Section III
Interpersonal and Contextual Factors That Contribute to Tobacco-Related Health Disparities

Chapter 9
Socioeconomic Status and Tobacco-Related Health Disparities

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Introduction

The importance of social determinants of health, including socioeconomic status (SES), is now widely recognized.[1] The United States' Healthy People 2020, which sets 10-year objectives to improve the health of all Americans, includes as one of its four overarching goals for the decade, "create social and physical environments that promote good health for all."[2,3] Socioeconomic status is an important risk factor across the tobacco use continuum, the causal pathway in the progression of smoking to disease including initiation, current use and intensity, intentions to quit and quit attempts, cessation, relapse, and tobacco-related morbidity and mortality. The Healthy People objective for cigarette smoking is that by the year 2020, only 12% of U.S. adults will be current smokers.[3] However, trends in smoking prevalence indicate that the national benchmark of 12% will be challenging to reach, especially for groups of lower socioeconomic status, including both lower educational attainment and lower income groups. As of 2015, about 15% of U.S. adults age 18 and older were cigarette smokers. However, 26.1% of adults living below the poverty level were smokers, compared with only 13.9% of adults living above the poverty level.[4] Moreover, mortality from lung cancer is estimated to be 77% higher among adults without a high school diploma, compared to those with at least a high school diploma.[5,6]

In the United States, SES is typically measured with indicators of income (e.g., annual family income in dollars) or educational attainment (years of schooling or credentials earned). SES is a complex multidimensional construct indicative of assets available or not available to individuals, including power, prestige, and economic resources,[7] all of which confer different health advantages and disadvantages and help determine individuals' life chances. The positive association between SES and health—that higher SES translates into better health—is among the most persistent and consistent epidemiological relationship researchers have observed.[8–10]

Historically, the relationship between SES and tobacco use was reversed: Individuals with higher income were at increased risk for tobacco use and related diseases. For example, in 1940, individuals with less than a high school education were least likely to smoke (35.8% smokers), whereas those with a high school education, some college course work, or a college education had a smoking prevalence of about 40%.[11] However, by 2000, only 14.2% of those with at least a college education were smokers, whereas the prevalence rates for the lower education groups were above 25%.[11] The dynamic relationship between SES (at least as measured by educational attainment) and smoking is thought to be related in part to changes in the social meaning of smoking over time, supported by the diffusion of innovation theory.[12,13] In the early 1900s, higher SES groups had the resources to adopt innovations such as the then-fashionable trend of cigarette smoking, while lower SES groups could not. As information became available about the health consequences of smoking (e.g., the 1964 Surgeon General's report) and about cessation approaches, higher SES groups initiated smoking at lower rates, and the smokers among them quit at higher rates compared with lower SES groups. Smoking trends eventually diffused to lower SES groups and have remained more concentrated there. Several factors may help explain the concentration of smoking in low-SES groups, including greater exposure to pro-tobacco messages and access to tobacco products, combined with higher levels of stress and lower access to health care (see chapter 10). This line of reasoning is very much in line with Link and Phelan's argument regarding social factors as fundamental causes of poor health.[14] Published data support the diffusion of innovation theory and demonstrate that lower SES groups have not yet benefitted equally from the anti-tobacco messages and policies[13,15,16] discussed in chapters 10 and 11.

SES and the Tobacco Use Continuum

SES influences health in general through multiple direct, indirect, and overlapping causal pathways. For example, low SES increases the risk of direct exposure to material deprivation, such as inadequate shelter, health care, clothing, or diet, and to hazardous environmental conditions such as violence. These factors, in turn, are associated with a range of health problems. Psychosocial stress (discussed in greater detail in chapter 5), which is generally higher among people with low versus high SES, has also been shown to have direct physiological effects on the body.[17] Specific health risk behaviors and fewer social resources (perceptions of control and lower social strain) associated with low SES may also mediate the pathway by which SES influences health outcomes.[18–20]

