Who’s Still Smoking? Disparities in Adult Cigarette Smoking Prevalence in the United States

Jeffrey Drope, PhD1; Alex C. Liber, MSPH2; Zachary Cahn, PhD3; Michal Stoklosa, MA4; Rosemary Kennedy, BSc5; Clifford E. Douglas, JD6; Rosemarie Henson, MSSW, MPH7; Jacqui Drope, MPH8

Abstract: The continuing high prevalence of cigarette smoking among specific sub-populations, many of them vulnerable, is one of the most pressing challenges facing the tobacco control community. These populations include individuals in lower education and/or socioeconomic groups; from certain racial/ethnic groups; in the lesbian, gay, bisexual, and transgender community; with mental illness; and in the military, particularly among those in the lowest pay grades. Although traditional tobacco control measures are having positive health effects for most groups, the effects are not sufficient for others. More attention to and support for promising novel interventions, in addition to new attempts at reaching these populations through conventional interventions that have proven to be effective, are crucial going forward to find new ways to address these disparities.

Keywords: health disparities, health inequities, smoking prevalence, tobacco

Introduction

Despite the overall substantial decrease in the prevalence of cigarette smoking in the United States in the last 50 years, there remain persistent intergroup disparities in cigarette smoking prevalence and secondhand smoke exposure. This article focuses on cigarette smoking as opposed to pipes, cigars, hookah, or other products. This is not to deny the importance of these other types of smoking; rather, we are focusing on tobacco cigarettes both to enhance the consistency of the comparisons that we are making and because of the overwhelming harms that stem from this particular product. Accordingly, the rest of this article will refer to “cigarette smoking” as simply “smoking.” Figure 1 (methodology discussed below) demonstrates the decrease in adult smoking prevalence from 42% in 1965 to 15% in 2015. Despite this progress, the absolute number of smokers has declined more slowly because of overall population growth, and there remain approximately 40 million smokers in the United States. This high absolute number of smokers begs an important question: who is still smoking? Tobacco use and associated disease burden is increasingly concentrated among vulnerable and frequently overlapping populations. When we incorporate disparities around access to care in this already problematic dynamic, the interaction is devastating from the standpoint of both health and equity.

Smokers tend to be disadvantaged socially and economically, and these demographic segments consequently tend to bear the majority of morbidity and premature mortality associated with smoking.1 To illustrate, Jha et al2 found that, among middle-aged males (ages 35-69 years) with a high-school education or less (12 years or less) in the United States, smoking-related deaths accounted for 40.5% of total deaths in 1996. By contrast, smoking-related deaths for those with more than a high-school education accounted for 22% of deaths in the same age group. Extrapolating further from these data, those authors calculated that the probability of a premature death from smoking was 15% for men with a high-school education or less versus 4% for those with more than a high school education. Although the data Jha et al used are now more than a decade old, we demonstrate in this review...
that many of the behavioral inequities that contribute to the health inequities that Jha et al observed remain.

This research examines some of the major disparities in smoking prevalence in the United States that persist by education, income, race/ethnicity, sexual orientation, mental illness diagnosis, geography, and active military status. Our primary goal is descriptive: to determine who is still smoking. However, we will point to other reviews and articles that have attempted the difficult task of disentangling the precise causal mechanisms of these differences. Causal attribution is difficult in part because individuals often belong to multiple groups (eg, an individual might suffer from mental illness and be in a lower socioeconomic group). We begin by demonstrating trends in smoking prevalence in these key groups. We also briefly discuss similar dynamics in secondhand smoke exposure. We then discuss some of the variables that appear to be significant drivers of these differences, and finally highlight some new initiatives to address these disparities.

Methods

We used the National Health Interview Survey (NHIS) to create Figures 1 through 4 and data from the National Survey on Drug Use and Health (NSDUH) to create Figure 5. Both the NHIS and the NSDUH are nationally representative surveys of the noninstitutionalized civilian American population, and each is conducted in person with more than 70,000 individuals annually. The NHIS covers the population of persons aged 18 years and older, whereas the NSDUH covers the population aged 12 years and older.

