1996-1998 and 1999-2001.

Period	Sex	
	Male	Female
1996-1998	4.16	0.94
1999-2001	4.50	1.03

Table 2 shows the mortality rates by sex, in the periods 1996-1998 and 1999-2001, and once again the rates in men are noticeably higher than in women.

In Brazil, the distribution of oral cancer deaths by age showed a great predominance of mortality at the age of 80 years and above (22.5 per 100,000), while a low rate (less than 0.16 per 100,000 population) was found among those aged 0 to 39 years.

With regard to geographical regions, the average rates above 80 years old were 27.82, 27.40, 25.61, 15.81 and 15.69 per 100,000 in the South, Southeast, Mid-West, Northeast and North, respectively.

Table 3 shows the oral cancer mortality rates in the geographical regions, divided according to age, in the periods 1996-1998 and 1999-2001.

In the two periods, oral cancer mortality rates were increasingly higher from the age of 40, peaking at the age of 80 and above. The Southeast and South regions had particularly high rates among those aged 40 years and more.

The study of the data concerning age distribution among oral cancer deaths revealed a striking proportion of records marked "unknown age", mainly in the period 1996-1998, which suggests considerable inattention in filling out

medical records, hindering any research work, especially in the Mid-West region. Nevertheless, a remarkable improvement of age reporting in all the regions was noted, in the period 1999-2001, indicated by a marked drop in the number of deaths by "unknown age".

DISCUSSION

A total of 25,972 deaths due to oral cancer were reported in the study period; however, these figures may have been underestimated, due either to poor access of patients to health care or to failure in filling out correctly the death certificate item about underlying cause of death.

Oral cancer data in Brazil in the period between 1996 and 2001 showed a mortality rate of about 2.67 per 100,000 population, with particularly high rates in the South and Southeast regions. Although there are limitations in comparisons among geographical region mortality rates, these findings corroborate those of a previous study (Wünsch-Filho, 2002), which reported a typical pattern in these southerly regions of rates higher than 3 per 100,000, while other regions (North, Northeast and Mid-West) showed low rates. Despite the high rates in the Southeast and South regions, the mortality rates of Southeast region remained steady throughout the period. On the other hand, the North, Northeast and Mid-West regions had higher rates in the period 1999-2001 than in 1996-1998.

At first glance, it could be hypothesized that the quality of health care information is much better in the South and Southeast regions, more specifically in relation to filling out the underlying cause on death certificates. However, the population of these regions could have been more exposed to potential risk factors such as tobacco and alcohol, which could explain such high rates. In fact, the impact of risk factors in the different Brazilian regions can only be known by means of an epidemiological study.

The male/female proportion was approximately 4 to 1, similar to those found in previous studies (Kligerman, 2002; Boing et al., 2006), although the methodologies were different. The GLOBOCAN survey (Parkin et al., 2001) estimated the

Table 3 - Oral cancer mortality rates (per 100,000 population), by age and region. Brazil, 1996-1998 and 1999-2001.

Period	Age	North	Northeast	Southeast	South	Mid-West
1996-1998	40+50	1.25	2.06	5.31	4.85	2.42
	50+60	3.81	4.55	12.94	12.89	8.61
	60+70	6.64	7.35	18.33	19.24	11.94
	70+80	9.54	10.37	22.04	21.55	17.55
	80+ +	14.84	14.02	27.36	26.73	22.87
	Unknown	1.34	2.48	4.38	0.95	17.94
1999-2001	40+50	1.63	2.24	4.81	4.84	3.2
	50+60	4.18	5.39	13.3	13.78	9.02
	60+70	7.79	8.23	18.18	18.86	13.83
	70+80	11.09	12.78	21.19	22.7	17.07
	80+ +	16.55	17.59	27.44	28.9	28.34
	Unknown	0.00	0.00	1.10	0.00	0.00

mortality worldwide in 2000, and the death rate from oral cavity cancer for males (80.8 per 100,000) was 1.7-fold higher than for females (47.1 per 100,000), while that from pharyngeal cancer for males (64.0 per 100,000) was 4.4-fold higher than for females (14.7 per 100,000).

Concerning age, mortality rates increased remarkably in those aged above 40 years, and peaked at the age of 80 years and more, similarly to the findings of a previous study (Mirra, 1999).