The association between SES and tobacco-related outcomes is multifactorial in nature. Individuals with low socioeconomic resources not only have a higher prevalence of smoking, they are also more likely than higher SES individuals to be exposed to secondhand smoke (SHS) in utero,[21] in the workplace, and at home.[22–25] They are less likely to live in homes where smoking is banned[26,27] and more likely than higher SES individuals to have peers and family members who smoke.[28,29] Lower SES people are less likely to have social networks that support quitting, thus influencing their exposure to SHS and risk of smoking initiation, and contributing to poor cessation outcomes.[30,31] Chapter 6 discusses the role of social relationships in tobacco-related health disparities (TRHD).

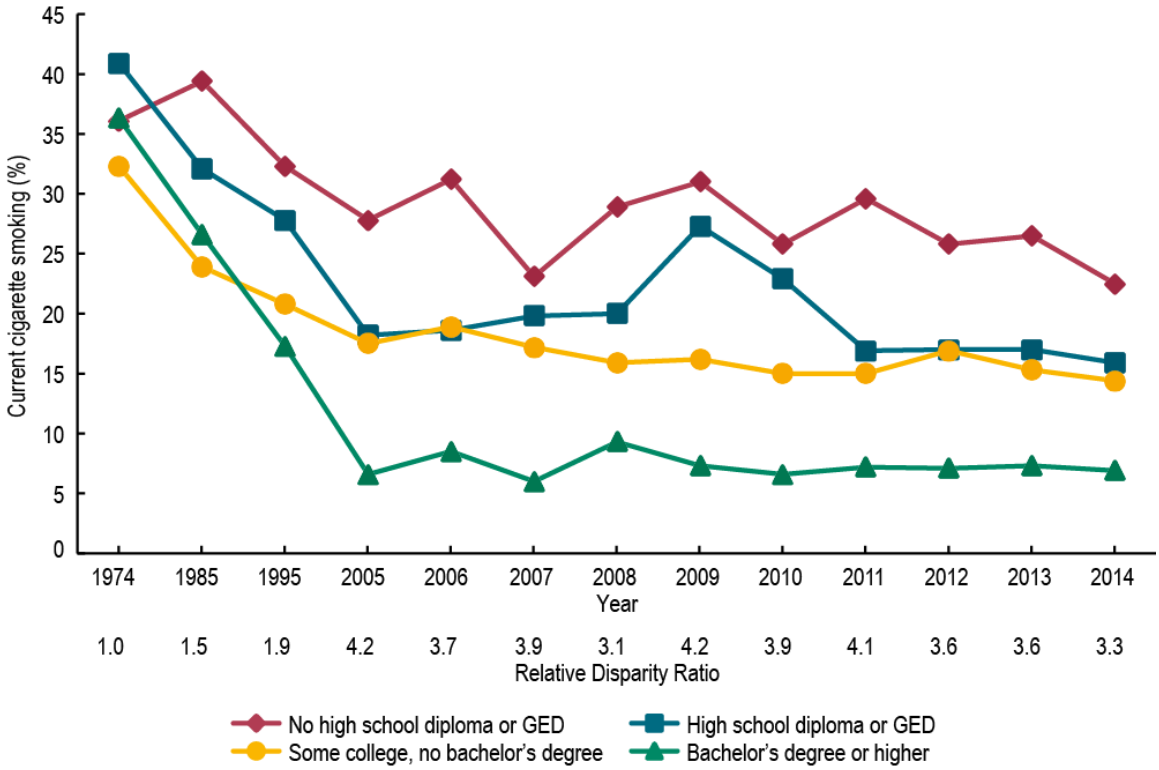
Psychosocial stress associated with low social status (both absolute and relative deprivation) combined with limited material and psychosocial resources could lead to smoking as a perceived coping mechanism or make it more difficult to quit.[13] In addition, compared with higher SES individuals, lower SES individuals, are more likely to live in lower SES neighborhoods and may be exposed to more tobacco advertising and hazardous environmental conditions (i.e., pollution) which could amplify the harmful health effects of smoking[32,33] and make it more difficult to quit.[34] Other psychosocial factors, including negative emotions, self-efficacy, and cognitive ability have been tested as mechanisms linking SES to smoking or cessation.[30,31,34,35]