We calculated past-month cigarette smoking prevalence in each survey to include those who had smoked at least 100 cigarettes in their lifetime and had smoked a cigarette on at least 1 day in the 30 days before the survey. Prevalence point estimates were adjusted by final person weights in each survey. Current cigarette smoking prevalence among Americans aged 18 years and older in the NHIS was multiplied by the population size of that group in each year to obtain the number of smokers displayed in Figure 1. NHIS respondents were divided by consistent categories of their highest educational attainment back to 1965 to create Figure 2. Figures 3 and 4 combined publicly available estimates of current smoking by poverty status and racial/ethnic groups with newer data from the 2015 to 2016 NHIS divided along the same categories by sex. To create Figure 5, NSDUH respondents between 2009 and 2014 were divided according to whether they reported suffering from a serious mental illness in the past year. For Figure 7 (sexual orientation), we used reported survey results from the 2012 and 2013 National Adult Tobacco Survey, which is a stratified, national random-digit-dialed, mobile and landline telephone survey of approximately 60,000 noninstitutionalized US adults aged 18 years or older. To examine geographic disparity, we use the Behavioral Risk Factors Surveillance System because of its very wide geographic coverage in all 50 states (Figs. 10 and 11). Because we were unable to find very recent data for several indicators, for Figure 6 (lifetime mental illness) and for Figures 8 and 9 (military tobacco use), we used secondary sources.

Results

Education

Although smoking prevalence in the United States has decreased in all education groups over the last one-half century (Fig. 2), the largest decrease has been among those who are college-educated. Fifty years ago, smoking prevalence for all education groups was fairly clustered, with nearly 40% of college-educated individuals smoking along with approximately 45% of individuals in all other education groups. Five decades later, 6.5% of college-educated individuals continue to smoke, while the prevalence is more than triple that among those with a high school education or less (23.1%).
Economists have been particularly interested in disentangling the causal effect of education on health outcomes, with smoking considered to be a major driver of these outcomes. They have generally found both a substantial causal role of schooling and a strong tendency for schooling to select for factors such as cognitive ability and early life stability that also drive smoking rates.7,8

Poverty
Although all income groups experienced overall declines in smoking over the last few decades, the largest relative decreases have been with higher socioeconomic groups (Fig. 3). Research consistently indicates that smoking has a strong socioeconomic dimension, with the lowest groups most likely to experience the worst outcomes. Siahpush et al

FIGURE 2. Current Cigarette Smoking Prevalence by Education Status (National Health Interview Survey, 1966-2016). Note that the analysis included only adults aged 25 years or older.

FIGURE 3. Current Cigarette Smoking Among Adults Aged 18 Years and Older by Poverty Status (Age-Adjusted, National Health Interview Survey, 1990-2016). FPL indicates Federal Poverty Level.
use the International Tobacco Control 4-country survey (which includes the United States) to show that smokers from socioeconomically disadvantaged groups tend to smoke more than wealthier smokers and to be more dependent on nicotine. Smokers with low socioeconomic status (SES) face disproportionate smoking-related illness as a result. Additional factors associated with lower SES, such as unhealthy diet and higher stress levels, tend to compound their health risk. In 2015 and 2016, current tobacco use prevalence was about 10% for adults in higher income households (greater than 400% of the Federal Poverty Level) compared with almost 25% for adults in households below the poverty line. Figure 3 illustrates the downward trend for all socioeconomic groups from 1990 to 2016 for both men and women, but note that the lowest income group for men experienced a 25% relative decrease (from 40.50% to 30.22%), while the highest income group experienced a 54% relative drop (from 22.50% to 10.42%). For women, it was a 21% relative decrease for the lowest income group (from 30.70% to 24.24%), while it was a 59% decline for those in the highest income group (from 19.00% to 7.87%).