Although information on oral cancer mortality in Brazil is available from the DATASUS (Brasil, 2006) up to 2004, this study was limited to data from 1996 to 2001, in order to avoid adjustments in relation to sex and age that might be needed if the period was extended and to avoid the possibility of an epidemiological transition. The probable lack of homogeneity of information quality in the various regions, and the lack of patients' access to medical care in some regions could be a limitation on the comparison of the regional rates. While government cancer statistics remain a valuable source of data, an improvement in the registration of death certificates is necessary to provide an updated cancer death database in Brazil, enabling both the planning and evaluation of programs aimed at cancer patient care. Community-wide campaigns could spread advice to patients on the need for early diagnosis, and such campaigns have been increasingly demanded as a result of improved educational approaches.

In conclusion, in the period between 1996 and 2001, a total of 25,972 oral cancer deaths were reported in Brazil, leading to a mortality rate of 2.67 per 100,000 population. Death distribution by sex showed a mortality ratio of approximately 4 times higher for males. An increasing trend in oral cancer mortality was observed in all Brazilian geographical regions, except in the Southeast. A remarkable increase in oral cancer mortality rates was seen from the age 40 years, peaking at 80 years old.

ACKNOWLEDGEMENTS:

To CNPq (Brazilian Research Council), Grant # 304140/2002-3.

RESUMO

Evolução da mortalidade por câncer de boca nas regiões geográficas do Brasil de 1996-2001.

Este estudo teve por objetivo descrever a mortalidade por câncer de boca no Brasil entre 1996 e 2001, segundo as regiões geográficas, idade e sexo. Constituiu material de estudo o banco de dados do Ministério da Saúde e do Instituto Brasileiro de Geografia e Estatística (IBGE). Foram estimados os coeficientes de mortalidade por câncer de boca (por 100.000 habitantes) segundo as variáveis de interesse para 1996, 1997, 1998, 1999, 2000 e 2001, bem como para os períodos 1996-1998 e 1999-2001,

permitindo verificar a evolução da mortalidade entre esses períodos. No período de 1996 a 2001, o país apresentou 25.972 óbitos por câncer de boca, com coeficiente de mortalidade de 2,67. Para os períodos 1996-1998 e 1999-2001 valeram 2,53 e 2,73, respectivamente, mostrando um aumento no coeficiente. Houve predomínio deste tipo de câncer no sexo masculino, sendo a relação masculino/feminino igual a, aproximadamente, 4. Todas as regiões apresentaram tendência crescente na mortalidade, com exceção da região sudeste. No período 1996-2001, os coeficientes médios de mortalidade foram 3,55 para a região Sudeste e 3,58 para a região Sul, sendo que as regiões Norte, Nordeste e Centro-Oeste apresentaram-se em patamar mais baixo de mortalidade, valendo, respectivamente, 0,86, 1,41 e 1,94 por 100.000, respectivamente. Maiores concentrações de óbitos foram observadas em idades mais avançadas, sendo mais frequentes a partir de 40 anos. Concluindo, a mortalidade por câncer de boca aumentou em todas as regiões brasileiras, com exceção da Sudeste, foi maior no sexo masculino e aumentou com a idade.

Palavras-chave: câncer de boca; epidemiologia; mortalidade; Brasil.

REFERENCES

- Antunes JL, Biazevic MG de, Araujo ME, Tomita NE, Chinellato LE, Narvai PC. Trends and spatial distribution of oral cancer mortality in São Paulo, Brazil 1980- 1998. *Oral Oncol* 2001; 37:345-50.
- Boing AF, Peres MA, Antunes JL. Mortality from oral and pharyngeal cancer in Brazil: trends and regional patterns, 1979-2002. *Rev Panam Salud Publica* 2006; 20:1-8.
- Brasil. Ministério da Saúde. Datasus. Available from URL: <http://www.datasus.gov.br> [16 oct 2006].
- Coleman MP, Estéve J, Damiecki P, Arslan A, Renard H. *Trends in cancer incidence and mortality*. Lyon: International Agency for Research on Cancer; 1993. IARC Scientific Publications no.121.
- Dever GEA. *A epidemiologia na administração dos serviços de saúde*. São Paulo: Pioneira; 1988. 394 p.
- Franceschi S, Bidoli E, Herrero R, Munoz N. Comparison of cancers of the oral cavity and pharynx worldwide: etiological clues. *Oral Oncol* 2000; 36:106-15.
- Hindle I, Nally F. Oral cancer: a comparative study between 1962-67 and 1980-84 in England and Wales. *Br Dent J* 1991; 170:15-20.
- Horowitz AM, Goodman HS, Yellowitz JA, Nourjah PAA. The need for health promotion in oral cancer prevention and early detection. *J Public Health Dent* 1996;56:319-30.
- Instituto Nacional do Câncer (Brasil). Prevenção e controle do câncer: normas e recomendações do INCA. *Rev Bras Cancerol* 2002;48: 317-32.

