Influence of Educational Level, Stage, and Histological Type on Survival of Oral Cancer in a Brazilian Population

A Retrospective Study of 10 Years Observation

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Abstract: The mortality rate associated with oral cancer is estimated at approximately 12,300 deaths per year, and the survival rate is only 40% to 50% for diagnosed patients and is closely related to the duration of time between disease perception and its diagnosis and treatment. Socio-economic risk factors are determinants of the incidence and mortality related to oral cancer. We conducted a retrospective, cross-sectional study of 573 records of patients with oral cancer at Haroldo Juaçaba Hospital – Cancer Institute of Ceará from 2000 to 2009 to evaluate the influence of socioeconomic factors on survival and epidemiological behavior of this neoplasia in a Brazilian population. In this study, patients with oral cancer were males greater than 60 years of age, presented squamous cell carcinoma in the floor of mouth and were characterized by low education levels. A total of 573 lesions were found in oral cavities. Cox proportional hazards regression model showed that the histological type, tumor stage, and low degree of education significantly influenced survival. A lower patient survival rate was correlated with a more advanced stage of disease and a worse prognosis. Squamous cell carcinoma is associated with a higher mortality when compared with other histological types of malign neoplasia.

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Abbreviations: RT = radiotherapy, SCC = squamous cell carcinoma, TNM = tumor size lymph node metastasis, WHO = World Health Organization.

INTRODUCTION

Cancer is a disease of great concern worldwide due to its high incidence and mortality. The World Health Organization (WHO) has estimated that in 2030, 27 million new cases and 75 million people will be with cancer. The greatest effect of this increased focus on oral cancer in underdeveloped countries is that various neoplasms predominate. Oral cancer is 1 of the 10 most frequently occurring cancers globally, and its incidence displays an increasing trend worldwide. In Brazil, there is an estimated risk of 11.54 and 3.92 new cases in every 100 thousand men and women, respectively.

Studies show that men over 50 years of age are more affected by oral cancer. The primary tumor site is the tongue, and the most common histological type is squamous cell carcinoma (SCC). With an estimated 12,300 deaths per year, oral cancer has a 5-year survival rate of approximately 40% to 50%. Despite being heavily influenced by the tumor stage, the survival of oral cancer patients is influenced by many factors of a social nature such as the time between disease perception, its diagnosis and treatment, access to health-care services, educational level and occupation of the patient, behavioral/cultural factors, exposure to risk factors such as chewing tobacco and some specific topographical distributions.

Characterization of survival of patients with oral cancer and the contributing factors is based on data on the incidence of the disease and mortality. This data should be constantly updated to provide managers and health planners, with new information regarding the disease, frequency, and distribution. Wong et al (Thailand) showed that socio-demographic factors such as marital status and religious belief may influence survival and prognosis of patients with oral cancer independent of other clinical factors. Although several studies evaluated the influence of these social factors on survival of oral cancer, the studies do not make an assessment investigating the relationship between their variables.

Thus, the objective of this study is to determine whether clinical features, histopathology, and socio-economic status influences the survival of patients with oral cancer treated at a tertiary institution in Brazil.

MATERIALS AND METHODS

Study Design

In this observational, retrospective, cross-sectional, quantitative study, we reviewed the medical records of 573 patients with oral malignant neoplasms treated at the Haroldo Juaçaba Hospital (Cancer Institute of Ceará).
Description of Variables
During the period between 2000 and 2009, a convenience sample was obtained that included patients with oral cancer. Socio-demographic data such as age, sex, education, race/color, type of admission to hospital (private health system or public health system) and clinical features and histopathology data, such as the tumor histological type, location in the oral cavity, tumor size lymph node metastasis, stage of the tumor, and survival following treatment completion were assessed. The level of education was obtained through direct interviews with the patients noted in medical records held at the time of entry in the hospital.

The location of the primary tumor was classified according to WHO criteria (lip, gingiva, anterior third of the tongue, hard palate, floor of the mouth and other parts, and parts not identified in the mouth) and the histological types were grouped into 2 groups: SCC and non-SCC (see results).

The stage of the tumor was defined according to the proposition of WHO: T is related to the tumor size, N indicates the lymph node involvement, and M is distant metastases. Regarding stages, it was considered stage I, stage II, stage III, or stage IV encompassing the IV A, IVB, and IVC stages.

Survival (months) was determined based on the difference between the date of the start of treatment and the date of death.

Statistical Analysis
Data were analyzed using statistical software SPSS (Statistical Package for Social Sciences) for Windows version 17.0, with a confidence level of 95% (P < 0.05).

Categorical data were analyzed by a Chi-square test with 95% confidence intervals. Survival analysis was investigated by Chi-square test, Kaplan–Meier method, and Cox regression model of survival.

Ethical Correlations
This study conformed to ethical principles and was accepted by the ethics committee under protocol 011/2011.

RESULTS

Exploratory Analysis
Within the period evaluated, 573 malignant lesions were determined. Of these, 63.9% occurred in males and 207 (36.1%) in females. The male:female ratio (1.8:1.0) was statistically significant (P < 0.001). The age distribution revealed a significantly greater proportion of patients in the 61 to 70-year-old age group (n = 144, 25.1%); (P < 0.001), and there were no cases of malignant tumor of the mouth in patients younger than 21 years. The 2 main sites of involvement were the mouth floor (n = 153, 25.3%) and tongue (n = 145, 25.3%) (P < 0.001) (Table 1).

The racial distribution showed a higher prevalence of patients in the 61 to 70-year-old age group (n = 144, 25.1%) (P < 0.001). There was no difference regarding the number of patients in the metropolitan area compared with countryside (P = 0.496) (Table 1).

