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# Tobacco's Role in Cancer Health Disparities

**Jennifer Irvin Vidrine, Ph.D.**[1], **Lorraine R. Reitzel, Ph.D.**[2], and **David W. Wetter, Ph.D.**[3]

Jennifer Irvin Vidrine: jirvinvidrine@mdanderson.org; Lorraine R. Reitzel: lrreitze@mdanderson.org; David W. Wetter: dwetter@mdanderson.org

[1]Department of Health Disparities Research – Unit 1440, The University of Texas M. D. Anderson Cancer Center, PO BOX 301402, Houston, TX, 77230-1402; Phone: 713-745-2383; Fax: 713-563-3445

[2]Department of Health Disparities Research – Unit 1440, The University of Texas M. D. Anderson Cancer Center, PO BOX 301402, Houston, TX, 77230-1402; Phone: 713-792-0523; Fax: 713-792-1152

[3]Department of Health Disparities Research – Unit 1440, The University of Texas M. D. Anderson Cancer Center, PO BOX 301402, Houston, TX, 77230-1402; Phone: 713-745-2682; Fax: 713-792-7196

## Abstract

Although public health efforts have dramatically reduced the prevalence of smoking over the past several decades, smoking remains the leading cause of preventable morbidity and mortality in the United States. Moreover, tobacco use is becoming increasingly concentrated among individuals with the lowest levels of education, income, and occupational status. Profound racial/ethnic and socioeconomic (SES) disparities exist for tobacco-related cancer incidence and mortality, and for access to and quality of cancer treatment. Furthermore, racial/ethnic minority and low SES smokers have greater difficulty quitting smoking, are less likely to use effective resources for quitting and have limited access to evidence-based cessation treatments. Widespread implementation of population-based tobacco cessation approaches may have had the unintended effect of increasing tobacco-related cancer health disparities. It is crucial that vulnerable populations of smokers be provided with effective and accessible treatments for tobacco dependence, as this would have a profound impact on reducing tobacco-related cancer health disparities.

## Introduction

Despite public health efforts that have had a dramatic influence on reducing the prevalence of cigarette smoking, smoking remains the leading cause of preventable morbidity and mortality in the United States [1]. In addition to causing chronic bronchitis, emphysema, heart disease and cerebrovascular diseases, smoking is linked with increased risk of at least 15 different cancers including cancers of the nasopharynx, nasal cavity and paranasal sinuses, lip, oral cavity, pharynx, larynx, lung, esophagus, pancreas, uterine cervix, kidney,

Correspondence to: Jennifer Irvin Vidrine, jirvinvidrine@mdanderson.org.

bladder, stomach, and acute myeloid leukemia. Furthermore, nearly one-third of all cancer deaths and 87% of lung cancer deaths are attributable to smoking [2].

One out of every 5 adults in the U.S. is a smoker [3]. However, smoking is not distributed equally across all facets of society. Rather, it is becoming increasingly concentrated among individuals with the lowest levels of education, income, and occupational status [3]. Moreover, smoking plays a critical role in health disparities, accounting for a large proportion of the differences in disease incidence and mortality associated with socioeconomic status (SES) [4]. For example, over 50% of the SES gradient in mortality among U.S. men is attributable to smoking [5••]. Unfortunately, smokers with low SES have greater difficulty quitting, at least in part because they are less likely to have access to, and use, effective resources for quitting [6]. In addition, striking racial/ethnic tobacco-related cancer health disparities exist among African Americans, Latinos and non-Latino white smokers [7–9]. These disparities are particularly important given that the U.S. population is becoming increasingly diverse. According to the U.S. Census Bureau, racial/ethnic minorities are projected to comprise the majority of the population by 2042 [10]. Thus, it is crucial that low SES and racial/ethnic minority smokers be provided with effective and accessible treatments for tobacco dependence, as eliminating tobacco-related cancer health disparities would have a profound impact on reducing health disparities overall.

