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REVIEW

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# Targets for improving disparate head and neck cancer outcomes in the low-income population

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## Abstract

Low-income patients have worse head and neck cancer outcomes than those with high-income. Yet, few targets have been identified to specifically improve outcomes in the low-income population. Here, we conduct a review on the current literature on head and neck cancer outcomes in the low-income population and identify targets for intervention. The degree of disparity is in the range of 20%-90% worse overall survival in the low-income population. Eliminating smoking would have the greatest effect on head and neck cancer mortality rates in the low-income population. Additionally, access to oral cancer exams, assistance with transportation, and continued expansion of telemedicine would facilitate early diagnosis and timely treatment in patients who develop head and neck cancer.

**KEYWORDS**

head and neck cancer, health policy, outcomes, underserved

## 1 | INTRODUCTION

In 1990, estimates by the American Cancer Society were that the cancer survival rates of low-income Americans were 10%–15% worse than their more affluent counterparts.[1] Among the major cancers, it seems that head and neck cancer exerts the greatest disproportionate effect on the poorest Americans. Larynx cancers are 80% more likely to occur in patients residing in the poorest parts of the country while oral cavity and pharynx cancers are 40% more likely to occur in these same patients.[2] A systematic review of socioeconomic status and cancer risk found the risk of oral cancer to be even higher: over 200% higher in countries with low income (as defined by the World Bank).[3] Moreover, low-income patients are more likely to present with advanced stage head and neck cancer.[4]

Thirty years later, survival rates in low-income patients with head and neck cancer have proven to be worse than the 1990 estimates as illustrated by our nation's two largest populations databases. Surveillance, epidemiology, and end results (SEER) studies show that Medicaid patients with salivary cancer have 70% worse overall survival and those with oral cancer have nearly 90% worse cancer-specific survival.[5,6] Studies from the National Cancer Database demonstrate that Medicaid patients have 80% worse overall survival and those with median income under $30 000 have 20% worse overall survival.[7] Institutional data by Choi et al. found that lower income was associated with 50% worse overall survival and 40% worse disease-specific survival for all head and neck subsites.[8] Ninety-day mortality is worse for head and neck patients with Medicaid and low-income zip codes, specifically 70% worse and 30% worse, respectively.[9] Even when limiting the analysis to young patients with fewer comorbidities, Medicaid patients have 60% worse survival for all head and neck sites.[10] For patients with metastatic disease, Medicaid patients have nearly 50% worse overall survival in SEER and 30% worse overall survival in the National Cancer Database.[11,12] Even in HPV-positive oropharynx cancer, patients with low income had worse 3-year overall survival.[13]

Clearly, head and neck cancers disproportionately affect poor Americans irrespective of primary site or stage. Addressing these shortcomings for low-income patients is more than an issue of fairness. Given the increased emphasis on measuring and improving cancer outcomes, it is reasonable to target interventions to subpopulations with the worst outcomes first, especially when effective measures have already been proven to work for other subgroups. Within head and neck cancers, the at-risk population are those Americans with the fewest resources. Forty percent of head and neck patients use credit or borrow money to pay for care and a quarter require the financial support of family members working longer hours.[14]

To help identify promising targets to address these cancer disparities, we reviewed the English literature with a focus on low-income head and neck cancer patients in the United States. Our objective is to identify evidence-based target categories for interventions to specifically address disparate head and neck cancer outcomes in low-income patients. We identified several broad target areas for intervention which appear to have the greatest potential. Primarily, the greatest need is for more aggressive anti-tobacco measures and cigarette taxes. Additionally, there is a need for increased access to cancer care, transportation support, oral cancer exams, expansion of telemedicine, and health insurance reform.

