Community Dent Oral Epidemiol 2007; 35: 489–499

Community Dentistry and Oral Epidemiology

Trends in the incidence, mortality, and survival rates of oral and pharyngeal cancer in a high-risk area in Michigan, USA

Justine L. Kolker[1], Amid I. Ismail[2], Woosung Sohn[2] and Neerrajah Ramaswami[2]

[1]Department of Operative Dentistry, School of Dentistry, University of Iowa, Iowa City, IA, [2]Department of Cariology, Restorative Sciences, and Endodontics, School of Dentistry, University of Michigan, Ann Arbor, MI, USA

Kolker JL, Ismail AI, Sohn W, Ramaswami N. Trends in the incidence, mortality, and survival rates of oral and pharyngeal cancer in a high-risk area in Michigan, USA. Community Dent Oral Epidemiol 2007; 35: 489–499. © 2007 Blackwell Munksgaard. No claim to original US government works

Abstract – *Objective:* The aim of this analysis was to analyze the incidence, mortality and survival rates for the city of Detroit and Wayne County, Michigan. In Detroit, about four out of the five residents are African-Americans. *Methods:* Rates and standard errors on oral cancer incidence, survival, and mortality by county of residence, race, gender, stage of diagnosis were provided by the Michigan Cancer Surveillance Program, which is maintained by the Michigan Department of Community Health. Rates were expressed per 100 000 individuals and age adjusted to reflect the distribution of the USA population in 2000. Analysis for trends was conducted by the authors using the National Cancer Institutes' joinpoint regression program (version 3.0). *Results:* In 1993–2002, the incidence rate of oral cancer in Michigan (one of the 50 states in the USA) was 11.3 per 100 000, and in the city of Detroit, it was 16.6. In African-American males in Michigan the incidence rate was 24.3 per 100 000, one of the highest among all American males. The city of Detroit, with 9% of the total state population, had 13.1% of all new cases. Between 1993 and 2002, there was a drop in incidence rates in Michigan and Detroit. However, there was an increase in mortality rates in Michigan and Detroit between 2000 and 2002. In Detroit, the incidence and mortality rates of 'white' and African-American males were not different and the highest incidence rates were found in adults between the ages of 50 and 74 years. In the state, the peak incidence rates were found in adults 75 years or older. In 2000–2002, residents of Detroit had the lowest percentage (28.3%) of cases detected at early cancerous stage (*in situ* or localized) compared with rates in Michigan. African-Americans in Michigan had a 5-year survival rate of 34.9% compared with the state average of 54.6%. *Conclusions:* African-American males in Detroit accounted for a larger proportion of the oral cancer cases relative to their population size. There was surprising similarity between the incidence and mortality rates of African and 'white' Americans in Detroit. While the incidence rates have declined in Michigan and Detroit, mortality rates have increased between 2000 and 2002. This finding is contrary to national trends. In order to target programs to prevent oral cancer, oral cancer statistics for in small areas or high-risk populations should be evaluated separately.

Key words: epidemiology; Michigan; oral cancer; statistics; trends

Amid I. Ismail, Department of Cariology, Restorative Sciences and Endodontics, School of Dentistry, University of Michigan, 1011 N. University Avenue, D2361, Ann Arbor, MI 48109-1078, USA
Tel: +1 734 647 9190
Fax: +1 734 936 1597
e-mail: ismailai@umich.edu

Submitted 31 March 2006;
accepted 31 August 2006

The American Cancer Society estimates that in 2006 there will be 30 990 new cases of oral and pharyngeal cancer (hereafter oral cancer) and 7430 deaths (1). The incidence rate of oral cancer in 2002 ranked eighth among all cancers in white-American males and sixth among African-American males (2: Fig. 3.1 M.1). The 2002 age-adjusted incidence rate of oral cancer was 15.3 and 17.5 per 100 000 for

doi: 10.1111/j.1600-0528.2007.00371.x

white- and African-American males, respectively (2: Table 1.1.1.1M). The incidence rate of oral cancer in African-American males increased by 4.2 times between the age groups 40–44 and 50–54 years (3: Table XX-2).

The Surveillance Epidemiology and End Results Program (SEER) of the National Cancer Institute (NCI) monitors cancer incidence and survival in the USA. In Michigan, between 1998 and 2002, based on the SEER data, the incidence rate of African-American males was 25.7 per 100 000, the highest among all SEER sites (3: Table XX-10). These data were collected from three counties in Southeast Michigan (Wayne, Macomb, and Oakland) and presented under the label 'Metropolitan Detroit'. The incidence rate for white-Americans in the Detroit Metropolitan area was 17.4 per 100 000, which was the second highest rate among all 13 SEER sites (3: Table XX-10). Data on the incidence and mortality of the city of Detroit (part of Wayne County), where about 85% of the residents are African-Americans, are not available in published reports.

