

BACKGROUND & Objective

Salivary gland tumors (SGTs) constitute 5% of head and neck cancers and 0.5% of all malignancies. The major salivary glands include the parotid, submandibular, and sublingual glands. Due to the histological diversity of SGTs, over 20 histological subtypes have been identified, with mucoepidermoid carcinoma (MEC), adenoid cystic carcinoma (AdCC), and polymorphic adenocarcinoma (PAC) being the most common. Previous studies using the SEER database have shown that younger age, female sex, and marriage confer a survival benefit in major salivary gland malignancies^{1,2}. However, multivariate analyses stratified by sex and examining the interaction of demographic factors on survival remain limited.

Objective: To evaluate the influence of demographic factors such as sex, marital status, race, socioeconomic status (SES), and age on survival in patients diagnosed with major salivary gland malignancies, with a particular focus on sex-based differences.

Methods

Data Source and Patient Selection

- Database:** SEER 2000–2021 Incidence – Research Plus Data (17 Registries, April 2023 Release).
- Inclusion Criteria:**
 - Primary malignancy of the parotid, submandibular, sublingual, or overlapping major salivary glands (ICD-O-3).
- Cohort Size:** 13,869 patients with major salivary gland malignancies.

Data Collection and Analysis

- Variables:** Demographics (age, sex, race, marital status, county-level SES), tumor characteristics (histology, site, grade), and survival outcomes.
- Statistical Methods:**
 - Kaplan-Meier (KM) survival analysis.
 - Cox proportional hazards (PH) modeling with Schoenfeld residuals to assess assumptions.
 - Multivariate analysis stratified by sex to assess interaction effects.

RESULTS

Cohort Characteristics

- Histology Distribution:** Adenocarcinoma (39.98%), MEC (36.80%), AdCC (16.25%), and other types (<10%).
- Median Age:** 60 years.
- Sex Distribution:** 51.91% female.
- Site of Origin:** 79.05% parotid gland, 13.64% submandibular gland.

Survival Analysis

- Overall Survival:** 10-year survival was 62.45% [61.29–63.60].
- Sex:** Females had significantly improved survival compared to males.
- Marital Status:** Widowed individuals had the worst survival, while single status conferred a slight survival benefit over married status.
- Race:** Asian/Pacific Islanders had the best survival, while White patients had the worst.
- Income:** Only the top income tertile conferred a modest survival benefit.

Multivariate Analysis

- Protective Factors:** Female sex, Asian/Pacific Islander race, higher income, being married, and age <40.
- Increased Risk:** Age >50 was associated with increased risk of malignancy.
- Proportional Hazards Assumption:** Sex, tumor grade, site, and histology violated the proportional hazards assumption, requiring stratification in secondary analysis.

Sex-Stratified Analysis

- Marital Status:** Marriage was protective for men but had no significant effect for women.
- Race:** No difference in survival between White and Black men, but Black women had slightly worse survival than White women.
- Income:** Higher income was protective for men but had no significant impact on women.
- Tumor Grade:** Women presented with lower stage disease, potentially contributing to better outcomes.