Although people are generally aware that smoking is harmful to health, those health risks often compete with other, more immediate concerns, especially among lower SES groups.[31] Some evidence suggests that smoking may be more harmful to health for lower versus higher SES individuals, supporting a social vulnerability or double jeopardy model. As Pampel and Rogers argue, "the health of low status groups may be harmed most by smoking because lifestyle choices exacerbate the health problems created by deprived material conditions."[36,p.306] Although some evidence suggests that use of tobacco can result in lower wages and lower net wealth,[37,38] such reverse causation is likely to play a relatively limited role compared with the effects of SES on tobacco use.

Figures 9.1 through 9.4 present prevalence rates from 1974 to 2014 by educational attainment, stratified by race (non-Hispanic black, non-Hispanic white) and gender, using data from the National Health Interview Survey (NHIS). Although the data do not indicate what proportions of the population fall into each category of educational attainment, the relative disparity ratios for all four gender–racial/ethnic groups have increased over time among those with at least a bachelor's degree compared with those without a high school diploma or general education development (GED) (i.e., relative disparity ratios in 1974 for the four groups begin between 1.0 and 1.9; by 2014 those ratios are in the 3.2–3.9 range). This indicates a steeper rate of decline in smoking among the most highly educated compared with the least educated. Levy and colleagues[39] report, however, that between 1992 and 2002, the rate of smoking decline among women was greater for those without a high school education than for women with

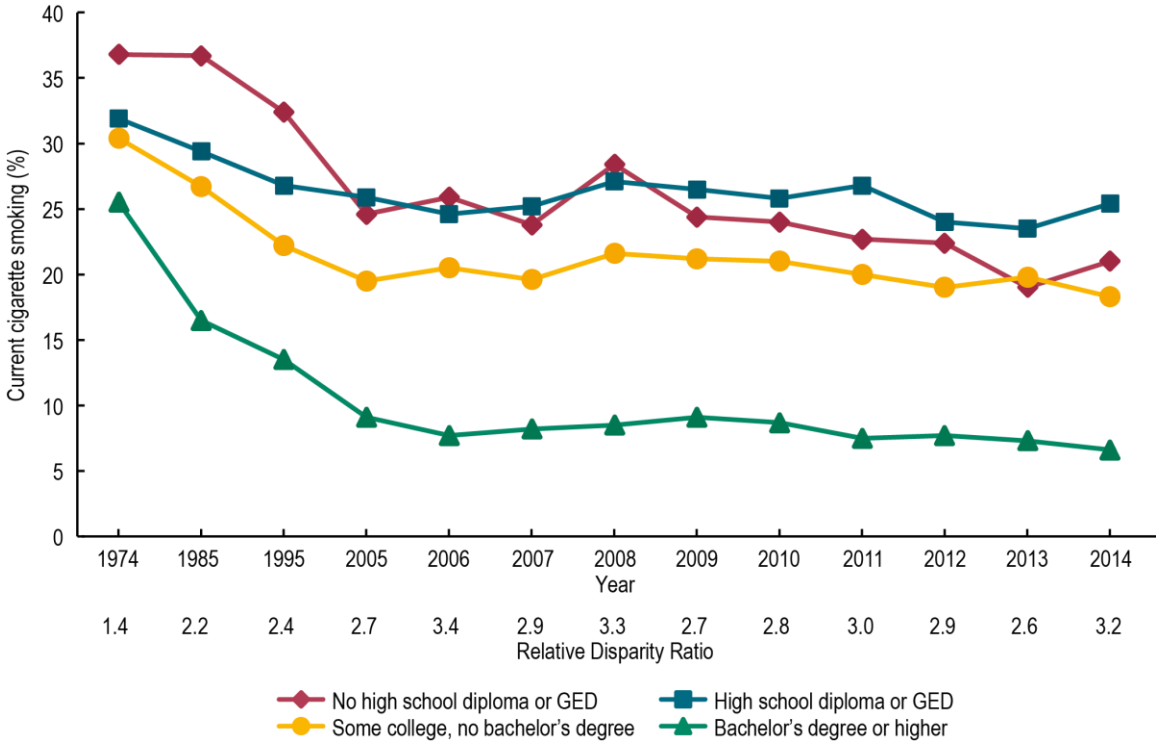
higher educational attainment. These findings might differ from those presented in the following figures because Levy and colleagues present estimates for all race/ethnicity groups combined (including white, black, Asian/Pacific Islander, Hispanic, and other), whereas the current analysis stratifies the data by white versus black/African American using data from a different time period.[39] Pampel[40] reports substantial declines in smoking among Hispanics with less education, for example, which may affect overall estimates.