The death rates from oral cancer in Michigan in 2002 were 3.3 and 6.9 per 100 000 for white- and African-Americans, respectively (2: Table 2.20.1.2M). In the Detroit Metropolitan area, the death rates from oral cancer among males were 3.6 and 6.4 for white- and African-Americans, respectively (3: Table XX-10).

In the USA, the 5-year survival rates of African-Americans (39.5%) after being diagnosed with oral cancer lagged behind those of white-Americans (61.8%) (3: Table XX-4). Racial disparities are very evident when evaluating the national oral cancer survival rates (4). The highest racial disparity in oral cancer was observed in males less than 60 years of age (5). African-American males under the age of 65 had a 5-year survival rate of 36.1%, while white-American males of similar age had a survival rate of 65.0% (3: Table XX-4). African-American males 65 and older had the lowest 5-year survival rate of 27.4%, while white-Americans had a survival rate of 54.8% (3: Table XX-4).

While the available data show that African-American males have a high burden of oral cancer nationally, the regional disparities in Michigan in oral cancer rates between the city of Detroit and the other counties that are part of the Metropolitan area have not yet been evaluated. The SEER program reports data for the Detroit Metropolitan Area, including Macomb, Oakland, and Wayne (which contains the city of Detroit) counties. These three counties are racially and economically different from the city of Detroit (6). In 2000 African-Americans made up 82% of the population in Detroit, 42% of the population in Wayne County, 10% of the population in Oakland County, and 3% of the population in Macomb County (6).

The 1996 US National Strategic Planning Conference on Preventing and Controlling Oral and Pharyngeal Cancer recommended the development of statewide prevention models which would include assessing local needs and educating those at the greatest risk of developing oral cancer (7). In order to develop a targeted prevention model it is first necessary to assess the burden of oral cancer in the state, counties, and small geographic areas where high-risk population groups, such as African-Americans, cluster. This article presents the most current data available on the incidence and mortality of oral cancer, by race and gender, in Detroit, Wayne County, other selected counties, and the state of Michigan.

Methods

The Michigan Department of Community Health (MDCH) provided age-adjusted oral cancer incidence, death, and survival rates and their standard errors for this analysis. Through the Michigan Cancer Surveillance Program (MCSP), the MDCH collects information on cancer patients from hospitals, laboratories, physicians, and dentists. Information pertaining to the diagnosis of a malignancy and the first course of treatment is collected by the MCSP using the standards for data collection set forth by the North American Association of Central Cancer Registries (8). Surveillance data are reported within 180 days of diagnosis on a continuous basis throughout the year. Information about deceased patients is collected from death certificates. The data are then sorted into counties or areas such as the city of Detroit. The data collected by MCSP followed the coding system of the International Classification of Diseases for Oncology, 3rd edition (ICD-O-3), in which cancer of the oral cavity and pharynx (to be called oral cancer) included cancers of the lip, tongue, floor of the mouth, gingiva, palate, other areas of the mouth, salivary glands, tonsils, nasopharynx, oropharynx, and hypopharynx (9, 10). For each individual with cancer, the MCSP collects information on age, sex, race, cancer site, and stage of cancer at diagnosis. Surveillance data were reported within 180 days of diagnosis on a continuous basis throughout each year.

The data in this report were processed by the Vital Records and Health Data Development Section of MDCH and included all oral cancers diagnosed between 1993 and 2002 (11). Only data from invasive oral cancers, which are considered malignant, were used to generate incidence, mortality, and survival rates for the state of Michigan, selected Michigan counties, and the city of Detroit. Cancers diagnosed at all stages (*in situ*, localized, regional, and distant) were used in evaluating the percent of cases diagnosed at early stages. Early stage is defined as both *in situ* (the presence of malignant cells within the cell group from which they arose, with no penetration of the basement membrane of the tissue and no stromal invasion) and localized (invasive cancer confined to the organ). These definitions represent the standard used in the USA for cancer registries and for the SEER program (8–10).

All rates were age adjusted to the US 2000 standard population, expressed as per 100 000 individuals, and were based on the 1993–2002 county and state level populations (6). SEER*Stat statistical software from the NCI was used to calculate 5-year relative survival rates by using survival life tables (12). Survival was defined as the ratio of the proportion of observed survivors (all causes of death) in a cohort of cancer patients to the proportion of expected survivors in a comparable cohort of cancer-free individuals (13). Survival data are only available for the state and no county or Detroit-specific data are yet available for analysis.