Various other reviews have attempted the difficult task of allocating the relative causal weight of all the various factors associated with poverty, or at least of cataloguing the various ways that poverty is linked to poor health behaviors, such as smoking. In addition to other disparities mentioned explicitly in this review, such as education and geography, lower income is often associated with challenges to health

FIGURE 4. Current Cigarette Smoking Among Adults Aged 18 Years and Older by Race and Ethnicity (Age-Adjusted, National Health Interview Survey, 1990-2016). Sources: Centers for Disease Control and Prevention, National Center for Health Statistics, and National Health Interview Survey.

FIGURE 5. Current Cigarette Smoking by Serious Mental Illness Status (National Survey on Drug Use and Health, 2009-2014).
insurance access, particularly in states that have maintained a restrictive Medicaid program. The rate of current cigarette smoking (28%) for adults who lack health insurance or rely on public health insurance is double compared with the rate for those who have private insurance (14%).

Race/Ethnicity
Among all racial and ethnic groups, there has mostly been a downward trend for both men and women, but there also remains considerable variation, as illustrated in Figure 4. Individuals who are of American Indian or Alaskan Native descent exhibit the highest smoking prevalence (24.3% men and 23.4% women), and women in this group also experienced a recent upward trend (after a nearly 2-decade downward trend). Individuals of Asian and Hispanic/Latino descent demonstrate the lowest prevalence (12.6% men and 3.5% women). The causal mechanisms of these differences are not well understood, although some research suggests that sociocultural differences and/or practices may explain some of the variation.

Mental Illness
The burden from smoking has been particularly high on individuals struggling with mental illness. Tam et al linked NHIS data from 1997 through 2009 to the 2011 National Death Index to construct life tables that enabled the estimation of hazard ratios for smoking status and serious psychological distress. They reported that smoking among individuals with a serious psychological distress accounted for two-thirds of the difference in life expectancy relative to nonsmokers without a serious psychiatric disorder. Evidence suggests that some individuals with mental illness may have a genetic predisposition toward addiction and/or may self-medicate using nicotine.

There is also significant variation among different mental illnesses, as illustrated in Figure 6. For example, nicotine addiction has proven to be particularly challenging for many suffering from psychiatric disorders, such as schizophrenia. Smoking prevalence was highest among those with schizophrenia, at nearly 60%. Individuals with such disorders may also experience additional risk factors, such as the easy availability of tobacco in some treatment centers.
Sexual Orientation

Smoking prevalence rates among lesbian, gay, bisexual, and transgender (LGBT) men and women in the United States are much higher than those among heterosexuals, as presented in Figure 7. The social stresses of living in a society that can be hostile to individuals in the LGBT community contribute to the higher prevalence. Furthermore, it is particularly well documented that, for many years, the tobacco industry has marketed specifically to the LGBT community, placing advertisements in community media outlets, attending pride festivals to hand out coupons for discounted cigarettes, and promoting their products in LGBT bars to gain customers and leverage aligned groups in the industry’s fight against smoking bans.

Military

Persistently higher smoking prevalence in the military has received scholarly attention in recent years. Figure 8 illustrates that, similar to the overall US population, smoking in the military has trended significantly downward in recent decades. In 1980, more than one-half of military personnel reported smoking. By 2011, smoking prevalence had dropped to less than one-quarter. Although unadjusted prevalence is still significantly higher than that in the general population, there has been a notable downward shift after a spike in the early 2000s.

However, as Figure 9 illustrates, disparities by pay grade within the military persist. For service members in the lowest 4 pay grades of enlisted members (E1-E4), smoking prevalence remained around 30% in 2011. In contrast, smoking prevalence in the highest 6 pay grades of commissioned officers (O4-O10) had dropped below 5%. Other disparities within this population included that smokers were more often male, high school-educated or less, and stationed outside of the United States.