Figure 9.1 Current Cigarette Smoking Among Black or African American Women, by Educational Attainment, Selected Years, 1974–2014



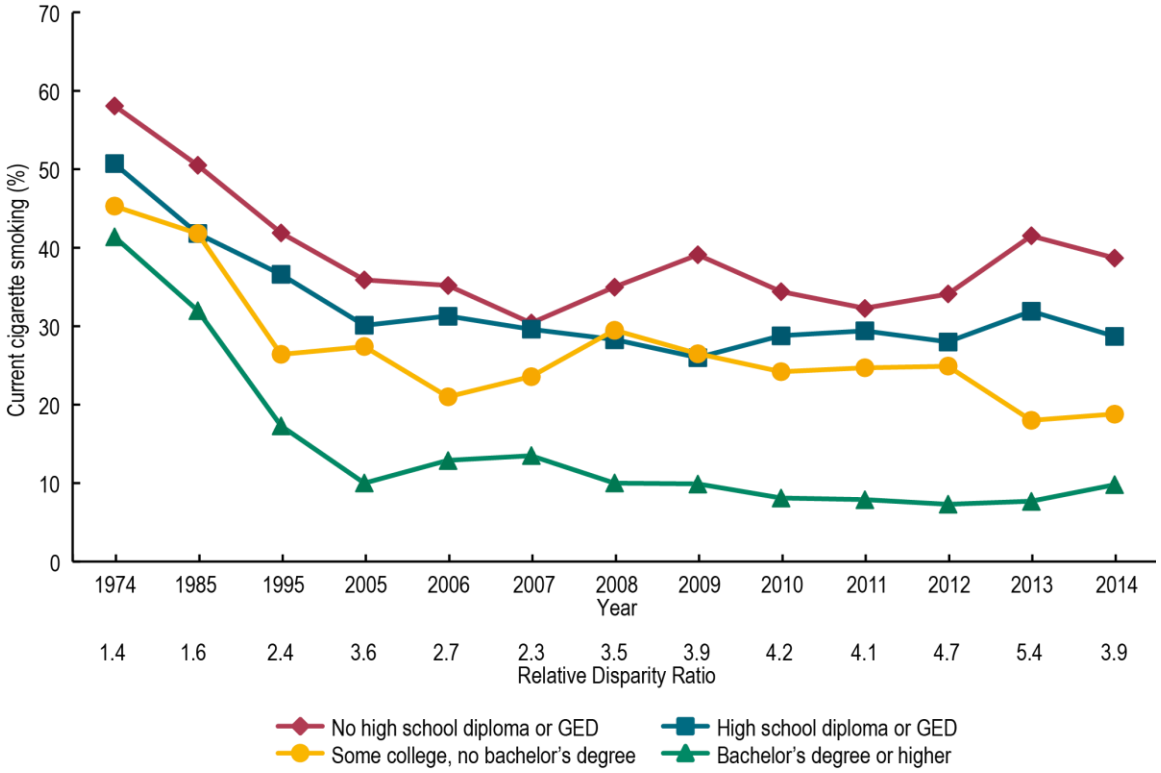
Notes: Includes people of Hispanic and non-Hispanic origin. Data prior to 1997 are not strictly comparable with data for later years due to the 1997 questionnaire redesign. See Appendix I, National Health Interview Survey. Estimates are age-adjusted to the year 2000 standard population using four age groups: 25–34 years, 35–44 years, 45–64 years, and 65 years and over. The following estimates have large standard errors (20–30% relative standard error) and are not considered reliable: bachelor's degree or higher in 1974, 2005, and 2010. Relative disparity ratios were calculated by dividing number with high school diplomas or GEDs by number with bachelor's degree or higher.
Source: Data were obtained from Centers for Disease Control and Prevention 2015 [Table 48],[145] based on National Health Interview Survey data.