## 2 | TOBACCO PREVENTION AND CESSATION

### 2.1 | Tobacco marketing and disadvantaged populations

Smoking is still the leading cause of preventable death in the United States—and this is no accident.[15] If one were to measure the success of a marketing campaign by profitability and product uptake, then tobacco marketing has no equal—first among affluent Americans and then among its poorest. From 1900 to 1963, per capita cigarette consumption increased by nearly 100-fold: from one per week to 83 per week.[16] In 1963, cigarette companies were spending $250 million annually on marketing—more than the federal spending on children's health programs ($200 million), and more than the combined advertising budgets of Anheuser-Busch ($85 million), Coca-Cola Co. ($82 million), and Johnson & Johnson ($58 million).[17–19]

Up until 1953, physicians were complicit if not culpable allies in the success of the tobacco advertising campaign. Indeed, it requires a serious omission of historical context to fault patients for smoking, even though some providers continue to perceive the inability to quit smoking as an issue of willpower or free choice.[20] The majority of physicians smoked during the 1950s.[21] Both The New England Journal of Medicine and The Journal of the American Medical Association profited from cigarette advertisements in their pages,[22] and advertisements touting that "more doctors smoke Camels than any other cigarette," and "20,679 physicians say 'Luckies are less irritating'" became fixtures in the pages of top magazines.[22] The 1942 AMA annual convention featured a Philip Morris-sponsored smoking lounge, and the 1947 convention featured doctors lining up to receive free cigarettes.[22,23] To this day, the amount that tobacco companies spend on marketing in the U.S. ($8.2 billion) is more than what the entire pharmaceutical industry spends on marketing ($6.6 billion) and nearly three times that which Congress receives from lobbyists in total ($3.4 billion).[24–26] The annual cost of smoking-related illness, by comparison, is over $300 billion—nearly a 5–1 societal cost-to-benefit ratio.[15]

There is a large body of evidence that patients with low socioeconomic status are more likely to smoke.[8,27–30] Carroll and colleagues identified that tobacco use approached 100% in disadvantaged Black patients with head and neck cancer, and half began smoking before age 15.[27] Estimates from populations data show that persons below the poverty threshold are approximately 30% more likely to smoke.[30] Furthermore, tobacco companies have specifically targeted groups of disadvantaged minorities over the years, including Hispanics, American Indians/Alaska Natives, and Black Americans.[31,32]

Numerous anti-tobacco measures have been installed to curtail the rise in smoking, including warning labels on cigarettes,[17] educational programs, and federal lawsuits against tobacco companies.[33] Consequently, there has been a general decline in smoking prevalence from 21% in 2005 to 14% in 2019.[34] However, disadvantaged Americans are still the most likely to smoke—21% of adults with an annual household income less than $35 000 smoke versus 7% of those whose incomes are greater than $100 000.[34] Twenty-five percent of adults on Medicaid smoke compared to 11% of adults with private insurance.[34]

### 2.2 | Anti-smoking measures

If the greatest risk factor for head neck cancer disproportionately affects those with low-income, then it follows that there is one measure to reduce the burden above all else: to eliminate smoking. According to the Centers for Disease Control, the most effective measure to curtail smoking is a simple one—to increase the price of tobacco products. A 10% price increase reduces consumption by 3%–5%.[17] One encouraging observation is that youth and lower income populations are the most sensitive to price increases.[35] However, tobacco companies have responded with subsidies to neutralize the costs of price increases, including discounts paid to retailers and wholesalers, promotional allowances, rebates, and incentive payments.[24] These subsidies constitute 90% of the marketing expenditures.[24]

Physicians who treat patients with head and neck cancer should continue to place smoking cessation at the forefront of cancer survivorship programs. Smoking cessation counseling, although recommended by the American Cancer Society Head and Neck Cancer Survivorship Care Guideline,[36] by itself is insufficient. Varenicline or combination nicotine replacement (e.g., patch and lozenge) plus behavioral support should be first line pharmacotherapy for tobacco addiction.[37] Counseling and behavioral therapy can be delivered

individually or in group settings, delivering smoking cessation treatments in-person or via telemedicine.[38,39] Making varenicicline and bupropion more widely available at lower costs would be beneficial, as a landmark randomized controlled trial of over 8000 patients showed the 24-week abstinence rate to be 21.8% with varenicicline and 16.2% with bupropion.[40] Varenicicline became available as a generic in 2020 and is covered by Medicaid and Medicare Part D, but without insurance the cost exceeds $500 for a 1-month supply.[41] Academic centers are implementing multidisciplinary smoking treatment programs with behavioral and pharmacologic treatments by oncology nurse practitioners and tobacco treatment specialists.[42] Incentive programs (payments to patients for abstinence) were recently assessed in a Cochrane Review to be highly effective compared to usual care, although the overall cessation rates are so low as to question their impact.[43] As an example, Halpern et al. randomized over 6000 smokers to one of four incentive programs, and the most effect group exhibited a 2.9% abstinence rate at 6 months post-intervention versus 0.1% in the group receiving smoking cessation education and motivational text messages, with the cost per quitter being $3600.[44] If fewer than one in 30 patients quits in a well-designed and well-funded clinical trial, it suggests more attention should be directed toward preventing smoking rather than to treat addiction after-the-fact.