Geography

There are substantial geographic differences in smoking prevalence. First, smoking prevalence varies considerably
across states. Figure 7 shows how these rates vary, from 8.7% in Utah to 26.2% in Kentucky. There is a notable dark stripe on the map leading from Michigan to Mississippi, including several adjacent states in the Midwest and Appalachia, where smoking prevalence is substantially above the national average. The Truth Initiative calls this “Tobacco Nation” and points to several driving factors, including policy, culture, and the strong and persistent influence of the tobacco industry in this region. Not surprisingly, findings from recent analysis of tobacco-attributable cancer mortality by state show poorer outcomes in most Tobacco Nation states.

In addition to interstate disparities, there are considerable disparities within states at the county level (and lower). To demonstrate such disparity, Figure 11 illustrates county-level smoking prevalence in Ohio. Generally, there is considerably higher prevalence in the more rural areas, including some in or bordering on Appalachia. Strong intrastate variation at the county level can be observed throughout the United States. In addition, geographic disparities exist within counties across cities, precincts, and neighborhoods.

Secondhand Smoke

Not surprisingly, secondhand smoke exposure is associated with demographic characteristics similar to those of active smoking. Recent estimates suggest that 58 million people, including 45% of children, are still exposed to secondhand smoke, especially in the home. Moreover, 40,000 annual deaths are attributed to secondhand smoke exposure. The prevalence of secondhand smoke exposure in the home varies by socioeconomic status and race/ethnicity, with those from lower socioeconomic groups in particular experiencing much greater exposure to secondhand smoke. However, some additional factors drive secondhand smoke disparities. Differences among socioeconomic and racial/ethnic groups may be driven in part by large differences between owners and renters. Housing differences might help to explain why black nonsmokers of all ages face far greater exposure to secondhand smoke, as measured by serum cotinine levels, although there is not a large disparity between black and white smoking prevalence. In addition to being more likely to rent, black smokers are less likely to report a (self-imposed) ban on smoking in the home. Recent US Housing and Urban Development policy to promote smoke-free homes and common areas in multiunit public housing seeks to address this challenge. Although secondhand smoke exposure has declined across all racial and SES groups, the lowest SES individuals have experienced the smallest decline, as has the black population, meaning that the SES
and racial disparities have worsened over time. Work- place smoking is also a driver of exposure to secondhand smoke, and research suggests that the patterns of those more likely to be exposed are similar to the smoking trends described above, including individuals with less education and in lower socioeconomic groups.

**Discussion**

**Why the Disparities?**

Recent research demonstrates that individuals in specific groups—including certain education, income, and racial/ethnic groups, among others—face increased exposure to tobacco industry marketing that promotes smoking. This is often because of the purposeful targeting of vulnerable populations, such as working class youth, inner cities areas that are predominantly black and/or low-income, and the LGBT community. In all cases, the industry is keen to target youth and young adults, who comprise nearly all of the total smoking uptake. Smoking rates in this population represent a bellwether for predicting future smoking patterns.

Disparities may also arise because of environmental factors that may or may not result from intentional industry targeting. For example, there are persistent neighborhood disparities in the tobacco retail environment. Research shows evidence not only of increased tobacco marketing but also of higher retailer density in neighborhoods with a larger proportion of African Americans and same-sex couples. It is more common for African American teens and those living in low-income households to be within walking distance of a tobacco retailer. Similarly, a recent study in the San Francisco Bay area indicated that adult smokers with serious mental illnesses live in neighborhoods with twice the tobacco retail density as individuals who do not have a mental illness. This environmental exposure was associated with greater nicotine dependence and lower efficacy to quit smoking. These causal relationships may work in both directions: more retailers sell tobacco because there are more tobacco users, and current tobacco users use more tobacco because there is heightened exposure to these tobacco retail environments.

Similarly, many groups disproportionately lack exposure to effective tobacco control policies and messages. For example, workplace smoking bans will not encourage cessation among people who work outdoors or are unemployed. More generally, per-capita tobacco control expenditures vary considerably across states, and higher levels are associated with lower smoking prevalence among both youths and adults.