Regarding education level, 169 (n = 37.1%) patients said they were illiterate and 188 (n = 41.3%) had incomplete primary school. These values were significantly higher compared with groups categorized by level of education (P < 0.001). The public health system (n = 402, 71.0%) was the main agreement by which patients were admitted to the hospital (P < 0.001) (Table 1).

| TABLE 1. Clinical, Demographic, Socioeconomic, and Therapeutic Profile of Patients With Oral Cancer Treated at the Haroldo Juça Hospital (Cancer Institute of Ceará) (2000–2009) |
|---------------------------------|---------|---------|---------|---------|
| Sex                            | N       | %       | 95% IC  | P-Value |
| Males                          | 366     | 63.9%   | 59.8–67.8 | <0.001  |
| Females                        | 207     | 36.1%   | 32.2–40.2 |         |
| Age                            |         |         |         |         |
| 21–30                          | 8       | 1.4%    | 0.6–2.7  | <0.001  |
| 31–40                          | 29      | 5.1%    | 3.4–7.2  |         |
| 41–50                          | 77      | 13.4%   | 10.7–16.5 |         |
| 51–60                          | 124     | 21.6%   | 18.3–25.2 |         |
| 61–70                          | 144     | 25.1%   | 21.6–28.9 |         |
| 71–80                          | 113     | 19.7%   | 16.5–23.2 |         |
| 81–90                          | 67      | 11.7%   | 9.2–14.6 |         |
| 91–100                         | 11      | 2.0%    | 1.0–3.4  |         |
| Race                           |         |         |         |         |
| Mixed                          | 347     | 60.6%   | 56.4–64.6 | <0.001  |
| White                          | 206     | 36.0%   | 32.0–40.0 |         |
| Others                         | 20      | 3.4%    | 2.1–5.3  |         |
| Origin                         |         |         |         |         |
| Metropolitan region            | 297     | 52.0%   | 47.8–56.2 | 0.496   |
| Countryside                    | 274     | 48.0%   | 43.8–52.2 |         |
| Education level                |         |         |         |         |
| Illiterate                     | 169 *** | 37.1%   | 32.7–41.0 | <0.001  |
| Incomplete primary school      | 188 *** | 41.3%   | 36.7–46.0 |         |
| Completed primary school       | 49      | 10.5%   | 7.9–13.7  |         |
| High school                    | 34      | 7.5%    | 5.2–10.3  |         |
| Higher education               | 16      | 3.6%    | 2.0–5.5  |         |
| Covenant                       |         |         |         |         |
| Public health system           | 402 *** | 71.0%   | 66.2–73.9 | <0.001  |
| Private health system          | 171     | 29.0%   | 26.1–33.8 |         |
| Location                       |         |         |         |         |
| Floor of mouth                 | 153 *** | 26.7%   | 23.1–30.5 | <0.001  |
| Tongue                         | 145 *** | 23.5%   | 21.8–29.1 |         |
| Hard palate                    | 105     | 18.3%   | 15.2–21.7 |         |
| Lip                            | 40      | 7.0%    | 5.0–9.4  |         |
| Gum                            | 16      | 2.8%    | 1.6–4.5  |         |
| Others                         | 114     | 19.9%   | 16.7–23.4 |         |
| Size of tumor                  |         |         |         |         |
| T1                             | 24      | 8.6%    | 5.6–12.5  | <0.001  |
| T2                             | 65      | 23.3%   | 18.5–28.7 |         |
| T3                             | 76      | 27.2%   | 22.1–32.9 |         |
| T4                             | 114 *** | 40.9%   | 35.0–46.9 |         |
| Lymph node                     |         |         |         |         |
| N0                             | 167 *** | 59.9%   | 53.8–65.7 | <0.001  |
| N1                             | 49      | 17.6%   | 12.3–22.5 |         |
| N>1                            | 63      | 22.6%   | 17.8–27.9 |         |
| Metastasis                     |         |         |         |         |
| M0                             | 273 *** | 99.3%   | 97.4–99.0 | <0.001  |
| M1                             | 2       | 0.7%    | 0.1–2.6  |         |
| Stage                          |         |         |         |         |
| I                              | 19      | 6.8%    | 3.9–9.8  | <0.001  |
| II                             | 53      | 17.9%   | 13.7–22.8 |         |
| III                            | 75      | 25.3%   | 20.5–30.7 |         |
| IV                             | 149 *** | 50.4%   | 44.4–56.2 |         |
| Treatment                      |         |         |         |         |
| Surgery                        | 107     | 18.7%   | 17.7–24.5 | <0.001  |
| Surgery + RT                   | 110     | 19.2%   | 18.3–27.7 |         |
| RT                             | 81      | 14.1%   | 13.0–19.6 |         |
| RT + CT                        | 46      | 8.0%    | 6.8–12.0  |         |
| CT                             | 17      | 3.0%    | 2.0–5.4  |         |
| Surgery + RT + CT              | 16      | 2.8%    | 1.8–5.1  |         |
| Surgery + CT                   | 5       | 0.9%    | 0.3–2.3  |         |
| No treatment                   | 191 *** | 33.3%   | 33.7–42.4 |         |

* P < 0.05.
** P < 0.01.
*** P < 0.001. Chi-square. CT = chemotherapy, RT = radiotherapy.
The majority of the tumors were diagnosed in floor of mouth (n = 153, 26.7%) and tongue (n = 145, 25.3%) (P < 0.001), as size T4 (n = 114, 40.9%) (P < 0.001), with no lymph nodes (N0) affected (n = 167, 59.9%) (P < 0.001) and no metastasis (M0) identified (n = 277, 99.3%) (P < 0.001). The most prevalent clinical stage was stage IV with 149 (30.4%) cases (P < 0.001). Noncompletion of treatment (n = 191, 33.3%) was the approach most significantly adopted (P < 0.001) (Table 1).

