

Abstract

As practitioners at a Comprehensive Cancer Center with an expansive catchment area, we wanted to determine whether longer travel for oral cancer care affected treatment choices or outcomes. Patients with oral cavity cancer from 2010-2016 were identified from NCDB (National Cancer Database). Distance traveled for cancer treatment was estimated using zip code centroid. Univariate and multivariate analyses were used to review the OS outcome.

Results: 21,236 patients were included and divided into four quartiles with mean distance traveled 44.4 miles and median distance of 17.6 miles. Travel distance was divided into quartiles as Q1 < 7.25 (5300), Q2 7.25- 17.6 (5,325), Q3 17.6-46.5 (5,278) and Q4 =>46.5 miles (5,297). Patient cancer staging included 39.3% stage IV, 13.1% stage III, 16.1% stage II and 31.6% stage I. The mean travel distances were 3.8 miles in Q1, 11.8 in Q2, 29.8 in Q3 and 133 miles in Q4. The median distances for the four quartiles were 3.8, 11.6, 27.8 and 83 miles respectively.

White non-Hispanics were more likely to travel longer distances for treatment than non-white groups. Travel distance increased in 2013-2016 compared to those who received treatment in 2010-2012. The farther the patients traveled, the less likely they were to get radiation treatment (p<0.001). The reverse was true for surgery-based management. The greater the distance traveled, the higher the percentage of patients getting surgery-based treatment (p<0.001). Incidence of negative margins also increased as the distance quartile increased.

There was a statistically significant association between distance traveled and facility type, regardless of insurance status. The likelihood of receiving treatment at an Academic/Research Program increased with travel distance (p<0.001).

Bivariate analysis revealed several differences between the first and fourth quartile cohorts found that patients with stage IV disease are more likely to travel farther (Q4). Interestingly, among oral cavity subsites, oral tongue patients were more frequent in the Q1 cohort than Q4. Whereas gingiva and alveolar cancer patients were more likely to travel greater distances for treatment (Q4) (p<0.05). As found with the full range of travel distances, a higher proportion of patients in Q4 obtained negative margins compared to Q1 (p<0.001) and were managed without radiation treatment in Q4 as compared to Q1. This finding is consistent with the identified higher likelihood of obtaining negative margins in the Q4 cohort.

Univariate analysis showed statistically worse overall survival (OS) in Black, radiation and positive margins cohorts, OS survival was worse in Q1 as compared to Q2 and Q3. Treatment in an academic center and Q4 were associated with better OS although results were not statistically significant.

Multivariate analysis showed better OS outcome in all quartiles when compared to Q1. Negative margins, which showed improvement towards higher quartiles, were also associated with statistically better OS.

Conclusion: To conclude, we found that increased travel distance was associated with more probability of surgical management, avoidance of radiation and obtaining negative surgical margins factors that are associated with improved OS.

Methods

The National Cancer Database (NCDB) was mined for 21,236 oral cavity patients who were divided into quartiles based on distance traveled for treatment. Travel distance quartiles and numbers in each were Q1 < 7.25 (5300), Q2 7.25- 17.6 (5,325), Q3 17.6-46.5 (5,278) and Q4 =>46.5 miles (5,297). The mean travel distances were 3.8 miles in Q1, 11.8 in Q2, 29.8 in Q3 and 133 miles in Q4. The median distances for the four quartiles were 3.8, 11.6, 27.8 and 83 miles respectively. Patient demographic and clinical characteristics were summarized by stage at diagnosis and treatment using means, medians, and standard deviations for the continuous variables and frequencies and cumulative frequencies for categorical data. Comparisons were made using the Kruskal–Wallis test for continuous variables or Pearson chi-square tests for categorical variables. Overall Survival (OS) was summarized by treatment, facility type and distance traveled for treatment using standard Kaplan-Meier methods, where estimates of the median OS were obtained with 95% confidence intervals (CIs). The primary endpoint of the study was to estimate OS, defined by the time from diagnosis to death due to any cause. Comparisons were made using the log-rank test. Univariate and multivariable Cox proportional hazard models were used to estimate the effects of different covariates on OS in study participants. Result estimates were expressed as hazard ratios (HR) with 95% confidence intervals (CI). All analyses were conducted in SAS v9.4 (Cary, NC) at a significance level of 0.05.