**Addressing Disparities**

Eliminating disparities in tobacco use through approaches specifically geared toward these populations is vital for achieving not only broader prevalence reduction goals but also improving health equity. The 2014 Surgeon General’s Report recognized the need to reduce smoking prevalence “more rapidly than the current trajectory” and called for eliminating the use of combustible tobacco products, which are responsible for 480,000 deaths in the United States each year (see National Center for Chronic Disease Prevention and Health Promotion, p 870-871). There is clearly a need to target interventions and make cessation services more widely available, particularly to vulnerable population groups. These innovations should include creative efforts to extend traditional approaches to groups that have proven difficult to reach in addition to novel approaches that are tailored to the subpopulation of interest. Some examples of novel and innovative interventions and tools that have recently been developed and implemented at the national, state, and community levels in the United States to address smoking disparities include the following:

- The US Food and Drug Administration’s “This Free Life” campaign aimed at the LGBT community;
- The establishment of strategic partnerships with the 2-1-1 information and referral system to promote smoke-free, low-income homes and to support cessation among 2-1-1 callers who are disproportionally low-income, unemployed, and/or uninsured;
- Reducing sales of untaxed or low-tax cigarettes on tribal lands;
- Setting minimum floor pricing policies across states;
- The development of simplified and standardized tobacco-assessment tools for retail settings to allow state and local partners to record their own retail data about product packaging, price, and placement to inform regulation of the retail environment;
- The development of antitobacco media campaigns using nonsmokers and/or former smokers to help smokers to quit, such as the Tips From Former Smokers campaign;
- Using social branding interventions to counter the tobacco industry’s marketing efforts in social environments like bars and nightclubs and on social media to aggressively target young adults and groups outside of the cultural mainstream;
- Expand health care access among low-income adults with attendant smoking-cessation counseling and medication benefits via Medicaid expansion and insurance exchange subsidies; and
- Support the US Department of Housing and Urban Development’s ban on smoking in public housing.

Many high-income countries have enjoyed considerable success in reducing adult smoking prevalence over the past decades, but very few have succeeded in lowering it below 10%. Reducing prevalence among disadvantaged population
groups tends to be particularly challenging. Given the continuing nicotine dependence of many smokers who are economically or socially challenged, to achieve further dramatic reductions in smoking prevalence in addition to continuing to vigorously use existing evidence-based interventions, additional innovative efforts are necessary to sufficiently increase cessation rates and prevent initiation in those groups.

Limitations

Because the emphases and goals of different national surveys vary, we were unable to rely on the same source of data for every figure in this research. Where possible, we relied on the NHIS to produce nationally representative estimates of tobacco use disparities over time. Unfortunately, the NHIS does not capture the proper measure of mental health needed for our work, which made us turn to the NSDUH for that information. Because neither the NHIS nor the NSDUH public data set contained state-level or county-level data, we used the Behavioral Risk Factors Surveillance System, which provides such geographic information. Although the data sets do not produce the same point estimates of cigarette smoking prevalence, there is ample evidence that these data sets are capturing the same larger trends in the data over time.

References

1. Tobacco Advisory Group of the Royal College of Physicians. Nicotine without smoke—tobacco harm reduction. London, UK: Royal College of Physicians; 2016. rcplondon.ac.uk/projects/outputs/nicotine-without-smoke-tobacco-harm-reduction-0. Accessed December 9, 2017.

2. Jha P, Petro R, Zatonski W, Boreham J, Jarvis MJ, Lopez AD. Social inequalities in male mortality, and in male mortality from smoking; indirect estimation from national death rates in England and Wales, Poland, and North America. Lancet. 2006;368:367-370.

3. Jamal A, Homa D, O’Connor E, et al. Current cigarette smoking among adults—United States, 2005-2014. MMWR Mortal Wkly Rep. 2015;64:1233-1240.

4. State and Community Tobacco Control Policy (SCTC) Research Initiative. Emerging Science in State and Community Tobacco Control Policy and Practice. May 2016. cancercontrol.cancer.gov/bpr/ctcb/sctc.html#project-sites. Accessed January 2, 2018.