Figure 9.2 Current Cigarette Smoking Among White Women, by Educational Attainment, Selected Years, 1974–2014



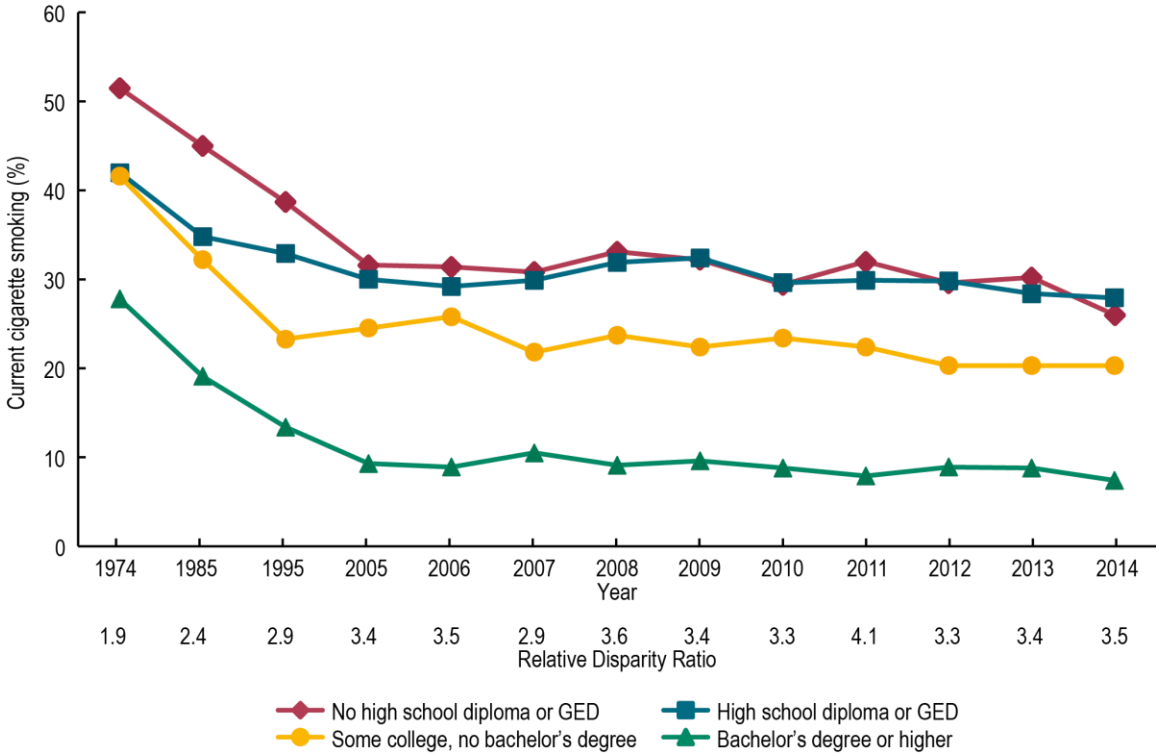
Notes: Includes people of Hispanic and non-Hispanic origin. GED = general education development. Data prior to 1997 are not strictly comparable with data for later years due to the 1997 questionnaire redesign. See Appendix I, National Health Interview Survey. Estimates are age-adjusted to the year 2000 standard population using four age groups: 25–34 years, 35–44 years, 45–64 years, and 65 years and over. Relative disparity ratios were calculated by dividing number with high school diplomas or GEDs by number with bachelor's degree or higher.
Source: Data were obtained from Centers for Disease Control and Prevention 2015 [Table 48],[145] based on National Health Interview Survey data.