Results

Table 1: Travel distance by tumor stage

Travel distance	All stage	T1 & T2	T3 & T4
Total	0.56 (0.55, 0.57)	0.71 (0.70, 0.72)	0.42 (0.41, 0.44)
Q1	0.52 (0.50, 0.53)	0.67 (0.65, 0.69)	0.38 (0.36, 0.40)
Q2	0.56 (0.55, 0.58)	0.71 (0.69, 0.74)	0.43 (0.40, 0.45)
Q3	0.59 (0.57, 0.61)	0.74 (0.71, 0.76)	0.45 (0.43, 0.480)
Q4	0.57 (0.55, 0.58)	0.72 (0.70, 0.75)	0.44 (0.42, 0.46)

Table 2. Patient demographics. N (%)

	total	T1 & T2	T3 & T4
Male	12,758 (61.1%)	5,739 (56.7%)	7,019 (63.1%)
Female	8,478 (39.9%)	4,376 (43.3%)	4,102 (36.9%)
ave. age	62.2	62.2	62.2
White	18,655 (87.9%)	9,097 (89.9%)	9,559 (86%)
Black	1,278 (6.0%)	374 (3.7%)	904 (8.1%)
NBPoC	1,101 (5.2%)	524 (5.2%)	577 (5.2%)
Unknown	201 (0.9%)	120 (1.2%)	81 (0.7%)