The joinpoint regression method which was developed by the NCI (version 3) was used to analyze trends in incidence, mortality, and survival rates (14). Annual rates were joined as linear segments on a logarithmic scale using joinpoint linear regression analysis. The tests of significance used a Monte Carlo permutation method. The standard errors for the adjusted rates were used to estimate confidence intervals for the difference in slopes (14). For the joinpoint regression analysis, we used rates for individual years between 1993 and 2002. Further details on the joinpoint regression program and a free version of the program can be obtained from the NCI website http://srab.cancer.gov/joinpoint/.

Results

Incidence

Between 1993 and 2002, a total of 10 744 new cases of invasive oral cancer were reported in Michigan; of these cases, 5032 (47%) were in the Detroit Tri-county area, which includes Macomb, Oakland, and Wayne Counties (Table 1). During this period, the age-adjusted incidence rate of oral cancer in Michigan was 11.3 per 100 000. Alcona County, in which 25% of the population was 65 years of age and older, had the highest incidence rate of 18.0.

The city of Detroit had an incidence rate of 16.6, which was 1.5 times higher than the total incidence rate of oral cancer in the state. Detroit, where 9% of the total state's population resides, had 13% of all oral cancer cases in Michigan. In Michigan, African-Americans had 1.3 times higher incidence rate than white-Americans (Table 1). The highest incidence rate for African-Americans was in Wayne County, which includes the city of Detroit.

In Michigan, males had 2.5 higher number of oral cancer cases than females and African-American males had the highest incidence rate (24.3 per 100 000), which was the highest among all race and gender groups; 1.5 times higher than the rate of white-American males; and 3.5 and 3.7 times higher than the rates of African- and white-American females, respectively (Table 2).

The incidence rates of African-American and white-American men differed in the state but not in the city of Detroit (Table 2). African-Americans aged 50–74 years in Michigan had an incidence rate of 72.9 per 100 000, which is 1.7 higher than the rates of similarly aged white males (Table 2). Interestingly, the incidence rates of oral cancer among both white- and African-American males in Detroit peaked between the ages of 50 and 74 years. This is different from the trend among white-Americans in the state where the highest incidence rate observed in the 75+ age group (Table 2).

While the incidence rates of oral cancer increased in Michigan's males in the mid-1990s, they started to decline in the late 1990s and early 2000s (Table 3). The decline in incidence rates in African-American males in Detroit was statistically significant in the 1993–1997 and 2000–2002 periods ($P < 0.05$) (Table 3). Between 1993 and 2002, African-American males had the largest reduction in incidence rates (Table 4).

Mortality

In Michigan, between 1993 and 2002, there were a total of 2594 deaths due to invasive oral cancer, the Detroit Tri-county area accounted for 46% of these oral cancer deaths (Table 1). Calhoun County, a rural county which includes the city of Battle Creek, where 17.8% of the population is African-American,

Table 1. Age-adjusted incidence and mortality rates, per 100 000, of oral cancer in Michigan, selected counties, and Detroit, 1993–2002

	Incidence count	Incidence rate			Mortality count	Mortality rate		
County/area	All races	All races	African-Americans	White-Americans	All races	All races	African-Americans	White-Americans
Alcona[a]	32	18.0	†	†	6	*	†	†
Calhoun[b]	171	11.9	*	11.6	59	4.0	*	4.1
Jackson[b]	185	11.8	*	11.4	49	3.1	*	2.9
Macomb[c]	947	11.7	*	11.7	205	2.6	*	2.5
Marquette[a,b]	103	16.4	†	†	25	3.9	†	†
Midland[b]	63	8.3	†	†	23	3.2	†	†
Oakland[b]	1249	11.2	10.3	11.3	263	2.4	*	2.4
Otsego[a]	39	16.7	†	†	4	*	†	†
St. Clair[a,b]	237	15.0	†	†	59	3.7	†	†
Wayne County[b,c]	2836	14.2	16.1	12.8	715	3.6	4.4	3.0
Wayne County without City of Detroit	1427	12.5	16.4	12.2	331	2.9	4.2	2.8
City of Detroit[a,b]	1409	16.6	16.2	15.9	384	4.5	4.4	4.1
State of Michigan	10 744	11.3	14.4	10.7	2594	2.7	4.0	2.5

Source: 1993–2002 Michigan Resident Cancer Incidence and Death Files. Cases were processed by the Michigan Department of Community Health, Vital Records and Health Data Development Section (incidence completed on April 25, 2005, mortality completed on June 3, 2005).

*Statistically unreliable rates – rates were not calculated when there were fewer than 20 total events.

†Due to small numbers of African-Americans in the county, separate rates for African-Americans and white-Americans could not be calculated.

[a]Counties were included if their incidence rate was 15 per 100 000 or greater.

[b]Counties were included if their mortality rate was 3.0 per 100 000 or greater.