The purpose of this paper is to provide an overview of the role of tobacco in influencing cancer-related health disparities. Both racial/ethnic disparities and SES disparities are addressed. First, overviews of 1) the association of race/ethnicity with smoking prevalence and cessation, and 2) the association of SES with smoking prevalence and cessation, are presented. Next, disparities in the delivery of tobacco cessation treatments are reviewed, and a description of how population-based tobacco cessation approaches may be increasing health disparities is provided. Finally, the potential role of T2 translational research in reducing tobacco-related cancer health disparities is described. It is important to note that many racial/ethnic groups not covered in this paper (e.g., American Indians and Alaska Natives) suffer a tremendous health burden attributable to tobacco use. However, the focus of the current paper is on African American, Latino, and non-Latino white smokers because, together, these groups comprise approximately 90% of the current U.S. population. Data on tobacco-related cancer health disparities for other important racial/ethnic groups are reviewed elsewhere [11].

## Race, Ethnicity, and Smoking

Although the prevalence of smoking has historically been higher among African American men than among white men [12], prevalence rates for the two groups have converged in recent years and are now similar. The prevalence of smoking is lower among Latinos compared to African Americans and non-Latino whites. Furthermore, striking disparities among African Americans, Latinos and non-Latino white smokers exist for the health consequences of smoking. For example, compared to non-Latino white men who smoke, African American men who smoke have substantially higher incidence and mortality rates for tobacco-related cancers of the lung and bronchus, oral cavity and pharynx, pancreas, esophagus, and larynx [7]. Latino smokers also suffer severe adverse health consequences

from tobacco use. Compared to non-Latino whites, Latinos are significantly more likely to be diagnosed with advanced stage lung cancer and less likely to undergo surgical treatment. In addition, Latinos diagnosed with early stage lung cancer have significantly poorer survival rates than non-Latino whites [8]. In addition, 5 of the 10 leading causes of mortality among Latinos are tobacco-related (i.e., heart disease, cancer, stroke, birth defects, and chronic respiratory diseases) [9]. Thus, there is striking evidence that African Americans and Latinos are severely burdened by the adverse health effects of smoking.

These data are somewhat surprising given that, compared to non-Latino whites, African Americans initiate smoking later in life [12], Latinos have a lower prevalence of smoking, and both African Americans and Latinos smoke substantially fewer cigarettes per day [13]. However, African Americans are more likely to smoke menthol cigarettes, which are associated with an increased intake of carbon monoxide and nicotine [14, 15]. Furthermore, African Americans metabolize nicotine and cotinine, a metabolite of nicotine, more slowly than non-Latino whites [16]. Thus, although the empirical data are not entirely clear, higher tobacco-related morbidity and mortality rates among African Americans may be partially attributable to a preference for menthol cigarettes as well as slower metabolism of nicotine and nicotine metabolites.

In addition to suffering disproportionately from the health consequences of smoking, existing evidence suggests that members of racial/ethnic minority groups may have greater difficulty quitting smoking. For example, despite being as likely to want to quit smoking and more likely to undergo quit attempts, Latino and African American smokers are less likely than non-Latino whites to be successful at quitting [17]. In 2000, the quit ratio (percentage of ever smokers who have quit smoking) was substantially higher among non-Latino whites (50.4%) than among African Americans (37.5%) and Latinos (42.9%) [14]. More recent data based on a sample of individuals ages 25 to 44 and insured through a Health Maintenance Organization indicate that the quit ratio has remained substantially higher among whites (52%) than among African Americans (35%), but has increased considerably among Latinos (49%) and is now comparable to whites [18]. However, these data are based on a sample of insured individuals, and Latinos are substantially less likely than African Americans or non-Latino whites to have health insurance. Compared to non-Latino whites, Latinos are two to three times less likely to have health insurance [19]. Thus, these findings are not likely to generalize to the large population of uninsured Latino smokers.