Oral cancer mortality

- Kligerman J. Estimativas sobre a incidência e a mortalidade por câncer no Brasil. *Rev Bras Cancerol* 2002; 48:175-9.
- Kujan O, Glenny AM, Duxbury J, Thakker N, Sloan P. Evaluation of screening strategies for improving oral cancer mortality: a Cochrane systematic review. *J Dent Educ* 2005; 69:255-65.
- Laurenti R. Usos das estatísticas de mortalidade. In: 2ª Reunião Nacional do Sub-Sistema de Informação sobre Mortalidade. Brasília; 1987.
- Leite IC, Koifman S. Survival analysis in a sample of oral cancer patients at a reference hospital in Rio de Janeiro, Brazil. *Oral Oncol* 1998; 34: 347-52.
- McLeod NM, Saeed NR, Ali EA. Oral cancer: delays in referral and diagnosis persist. *Br Dent J* 2005; 198:681-4.
- Mello-Jorge MHP, Gotlieb SLD, Laurenti R. O sistema de informações sobre mortalidade: problemas e propostas para o seu enfrentamento. I - mortes por causas naturais. *Rev Bras Epidemiol* 2002; 5: 197-211.
- Mirra AP, coordenador. *Incidência de cancer no município de São Paulo, Brasil 1983-1988-1993: tendência no período 1969-1993*. Brasília: Ministério da Saúde; 1999. 103p.
- Organização Mundial de Saúde. Centro da OMS para Classificação de Doenças em Português. *Manual de classificação estatística internacional de doenças e problemas relacionados à saúde: CID 10*. 7ª ed. São Paulo: EDUSP; 1999.
- O'Sullivan EM. Oral and pharyngeal cancer in Ireland. *Ir Med J* 2005; 98:102-5.
- Parkin DM, Bray F, Ferlay J, Pisani P. Estimating the world cancer burden: Globocan 2000. *Int J Cancer* 2001; 94:153-6.
- Sudbo J. Novel management of oral cancer: a paradigm of predictive oncology. *Clin Med Res* 2004; 2:233-42.
- Sundefeld MLMM, Gotlieb SLD, Biazolla ER. Prognostic factors and survival of patients diagnosed with primary squamous cell carcinoma of the mouth, in Araçatuba, São Paulo State, Brazil, 1980 to 1995. In: Varma AK, Roodenburg JLN, editors. *Oral oncology*. New Delhi: MacMillan; 2001. p.435-40.
- Swango PA. Cancers of oral cavity and pharynx in the United States: an epidemiological overview. *J Public Health Dent* 1996; 56: 309-18.
- Tomar SL, Loree M, Logan H. Racial differences in oral and pharyngeal cancer treatment and survival in Florida. *Cancer Causes Control* 2004; 15:601-9.
- Tumino R, Vicario G. Head and neck cancers: oral cavity, pharynx, and larynx. *Epidemiol Prev* 2004; 28:28-33.
- WHO. World Health Organization. Control of oral cancer in developing countries. A WHO meeting. *Bull World Health Organ* 1984, 62: 817-30.
- Wünsch-Filho V. The epidemiology of oral and pharynx cancer in Brazil. *Oral Oncol* 2002; 38:737-46.
- Wünsch-Filho V, Camargo EA. The burden of mouth cancer in Latin America and the Caribbean: epidemiologic issues. *Semin Oncol* 2001; 28:158 -68.