[c]The Surveillance Epidemiology and End Results (SEER) Detroit Registry includes Macomb, Oakland and Wayne Counties.

Table 2. Age-specific and age-adjusted incidence and mortality rates, per 100 000, of oral cancer by gender and race, in Michigan and in Detroit, 1993–2002

	Incidence rates				Mortality rates			
	Males		Females		Males		Females	
Age groups	African-American	White-American	African-American	White-American	African-American	White-American	African-American	White-American
Michigan								
All ages by gender	16.9		6.7		4.1		1.7	
All ages by race and gender	24.3	15.9	6.9	6.5	6.7	3.7	2.0	1.6
<50	5.5	3.3	2.1	1.6	1.3	0.4	0.3	0.1
50–74	72.9	44.1	18.3	16.8	19.8	9.9	5.9	3.7
75+	55.6	65.1	20.2	30.8	20.5	20.9	7.3	12.3
Detroit								
All ages by gender	28.5		7.5		7.5		2.2	
All ages by race and gender	28.6	25.7	7.2	7.3	7.5	6.7	2.1	1.9
<50	7.3	4.6	2.4	2.7	1.7	*	0.3	*
50–74	84.6	88.0	19.7	18.4	22.2	23.5	6.6	5.8
75+	57.2	62.1	17.2	22.8	19.6	21.7	7.5	7.3

Source: 1993–2002 Michigan Resident Cancer Incidence and Death Files. Cases were processed by the Michigan Department of Community Health, Vital Records and Health Data Development Section. (Incidence completed on April 25, 2005, Mortality completed on June 3, 2005.).
*Statistically unreliable rates – rates were not calculated when there were fewer than 20 total events.

Table 3. Joinpoint regression estimates of the incidence, mortality, and survival trends in males from Michigan and Detroit, 1993–2002

Comparison	Race	Area	No. joints	Year-joints	APC
Incidence	White	Michigan	2	1993–1997	−1.0
				1997–2000	1.3
				2000–2002	−3.6
	African-Americans	Michigan	2	1993–1997	−3.7
				1997–2000	1.7
				2000–2002	−14.0
	White	Detroit	2	1993–1995	3.4
				1995–1998	6.2
				1998–2002	−8.0
	African-Americans	Detroit	2	1993–1997	−7.9*
				1997–2000	10.8
				2000–2002	−14.8*
Mortality	White	Michigan	2	1993–1996	−1.4
				1996–1999	−5.6
				1999–2002	1.1
	African-Americans	Michigan	2	1993–1996	1.9
				1996–1999	−11.2
				1999–2002	8.8
	White	Detroit		†	
	African-Americans	Detroit	1	1994–2000	−7.5
				2000–2002	14.4
Five-year survival	White	Michigan	1	1993–1995	3.9
				1996–1998	−1.3
Five-year survival	African-Americans	Michigan	1	1993–1995	10.5
				1996–1998	−3.6
One-year survival	White	Michigan	2	1993–1995	1.4
				1995–1999	0.6
				1999–2002	−3.8
One-year survival	African-Americans	Michigan	2	1993–1995	−2.9
				1995–1999	1.0
				1999–2002	−2.6

*Annual percent change (APC) is significantly different from zero ($P < 0.05$).
†Rates were not estimated because of small numbers.

Table 4. Trend of age-adjusted incidence rates of oral cancer in Michigan, 1993 and 2002

			Males		Females	
Area	Year	All Residents	African-American	White-American	African-American	White-American
Michigan	1993	12.0	26.3	17.0	9.2	6.9
	2002	11.2	18.4	15.7	5.1	6.9
Wayne County	1993	16.6	32.2	20.1	10.3	9.7
	2002	12.8	22.2	18.0	5.4	7.4
Wayne County without	1993	13.5	*	19.1	*	9.1
City of Detroit	2002	12.1	*	16.8	*	7.4
City of Detroit	1993	20.7	33.3	27.7	10.5	*
	2002	13.6	23.8	23.0	5.1	*

Source: 1993–2002 Michigan Resident Cancer Incidence and Death Files. Cases were processed by the Michigan Department of Community Health, Vital Records and Health Data Development Section (incidence completed on December 14, 2005, mortality completed on December 14, 2005).
*Statistically unreliable rates – rates were not calculated due to low number of events.

had a death rate of 4.0 per 100 000. Wayne County had a mortality rate that was 1.3 times higher, and Detroit had a rate 1.7 times higher, than the oral cancer death rate in Michigan. Interestingly, oral cancer death rates in Detroit were not that different between African- and white-Americans (Table 2); however, in Wayne County, excluding the city of Detroit, African-Americans (4.2 per 100 000) had higher death rates than white-Americans (2.8 per 100 000) (Table 1).