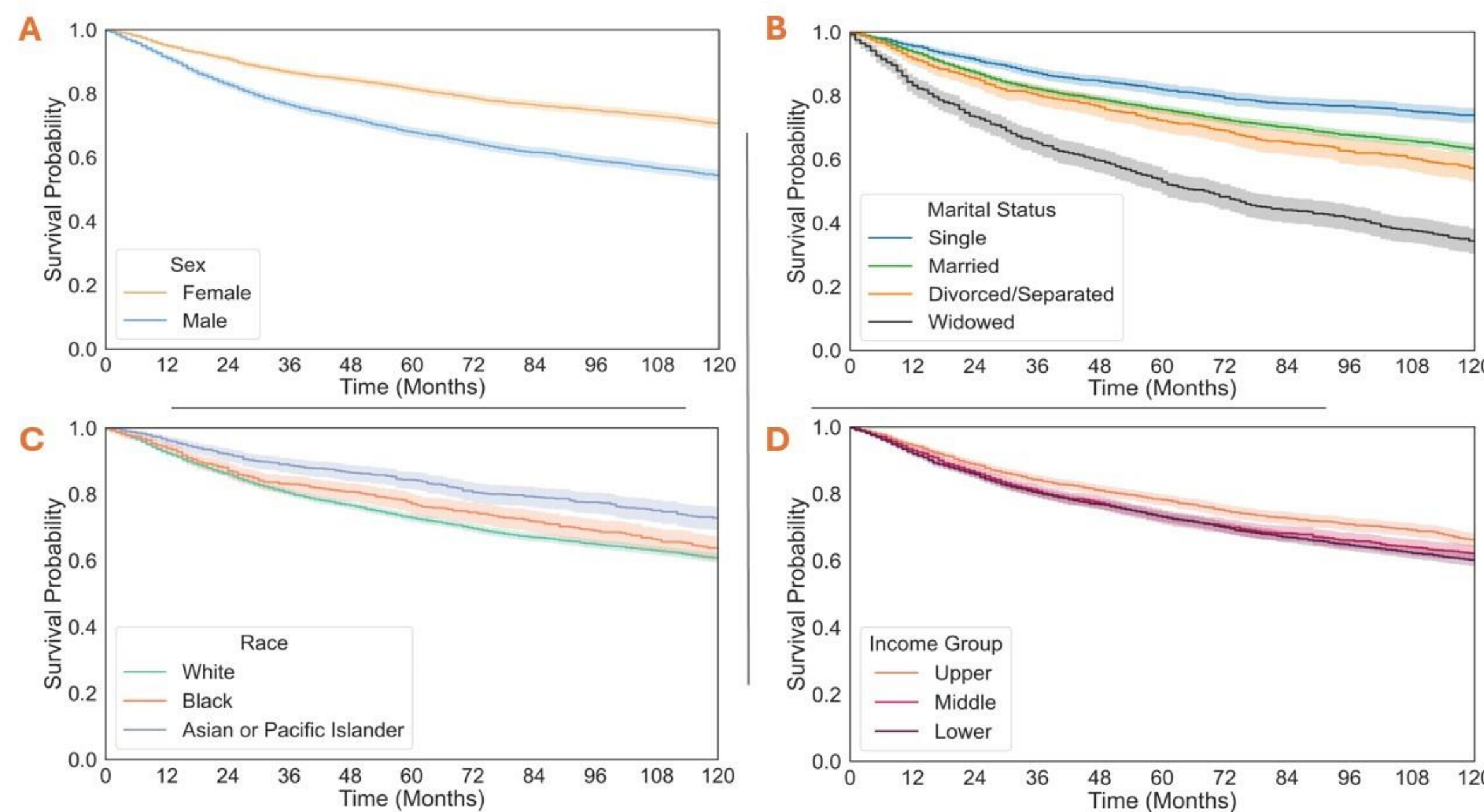