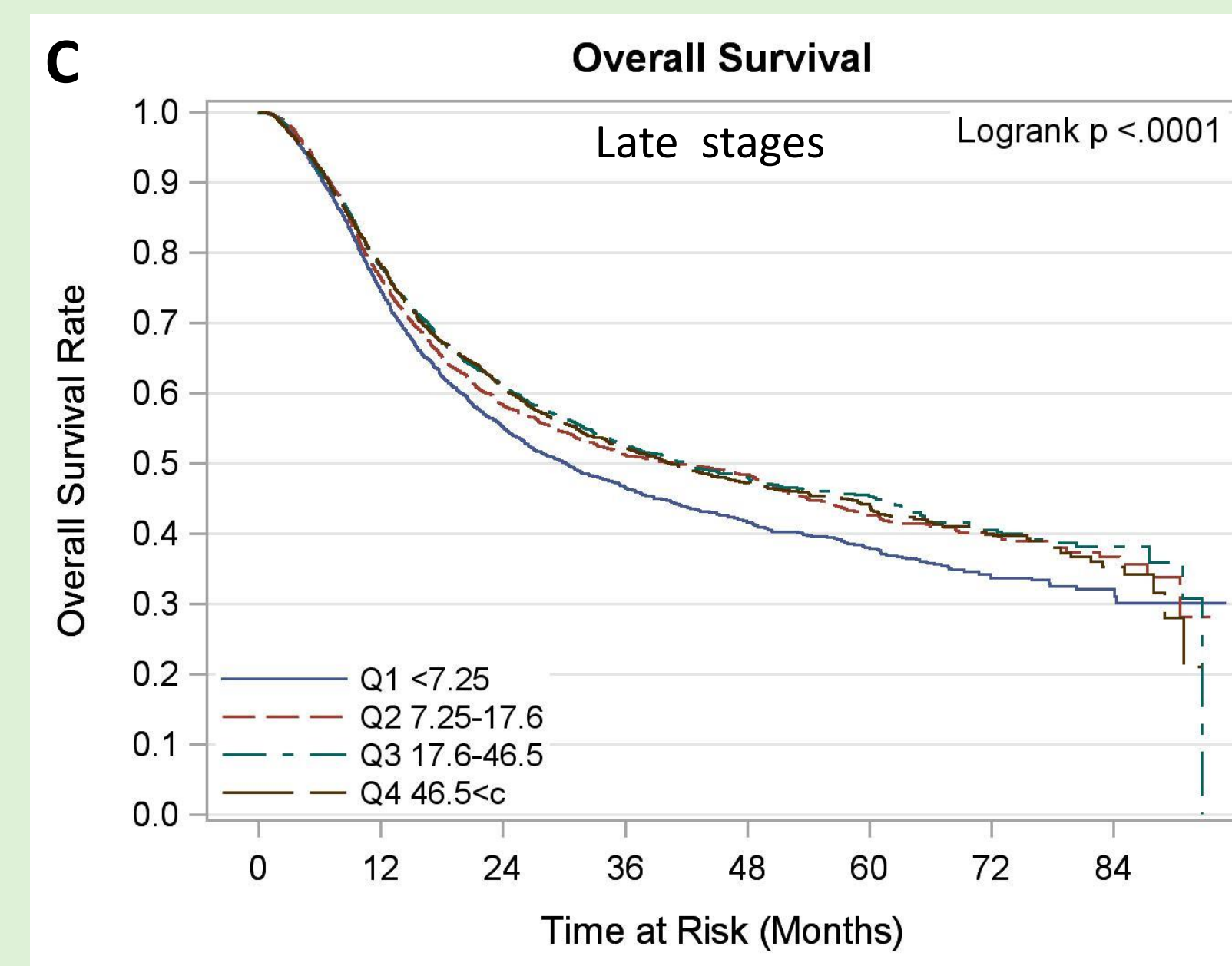
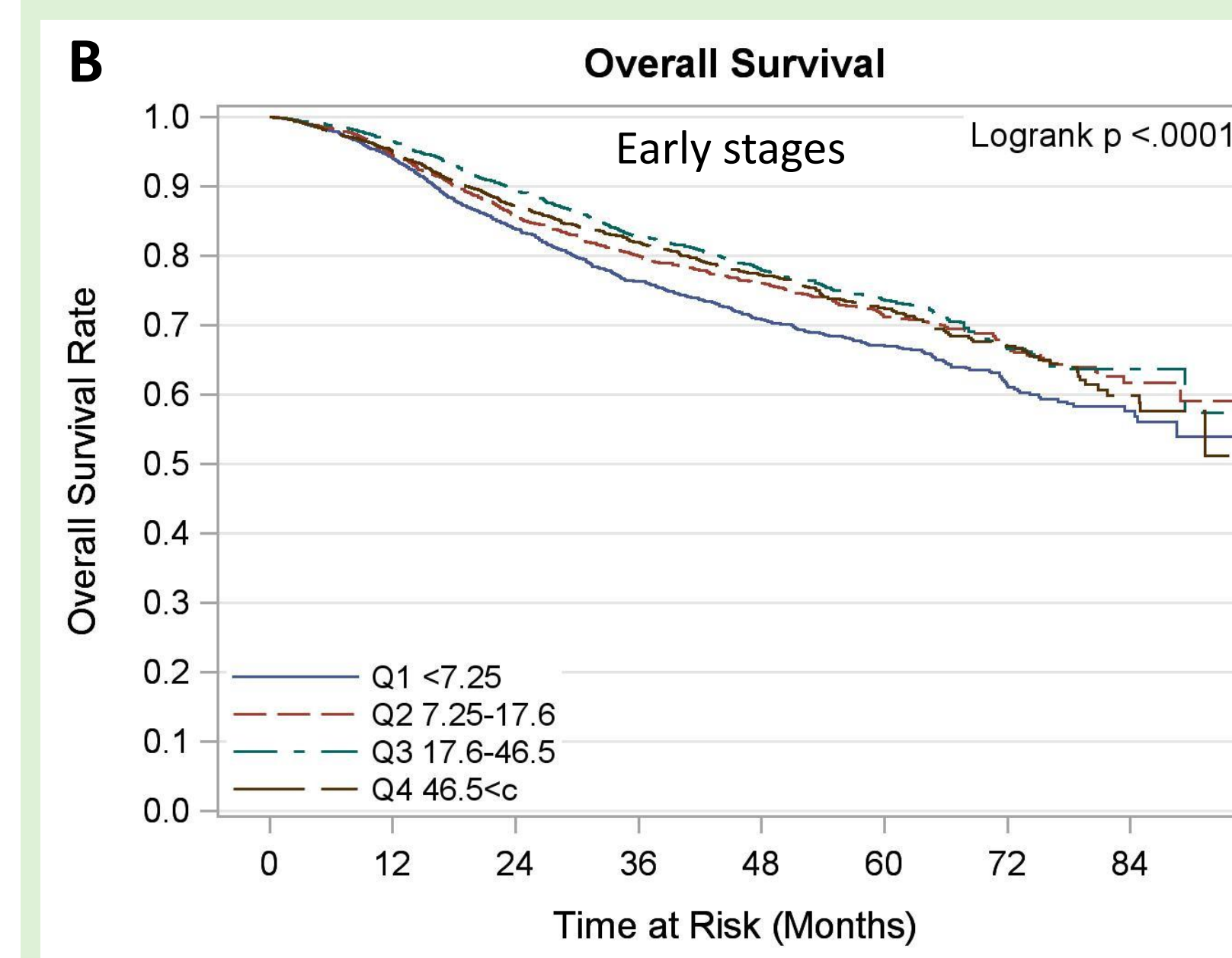
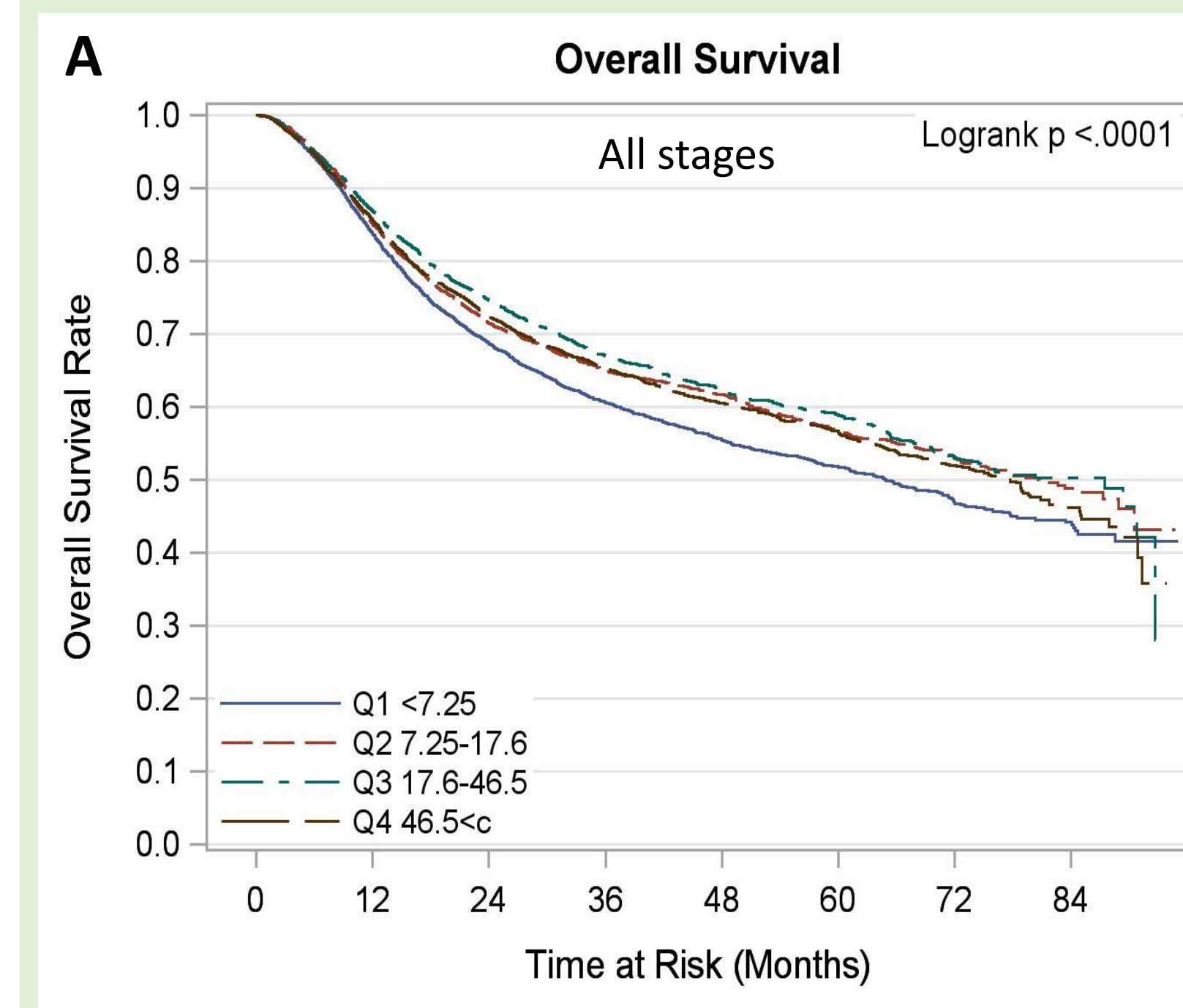