Table 5. Numbers of oral cancer cases diagnosed at an early stage (in situ or localized) for areas of Michigan in 1993–1995 and 2000–2002

	1993–1995			2000–2002		
Geographic area	No. all cancers diagnosed	No. cancers diagnosed at an early stage	% Cases diagnosed at an early stage	No. all cancers diagnosed	No. cancers diagnosed at an early stage	% Cases diagnosed at an early stage
State of Michigan	3214	1281	39.9	3509	1321	37.6
Macomb County[a]	273	89	32.6	308	134	43.5
Oakland County[a]	375	166	44.3	434	158	36.4
Wayne County[a]	944	277	29.3	858	294	34.3
Wayne County without City of Detroit	467	164	35.1	455	180	39.6
City of Detroit	477	113	23.7	403	114	28.3

Source: Michigan Resident Cancer Incidence File, includes cases diagnosed in 1993–1995, and 2000–2002. Processed by the Michigan Department of Community Health, Vital Records and Health Data Development Section. (Data completed on December 12, 2005.).
[a]The Surveillance Epidemiology and End Results (SEER) Detroit Registry includes Macomb, Oakland and Wayne Counties.

The mortality rates in African-American males in Michigan declined in the 1990s, but the rates, though not statistically significant, started to slightly increase after 2000 (Tables 3 and 5). In Detroit the rate of increase for African-American males in the early 2000s was higher than in the rest of Michigan (Table 3).

Early detection

Between 1993 and 1995, the percentage of oral cancer cases that were detected at the early stage (both *in situ* and localized) was 39.9 (Table 5). This percentage dropped by about two percentage points between 2000 and 2002. Oakland County, a relatively high income area, had a high early detection percentage (44.3%). The lowest early detection percentage was in Detroit (23.7%) between 1993 and 1995, which increased to 28.3% between 2000 and 2002 (Table 5).

Survival (data on counties and cities in Michigan are not available)

African-American males in Michigan had slight improvement in relative survival rates in the 1990s, but this trend reverted back in 2002 (Table 3). The overall relative survival rates in Michigan have worsened since 2001 (Table 6). African-Americans had the lowest relative survival rate in the state and

Table 6. Oral cancer survival rates for Michigan residents, 1993–2002

	All races		White		African-Americans	
Year of diagnosis	Rate	SE	Rate	SE	Rate	SE
One-year survival rates						
1993	79.4	1.4	80.1	1.6	74.3	3.8
1994	79.9	1.5	80.4	1.7	75.6	3.8
1995	80.8	1.4	82.4	1.5	70.0	4.1
1996	81.5	1.4	83.1	1.5	72.6	3.7
1997	81.5	1.4	83.0	1.5	72.6	4.1
1998	81.7	1.4	83.4	1.5	69.9	4.2
1999	80.5	1.4	81.3	1.5	75.9	4.0
2000	82.9	1.3	85.3	1.4	69.8	4.1
2001	82.5	1.4	83.3	1.5	75.6	4.1
2002	74.6	2.0	75.8	2.2	59.0	6.3
Five-year survival rates						
1993	51.8	1.9	55.0	2.1	32.7	4.3
1994	54.6	2.0	56.6	2.3	37.7	4.6
1995	57.8	2.0	60.8	2.2	39.4	4.7
1996	52.9	2.0	55.0	2.2	39.3	4.4
1997	56.6	2.0	59.2	2.2	39.1	4.8
1998	54.6	2.1	56.8	2.4	34.9	5.0

only about one-third survived 5 years after their diagnosis with oral cancer (Table 6). In 2002, there was a marked decrease in the survival of African-Americans with a previous diagnosis of oral cancer.

Discussion

This article presents data on the incidence and mortality of oral cancer in Michigan and the city of Detroit. Like all cancer statistics, the rates presented in this paper are limited by the quality of the surveillance systems and reporting that are adopted by the cancer registries in the USA. The standardization, training, and quality assurance exercised by the Michigan, and other state cancer registries, are extensive. However, the reader should expect that all data on cancers may be affected by several biases that are inherent in all cancer statistics. We recognize that some oral cancers may have different etiology and classifications. To allow for national comparisons we followed the definitions of oral cancer set forth by the NCI and SEER which define 'Oral Cavity and Pharynx' as a group using ICD-O-3 codes C000–C148 (3). This includes the lip, tongue, salivary gland, floor of mouth, gum and other mouth, nasopharynx, tonsil, oropharynx, hypopharynx, and other oral cavity and pharynx. By using this definition we were able to compare our results to data reported by SEER as well as other recent publications such as Morse, who also used the same definition of oral and phyaryngeal cancer (15).