Figure 9.3 Current Cigarette Smoking Among Black or African American Men, by Educational Attainment, Selected Years, 1974–2014



Notes: Estimates are age-adjusted to the year 2000 standard population using four age groups: 25–34 years, 35–44 years, 45–64 years, and 65 years and over. GED = general education development. The following estimates for black women and men have large standard errors (20–30% relative standard error) and are not considered reliable: high school diploma or GED in 1974; some college, no bachelor's degree in 1974; bachelor's degree or higher in 1974, 1985, 1995, 2002, 2003, 2007, 2008, and 2012. Relative disparity ratios were calculated by dividing number with high school diplomas or GEDs by number with bachelor's degree or higher.
Source: Data were obtained from Centers for Disease Control and Prevention 2015 [Table 48],[145] based on National Health Interview Survey data.

Figure 9.4 Current Cigarette Smoking Among White Men, by Educational Attainment, Selected Years, 1974–2014



Notes: Includes people of Hispanic and non-Hispanic origin. GED = general education development. Estimates are age-adjusted to the year 2000 standard population using four age groups: 25–34 years, 35–44 years, 45–64 years, and 65 years and over. Data prior to 1997 are not strictly comparable with data for later years due to the 1997 questionnaire redesign. See Appendix I, National Health Interview Survey. Relative disparity ratios were calculated by dividing number with high school diplomas or GEDs by number with bachelor's degree or higher.
Source: Data were obtained from Centers for Disease Control and Prevention 2015 [Table 48],[145] based on National Health Interview Survey data.

SES measurement has important implications for conclusions regarding the nature and extent of socioeconomic, and especially racial/ethnic, disparities in health.[7,8,41–43] Indicators of SES (e.g., educational attainment, income, occupational status, wealth) are not interchangeable, reflecting the multidimensional nature of the construct. Further, evidence demonstrates the different associations between SES and health—and between race/ethnicity and health—when different SES measures are used in analyses.[7,41] To illustrate, wealth refers to total financial resources amassed over a lifetime, versus income, which refers to the capital obtained during a specified period of time (e.g., annual earnings in dollars).[7,44,45] Wealth can buffer the effects of temporary low income, as in the event of illness or unemployment, and compared with income, wealth can better reflect long-term family resources and, hence, the resources available across an individual's lifetime. Wealth might be particularly important to understanding racial/ethnic disparities in health because differences in wealth by racial/ethnic group are far greater than the corresponding differences in income.

In addition, standard SES measures are often quite limited and might not always fully capture relevant aspects of the construct. For example, educational attainment reflected in credentials earned does not take into account the quality of the education attained, and there is debate as to whether education should be measured as years of schooling or credentials earned.[9] In addition, studies often combine individuals with less than 9 years of education and those with 9–11 years, although the former group has

much lower rates of smoking compared with the latter group.[46] Wealth data are also difficult to collect; the topic is considered sensitive, the collection of reliable information is laborious, and the values of assets and debts vary over time and may require professional appraisal.[44]

It is also important to take both levels and time into account when considering measurement of SES. Individual-, household- or family-, and neighborhood-level SES could each independently contribute to TRHD. Independent of an individual's SES, residence in low-SES neighborhoods, typically measured at the level of census tracts, is thought to influence health through the decreased availability of health-promoting goods and services and/or increased exposure to health-damaging residential environments (e.g., crime, noise, delinquency, tobacco and alcohol advertising and availability). In addition, normative values and behaviors, psychological stress, social cohesion among neighbors, and access to information can vary according to neighborhood deprivation and can influence the health of all residents.[47–49] The point in the life course when SES is measured (e.g., at birth, adolescence, or adulthood) may also matter. For example, parental SES during early childhood could theoretically affect the likelihood of smoking initiation among adolescents[13] and continuation of smoking during adulthood, independent of the adult's own SES.