## Socioeconomic Status and Smoking

In addition to contributing to racial/ethnic disparities in the incidence and mortality of cancer and other diseases, smoking accounts for a large proportion of the differences in disease incidence and mortality attributable to SES [4]. For example, education is one of the strongest sociodemographic predictors of smoking prevalence and cessation, with lower education linked to higher smoking prevalence and lower cessation rates [20]. Between 1974 and 1985, education surpassed gender as the strongest sociodemographic correlate of smoking [21]. Similarly, more recent data indicate that smoking prevalence is nearly three-fold higher among individuals who have not completed high school than among individuals who have earned a college degree [22].

Considerable data indicate that smokers with lower SES are less successful at quitting smoking [23•]. Between 1974 and 1985, the rate of smoking cessation increased twice as fast among smokers with higher levels of education as compared to those with lower levels of education [21]. More recent national data indicate that the quit ratio ranged from 34% among individuals with lower educational levels to 74% among individuals with graduate degrees [20]. Indeed, smokers with higher SES are more likely than those with lower SES to use effective resources for quitting smoking and to have more restrictive home environments in terms of smoking, which appears to partially explain their higher cessation rates [6]. Moreover, disparities in tobacco use by SES have increased over the last several decades despite widespread availability of free, effective cessation treatment.

## Racial/Ethnic Disparities in Tobacco-Related Cancer Incidence and Mortality

African Americans have higher lung cancer incidence and mortality rates than any other racial/ethnic group in the United States, and lung cancer is the second most common cancer among African Americans [7]. Between 2000 and 2003, lung cancer incidence among African American men was 40% greater than among non-Latino white men. During the same period, lung cancer mortality was 30% higher among African American men than among non-Latino white men [12]. Furthermore, African Americans are generally diagnosed at earlier ages [24, 25], diagnosed with later stage cancers [26] and have lower stage-specific survival than non-Latino whites [27]. That is, African Americans under age 50 are two times as likely as non-Latino whites the same age to be diagnosed with lung cancer, and the mean age at diagnosis is substantially lower for African Americans compared to non-Latino whites (i.e., mean age of 66 vs. mean age of 71) [28]. African Americans are also more likely to be diagnosed with later stage lung cancer [26].

In addition, African Americans are diagnosed with oral and pharyngeal cancers at an earlier age than non-Latino whites (i.e., mean age of 57 vs. mean age of 64) and die from oral and pharyngeal cancers at earlier ages (i.e., mean age of 61 vs. mean age of 70). Morse and Kerr [25] recently concluded that although the incidence and mortality of oral and pharyngeal cancers have declined among African Americans and non-Latino whites over the past quarter century, racial disparities persist. The most striking disparities are among African American males. Similarly, compared to non-Latino whites, African Americans are generally diagnosed with head and neck squamous cell carcinoma (HNSCC) at a significantly younger age, are more likely to be diagnosed with advanced stage disease, and have significantly lower 5-year survival rates. Evidence suggests that these disparities are largely attributable to differences in access to and quality of cancer treatment and care. For example, Bach and colleagues found that African Americans with early stage lung cancer were significantly less likely than non-Latino whites with similarly staged cancer to undergo surgical treatment [29]. Additional potential mechanisms among African Americans include greater smoking efficiency and intensity, metabolic differences, genetic susceptibilities, and a preference for menthol cigarettes [24]. With regard to genetic susceptibility, Cote and colleagues found that first degree relatives of African Americans diagnosed with lung cancer before the age of 50 had an elevated risk of lung cancer [30]. In addition, whereas 33% of all

cancers are attributable to tobacco use in the general population, 63% of cancers are attributable to tobacco among African American men [31].