The goal of this article was to identify the targeted areas in the state where an intervention program should be planned. Such a program is now underway in Wayne Country and the city of Detroit. The program, which is funded by a grant from the National Institute of Dental Craniofacial Research and the Delta Dental Fund of Michigan, focuses on increasing the awareness of the importance of early detection of oral cancer and the disparities that afflict African-American males. The program provides education, free screening, biopsy surface, and referral for surgical care using social marketing tools. Over the next 5 years the impact of the program on oral cancer incidence and mortality will be evaluated using data collected by the MCSP.

Overall, the incidence of oral cancer in Michigan is not that different from the trends in the USA (3). Males in Michigan had an incidence rate of 16.9 per 100 000 compared with a rate of 15.5 for American males (2: Table 1.1.1.1M). Females in Michigan had a rate of 6.7 versus a rate of 6.0 for American females (2: Table 1.1.1.1F). African-American males in Michigan had an incidence rate of 24.3 per 100 000, which was higher than that of African-American males in the USA (17.5) (2: Table 1.1.1.1M). Interestingly, the incidence rate of white-American males in Detroit was 25.7 per 100 000. The similarity in incidence and death rates between African- and white-American males living in Detroit may indicate that personal, environmental, and community factors may be the primary causes for the high incidence rather than race *per se*. One possible explanation for the lack of difference in oral cancer incidence and mortality rates in Detroit is that the so-called 'white' Americans in the city (12.3% of the population) are really a mixed population of predominately Arab and Chaldean Americans, who are classified as 'white'. Also included in the group are Hispanics (5.0% of the population in Detroit). Unfortunately, the statistics available from the MCSP do not allow for the evaluating of oral cancer in different population groups.

The disparity in incidence rates between older Michigan African- and white-American males is even more troubling. The incidence rate of oral cancer among African-American males in Michigan and Detroit peaks during the ages of 50 and 74. Among white-Americans in Michigan the highest incidence rate is reached after the age of 75 years. The finding regarding the incidence rate among Michigan males is similar to those reported by Swango (16). In that study, African-American males who were aged 55–59 in 1988–1992 had the highest oral cancer incidence rate (91.9 per 100 000), while the highest rate for white-American males was found in those aged 85 or older (15). Similarly, Morse found that in evaluating SEER data from 1998 to 2002 African-American males had their highest incidence rates at earlier ages than other race and gender groups (15).

The good news is that the incidence of oral cancer in Michigan is declining. This decline is significant in African-Americans in Detroit who had an annual percent change (APC) of −14.8%. This is higher than the average decline in APC in the 13 SEER registries, which was around 3% for African-American males (3: Table XX-9). However, the decline in incidence of oral cancer in

African-American males is lower than that observed in American Indian/Alaskan Natives (3: Table XX-9). Moreover, the decline may be because low-income African-Americans, who are the recipients of state healthcare assistance plans (Medicaid), may have been less likely to seek care after the elimination of the dental care program for low-income adults.

This analysis shows another surprising finding regarding death rates from oral cancer. While nation-wide epidemiological data show that African-American males have consistently higher death rates, in Detroit both African- and white-American males had similar death rates (7.5 and 6.7). As stated before, Detroit's 18.4% non-African-American population may share the same rates of exposure to risk factors that lead to the development of oral cancer as well as the same limited access to primary care. Racial differences are not *per se* associated with developing oral cancer; rather it is the increased exposure to risk factors and delayed early detection. These factors are more determined by social and economic factors rather than by genetic differences (17). These issues require further research because we could not find studies comparing the behavioral risk factors between white- and African-American adults in Detroit.

The mortality rates for Michigan residents reported in this study are slightly lower than those reported for the USA (3). However, among all age and race/ethnicity groups the mortality rates increased with age in Michigan between 2000 and 2002. This finding is different from that reported by the SEER sites for all the USA. According to the data collected by the MCSP, mortality rates in Michigan have increased for African- and white-Americans, while in the rest of the country there has been a consistent decline since 1978 (3: Table XX-3). While this finding cannot be fully explained by the available data, Michigan's economy has deteriorated since the late 1990s and there has been a significant loss in jobs and support for low-income individuals. The lack of health insurance and delays in seeking care are probable factors. The relatively high oral cancer mortality rate among African-American males aged 50–74 lends support to this explanation. Oral cancer in African-American males develops earlier in life and causes earlier death than in white-Americans. This is in agreement with the findings of Swango that the peak mortality rate for African-Americans was at an age 25 years younger than the peak for white-Americans (16).