SCC (n = 524, 91.4%) was the main histological type (P < 0.001) in relation to non-SCC (n = 49, 8.6%). This group comprised adenosid cystic carcinoma (n = 18, 3.2%), adenocarcinomas (n = 6, 1.1%), cystadenocarcinomas (n = 4, 0.7%), undifferentiated neoplastic malignancy (n = 5, 0.8%), malignant melanoma and clear cell adenocarcinoma (n = 3, 0.5%), malignant large B-cell lymphoma, mucinous adenocarcinoma (n = 2, 0.3%), and acinic cell carcinoma, epithelial-myoepithelial carcinoma, carcinosarcoma, myoepithelioma, malignant non-Hodgkin lymphoma, and T-cell lymphoma (n = 1, 0.2%).

### Ten-Year Survival

The 10-year survival rate was 56.5%. We observed that variables non-SCC (n = 27, 84.4%, P = 0.001), patients in the 3rd decade of life (n = 5, 100.0%, P = 0.037), multiracial (P = 0.018), surgery alone (n = 53, 67.9%, P = 0.002), or surgery combined with radiotherapy (RT, n = 48, 70.6%, P = 0.001) showed average survival rate higher compared with other variables (Chi-square test). Clinically, patients with T1 tumor (n = 20, 90.9%, P = 0.001), stage I (n = 16, 94.1%, P < 0.001) showed significantly higher survival percentages. The lymph node involvement only influenced the survival rate (P = 0.049), and the presence of distant metastases was not related to the survival percentage (P = 0.294) (Table 2, Fig. 1).

The long-rank Mantel–Cox test showed that the variables resulting in higher survival rates were non-SCC patients (99.0 ± 7.2) (P = 0.002) in the 3rd decade of life (P = 0.034) and multiracial patients (79.2 ± 8.3) (P = 0.018). Other factors producing higher survival rates included only surgical treatment (81.8 ± 6.4) (P = 0.005), surgery combined with RT (80.9 ± 6.0) (P = 0.005), T1 tumor gradation (96.8 ± 7.5) (P = 0.034), and stage I classification (101.2 ± 6.5) (P = 0.005).

In a Cox proportional hazards regression model, categorization factors that significantly influenced the survival rate were histological type (P = 0.017), education level of the patient (P = 0.022), and tumor stage (P < 0.001). Sex (P = 0.336), age (P = 0.106), race (P = 0.126), origin (P = 0.379), covenant (P = 0.157), location (P = 0.587), size of tumor (P = 0.211), lymph node metastasis (P = 0.080), distant metastasis (P = 0.217), and treatment (P = 0.854) did not influence survival.

### Evaluation of Histological Type

The number of SCCs in men (n = 349, 66.6%) was 3.7 (IC95% = 2.0–6.9) times greater than the number of SCC in women (n = 175, 33.4%) (P < 0.001). The non-SCC were diagnosed specifically at the age groups of 21 to 30 (n = 6, 12.2%) and 31 to 40 (n = 10, 20.4%) (P < 0.001) (Table 3).

The race (P = 0.795), the origin (P = 0.452), and the agreement of admission to hospital did not significantly influence the distribution of these 2 histological types. However, in relation to education, SCC (n = 162, 38.8%) was diagnosed significantly more than non-SCC (n = 7, 18.4%) in illiterate individuals (P = 0.007) (Table 3).

Clinically, the SCC showed a higher prevalence in the floor of the mouth (n = 150, 28.6%), tongue (n = 141, 26.9%), and lip (n = 38, 7.3%), while the non-SCC showed high prevalence in the hard palate (n = 25, 51.0%) and other sites (n = 15, 30.6%) (P < 0.001) (Table 3).

The SCC was diagnosed significantly more often as size T3 (n = 75, 28.4%) and T4 (n = 113, 42.8%) (P < 0.001). The involvement of more than 1 lymph node showed a greater association with SCC (n = 63, 23.8%) than non-SCC (n = 0, 0%) (P = 0.022), but the presence of metastases was not associated with the histological type (P = 1.000). The non-SCC had a higher prevalence of diagnosis in stage I (n = 5, 31.3%) and II (n = 8, 50.0%). In turn, SCC tumors were diagnosed more commonly in stage III (n = 73, 28.4%) and IV (n = 125, 48.7%) (P < 0.001) (Table 3).

### Evaluation of Education

Regarding schooling, female patients showed a high prevalence among illiterate individuals (n = 82, 48.5%) and completion of only grade school (n = 20, 41.7%). The proportion of men was significantly greater among individuals with incomplete primary school (n = 136, 72.3%), high school (n = 24, 75.0%), and higher education (n = 12, 75.0%) (P = 0.001) (Table 4).

The age of the patient showed an inverse association with the degree of schooling (P < 0.001). The number of multiracial patients was significantly larger in the illiterate group (n = 123, 72.8%) (P < 0.001), and the patients from countryside were illiterate (n = 106, 63.1%) (P = 0.014) (Table 4).

There was a higher prevalence of public health system patients among the illiterate individuals (n = 131, 77.5%) and the group with an incomplete primary school (n = 137, 72.9%) (P < 0.001) (Table 4).

The tumor size was inversely associated with the level of education. Illiterate patients (n = 44, 55.7%), with an incomplete primary school level (n = 36, 38.7%) and completed primary school (n = 10, 41.6%) showed an increased proportion of T4 tumors, while patients with a higher education level (n = 0, 0.0%), showed a high frequency of tumors with sizes of T2 (n = 4, 66.7%) and T1 (n = 2, 33.3%) (P = 0.011) (Table 4).

Tumor stage of IV was significantly more prevalent in all educational levels except the group of higher education (P = 0.032) (Table 4).

The main therapeutic decision in illiterate patients (n = 82, 48.4%) and incomplete primary school (n = 60, 32.8%) was therapeutic abstention, whereas patients with completed primary school were mainly treated with surgery (n = 12, 25.0%). High school patients were treated significantly more with surgery and RT (n = 10, 29.4%), and higher education patients were treated only with RT (n = 4, 37.5%) (P = 0.013) (Table 4).