5. Young-Wolff KC, Henriksen L, Delucchi K, Prochaska JJ. Tobacco retailer proximity and density and nicotine dependence among smokers with serious mental illness. Am J Public Health. 2014;104:1454-1463.

6. McClave AK, McKnight-Eily LR, Davis SP, Dube SR. Smoking characteristics of adults with selected lifetime mental illnesses: results from the 2007 National Health Interview Survey. Am J Public Health. 2010;100:2464-2472.

7. Conti G, Heckman J, Urzua S. The education-health gradient. Am Econ Rev. 2010;100:234-238.

8. Cutler DM, Lleras-Muney A. Understanding differences in health behaviors by education. J Health Econ. 2012;29:1-28.

9. Siahpush M, McNeill A, Borland R, Fong GT. Socioeconomic variations in nicotine dependence, self-efficacy, and intention to quit across four countries: findings from the International Tobacco Control (ITC) Four Country Survey. Tob Control. 2006;15(suppl 3):ii71-ii75.

10. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General. Atlanta, GA: Centers for Disease Control and Prevention; 2014. nbic.nlm.nih.gov/books/NBK179276/. Accessed December 9, 2017.

11. Tobacco Advisory Group of the Royal College of Physicians. Harm Reduction in Nicotine Addiction: Helping People Who Can’t Quit. London, UK: Royal College of Physicians; 2007.

12. Cutler DM, Lleras-Muney A, Vogl T. Socioeconomic status and health: dimensions and mechanisms. In: Gled S, Smith PC, eds. The Oxford Handbook of Health Economics. New York: Oxford University Press; 2011. oxfordhandbooks.com/view/10.1093/oxfordhb/9780199238828.001.000/1/oxfordhb-9780199238828-e-7. Accessed December 9, 2017.

13. Pampel FC, Krueger PM, Denney JT. Socioeconomic disparities in health behaviors. Annu Rev Sociol. 2010;36:349-370.

14. Hiscock R, Bauld L, Amos A, Fidler JA, Munafò M. Socioeconomic status and smoking: a review. Ann N Y Acad Sci. 2012;1248:107-123.

15. Sommers BD, Musco T, Finegold K, Gunja MZ, Burke A, McDowell AM. Health reform and changes in health insurance coverage in 2014. N Engl J Med. 2014;371:867-874.

16. Wherry LR, Miller S. Early coverage, access, utilization, and health effects associated with the Affordable Care Act Medicaid expansions: a quasi-experimental study. Ann Intern Med. 2016;164:795-803.

17. Frean M, Gruber J, Sommers BD. Premium subsidies, the mandate, and Medicaid expansion: coverage effects of the Affordable Care Act. J Health Econ. 2017;53:72-86.

18. US Department of Health and Human Services. Office of Disease Prevention and Health Promotion. Healthy People 2020. Washington, DC: US Department of Health and Human Services; 2015. http://healthypeople.gov/2020/leading-health-indicators/2020-lhi-topics/Tobacco/data. Accessed August 28, 2017.

19. Jamal A, Agaku I, O’Connor E, King B, Kenemer J, Neff L. Current cigarette smoking among adults—United States, 2005-2017. MMWR Morb Mortal Wkly Rep. 2018;67:1108-1112.

20. US Department of Health and Human Services. Tobacco Use Among US Racial/Ethnic Minority Groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: A Report of the Surgeon General. Atlanta, GA: US 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; 1998. profiles.nlm.nih.gov/nn/b/b/f/q. Accessed December 11, 2017.

Acknowledgements: We thank the many individuals who provided feedback on an earlier version of this research, including Katie McMahon, Kirsten Sloan, Carter Steger, Gregg Haiffy, and Lisa Lacasse (American Cancer Society Cancer Action Network); and Ted Gansler and Lee Westmaas (American Cancer Society-Intramural Research). We also thank other experts who provided insightful feedback, including William Bailey, Neal Benowitz, Pam Clark, Joanna Cohen, Eric Donny, Michael Eriksen, Michael Fiore, Terry Fontham, Bill Novelli, and Barbara Schillo.