In this chapter, multiple socioeconomic factors will be examined in relation to the tobacco use continuum, with a particular focus on the intersections between SES and race/ethnicity. Throughout this monograph, race/ethnicity is conceptualized as a social construct that reflects differences in social environments shaped by the economic and historical experiences of groups.[50,51] The distribution of socioeconomic factors such as education, income, and wealth differs substantially by race/ethnicity in the United States[43]; it is therefore critical to consider race/ethnicity and SES jointly when examining the tobacco use continuum. Given the high prevalence of tobacco use among lesbian, gay, bisexual, and transgender (LGBT) populations[52,53] and advertising by the tobacco industry targeted to them, LGBT groups were examined in relation to the tobacco use continuum if the data were further classified by SES.

Notwithstanding issues of residual confounding by SES (i.e., the inability to measure SES perfectly),[42] it is important to note that racial/ethnic TRHD cannot be reduced to SES differences alone. This is particularly relevant for current smoking because whites smoke at higher rates than most other racial/ethnic groups, except the American Indian/Alaska Native aggregate group, despite the overall socioeconomic advantage of whites compared with most other groups.[54] In addition to SES, the experiences of racism at all levels, including internalized, interpersonal, and institutional,[55] must be considered. Racism, although related to socioeconomic disparities among racial/ethnic groups (e.g., residential segregation—one form of institutional racism—influences socioeconomic attainment through the availability of high-quality education and employment opportunities) is covered in chapter 5.

Literature Search Strategy

This chapter presents a literature review on socioeconomic factors that may contribute to TRHD. Five primary socioeconomic factors were examined: (1) educational attainment, (2) income, (3) wealth, (4) neighborhood SES, and (5) life-course measures of SES. Each factor was examined across the tobacco use continuum—smoking initiation; current smoking; intensity, frequency, and duration of smoking; quitting and cessation; treatment; SHS exposure; and tobacco-related cancer morbidity and mortality. Each primary SES factor was used as a search term and combined with each tobacco use continuum indicator. Studies that examined relationships overall as well as within racial/ethnic groups were also included. Occupational status is not included as an SES indicator because the topic is discussed in chapter 8.

The search was limited to studies published between 2000 and 2011 and those using data from the United States only. For studies of neighborhood SES, the search was limited to multilevel studies using individual measures of tobacco-related outcomes (that is, ecological studies were not included).

The literature search was conducted in the PubMed, Web of Science, EconLit, and PsychInfo databases. The same search terms were used to search all databases, and multiple search terms were used for socioeconomic factors and stages on the tobacco use continuum. When searches yielded many results, more specific fields were used. After a database search was complete, all search results were merged, and duplicates, irrelevant articles, and abstract-only publications were removed. Studies such as the following were excluded: those identified in the income search that were conducted in a low-income sample but did not investigate income as an independent variable; studies identified in the neighborhood-SES search by the word *community* because they were community-based intervention trials; and studies examining neighborhood characteristics other than SES (e.g., neighborhood disorder, collective efficacy, built/physical environment).

In addition to studies identified by the initial search, studies were included that had been reviewed by Fagan and colleagues[56] or Schapp and Kunst[57] and were published (1) between 2000 and 2011 or (2) before 2001 and explicitly examined socioeconomic disparities in tobacco-related outcomes by race/ethnicity. Reference lists in articles identified by the initial search were also examined. The literature was also searched for articles that explicitly examined SES factors among LGBT populations in relation to the tobacco use continuum.