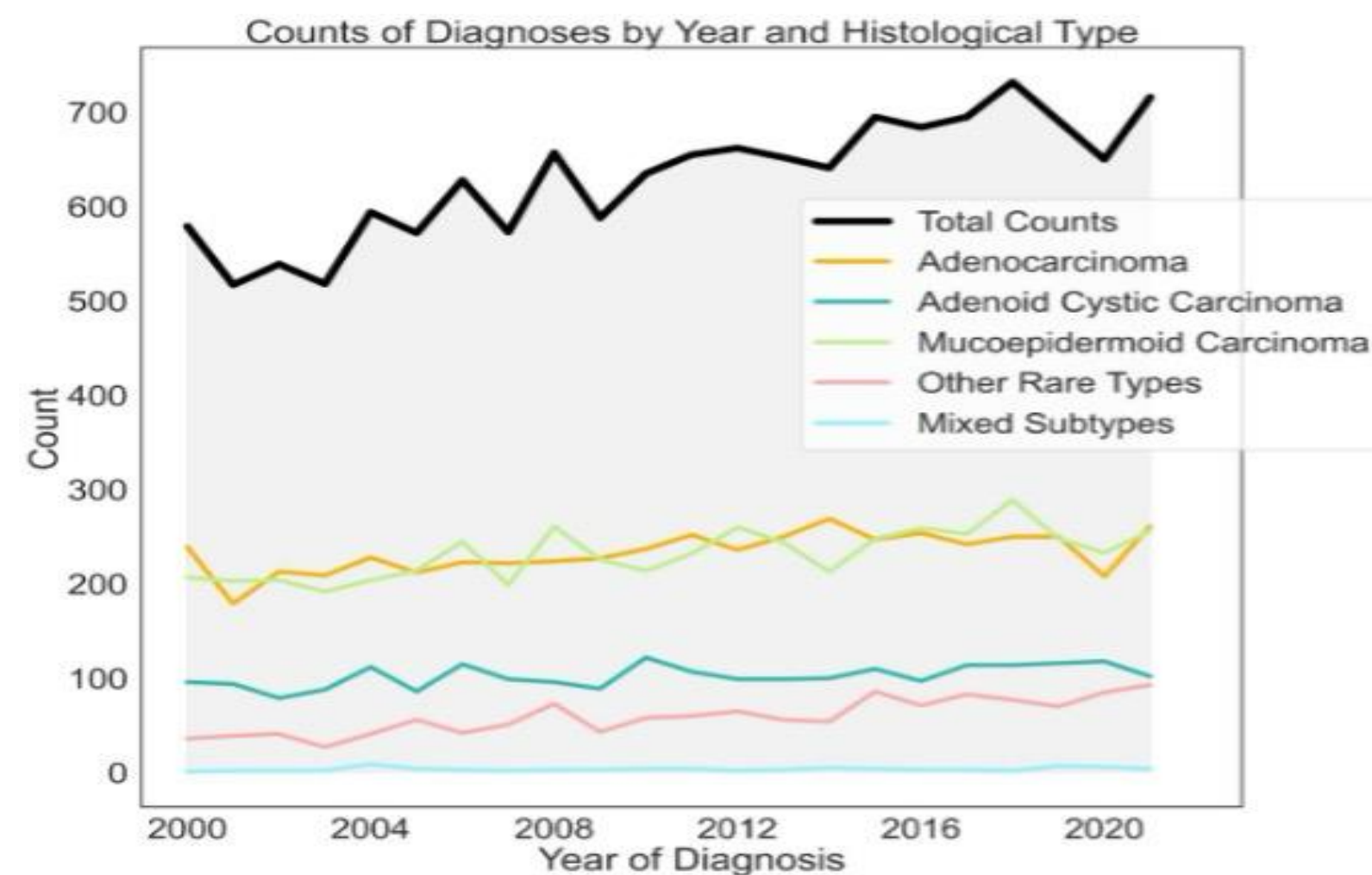