Conclusions

The high prevalence of cigarette smoking among vulnerable populations is one of the most pressing challenges facing the tobacco control community. Included among these populations are individuals in lower education and/or socioeconomic groups, from certain racial/ethnic groups, in the LGBT community, with mental illness, in the military, and in certain geographic areas. The main challenge is that, although the evidence demonstrates that traditional tobacco control measures are having positive health effects for most groups, the effects have often not been as large as needed for some. More attention to and support for promising novel interventions, in addition to new attempts at reaching these populations through conventional interventions that have proven to be effective, are crucial going forward to find new ways to address these disparities.
with serious mental illness. Am J Prev Med. 2016;51:958-966.

22. Kalman D, Morissette SB, George TP. Co-morbidity of smoking in patients with psychiatric and substance use disorders. Am J Addict. 2005;14:106-123.

23. Aubin HJ, Rollema H, Svensson TH, Winterer G. Smoking, quitting, and psychiatric disease: a review. Neurosci Biobehav Rev. 2012;36:271-284.

24. NIH State-of-the-Science Panel. National Institutes of Health State-of-the-Science conference statement: tobacco use: prevention, cessation, and control. Ann Intern Med. 2006;145:839-844.

25. Prochaska JJ. Failure to treat tobacco use in mental health and addiction treatment settings: a form of harm reduction? Drug Alcohol Depend. 2010;110:177-182.

26. Remafedi G. Lesbian, gay, bisexual, and transgender youths: who smokes, and why? Nicotine Tob Res. 2007;9(suppl 1): S65-S71.

27. Gruskin EP, Byrne KM, Altschuler A, Goebel K. Lesbian and gays face tobacco targeting. Tob Control. 1994;3:65-67.

28. Smith EA, Grundy Q, Malone RE. “It’s not a worth a thousand words: noncommercial tobacco content in the lesbian, gay, and bisexual press. J Health Commun. 2006;11:635-649.

29. Fallin A, Davis B. LGBT organisation successfully advocated for ban on tobacco promotions in San Jose, California. Tob Control. 2016;25:504-505.

30. Leibel K, Lee JG, Goldstein AO, Ribisl KM. Is there a relationship between the concentration of same-sex couples and tobacco retailer density? Nicotine Tob Res. 2016;18:147-155.

31. Lortet-Tieulent J, Goding Sauer A, Siegel RL, et al. State-level cancer mortality attributable to cigarette smoking in the United States. JAMA Intern Med. 2016;176:1792-1798.

32. Dwyer-Lindgren L, Mokdad AH, Srebotnjak T, Flaxman AD, Hansen GM, Murray CJ. Cigarette smoking prevalence in US counties: 1999-2012 [serial online]. Popul Health Metr. 2014;12:5.

33. Diez Roux AV, Mair C. Neighborhoods and health. Ann N Y Acad Sci. 2010;1186:125-145.

34. Pan WK, Dwyer-Lindgren L, Mokdad AH, Srebotnjak T, Flaxman AD, Hansen GM, Murray CJ. Cigarette smoking prevalence in US counties: 1999-2012 [serial online]. Popul Health Metr. 2014;12:5.

35. Smith S. United States Military Ranks and Pay Grades. New York: The Balance; 2016. thebalance.com/united-states-military-ranks-and-pay-grades-3357045. Accessed December 8, 2017.

36. Lortet-Tieulent J, Goding Sauer A, Siegel RL, et al. State-level cancer mortality attributable to cigarette smoking in the United States. JAMA Intern Med. 2016;176:1792-1798.

37. Barlas FM, Higgins WB, Pflieger JC, Diecker K. Health Related Behaviors Survey of Active Duty Military Personnel. Fairfax, VA: ICF International, Inc; 2013. dtic.mil/docs/citations/ADA582287. Accessed October 7, 2017.