Although the incidence of lung cancer is considerably less common among Latinos than among African Americans and non-Latino whites, cancer is the second leading cause of mortality among Latinos, and lung cancer is among the top contributors to cancer mortality among Latino men and women (32). Historically, age-adjusted lung cancer mortality rates increased dramatically among Latinos between the late 1970s and early 1980s in New Mexico [32]. Fortunately, more recent national data indicate that the incidence of lung cancer has actually begun to decline slightly among Latinos [33]. However, evidence suggests that Latinos experience disparities in lung cancer treatment and mortality that are similar to those of African Americans. National SEER data reflect that compared to non-Latino whites, Latinos are significantly more likely to be diagnosed with more advanced stage lung cancer and less likely to undergo surgical treatment. In addition, Latinos with early stage lung cancer have significantly poorer survival and higher mortality rates than non-Latino whites. Thus, these disparities in lung cancer survival appear to be largely attributable to lower rates of surgical treatment and a higher proportion of diagnoses occurring at later cancer stages [8]. Among Latinos, lung cancer is also the third most commonly diagnosed cancer, the leading cause of cancer death among men, and the second leading cause of cancer death among women. Cigarette smoking accounts for the vast majority of lung cancer cases [33]. Therefore, despite having lower rates of lung cancer than African Americans and non-Latino whites, tobacco use among Latinos is a significant public health problem that merits special attention.

## SES Disparities in Tobacco-Related Cancer Incidence and Mortality

Factors including poverty, poor education, and inadequate or no heath insurance contribute to SES disparities in tobacco-related cancers As elucidated by Dr. Samuel Broder, a former director of the National Cancer Institute, “poverty is a carcinogen” [7, 34]. A positive SES gradient for lung cancer exists among both African Americans and non-Latino whites such that individuals with higher SES have experienced the largest declining trends over time in lung cancer mortality. Interestingly, among Latinos, individuals living in middle SES communities experienced the best trends in lung cancer mortality over time, whereas individuals living in the lowest and highest SES communities experienced the worst trends [35].

Data also indicate that smokers with low SES smoke more efficiently than individuals with higher SES. That is, lower SES individuals generally smoke more of each cigarette (i.e., taking more puffs and inhaling more deeply) than higher SES smokers [16]. Therefore, there is a critical need to increase the prevention of tobacco-related cancers among low SES individuals, regardless of their race/ethnicity.

## Disparities in the Delivery of Smoking Cessation Treatments

As described above, members of racial/ethnic minority groups and smokers with lower SES suffer tremendous health consequences from smoking and appear to have a harder time

quitting. These smokers are also less likely to utilize existing evidence-based resources for quitting and, despite the availability of effective smoking cessation resources, have limited access to such resources. For example, numerous studies have indicated that African Americans [18] and Latinos [17] are substantially less likely than whites to use nicotine replacement therapy (NRT). In fact, when NRT became available over-the-counter (OTC), use among non-white minorities declined dramatically (i.e., 20.7% before NRT became available OTC vs. 3.2% after NRT became available OTC). This phenomenon may have been partially attributable to an increase in out-of-pocket costs for NRT for a large proportion of smokers. After the switch to OTC status, the number of insurance companies that covered the cost of NRT declined. Thus, non-white minority smokers may have been disproportionately burdened by increased out-of-pocket costs for NRT, as the availability of OTC NRT did not change utilization patterns among non-Latino whites [36]. In addition to being less likely to use NRT, African American and Latino smokers are less likely than non-Latino white smokers to be asked about their smoking status or advised to quit smoking by healthcare providers. A recent study also found that African American and Latino smokers were significantly less likely than white smokers to report using tobacco cessation treatments (i.e., pharmacotherapy or behavioral intervention) during a recent quit attempt [37•].