### Assessment of Stage

Female patients were diagnosed mainly as stage I (n = 13, 68.4%), while men were diagnosed significantly more often as stage II (n = 39, 73.6%), III (n = 45, 60.0%), and IV (n = 99, 66.4%) (P = 0.009). There was a direct association between age and stage of the tumor (P = 0.002) (Table 5).

The patient’s origin (P = 0.692) and the method of admission to the hospital (P = 0.170) did not influence the tumor staging. However, the therapy most frequently adopted was abstention from treatment for stage I (n = 3, 42.1%), RT alone...
TABLE 2. Ten-year Survival of Patients Diagnosed With Oral Cancer in Haroldo Juaçaba Hospital (Cancer Institute of Ceará) (2000–2009)

|                         | Total Survival (k) in 10 years | P-Value | Total Survival (months) in 10 years | P-Value |
|-------------------------|--------------------------------|---------|-------------------------------------|---------|
| Total                   | 258 (56.7%)                    |         | 67.1 ± 2.7                          |         |
| Histologic type         |                                |         |                                     |         |
| SCC                     | 228 (55.1%)                    | 0.001   | 64.7 ± 2.7                          | 0.002   |
| Non-SCC                 | 27 (84.4%)                     |         | 99.7 ± 7.2                         |         |
| Sex                     |                                |         |                                     |         |
| Males                   | 159 (55.0%)                    | 0.118   | 65.7 ± 3.3                          | 0.405   |
| Females                 | 96 (62.7%)                     |         | 69.5 ± 4.3                          |         |
| Age                     |                                |         |                                     |         |
| 21–30                   | 5 (100.0%)                     | 0.037   | 50.0 ± 15.1                         | 0.034   |
| 31–40                   | 16 (66.7%)                     |         | 79.2 ± 8.2                          |         |
| 41–50                   | 37 (66.7%)                     |         | 75.7 ± 5.4                          |         |
| 51–60                   | 55 (56.7%)                     |         | 71.3 ± 4.4                          |         |
| 61–70                   | 60 (54.1%)                     |         | 69.4 ± 4.2                          |         |
| 71–80                   | 55 (61.1%)                     |         | 75.0 ± 4.5                          |         |
| 81–90                   | 26 (46.4%)                     |         | 62.5 ± 9.8                          |         |
| 91–100                  | 1 (12.5%)                      |         | 50.0 ± 15.1                         |         |
| Race                    |                                |         |                                     |         |
| Mixed                   | 147 (52.9%)                    | 0.294   | 63.8 ± 3.4                          | 0.018   |
| White                   | 95 (60.1%)                     |         | 79.2 ± 8.3                          |         |
| Others                  | 4 (66.7%)                      |         | 70.9 ± 4.5                          |         |
| Origin                  |                                |         |                                     |         |
| Metropolitan region     | 129 (55.1%)                    | 0.626   | 66.5 ± 4.0                          | 0.413   |
| Countryside             | 124 (57.4%)                    |         | 67.6 ± 3.6                          |         |
| Education level         |                                |         |                                     |         |
| Illiterate              | 58 (42.3%)                     | 0.010   | 54.5 ± 4.6                          | 0.001   |
| Incomplete primary school| 81 (54.4%)                    |         | 70.0 ± 4.3                          |         |
| Completed primary school| 19 (50.0%)                     |         | 48.0 ± 6.0                          |         |
| High school             | 13 (65.0%)                     |         | 72.2 ± 8.7                          |         |
| Higher education        | 12 (85.7%)                     |         | 99.3 ± 9.6                          |         |
| Covenant                |                                |         |                                     |         |
| Public health system    | 188 (57.0%)                    | 0.696   | 63.5 ± 3.0                          | 0.323   |
| Private health system   | 67 (54.9%)                     |         | 70.5 ± 4.8                          |         |
| Location                |                                |         |                                     |         |
| Floor of mouth          | 68 (56.7%)                     | 0.871   | 66.0 ± 5.3                          | 0.575   |
| Tongue                  | 66 (55.0%)                     |         | 65.5 ± 5.3                          |         |
| Hard plate              | 44 (65.5%)                     |         | 60.6 ± 6.1                          |         |
| Lip                     | 21 (67.7%)                     |         | 93.5 ± 8.4                          |         |
| Gingiva                 | 7 (53.8%)                      |         | 63.0 ± 14.5                         |         |
| Others                  | 49 (55.1%)                     |         | 67.1 ± 5.8                          |         |
| Size of tumor           |                                |         |                                     |         |
| T1                      | 20 (90.9%)                     | 0.001   | 96.2 ± 7.5                          | 0.034   |
| T2                      | 33 (62.3%)                     |         | 73.6 ± 7.3                          |         |
| T3                      | 28 (45.2%)                     |         | 54.7 ± 6.9                          |         |
| T4                      | 47 (49.3%)                     |         | 61.0 ± 5.7                          |         |
| Lymph node              |                                |         |                                     |         |
| N0                      | 82 (61.2%)                     | 0.092   | 73.6 ± 4.7                          | 0.049   |
| N1                      | 22 (48.9%)                     |         | 59.0 ± 8.3                          |         |
| N>1                     | 24 (45.3%)                     |         | 51.7 ± 7.8                          |         |
| Metastasis              |                                |         |                                     |         |
| M0                      | 127 (55.2%)                    | 0.294   | 65.8 ± 3.7                          | 0.976   |
| M1                      | 0 (0.0%)                       |         | 50.5 ± 26.5                         |         |
| Stage                   |                                |         |                                     |         |
| I                       | 16 (94.1%)                     | <0.001  | 101.2 ± 6.5                         | 0.005   |
| II                      | 26 (61.9%)                     |         | 74.8 ± 8.0                          |         |
| III                     | 32 (52.5%)                     |         | 62.8 ± 7.0                          |         |
| IV                      | 55 (44.7%)                     |         | 54.6 ± 5.0                          |         |
| Treatment               |                                |         |                                     |         |
| Surgery                 | 48 (70.6%)                     | 0.002   | 81.3 ± 6.4                          | 0.005   |
| Surgery + RT            | 53 (67.9%)                     |         | 80.9 ± 6.0                          |         |
| RT                      | 38 (52.8%)                     |         | 66.0 ± 6.2                          |         |
| RT + CT                 | 18 (43.9%)                     |         | 39.3 ± 5.7                          |         |
| CT                      | 3 (18.8%)                      |         | 28.9 ± 10.6                         |         |
| Surgery + RT + CT       | 6 (50.0%)                      |         | 29.8 ± 6.8                          |         |
| Surgery + CT            | 2 (50.0%)                      |         | 48.0 ± 16.1                         |         |
| No treatment            | 87 (54.0%)                     |         | 64.6 ± 4.5                          |         |