Figure 1: Kaplan Meir Plots of the 10-year survival across demographic variables.

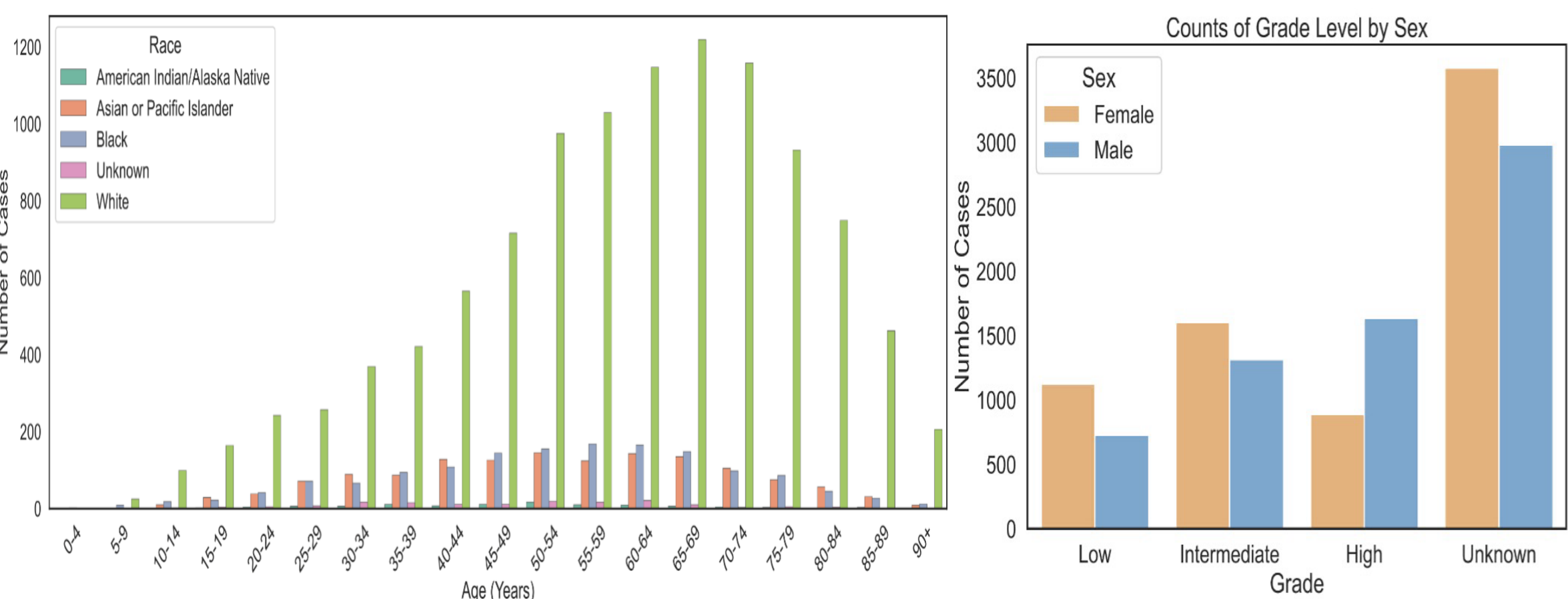


Figure 3: Histogram of the distribution of tumor stage stratified by sex.