While the Centers for Disease Control and Prevention reports that cigarette taxes have proven to be the most effective intervention for reducing smoking, federal tobacco rates have not increased in the past 10 years. Currently, a federal proposal named "Tobacco Tax Equity Act of 2021" would double taxes on cigarettes, including vapor-based nicotine products, and increase tax rates on chewing tobacco and pipe tobacco by nearly 2000% to equal the tax rate of cigarettes.[45] Medical organizations, including the American Medical Association, American College of Cardiology, American College of Chest Physicians, and the American Head and Neck Society, should openly support such anti-tobacco legislation.

## 3 | INCREASED ACCESS TO CARE

The strongest predictor of mortality in head and neck squamous cell carcinoma (HNSCC) is the stage of the tumor at diagnosis.[46] Patients with late-stage tumors typically require aggressive surgery and chemoradiation that is associated with poor speech and swallow, poor quality of life, and worse prognosis. Difficulty with access to care has been associated with late presentation of HNSCC and other cancers.[47] Travel distance may disproportionately affect HNSCC patients, who frequently have a low socioeconomic status and can lack resources for transportation.[48] Farquhara et al., evaluated the effect of travel time and socioeconomic status on stage of diagnosis in head and neck cancer patients in North Carolina.[49] Driving time was independently associated with an advanced T-stage at diagnosis for low-income HNSCC patients (OR 1.97 for each hour driven (95% CI 1.36–2.87) after adjusting for other of other covariates such as medical insurance, indicators of socioeconomic status, and rural location. An inverse relationship between travel distance and outcome was found in two studies, showing that larger travel distance was associated with lower 90-day mortality post-treatment.[9,13] The ability to travel long distance for care may be linked to the willingness to receive (and ability to afford) the best cancer care available irrespective of distance.

For the average patient, travel for treatment is expensive, time-consuming, and threatens job security.[1] Possible solutions include improved access to primary care and community efforts for screening among low-income patients and building strategic alliances between academic cancer centers and rural hospitals. The implementation of the Rural Cancer Outreach Program (RCOP) resulted in a significant total volume increase of 452% at the Medical College of Virginia.[50] Alliance relationships between academic and rural hospitals were shown to be sustainable and rewarding, as there were increased hospital profits due to an increase in patient visits and reduction in costs. Additionally, care coordinators can be utilized to recommend accessible specialists, ensure follow up, and help with transportation.

### 3.1 | Travel support for cancer care

Transportation barriers have been well documented among low-income patients and affect timeliness of cancer care.[51] Medicaid and uninsured patients have twice the frequency of radiation therapy interruptions than their private insurance counterparts.[52] Medicaid and African American populations are twice as likely to experience treatment delay mainly due to missed appointments and delayed treatment evaluation.[53] Longer treatment package times for these Medicaid patients increase the risk of death by 4% for each week they are delayed.[54] Timely radiation therapy is also less frequent in patients with Medicaid, no insurance, and from lower education zip codes.[55]

One misconception is that there are no or few resources to assist low-income patients with travel assistance. In recent times, there has been an increase in the number of services available to facilitate transport for medical care. The American Association of Retired Persons offers an extensive list of resources available to patients to assist low-income patients.[56] Patients can also dial "211" to receive referrals for health and social support systems in their local area. Ride-share programs such as Uber Health have platforms that allow for free rides to and from vaccination sites and local taxis can offer vouchers for disabled riders. Some government programs, such as Louisiana Healthcare Connect, also have reservation-based services for transportation to Medicaid-covered services. These services are no-cost and can be scheduled by phone or online.