*P < 0.05.
**P < 0.01.
***P < 0.001, Chi-square,
†P < 0.05.
|P < 0.01.††P < 0.001, long rank Mantel–Cox test (mean ± standard error). CT = chemotherapy, NI = not informed (all caselas survival censored form), RT = radiotherapy, SCC = squamous cell carcinoma.
FIGURE 1. Ten-year survival of patients diagnosed with oral cancer in Haroldo Juaçaba Hospital (2000–2009) (long-rank Mantel–Cox).
| Histologic type | SCC          | Non-SCC       | P-Value |
|-----------------|--------------|---------------|---------|
| Sex             |              |               |         |
| Males           | 349 (66.6%)  | 17 (34.7%)    | <0.001  |
| Females         | 175 (33.4%)  | 32 (65.3%)    |         |
| Age             |              |               |         |
| 21–30           | 2 (0.4%)     | 6 (12.2%)     | <0.001  |
| 31–40           | 19 (3.6%)    | 10 (20.4%)    |         |
| 41–50           | 70 (13.4%)   | 7 (14.3%)     |         |
| 51–60           | 119 (22.7%)  | 5 (10.2%)     |         |
| 61–70           | 130 (24.8%)  | 14 (28.6%)    |         |
| 71–80           | 110 (21.0%)  | 3 (6.1%)      |         |
| 81–90           | 63 (12.0%)   | 4 (8.2%)      |         |
| 91–100          | 11 (2.1%)    | 0 (0.0%)      |         |
| Race            |              |               |         |
| Mixed           | 318 (60.7%)  | 29 (59.2%)    | 0.795   |
| White           | 187 (35.7%)  | 19 (38.8%)    |         |
| Others          | 19 (3.6%)    | 1 (2.0%)      |         |
| Origin          |              |               |         |
| Metropolitan region | 269 (51.3%) | 28 (57.1%)    | 0.452   |
| Countryside     | 253 (48.7%)  | 21 (42.9%)    |         |
| Education level |              |               |         |
| Illiterate      | 162 (38.8%)  | 7 (18.4%)     | 0.007   |
| Incomplete primary school | 170 (40.8%) | 18 (47.4%)    |         |
| Completed primary school | 45 (10.8%) | 3 (7.9%)      |         |
| High school     | 28 (6.7%)    | 6 (15.8%)     |         |
| Higher education | 12 (2.9%)    | 4 (10.5%)     |         |
| Covenant        |              |               |         |
| Public health system | 373 (71.2%) | 29 (59.2%)    | 0.079   |
| Private health system | 151 (28.8%) | 20 (40.8%)    |         |
| Location        |              |               |         |
| Floor of mouth  | 150 (28.6%)  | 3 (6.1%)      | <0.001  |
| Tongue          | 141 (26.9%)  | 4 (8.2%)      |         |
| Hard plate      | 80 (15.3%)   | 25 (51.0%)    |         |
| Lip             | 38 (7.3%)    | 2 (4.1%)      |         |
| Gingiva         | 16 (3.1%)    | 0 (0.0%)      |         |
| Others          | 99 (18.9%)   | 15 (30.6%)    |         |
| Size of tumor   |              |               |         |
| T1              | 19 (7.2%)    | 5 (33.3%)     | <0.001  |
| T2              | 57 (21.6%)   | 8 (53.3%)     |         |
| T3              | 75 (28.4%)   | 1 (6.7%)      |         |
| T4              | 113 (42.8%)  | 1 (6.7%)      |         |
| Lymph node      |              |               |         |
| N0              | 153 (58.0%)  | 14 (93.3%)    | 0.022   |
| N1              | 48 (18.2%)   | 1 (6.7%)      |         |
| N>1             | 63 (23.8%)   | 0 (0.0%)      |         |
| Metastasis      |              |               |         |
| M0              | 262 (99.3%)  | 15 (100.0%)   | 1.000   |
| M1              | 2 (0.7%)     | 0 (0.0%)      |         |
| Stage           |              |               |         |
| I               | 14 (5.4%)    | 5 (31.3%)     | <0.001  |
| II              | 45 (17.5%)   | 8 (50.0%)     |         |
| III             | 73 (28.4%)   | 2 (12.5%)     |         |
| IV              | 123 (48.7%)  | 1 (6.2%)      |         |
| Treatment       |              |               |         |
| Surgery         | 91 (17.4%)   | 16 (32.7%)    | 0.025   |
| Surgery + RT    | 104 (19.8%)  | 6 (12.2%)     |         |
| RT              | 74 (14.1%)   | 7 (14.3%)     |         |
| RT + CT         | 43 (8.2%)    | 3 (6.1%)      |         |
| CT              | 15 (2.9%)    | 2 (4.1%)      |         |
| Surgery + RT + CT | 16 (3.1%)   | 0 (0.0%)      |         |
| Surgery + CT    | 3 (0.6%)     | 2 (4.1%)      |         |
| No treatment    | 178 (34.0%)  | 13 (26.5%)    |         |