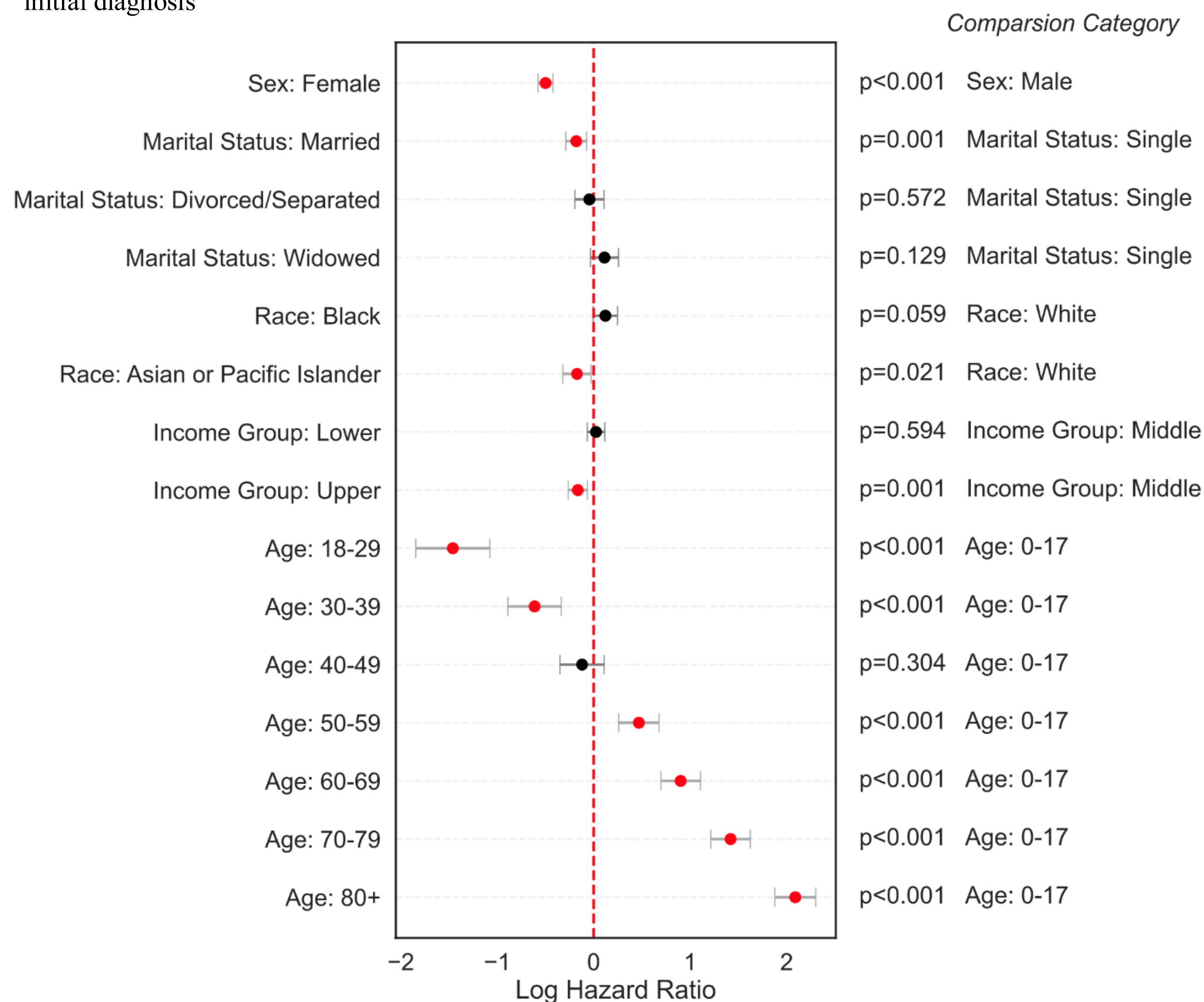


Figure 4: Cox Proportional Hazards (PH) Model plotted on Forest Plot to demonstrate impacts of various demographic factors on survival.