It is well documented that tobacco use (18–22) and alcohol consumption (18–21, 23) are oral cancer risk factors. In the 2002 National Survey on Drug Use and Health, 28% and 25% of African- and white-Americans, respectively, reported cigarette use in the past month (24). There are also gender differences in regard to tobacco use. In 2004, 24.9% of the males and 21.7% of the females in Michigan reported smoking (25). Among a sample of low-income African-American women in Detroit the reported smoking of tobacco was 41.0% (26). Of the 5.4% male participants in the same study, 59.3% reported that they were current smokers (26). These high rates among a small subset of Detroiters may be an indication of high smoking rates among other Detroit low-income African-American men, which again may be one of the factors causing the high oral cancer incidence and mortality rates.

Day et al. found that the odds ratios for oral cancer associated with smoking were similar between white- and African-Americans, but the risk associated with total alcohol intake was greater for African-Americans (27). They also found that the prevalence of smoking and heavy drinking was higher among African-Americans and the use of tobacco and alcohol together accounted for much of the observed difference in oral cancer rates among races (27). Approximately 93% of the squamous cell esophageal cancer in African-Americans has been attributed to drinking more than one drink per day and/or smoking at least one pack of cigarettes per day (28). Additionally, there are also differences in alcohol consumption based on gender. In Michigan, 5.3% of males are at risk for heavy drinking, while only 4.2% of females are at risk (25). The frequency and amount of alcohol consumption in Detroit is unknown, so we cannot assume that there may be a high amount of alcohol use which may be a factor of the high oral cancer incidence rates in Detroit.

This analysis has shown some significant disparities in the early detection rate and survival rate. Five-year survival rates for both white- and African-Americans in Michigan were lower than national rates (3). Although survival rates for Michigan African-American males improved in the 1990s, there survival rates were still much lower than the survival rates for Michigan white-Americans. Wayne County, and especially Detroit, had consistently lower percentages of oral cancer detected at early stages when compared with adjacent counties and the state. In Detroit less than one-third of all oral cancers were detected at early

stages, this is considerably lower than the Health People 2010 objective of detecting 50% of oral cancer lesions at early stages (29). This goal cannot be achieved without significant investment in education, training of health providers, promotion of early screening, and behavioral changes.

This analysis of oral cancer rates in the city of Detroit found no differences in mortality and incidence rates between African- and white-American men residing in the city of Detroit. In the state and the nation, the oral cancer rates are higher in African- than white-American men. While the incidence rates of oral cancer in Michigan and Detroit have declined in the late 1990s and early 2000s, the mortality rates have increased. The increase in mortality rate is contrary to the trend in the rest of the USA.

Acknowledgments

This project was funded by the National Institute of Dental and Craniofacial Research/National Institutes of Health Grants DE 14410-03 and DE 16194-01.

The authors would like to thank Georgia Spivak and Glenn Copeland from the MDCH for providing the data for this paper.