* P < 0.05.
** P < 0.01.
*** P < 0.001, Chi-square. CT = chemotherapy, RT = radiotherapy, SCC = squamous cell carcinoma.
| Education Level | Illiterate | Incomplete Primary School | Completed Primary School | High School | Higher Education | P-Value |
|-----------------|------------|--------------------------|-------------------------|------------|-----------------|---------|
| Sex             |            |                          |                         |            |                 |         |
| Males           | 87 (51.5%) | 136 (72.3%)              | 28 (58.3%)              | 24 (75.0%) | 12 (75.0%)      | 0.001   |
| Females         | 82 (48.5%) | 52 (27.7%)               | 20 (41.7%)              | 10 (29.4%) | 4 (25.0%)       |         |
| Age             |            |                          |                         |            |                 |         |
| 21–30           | 1 (0.6%)   | 0 (0.0%)                 | 0 (0.0%)                | 2 (5.9%)   | 1 (6.3%)        | <0.001  |
| 31–40           | 1 (0.6%)   | 10 (5.3%)                | 3 (6.3%)                | 5 (14.7%)  | 5 (31.3%)       |         |
| 41–50           | 10 (5.9%)  | 30 (16.0%)               | 17 (14.6%)              | 11 (32.4%) | 3 (18.8%)       |         |
| 51–60           | 27 (16.0%) | 45 (25.9%)               | 14 (29.2%)              | 8 (23.5%)  | 1 (6.3%)        |         |
| 61–70           | 55 (32.5%) | 43 (22.9%)               | 9 (18.8%)               | 4 (11.8%)  | 3 (18.8%)       |         |
| 71–80           | 34 (20.1%) | 42 (22.3%)               | 11 (22.9%)              | 4 (11.8%)  | 2 (12.5%)       |         |
| 81–90           | 34 (20.1%) | 17 (9.0%)                | 3 (6.3%)                | 0 (0.0%)   | 1 (6.3%)        |         |
| 91–100          | 7 (4.1%)   | 1 (0.5%)                 | 1 (2.1%)                | 0 (0.0%)   | 0 (0.0%)        |         |
| Race            |            |                          |                         |            |                 |         |
| Mixed           | 123 (72.8%)| 113 (60.1%)              | 28 (58.3%)              | 14 (41.2%) | 7 (43.8%)       | 0.006   |
| White           | 42 (24.9%) | 71 (37.8%)               | 17 (35.4%)              | 20 (58.8%) | 9 (56.2%)       |         |
| Others          | 4 (2.3%)   | 4 (2.1%)                 | 3 (6.3%)                | 0 (0.0%)   | 0 (0.0%)        |         |
| Origin          |            |                          |                         |            |                 |         |
| Metropolitan region | 62 (36.9%) | 97 (51.6%)              | 31 (64.6%)              | 31 (91.2%) | 13 (81.3%)      | 0.014   |
| Countryside     | 106 (63.1%)| 91 (48.4%)               | 17 (35.4%)              | 3 (8.8%)   | 3 (18.8%)       |         |
| Covenant        |            |                          |                         |            |                 |         |
| Private health system | 38 (22.5%) | 51 (27.1%)              | 17 (35.4%)              | 18 (52.9%) | 9 (56.3%)       | <0.001  |
| Public health system | 131 (77.5%)| 137 (72.9%)             | 31 (64.6%)              | 16 (47.1%) | 7 (43.8%)       |         |
| Location        |            |                          |                         |            |                 |         |
| Lip             | 9 (5.3%)   | 17 (9.0%)                | 5 (10.4%)               | 0 (0.0%)   | 1 (6.3%)        | 0.204   |
| Tongue          | 43 (25.4%) | 44 (23.4%)               | 13 (27.1%)              | 14 (41.2%) | 5 (31.3%)       |         |
| Gingiva         | 6 (3.6%)   | 3 (1.6%)                 | 3 (6.3%)                | 0 (0.0%)   | 1 (6.3%)        |         |
| Floor of mouth  | 39 (23.1%) | 53 (28.2%)               | 10 (20.8%)              | 10 (29.4%) | 2 (12.5%)       |         |
| Hard plate      | 35 (20.7%) | 32 (17.0%)               | 4 (8.3%)                | 7 (20.6%)  | 5 (31.3%)       |         |
| Others          | 37 (21.9%) | 39 (20.7%)               | 13 (27.1%)              | 3 (8.8%)   | 2 (12.5%)       |         |
| Size of tumor   |            |                          |                         |            |                 |         |
| T1              | 4 (5.1%)   | 7 (7.5%)                 | 1 (4.2%)                | 1 (5.6%)   | 2 (33.3%)       | 0.011   |
| T2              | 11 (13.9%) | 21 (22.6%)               | 7 (29.2%)               | 7 (38.9%)  | 4 (66.7%)       |         |
| T3              | 20 (25.3%) | 29 (31.2%)               | 6 (25.0%)               | 4 (22.2%)  | 0 (0.0%)        |         |
| T4              | 44 (55.7%) | 36 (38.7%)               | 6 (41.6%)               | 6 (33.3%)  | 0 (0.0%)        |         |
| Lymph node      |            |                          |                         |            |                 |         |
| N0              | 48 (60.8%) | 56 (60.2%)               | 14 (58.3%)              | 11 (61.1%) | 4 (66.7%)       | 0.647   |
| N1              | 10 (12.7%) | 14 (15.1%)               | 6 (25.0%)               | 4 (22.2%)  | 2 (33.3%)       |         |
| N>1             | 21 (26.5%) | 23 (24.7%)               | 4 (16.7%)               | 3 (16.7%)  | 0 (0.0%)        |         |
| Metastasis      |            |                          |                         |            |                 |         |
| M0              | 78 (98.7%) | 93 (100.0%)              | 23 (95.8%)              | 18 (100.0%)| 6 (100.0%)      | 0.404   |
| M1              | 1 (1.3%)   | 0 (0.0%)                 | 1 (4.2%)                | 0 (0.0%)   | 0 (0.0%)        |         |
| Stage           |            |                          |                         |            |                 |         |
| I               | 4 (4.6%)   | 3 (3.2%)                 | 1 (3.7%)                | 1 (5.3%)   | 2 (28.6%)       | 0.032   |
| II              | 11 (12.6%) | 16 (17.0%)               | 7 (25.9%)               | 7 (36.8%)  | 2 (28.6%)       |         |
| III             | 17 (19.5%) | 28 (29.8%)               | 6 (22.2%)               | 4 (21.1%)  | 2 (28.6%)       |         |
| IV              | 55 (63.2%) | 47 (50.0%)               | 13 (48.1%)              | 7 (36.8%)  | 1 (14.2%)       |         |
| Treatment       |            |                          |                         |            |                 |         |
| Surgery         | 24 (14.2%) | 29 (15.4%)               | 12 (25.0%)              | 5 (14.7%)  | 3 (18.8%)       | 0.013   |
| Surgery + RT    | 28 (16.6%) | 41 (21.8%)               | 11 (22.9%)              | 10 (29.4%) | 2 (12.5%)       |         |
| RT              | 17 (10.1%) | 28 (14.9%)               | 7 (14.6%)               | 8 (23.5%)  | 6 (37.5%)       |         |
| RT + CT         | 10 (5.9%)  | 15 (8.0%)                | 3 (6.3%)                | 3 (8.8%)   | 1 (6.2%)        |         |
| CT              | 4 (2.4%)   | 8 (4.3%)                 | 3 (6.3%)                | 1 (3.0%)   | 0 (0.0%)        |         |
| Surgery + RT + CT| 3 (1.8%)  | 5 (2.7%)                 | 1 (2.0%)                | 3 (8.8%)   | 1 (6.2%)        |         |
| Surgery + CT    | 1 (0.6%)   | 2 (1.1%)                 | 0 (0.0%)                | 1 (3.0%)   | 0 (0.0%)        |         |
| No treatment    | 82 (48.4%) | 60 (32.8%)               | 11 (22.9%)              | 3 (8.8%)   | 3 (18.8%)       |         |