Figure 1: Overall survival by tumor stage and patient travel distance.

A, quartile survival for all tumor stages;

B, quartile survival for early (T1 & T2)

tumor stages;

C, quartile survival for late (T3 & T4) tumor stages.

Results

- Patients who traveled the shortest distance (Q1) were noted to have the worst 5-year survival rate among all early and late-stage oral cavity cancers.

- White non-Hispanics were more likely to travel longer distances for treatment than non-white groups.

- Patients with Stage IV oral cavity disease were noted to travel the farthest (Q4)

- Among oral cavity subsites, patients with gingival and alveolar cancers were more likely to travel greater distance compared to patients with oral tongue cancer

- There was a statistically significant association between distance traveled and facility type, regardless of insurance status. The likelihood of receiving treatment at an Academic/Research Program increased with travel distance (p<0.001).

- The farther the patients traveled, the more likely they were to receive primary surgical based management with less likelihood of post-operative radiation for early stage disease (p<0.001). This is likely related to the statistically significant increased rate of negative surgical margins in Q4.

Conclusions

- To conclude, we found that increased travel distance was associated with more probability of surgical management, avoidance of radiation and obtaining negative surgical margins factors that are associated with improved OS.

- Travel distance increased in 2013-2016 compared to those who received treatment in 2010-2012.

- Univariate analysis showed statistically worse overall survival (OS) in Black, radiation and positive margins cohorts, OS survival was worse in Q1 as compared to Q2 and Q3. Treatment in an academic center and Q4 were associated with better OS although results were not statistically significant.

- Multivariate analysis showed better OS outcome in all quartiles when compared to Q1. Negative margins, which showed improvement towards higher quartiles, were also associated with statistically better OS.