Important disparities in the delivery of smoking cessation treatments also exist for smokers with low SES. For example, Thorndike and colleagues [36] found that after NRT became available OTC, lower income smokers (17.2%) were less likely than higher income smokers (26.1%) to use NRT during a quit attempt. Interestingly, there were no differences in NRT use between the two groups prior to the availability of OTC NRT (19.5% and 18.5%, respectively). Thus, a policy change intended to increase access to NRT among all smokers appears to have had the unintended effect of reducing use of an evidence-based smoking cessation tool among underserved smokers. Similarly, Honjo [6] and colleagues found that smokers with lower SES were less likely to use effective smoking cessation resources and less likely to have restrictive home environments with regard to smoking, and that greater use of effective resources for quitting and more restrictive home environments led to higher smoking cessation rates. Thus, the results suggested that the use of cessation resources and one’s home environment are important mechanisms underlying the SES gradient for smoking cessation.

## Impact of Population-Based Tobacco Cessation Approaches on Tobacco-Related Cancer Disparities

Population-based approaches to reducing tobacco-related cancer risks are often highly effective at the population-level, as evidenced by the dramatic decline in smoking prevalence in the United States over the past 45 years. This decline has been described as one of the most important public health achievements of the 20$^{th}$ century [38], and has led to a reduction in the incidence of smoking-related cancers [39]. However, the overall decline in smoking prevalence has changed the population of remaining smokers, as smoking has become increasingly concentrated among individuals with low SES [3]. That is, although declines in smoking prevalence have occurred across all SES groups, differences in

prevalence between low and high SES groups have become increasingly pronounced over time [40].

The phenomenon of increasing health disparities related to tobacco use may be partially attributable to the widespread implementation of population-based tobacco cessation approaches over the past several decades. That is, such approaches may have had the unintended consequence of increasing health disparities [41••]. For example, as described above, changing NRT to nonprescription status was a policy change intended to eliminate barriers to the use of NRT. This policy change had the unfortunate consequence of ultimately leading to a six-fold reduction in the use of NRT among non-white minorities and to create a two-fold difference in NRT use by SES [36]. Thus, prominent public health researchers have noted that in order to eliminate disparities, intervention approaches must specifically target those groups that are most vulnerable and at risk. These groups include smokers with low SES and members of racial/ethnic minority groups [41••–43].

## The Role of T2 Translational Research in Reducing Tobacco-Related Cancer Disparities

The past three decades have generated a tremendous amount of research and knowledge regarding how best to help smokers quit. These data indicate that the use of evidence-based treatments can increase smoking abstinence rates by as much as fourfold [43]. Importantly, these interventions have demonstrated impressive efficacy and real-world effectiveness with low SES [44] and minority smokers [45]. Unfortunately, the creation of effective cessation treatment has not been sufficient to substantially reduce smoking prevalence among vulnerable populations. Far more attention and research dollars have been directed toward the development of tobacco cessation interventions than to dissemination and utilization of evidence-based knowledge. This is a concern because although effective interventions exist, low SES and racial/ethnic minority smokers have limited access to them [17, 44] and such treatments are grossly underutilized [43, 46]. Thus, this lack of dissemination will ultimately diminish progress toward reducing tobacco-related health disparities [47]. Rather, aggressively targeted, proactive dissemination strategies will be required to reach vulnerable populations of smokers [43]. Because individuals with limited resources often have the greatest health burdens, it is especially critical to consider factors that may enhance the reach and impact of smoking cessation interventions within these populations.

Even modest increases in the reach (i.e., the number, proportion, and representativeness of smokers who attempt to quit) and effectiveness (i.e., the number or proportion of smokers willing to utilize existing treatments) of existing evidence-based smoking cessation interventions could dramatically reduce tobacco-related health disparities at the population level [48]. Moreover, enhancing the dissemination of existing “best practices” for tobacco cessation would likely have an even stronger impact through reaching smokers with the least motivation to quit, highest smoking rates, and most profound smoking-related health disparities [43].