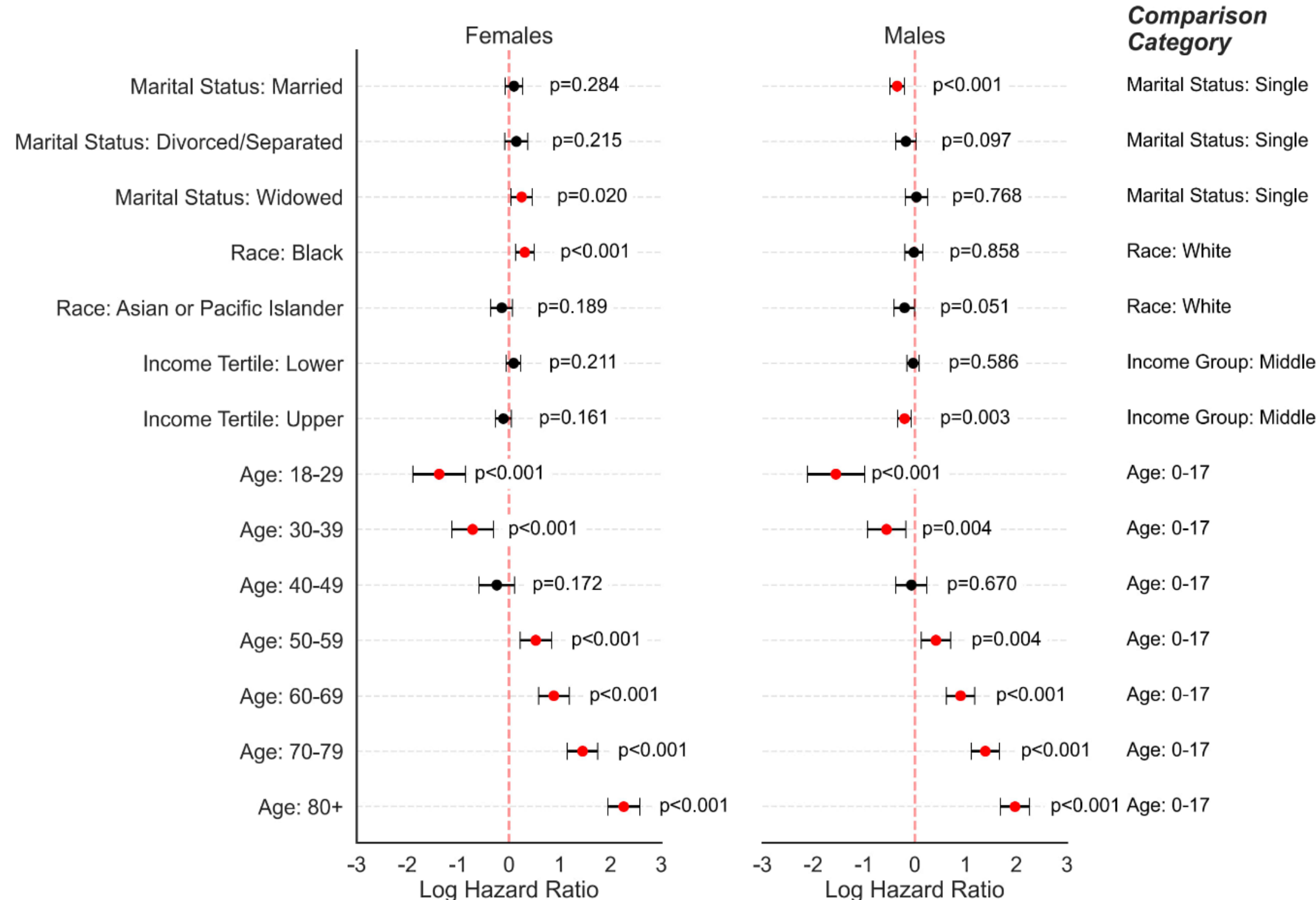


Figure 5: Cox Proportional Hazards (PH) Model plotted on Forest Plot stratified by sex across marital status, race, income, and age at diagnosis.

DISCUSSION

Key Findings

Our analysis of major salivary gland malignancies using the SEER database from 2000 to 2021 identified notable sex-based differences in survival. Female sex was consistently associated with improved overall survival, which may be attributed to earlier diagnosis and a higher proportion of lower-grade tumors at presentation³. Marital status, race, socioeconomic factors, and age also influenced survival outcomes, with distinct patterns between sexes.

Sex and Survival Differences

Female sex conferred a survival advantage across multiple models, suggesting that women may benefit from earlier healthcare engagement and a higher likelihood of seeking timely medical evaluation⁴. Additionally, women were more likely to present with lower-grade tumors, contributing to better outcomes³. In contrast, men had poorer overall survival despite adjustment for key prognostic variables, highlighting possible delays in diagnosis or differences in biological tumor behavior⁵.

Marital Status and Socioeconomic Impact

Marital status influenced survival outcomes differently in men and women. Being married was protective in both sexes, but the effect was more pronounced in men⁶. Widowed men had significantly worse outcomes compared to their female counterparts, suggesting that the loss of a spouse may impact men's emotional and physical health more severely, leading to delayed care and reduced adherence to treatment⁷. Socioeconomic status, particularly higher income, conferred a survival benefit that was more prominent in men, while women's outcomes appeared less sensitive to income variations⁸.

Racial Disparities and Age Impact

Racial differences were also observed, with Asian and Pacific Islander patients demonstrating superior survival outcomes. This effect is seen in other cancers as well⁹. Interestingly, White females had a slight survival advantage compared to other groups when stratified by sex. Age was a significant predictor of survival in both sexes, with increasing age associated with worse outcomes, though the decline in survival was steeper in men.

Conclusion

Demographic factors such as sex, race, marital status, and income influence survival in major salivary gland malignancies, with significant sex-based differences. Women tend to present with lower-grade disease and have better outcomes, while income and marriage confer greater survival benefits for men. These findings underscore the need for targeted interventions to address sex-specific disparities in survival outcomes.

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