* P < 0.05. Chi-square. CT = chemotherapy, RT = radiotherapy.
TABLE 5. Influence of the Stage of Oral Cancer in Patients Diagnosed at Haroldo Juacaba Hospital (Cancer Institute of Ceará) (2000–2009)

| Stage | I   | II   | III  | IV   | P-Value |
|-------|-----|------|------|------|---------|
| Sex   |     |      |      |      |         |
| Males | 6 (31.6%) | 39 (73.6%)* | 45 (60.0%)* | 99 (66.4%)* | 0.009   |
| Females | 13 (68.4%)* | 14 (26.4%) | 30 (40.0%) | 50 (33.6%) |         |
| Age   |     |      |      |      |         |
| 21–30 | 3 (15.8%)* | 2 (3.8%) | 0 (0.0%) | 0 (0.0%) | 0.002   |
| 31–40 | 1 (5.3%) | 3 (5.7%) | 2 (2.7%) | 5 (3.3%) |         |
| 41–50 | 5 (26.3%)* | 6 (11.3%) | 12 (16.0%) | 24 (16.1%) |         |
| 51–60 | 6 (31.5%) | 11 (20.7%) | 12 (16.0%) | 35 (23.5%) |         |
| 61–70 | 3 (15.8%) | 17 (32.1%)* | 16 (21.3%) | 37 (24.8%) |         |
| 71–80 | 1 (5.3%) | 8 (15.1%) | 22 (29.3%)* | 29 (19.5%) |         |
| 81–90 | 0 (0.0%) | 4 (7.5%) | 10 (13.3%)* | 16 (10.7%)* |         |
| 91–100 | 0 (0.0%) | 2 (3.8%) | 1 (1.4%) | 3 (2.1%) |         |
| Race  |     |      |      |      |         |
| Mixed | 12 (63.2%)* | 33 (62.3%)* | 36 (48.0%) | 98 (55.0%)* | 0.009   |
| White | 5 (26.3%) | 18 (34.0%) | 36 (48.0%)* | 47 (31.5%) |         |
| Others | 2 (10.5%) | 2 (3.7%) | 3 (4.0%) | 0 (13.5%) |         |
| Origin |     |      |      |      |         |
| Metropolitan region | 11 (57.9%) | 27 (50.9%) | 45 (60.8%) | 80 (53.7%) | 0.692   |
| Countryside | 8 (42.1%) | 26 (49.1%) | 29 (39.2%) | 68 (45.6%) |         |
| Covenant |     |      |      |      |         |
| Private health system | 5 (26.3%) | 22 (41.5%) | 28 (37.3%) | 42 (28.2%) | 0.170   |
| Public health system | 14 (73.7%) | 31 (58.5%) | 47 (62.7%) | 107 (71.8%) |         |
| Treatment |     |      |      |      |         |
| Surgery | 8 (15.8%) | 16 (28.3%) | 8 (44.0%)* | 11 (15.4%) | <0.001  |
| Surgery + RT | 3 (0.0%) | 15 (0.0%) | 33 (2.7%) | 23 (6.0%) |         |
| RT | 5 (26.3%) | 14 (36.4%)* | 12 (16.0%) | 22 (14.8%) |         |
| RT + CT | 0 (0.0%) | 1 (1.9%) | 2 (0.0%) | 33 (1.3%) |         |
| CT | 0 (0.0%) | 0 (1.9%) | 2 (2.7%) | 9 (22.1%)* |         |
| Surgery + RT + CT | 0 (15.8%) | 1 (9.4%) | 3 (20.0%)* | 5 (29.6%)* |         |
| Surgery + CT | 0 (0.0%) | 1 (1.9%) | 0 (4.0%) | 2 (3.4%) |         |
| No treatment | 3 (42.1%)* | 5 (30.2%)* | 15 (10.6%) | 44 (7.4%) |         |

* P < 0.05. Chi-square. CT = chemotherapy, RT = radiotherapy.

