US Mortality Rates for Oral Cavity and Pharyngeal Cancer by Educational Attainment

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Objective: To describe trends in mortality rates for patients with oral cavity and pharynx cancer by educational attainment, race/ethnicity, sex, and association with human papillomavirus infection.

Design: Study of age-standardized mortality rates for patients with oral cavity and pharynx cancer by level of education using National Center for Health Statistics data.

Setting: Twenty-six states.

Patients: White and black men and women aged 25 to 64 years.


Results: From 1993 to 2007, overall mortality rates for patients with oral cavity and pharynx cancer decreased among black and white men and women; however, rates among white men have stabilized since 1999. The largest decreases in mortality rates were among black men and women with 12 years of education (−4.95% and −3.72%, respectively). Mortality rates for patients with oral cavity and pharynx cancers decreased significantly among men and women with more than 12 years of education, regardless of race/ethnicity (except for black women), whereas rates increased among white men with less than 12 years of education. Mortality trends vary substantially for human papillomavirus–related and human papillomavirus–unrelated sites.

Conclusions: We observed decreasing mortality rates for patients with oral cavity and pharyngeal cancer among whites and blacks; however, decreases were greatest among those with at least 12 years of education. This difference in mortality trends may reflect the changing prevalence of smoking and sexual behaviors among populations of different educational attainment.


Mortality rates among patients with major types of cancer, including lung, colon and rectum, female breast, and prostate, have decreased in the United States since the early 1990s due to decreases in risk factors (eg, smoking for lung cancer) and improved detection and treatment (colorectal, breast, and prostate cancer). The decreases in mortality rates among patients aged 25 to 64 years were largely limited to those with higher educational attainment. Death rates among patients with oral cavity and pharyngeal cancer have also decreased for the past few decades in the United States; however, the extent to which this varies by educational attainment, to our knowledge, has not been previously examined for head and neck cancer. This study explores the trends in mortality rates for patients with oral cavity and pharynx cancers by educational attainment.

Methods

The mortality data for this study were obtained from the National Center for Health Statistics. The National Center for Health Statistics collects mortality data obtained from death certificates of all deaths that occurred in the United States and its territories. International Classification of Diseases, Ninth Revision (ICD-9) (1993-1998) and International Classification of Diseases, Tenth Revision (ICD-10) (1999-2007) codes were used to distinguish between cancers that are and are not associated with human papillomavirus (HPV) infection. HPV-associated cancer included ICD-10 codes C01, C02.4, C09 to C10, and C14.2 for 1999 to 2007 and ICD-9 codes 141.0, 141.6, 146.1, and 149.1 for 1993 to 1998. HPV-unassociated cancer included ICD-10 codes C00, C02.0 to C02.3, C02.8 to C02.9, C03.0 to C08.9, C11.0 to C13.9, C14.0, and C14.8 for 1999 to 2007 and ICD-9 codes 140, 141.1 to 141.3, 141.7 to 141.9, 142.0 to 145.9, 147.2 to 149.0, and 149.8 to 149.9 for 1993 to 1998. Educational attainment as provided by a family member is re-
corded on the death certificate as number of years of formal schooling completed beginning with 1989 death certificates. Beginning with the 2003 mortality data, a newer death certificate that relies on diploma or degree earned has been introduced and implemented in 24 states as of the 2007 mortality data. Therefore, our analysis on the mortality trends from 1993 through 2007 is restricted to the 26 states that continued to use the 1989 version of the death certificate for reporting educational attainment (Figure 1). We categorized educational attainment into 3 categories: less than 12 years of school (did not graduate from high school), 12 years of school (high school graduate), and more than 12 years of school (some college). We also restricted the analysis to individuals aged 25 to 64 years because individuals who die before the age of 25 may not have completed their education. In addition, educational attainment information is more accurately recorded on death certificates and better predicts socioeconomic status (SES) for individuals younger than 65 years.6,7

Yearly US population estimates were obtained from the US Census Bureau. Data regarding state, race/ethnicity, sex, and educational attainment were based on the Annual Social and Economic Supplement to the Current Population Survey, a monthly survey of approximately 50,000 households. Mortality and population data were categorized to create corresponding numerators and denominators for the following categories: years 1993 to 2007, race/ethnicity (non-Hispanic black and non-Hispanic white), sex, educational attainment, and HPV association.

Annual age-standardized mortality rates (per 100,000 population and standardized to the 2000 US Census) for 2005 to 2007 were calculated among the 25- to 64-year-olds by race/ethnicity, sex, cancer site, HPV association, and educational attainment. Temporal trends for mortality rates from 1993 to 2007 were calculated by weighted least squares linear regression models to the log-transformed annual age-standardized mortality rates with the use of the Joinpoint Regression program, version 3.0 (National Cancer Institute, Silver Spring, Maryland). Separate models were fit for each sex, race/ethnicity, and educational attainment for all patients with oral and pharynx cancers, for patients with HPV-unassociated oral cancers, and for patients with HPV-associated oral cancers. Annual change in mortality rates was reported as annual percent change (APC), which was obtained from the slopes of the fitted regression models generated by the Joinpoint program. All statistical tests were 2-sided (P<.05). The APCs that were statistically significant indicated a change in the direction noted. The APCs that were not significantly different from zero were viewed as stable trends.