Enhancing the dissemination of effective smoking cessation treatments to vulnerable populations falls under the umbrella of type II translational research, which broadly focuses

on increasing widespread utilization of evidence-based interventions by a target audience. In addition to dissemination research, type II translational research encompasses effectiveness and implementation research [47]. Effectiveness research evaluates the impact of efficacious interventions when they are delivered in “real world” settings with a focus on generalizability. Implementation research focuses on mechanisms underlying the successful integration of evidence-based interventions within systems such as worksites, schools, or clinics [47]. Both will be required to elucidate the best methods and conditions to increase uptake and utilization of evidence-based interventions and to identify barriers that may impede the widespread adoption of such interventions among low SES and racial/ethnic minority smokers [49].

Several prominent researchers have argued that it is imperative that widespread dissemination of evidence-based smoking cessation interventions be fully integrated into existing treatment delivery systems if they are to have a significant impact [43, 46]. For example, Borland and Seagan [46] have suggested that a crucial strategy for increasing the impact of smoking cessation quitlines is to formalize partnerships with health care providers that include formal referral mechanisms. Similarly, the Centers for Disease Control and Prevention (CDC) have included partnerships with healthcare systems as a best practice for promoting the utilization of quitlines [50]. Such systems level changes could ultimately have a dramatic impact on reducing racial/ethnic and socioeconomic tobacco-related cancer health disparities.

In response to these recent calls to improve the dissemination of evidence-based smoking cessation interventions through integration with existing treatment delivery systems and developing partnerships with health care providers, our research team has developed a unique partnership between a smoking cessation quitline and one of the nation’s largest safety net public health care systems, which serves a very low SES and predominantly minority population. The specific focus of the partnership is on increasing dissemination and enhancing utilization of an existing evidence-based smoking cessation resource, the State of Texas Quitline (i.e., Quitline), within the Harris County Hospital District (HCHD) community health clinics. The State of Texas Quitline is provided by the American Cancer Society (ACS). The HCHD clinics provide access to cost-effective, quality health care delivered in a compassionate manner to all residents of Harris County regardless of their ability to pay. The patient population served by the HCHD is racially/ethnically diverse, predominantly low SES, and underserved. The vast majority of patients are low-income (41% below the poverty level) and 87% are members of racial/ethnic minority groups. The 10 HCHD community health clinics that are part of the current partnership served nearly 170,000 unique patients in 2007. Furthermore, the HCHD clinics have a well-developed infrastructure for broad and immediate dissemination of this existing evidence-based cessation treatment.

## Conclusions

The role of tobacco in influencing cancer health disparities is tremendous. Although the past three to four decades have produced a dramatic decline in the overall prevalence of smoking in the United States, this decline has not been distributed equally across all segments of

society. Rather, smoking has become increasingly concentrated among individuals with the lowest levels of education, income, and occupational status, and generally has a disproportional impact on members of racial/ethnic minority groups [3].

Although disparities in smoking prevalence among African Americans and non-Latino whites appear to have been largely eliminated, and Latinos have historically had a lower smoking prevalence than non-Latino whites, profound racial/ethnic and SES disparities exist for tobacco related cancers. African Americans are more likely to be diagnosed with later stage cancers and have higher lung cancer mortality rates than non-Latino whites. Latinos experience similar disparities with regard to being diagnosed with more advanced stage tobacco-related cancers, and both African Americans and Latinos suffer from disparities in the treatment of tobacco-related cancers. Tremendous disparities in tobacco-related cancer incidence and mortality also exist for smokers with low SES.

Considerable data indicate that racial/ethnic minority and low SES smokers have greater difficulty quitting than non-Latino whites. In addition, these individuals have limited access to evidence-based smoking cessation treatment and are less likely to use effective resources for quitting smoking. In fact, the widespread implementation of population-based tobacco cessation approaches over the past several decades may have had the unintended effect of reducing the use of effective treatments within low-SES and minority populations [41••]. One way to address these disparities is to aggressively target vulnerable populations of smokers through the use of proactive treatment dissemination strategies [43]. Such dissemination strategies would likely be successful in reaching smokers with the least motivation to quit, highest smoking rates, and most profound smoking-related health disparities [43].

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