(\(n = 14, 36.4\%\)) and abstention from therapy (\(n = 5, 30.2\%\)) for stage II, surgery alone (\(n = 8, 44.0\%\)) for stage III, and chemotherapy alone for stage IV tumors (\(n = 9, 22.1\%\)) (\(P < 0.001\)) (Table 5).

DISCUSSION

Oral cancer is a disease strongly influenced by social factors.14,15 In this sample, the majority of patients were male. This is in accordance with the epidemiological profile of our population where most men are smokers.16,17

In the present study, oral cancer was more common in individuals with 61 to 70 years of age. Ayaz et al18 in Pakistan noted an increasing involvement of oral malignant lesions in patients less than 40 years of age, diverging from our data. Despite this contradiction, Wunsch-Filho16 reported that cigarette smoking is a principle risk factor for oral cancer and combined with an increase in age magnifies the development of these lesions.

The primary locations of the tumors with the highest prevalence were the floor of the mouth and tongue. Chen et al11 and Bhurgri et al19 (Pakistan and Taiwan, respectively) discovered that the floor of the mouth is the most common site of cancer involvement and is associated with the habit of chewing tobacco and betel. Gellrich et al20 (Europe) also found that the floor of the mouth was a prevalent site of cancer development, but this site was not related to the habit of chewing. Other epidemiological studies showed that the tongue is the most affected site.21–23

In the present study, the racial distribution of the sample showed a higher prevalence of lesions in patients of mixed race. This increased incidence was related to the large number of people in our country who are considered multiracial.24 Gervasio et al25 stated that significant mixing of the population has made it difficult to perform race analyses, as multiracial people are considered the majority.

Regarding education, the majority of the patients had an incomplete primary school or was illiterate. Oral cancer is related to a low education level, which may be due in part to a reduced access to information about the disease in general, including the diagnosis and treatment.8,16,26 Due to the economic status of these patients, many were admitted to the hospital through the public health system.22

Studies in developing countries have found that oral cancer is diagnosed at advanced stages, unlike in developed countries in which the most prevalent stages are I and II.12,27–30,31,32 This situation revealed a strong influence of socioeconomic factors on the delayed diagnosis.
The SCC was the main histological type detected in the present study, weighing in strongly in survival rate of 10 years, observed in 56.5%. Few studies have investigated long periods of survival and the majority of these have been restricted to 5 years. During this evaluation period, survival varies from 30% to 80% and changes according to the study site, socioeconomic, and cultural factors.

The patient age is a major factor in the survival of oral cancer. In this study, and in another by Razak et al, an inverse association between age and stage of disease was observed. Individuals older than 60 years were associated with stages II, III, and IV, and a worse survival compared to younger patients.

Consistent with a study by Razak et al in which size T1 tumors were associated with a significantly better survival, Yip et al showed that after 5 years, no groups of patients diagnosed with T4 tumors in India remained alive.

In the present study, only patients with stage I disease had good survival rates; women comprised a high percentage of patients in this group because they sought earlier and more health services compared with men, thus affecting the survival rate. Thus, men tended to survive for shorter periods of time, as a result of the delayed diagnosis.

In the current study, illiterate patients showed an increased frequency of therapeutic abstention, revealing a close relationship between a low education level, late diagnosis, and poor prognosis. Despite this data, Wong et al reported that there was no correlation between patient survival and their schooling.

Consequently, associated surgery or omitting RT treatments normally used for tumors diagnosed early were associated with a survival rate significantly higher than the other treatment options. Al-Rawi and Talabani (Iraq) stated that earlier stages lead to less invasive treatments, which are associated with a better prognosis.

Patients with SCC had a worse survival rate compared with those with non-SCC. The SCC patients consisted mostly of men with an advanced age, whereas females with younger age ranges had a higher prevalence of non-SCC. Additionally, patients with SCC were more frequently in illiterate and incomplete primary school groups and in association with disease stages III and IV. These data were in agreement with previous studies showing that cancers such as non-SCC are more prevalent in women. In men SCC is more common and often diagnosed much later, leading to a worse prognosis.

Thus, the SCC malignancy accounts for more than 90% of the oral cancers analyzed in the present study. Previous studies have demonstrated that the illness process is treated differently in the population with a lower level of education. This has led some authors to consider oral cancer, particularly when speaking of SCC, as a disease that is characteristic of people with a low economic and educational level. Oji and Chukwunewe (Nigeria) concluded that one of the factors closely related to an advanced stage of oral cancer is the lack of education of the population. In Brazil, patients with a lower income and education level had a higher mortality rate due to oral cancer. Although studies showed that oral cancer survival is closely related to social factors, the present study demonstrated that the educational level of the patients influenced the survival significantly. The majority of the studies evaluated 5-year survival, but our results exhibit 10 years of follow-up. In addition, we observed a significantly lower survival rate in patients with SCC compared to patients with malignancies of other histological types.

The incidence of oral cancer in a population of Northeast Brazilians contained a large proportion of SCC and that the survival of the patients was inversely related to their level of education, which could lead to a diagnosis at advanced stages of disease, abstention from treatment, and poor prognosis.

In the present study, the influence of socioeconomic factors on the prognosis of oral cancer suggests that the association between poverty and mortality due to oral cancer requires intervention by public health policies in populations with low social status and income levels to improve life expectancy and quality of life. It is important to emphasize that the Haroldo Juacaba Hospital serves as a reference treatment center for lower income individuals fighting all types of cancer in the state of Ceará (northeastern Brazil). Large multicenter studies are needed to know the closest oral cancer profile of this population.

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