Figure 1. States (gray-shaded) that are included in the analysis.
The Table lists the age-standardized mortality rates for 2005 to 2007 and trends for 1993 to 2007 for cancers of the oral cavity and pharynx for white and black men and women aged 25 to 64 years by educational attainment. These data are also illustrated in Figure 2. From 1993 to 2007, overall mortality rates for cancers of the oral cavity and pharynx decreased in both blacks and whites; however, rates have stabilized in white men since 1999. The decreases in mortality rates were limited in blacks to those with at least 12 years of education (although the trend was not significant for black women with more than 12 years of education) and in whites to those with more than 12 years of education. The largest decreases in mortality rates occurred among black men and women with 12 years of education (−4.95% and −3.72%, respectively). As noted in the Table, the Joinpoint model identified more than one trend from 1993 to 2007 for 3 subgroups (data not shown). For example, among white men with less than 12 years of education, mortality rates increased 6.80% per year from 1995 to 2002, after which mortality rates stabilized. Throughout the entire study period, mortality rates have remained highest among the least educated and lowest among those with some college education, regardless of sex or race/ethnicity.

The Table also presents mortality rates for patients with cancers of the oral cavity and pharynx by HPV association. Similar to the overall trends, mortality rates for patients with HPV-unassociated cancers decreased significantly among both blacks and whites, with faster decreases observed for blacks compared with whites. For all groups, the decreases in HPV-unrelated sites were limited to those with at least 12 years of education; mortality rates increased for white men with less than 12 years of education (2.72% per year, \( P < .01 \)). In contrast, mortality rates for sites related to HPV infection decreased only among black men. Notably, from 1993 to 2007, mortality rates increased for white men with less than 12 years of education (2.72% per year, \( P < .01 \)).
increased by 1.58% per year for HPV-related sites among white men. By educational attainment, mortality rates increased significantly among all white men except for those with more than 12 years of education.

This analysis demonstrates that trends in mortality rates for HPV-associated and HPV-unassociated oral cavity and
pharynx cancer vary by educational attainment. Decreases in mortality rates for cancers of the oral cavity and pharynx combined were limited to blacks with at least 12 years of education and whites with more than 12 years of education. Similar trends were observed for cancers not associated with HPV, whereas the pattern differed for HPV-associated cancers, with decreases in mortality rates observed only among black men.

Trends in oral cavity and pharynx mortality rates by educational attainment could be affected by differences in risk factors and access to care. Smoking and alcohol are the 2 major known risk factors for oral cavity and pharynx cancers not related to HPV infection. The disparity in reducing mortality rates from oral cavity and pharynx cancers not related to HPV by educational attainment may reflect differences in smoking patterns. Progress in reducing smoking prevalence has been much larger in the most educated than the least educated persons. For example, the smoking prevalence in 2006 was nearly 3 times as high in those with less than 12 years of education (26.7%) than in those with 16 years or more of education (9.6%). Similar educational disparities in mortality trends have been observed in other countries. For example, in Norway, mortality rates decreased more rapidly among those with the highest level of education.

The major risk factors for HPV-related oral cavity and pharynx cancers are related to sexual behaviors, particularly oral sexual activity. The increase in HPV-related oral cavity and pharynx cancers among white men may reflect racial differences and changing patterns of sexual behaviors. It has been reported that white males (aged 15–19) were nearly 3 times more likely to engage in oral sexual activity compared with black men. Consistent with our findings, a number of studies in the United States and elsewhere reported increases in HPV-related cancer incidence rates among white men younger than 60.

Some of the less favorable trends for both HPV-related and -unrelated cancer sites in the less educated groups may also be due to lack of access to early detection and adequate treatment and follow-up. Persons with lower SES are also more likely to have their cancer diagnosed at advanced stages of the disease and less likely to receive optimal treatment.

A strength of our study is the use of mortality data based on nearly 50% of non-Hispanic blacks and whites from 1993 to 2007 together with access to an individual measure of SES, that of educational attainment. Another strength of our study is the large sample size that allows for further stratification by race/ethnicity, sex, educational attainment, and HPV association.

First, a limitation of our study is the imprecise measurement of education as a proxy for SES. Family members may not complete the query correctly; thus, there is a chance for misclassification of educational attainment. Second, SES is a complex construct that is not wholly described by educational attainment. Third, because we limited our analysis to patients 25 to 64 years of age, the results may not be generalizable to individuals older than 65, especially because this group generally has access to universal health care via Medicare.

Fourth, our analysis was limited to states that still used the old version of the death certificate, which recorded education as years completed, whereas education is recorded on the new certificate by the degree earned; however, results were similar for both groups. Our analysis could also be affected by inaccuracies in underlying cause of death from the death certificate. Finally, we could not analyze the mortality data by stage at diagnosis and receipt of treatment.

In conclusion, to our knowledge, this study is the first large US study to examine mortality rates of patients with oral cavity and pharynx cancers by educational attainment. Among patients with oral cavity and pharyngeal cancer, we observed decreasing mortality rates among whites and blacks; however, decreases were greatest among those with at least 12 years of education. This difference in mortality trends may reflect the changing prevalence of smoking and sexual behaviors among populations of different educational attainment.

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Author Contributions: Drs Chen and DeSantis had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Chen, DeSantis, and Jemal. Acquisition of data: Chen and Jemal. Analysis and interpretation of data: Chen, DeSantis, and Jemal. Drafting of the manuscript: Chen and Jemal. Critical revision of the manuscript for important intellectual content: Chen and DeSantis. Statistical analysis: DeSantis. Administrative, technical, and material support: Chen and Jemal. Study supervision: Chen and DeSantis.

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