38. Barlas FM, Higgins WB, Pflieger JC, Diecker K. Health Related Behaviors Survey of Active Duty Military Personnel. Fairfax, VA: ICF International, Inc; 2013. dtic.mil/docs/citations/ADA582287. Accessed October 7, 2017.

39. Smith EA, Grundy Q, Malone RE. ‘It’s not a priority when we’re in combat’: public health professionals and military tobacco control policy. Am J Public Health. 2015;105:660-664.

40. Homa DM, Neff LJ, King BA, et al. Vital signs: disparities in nonsmokers’ exposure to secondhand smoke—United States, 2012-2013. MMWR Morb Mortal Wkly Rep. 2015;64:103-108.

41. Dai H, Hao J. The prevalence of exposure to workplace secondhand smoke in the United States: 2010 to 2015. Nicotine Tob Res. 2017;19:1300-1307.

42. Agaku IT, King BA, Husten CG, et al. Tobacco product use among adults—United States, 2012-2013. MMWR Morb Mortal Wkly Rep. 2014;63:542-547.

43. Brown-Johnson CG, England LJ, Glantz SA, Ling PM. Tobacco industry marketing to low socioeconomic status women in the USA. Tob Control. 2014;23(2):e139-e146.

44. Barbeau EM, Leafy-Sperounis A, Balbach JD. Smoking, social class, and gender: what can public health learn from the tobacco industry about disparities in smoking? Tob Control. 2004;13:115-120.

45. Yerger VB, Przewoznik J, Malone RE. Racialized geography, corporate activity, and health disparities: tobacco industry targeting of inner cities. J Health Care Poor Underserv. 2007;18(4 suppl):10-38.

46. Lee JGL, Pan WK, Henriksen L, Goldstein AO, Ribisl KM. Is there a relationship between the concentration of same-sex couples and tobacco retailer density? Nicotine Tob Res. 2016;18:147-155.

47. Yu D, Peterson NA, Sheffer MA, Reid RJ, Schneider JE. Tobacco outlet density and demographics: analysing the relationships with a spatial regression approach. Public Health. 2010;124:412-416.

48. Tauras JA, Chaloupka FJ, Farrelly MC, et al. State tobacco control spending and youth smoking. Am J Public Health. 2005;95:338-344.

49. Farrelly MC, Pechacek TF, Thomas KY, Nelson D. The impact of tobacco control programs on adult smoking. Am J Public Health. 2008;98:304-309.

50. Center for Tobacco Products. This Free Life Campaign. Silver Spring, MD: US Food and Drug Administration; 2016. fda.gov/Tobacco-Products/PublicHealthEducation/PublicEducationCampaigns/ThisFreeLifeCampaign/default.htm. Accessed October 4, 2017.

51. Kegler MC, Haardorfer R, Berg C, et al. Challenges in enforcing home smoking rules in a low-income population: implications for measurement and intervention design. Nicotine Tob Res. 2016;18:976-981.

52. Rubin R. Successful CDC campaign “tips from former smokers” to be expanded. JAMA. 2015;313:558-558.

53. Fallin A, Neillands TB, Jordan JW, Ling PM. Social branding to decrease lesbian, gay, bisexual, and transgender young adult smoking. Nicotine Tob Res. 2015;17:983-989.

54. Ling PM, Lee YO, Hong J, Neillands TB, Jordan JW, Glantz SA. Social branding to decrease smoking among young adults in bars. Am J Public Health. 2014;104:751-760.

55. Fallin A, Neillands TB, Jordan JW, Hong JS, Ling PM. Wreaking “havoc” on smoking: social branding to reach young adult “partiers” in Oklahoma. Am J Prev Med. 2015;48(1 suppl 1):S78-S85.

56. Levy DE, Adams IF, Adamkiewicz G. Delivering on the promise of smoke-free public housing. Am J Public Health. 2017;107:380-383.