### 3.2 | Increased oral cancer exams among nonotolaryngologists

One of the Healthy People 2020 targets was to increase the availability of oral cancer exams to improve the proportion of oral cancers diagnosed at stage I (from 33% in 2007 up to 36%).[57] While some community-based screening programs targeting high-risk individuals

have been shown to be cost-effective based on a Markov model,[58] results of mass screening events in practice can be low-yield. By contrast, many oral cancers are diagnosed by a patient or dentist noticing a visible sore.[59–61] In the 2000s, Maryland performed an in-depth needs assessment to improve upon what was then the worst oral cancer mortality rate for Black patients among all states.[62] Their findings revealed that merely being able to access to dental providers was in itself insufficient, as the majority of dental exams were subpar. In fact, the majority of dentists and dental hygienists surveyed did not perform palpation when performing oral cancer exams and overlooked oral cancer exams in edentulous patients. Subsequently, an oral cancer curriculum was shared with over 700 healthcare professionals, and in the following years the percent of residents reporting a recent oral cancer exam increased from 33% to 40%.[63] A main takeaway from the Maryland experience is that the dental workforce should be competent in providing oral cancer exams, and recognition of cancerous lesions should be mandatory curriculum for dental students and hygienists.

## 4 | EXPANSION OF TELEMEDICINE

During the coronavirus 2019 (COVID-19) pandemic, healthcare professionals and institutions were forced to drastically alter their clinical practices in order to accommodate for the limitations of in-person visits due to risk of viral transmission. Indeed, during the height of the pandemic, The American Academy of Otolaryngology-Head and Neck Surgery advised limiting patient care to those with emergent problems with recommendations to consider telemedicine as an alternative.[64] This paved the way for a rapid adaptation of telemedicine in our department as well as others. Tam et al. demonstrated that over 70% of head and neck cancer encounters completed within their institution between March and April 2020 were seen through virtual or telephone means.[65] Telemedicine has been previously proposed as an important mechanism to facilitate treatment of head and neck cancer, especially in centers where multidisciplinary expertise is not available.[66] Improving access to telemedicine may also provide a cost benefit as well. Beswick et al. demonstrated that through the telemedicine model at the Veterans Health Administration, virtual visits for head and neck cancer patients appear to help remove a barrier to medical care by decreasing the cost of travel to an appointment as well help expedite work-up and intervention for patients in remote locations.[67] It is important to see the potential benefit of translating these findings in order to improve head and neck cancer outcomes in the low-income population. As clinics and practices have begun to reinstate in-person visits, the infrastructure that was created for the COVID-19 surge of telemedicine visits could be repurposed to better serve the disadvantaged and rural population and improve their access to care. Improving the efficiency and convenience of initial visits with disadvantaged patients could facilitate significantly improved outcomes. Patients who would have otherwise been unable to see a physician due to distance, financial and logistical burden of traveling, or difficulty coordinating childcare would now be able to receive the initial education that could help identify risk factors for head and neck cancer. More studies are needed to evaluate the utility of a telemedicine model in this patient population, which could lead to increased funding for programs to improve outreach and ultimately reduce the disparities seen in head and neck cancer outcomes.

## 5 | ROLE OF MEDICAID EXPANSION

One of the tenants of the Affordable Care Act of 2010 was to decrease costs by decreasing the proportion of uninsured patients and to improve access to preventive care by expanding Medicaid eligibility from 61% to 138% of the federal poverty limit.[68] Individual states were given the option of expanding or not expanding. States that expanded Medicaid have demonstrated a reduction in uninsured patients, an increased use of health care services, and improvement in several metrics of healthcare quality.[69] Cancer patients received many benefits, including increased coverage, earlier stage at diagnosis, and access to high-volume hospitals.[70–73] In analyzing the success of Medicaid expansion for head and neck cancer patients, it is helpful to categorize analysis into three phases: (1) coverage, (2) diagnosis, and (3) treatment outcomes.