References

1. American Cancer Society. Cancer facts and figures 2005 [WWW document]. Atlanta, GA: American Cancer Society; 2006. URL http://www.cancer.org/downloads/STT/CAFF2006PWSecured.pdf [accessed on 14 June 2006].
2. U.S. Cancer Statistics Working Group. United States cancer statistics: 2002 incidence and mortality [WWW document]. Atlanta, GA: Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; 2005. URL http://www.cdc.gov/cancer/npcr/uscs/pdf/2002_USCS.pdf. (Figure 3.1 M.1, Table 1.1.1.1M, Table 1.1.1.1F and Table 2.20.1.2M) [accessed on 14 June 2006].
3. Ries LAG, Eisner MP, Kosary CL, Hankey BF, Miller BA, Clegg L et al., editors. SEER cancer statistics review, 1975–2002 [WWW document]. Bethesda, MD: National Cancer Institute. URL http://seer.cancer.gov/csr/1975_2002/, based on November 2004 SEER data submission, posted to the SEER web site 2005. URL http://seer.cancer.gov/cgi-bin/csr/1975_2002/search.pl#results (Tables XX-2, XX-3, XX-4, XX-9, XX-10) [accessed on 14 June 2006].
4. Arbes SJ Jr, Olshan AF, Caplan DJ, Schoenbach VJ, Slade GD, Symons MJ. Factors contributing to the poorer survival of black Americans diagnosed with oral cancer (United States). Cancer Causes Control 1999;10:513–23.
5. Moore RJ, Doherty DA, Do KA, Chamberlain RM, Khuri FR. Racial disparity in survival of patients with squamous cell carcinoma of the oral cavity and pharynx. Ethn Health 2001;6:165–77.
6. U.S. Census Bureau. Census 2000 summary [WWW document]. URL http://factfinder.census.gov [accessed on 14 June 2006].
7. Centers for Disease Control and Prevention. Preventing and controlling oral and phyaryngeal cancer. Recommendations from a National Strategic Planning Conference [WWW document]. MMWR 1998;47 (No.RR-14). URL http://www.cdc.gov/mmwr/PDF/RR/RR4714.pdf [accessed on 14 June 2006].
8. Havener L, Hulstrom D. Standards for Cancer Registries, Volume II: Data standards and Data Dictionary, 10th ed., Version 11. Springfield, IL: North American Association of Central Cancer Registries; 2004.
9. Michigan Department of Community Health. Michigan Cancer Surveillance Program: cancer reporting manual [WWW document]. 2002. URL spivakg@michigan.gov [accessed on 14 June 2006].
10. Fritz A, Percy C, Jack A, Shanmugaratnam K, Sobin L, Parkin DM, Whelan S. International classification of diseases for oncology. 3rd edn. Geneva, Switzerland: World Health Organisation; 2000. p. 1–247.
11. Michigan Department of Community Health. Invasive cancer incidence by primary site and age at diagnosis Michigan residents, 2000. Lansing, MI: Michigan Department of Community Health; 2002.
12. National Cancer Institute. Surveillance epidemiology and end results, SEER*State 6.1 [WWW document]. URL http://seer.cancer.gov/seerstat/ [accessed on 14 June 2006].
13. National Cancer Institute. Measures of cancer survival [WWW document]. URL http://srab.cancer.gov/survival/measures.html [accessed on 14 June 2006].
14. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Stat Med 2000;19:335–51 (correction: 2001;20:655).
15. Morse DE, Kerr AR. Disparities in oral and pharyngeal cancer incidence, mortality and survival among black and white Americans. J Am Dent Assoc 2006;137:203–12.
16. Swango PA. Cancers of the oral cavity & pharynx in the United States: an epidemiologic overview. J Public Health Dent 1996;56:309–18.
17. Galeo S, Ahem J. Distribution of education and population health. An ecological analysis of New York City neighborhoods. Am J Public Health 2005;95:2198–205.
18. Blot WJ, McLaughlin JK, Winn DM, Austin DF, Greenberg RS, Preston-Martin S et al. Smoking and drinking in relation to oral and pharyngeal cancer. Cancer Res 1988;48:3282–7.
19. Franceschi S, Talamini R, Barra S, Baron AE, Negri E, Bidoli E et al. Smoking and drinking in relation to cancers of the oral cavity, pharynx, larynx, and esophagus in northern Italy. Cancer Res 1990;50:6502–7.
20. Franco EL, Kowalski LP, Oliveira BV, Curado MP, Pereira RN, Silva ME et al. Risk factors for oral cancer in Brazil: a case–control study. Int J Cancer 1989;43:992–1000.
21. Merletti F, Boffetta P, Ciccone G, Mashberg A, Terracini B. Role of tobacco and alcoholic beverages

in the etiology of cancer of the oral cavity/oropharynx in Torino, Italy. Cancer Res 1989;49:4919–24.
22. U.S. Department of Health and Human Services. The health consequences of smoking: a report of the surgeon general. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2004.
23. Elwood JM, Pearson JC, Skippen DH, Jackson SM. Alcohol, smoking, social and occupational factors in the aetiology of cancer of the oral cavity, pharynx and larynx. Int J Cancer 1984;34:603–12.
24. Office of Applied Studies. Results from the 2002 National Survey on Drug Use and Health: summary of national finding (DHHS Publication No. SMA 03–3836, NHSDA Series H-22). Rockville, MD: Substance Abuse and Mental Health Services Administration; 2003.
25. National Center for Chronic Disease Prevention and Health Promotion. Behavioral risk factor surveillance system [WWW document]. Atlanta, GA: CDC; 2004. URL http://www.cdc.gov/brfss/index.htm [accessed on 14 June 2006].
26. Delva J, Tellez M, Finlayson TL, Gretebeck KA, Siefert K, Williams DR et al. Cigarette smoking among low-income African-Americans: a serious public health problem. Am J Prev Med 2005;29: 218–20.
27. Day GL, Blot WJ, Austin DF, Bernstein L, Greenberg RS, Preston-Martin S et al. Racial differences in risk of oral and pharyngeal cancer: alcohol, tobacco, and other determinants. J Natl Cancer Inst 1993;85: 465–73.
28. Brown LM, Hoover RN, Greenberg RS, Schoenberg JB, Schwartz AG, Swanson GM et al. Are racial differences in squamous cell esophageal cancer explained by alcohol and tobacco use? J Natl Cancer Inst 1994;86:1340–5.
29. U.S. Department of Health and Human Services. Healthy People 2010. 2nd edn. With Understanding and Improving Health and Objectives for Improving Health. 2 vols. Washington, DC: US Government Printing Office; 2000.