### 5.1 | Coverage

Medicaid expansion was highly successful in improving insurance coverage, as a dramatic decrease in noninsurance status for patients with head and neck cancer has been reported in multiple analyses of SEER data. Babu et al. reports that Medicaid expansion led to a relative decrease in the uninsured rate by 63%.[73] Furthermore, the proportion of uninsured Black patients relatively decreased by 73%.[73] Osazuwa-Peters et al. and Cannon et al. similarly analyzed SEER data and report a reduction in uninsured rates among head and neck patients,[74] particularly seen in low income and low education counties.[75] Specifically, the rate of uninsured patients decreased from 6.2% to 3.0% after Medicaid expansion (difference 3.2%; 95% CI 2.9%-3.5%).[74]

### 5.2 | Early diagnosis

Osazuwa et al. compared the SEER data on expansion states versus nonexpansion states, and found that Medicaid expansion was associated with a 17% increase in likelihood of an early stage head and neck cancer diagnosis for young adults aged 18-34 and 7.5% for women.[75] However, they did not detect a significant benefit for low-income patients. In National Cancer Database (NCDB), Panth et al. detected that, while the odds of early-stage diagnosis was not significantly improved post Affordable Care Act, there was a mild improvement in early-stage diagnosis specifically for Medicaid patients (aOR = 1.12, 95% CI 1.03, 1.21; $p = .007$).[76]

### 5.3 | Treatment outcomes

Given the limited length of time that has elapsed since Medicaid expansion, proxies of treatment outcomes known have been reported in lieu of survival metrics. One of these proxies, which has also been suggested as a quality indicator, is the timely provision of adjuvant radiation after surgery for head and neck cancer. National Comprehensive Cancer Network guidelines recommend fewer than 6 weeks between surgery and adjuvant radiation.[77] Adjusting for multiple variables including age, stage, insurance, and radiation dose, radiation after 6 weeks from surgery is associated with 13% worse overall survival.[78] Unfortunately, over 60% of head and neck patients undergoing curative intent surgery do not receive their radiation within 6 weeks.[55,79]

An analysis of 11 717 patients in NCDB aimed to identify the effect of Medicaid expansion on timeliness of adjuvant radiation. Medicaid patients were found to have more frequent delay of postoperative radiation than private insurance patients both before and after Medicaid expansion with no appreciable change with expansion (77% vs. 60% rate of delayed radiation in Medicaid vs. private, respectively).[79] The authors' main conclusion was that Medicaid expansion alone did not decrease radiation delay.

Medicaid expansion alone, while successful in providing insurance to the previously uninsured and early diagnosis, faces obstacles as a sustainable long-term solution. In otolaryngology, a 221% shortfall for Medicaid reimbursement exists across all operative services.[80] Poor reimbursement relative to other payers is one main reason explaining the lower rate of Medicaid acceptance for new patient visits.[81] For instance, fewer than 8% of dentists accept Medicaid and those that do often limit the number of Medicaid patients they evaluate.[82] One in four physicians in the U.S. does not accept Medicaid.[83]

Earlier diagnosis of head and neck cancers would benefit low-income patients, but given Medicaid reimbursement shortfalls and limited provider availability, additional measures are required to ensure patients are expeditiously evaluated. Recent proposals for "Medicaid block grants" (i.e., lump sum payments to states with minimal conditions) are being considered. In theory, block grants afford states more flexibility in health care spending. While block grants have reduced federal healthcare spending in Canada where a private insurance market is essentially nonexistent, some have argued that block grants in the U.S. may lead to a paradoxical shortage of care for Medicaid patients.[84]

## 6 | CONCLUSION

The head and neck cancer outcomes in low-income populations lag behind those of the more affluent—and the degree is dramatic. The degree of disparity is in the range of 20%–90% worse overall survival across most subtypes.[5–13] Yet the necessary solutions advocated in this review have already been proven to work—as drastically better outcomes have already been achieved in more affluent populations. Eliminating smoking, which is two to three times more prevalent in low-income populations, should be at the forefront of preventive measures. Oncologists should support increases in cigarette taxes (which are the most effective measure to reduce smoking) as well work to increase the availability of varenicicline, bupropion, and behavioral therapies to help patients reduce smoking. Additionally, access to oral cancer exams, assistance with transportation, and continued expansion of telemedicine would facilitate early diagnosis and timely treatment in patients who develop head and neck cancer. Ongoing health insurance reform is also needed, as Medicaid expansion without reform will not provide sufficient access to cancer care.

## CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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