To supplement the literature review, data from the 2010 NHIS Cancer Control Supplement (CCS) were analyzed in terms of variables on the tobacco use continuum by educational attainment and income (based on federal poverty levels [FPL]) for non-Hispanic black, Hispanic/Latino, and non-Hispanic white adults. Tobacco use continuum variables included age of initiation, current smoking (smoked every day or some days), number of cigarettes smoked per day, quit attempts, years quit, use of cessation treatments, SHS exposure, and smoking-related cancer diagnosis. The sample included 27,157 respondents ages 25–64 years, of which 10,884 were ever-smokers, 5,147 were current smokers, 5,737 were former smokers, 16,083 were never-smokers, and 3,326 were current smokers who had made a quit attempt in the past year. Data on the 3,326 current smokers who had made a quit attempt were combined with data on former smokers for the cessation treatment analysis. The sample also included 7,529 respondents age 60 and older. Educational attainment was divided into four groups (less than high school, high school graduate or GED, some college, college graduate). Using the imputed income files provided by the National Center for Health Statistics for NHIS respondents with missing income data, income was defined as the ratio of total family income to the Federal poverty threshold

(<100%, 100% to <200%, 200% to <400%, and ≥400%). Prevalences that were adjusted to the age distributions from the 2000 Census were estimated using SUDAAN (version 10.0.1); means of tobacco use variables among adults ages 25–64 years and, for tobacco-related cancers, adults 60 and older were also estimated. (Results of these analyses are discussed in a subsequent section and presented in Table 9.1.)

Educational Attainment and TRHD

The initial literature search identified 36 articles that examined associations between educational attainment and the tobacco use continuum and 4 studies that examined associations between education and tobacco outcomes within LGBT populations. Fourteen studies (2000–2011) that were not identified in the initial search were also included. Because an extensive literature exists on current smoking, this review is organized into nationally representative studies of adults, non-nationally representative studies of adults, studies of tobacco outcomes during pregnancy and the post-partum period, studies of adolescents, and studies that stratified by race/ethnicity or LGBT identification.

Education and Smoking Initiation

Three studies demonstrated associations between lower education and higher prevalence/younger age of smoking initiation. One study reported that years of education were significantly correlated with smoking initiation measured as an affirmative response to the question "Have you smoked at least 100 cigarettes in your life?" with a higher prevalence of smoking initiation among those with fewer years of education.[58] Kandel[59] found that the age of smoking initiation increased as education level increased, from 14.9 years among those with less than a high school education to 16.2 years for college graduates. In a 1-year follow-up study of Houston-area students, Gritz and colleagues[60] found that having at least one parent with at least a high school diploma was protective against starting smoking among white students (odds ratio [OR] 0.48; 90% confidence interval [CI] 0.27–0.84) but was associated with higher odds of starting smoking among African American students (OR 2.12; 90% CI 1.18–3.84).

Education and Current Smoking Among Adolescents

Several studies examined associations between parental education and adolescent current smoking. Among 1,250 adolescents ages 12 to 17 in the 1993 Massachusetts Tobacco Survey (a probability sample of Massachusetts households), Soteriades and DiFranza[61] found that each decrease in the education level of a parent was associated with 31% higher odds of adolescent smoking. Education levels were categorized as some college, high school graduate, and not a high school graduate; bachelor's degree or higher was the reference category. This association was only attenuated by 10% when parental smoking was taken into account.

In addition, data from the Monitoring the Future (MTF) study—a national survey of about 50,000 students—indicate an approximately inverse gradient between parental education and prevalence of smoking in the past 30 days among 8th-, 10th-, and 12th-graders in 2011.[62] Parental education (an average score of mother's and father's education) was divided into categories ranging from completed grade school or less to graduate or professional school after college. For example, among 10th-graders with parents in the lowest education category, 14.6% reported having used cigarettes in the past 30 days compared with 16.2%, 12.7%, 8.6%, and 8.0%, respectively, for 10th-graders with parents in the increasingly higher education categories.[62]

Conversely, in a prospective study of 1,004 5th-, 8th-, and 12th-graders from Houston area schools who were followed for 1 year, Gritz and colleagues[60] found that the prevalence of ever smoking was slightly, but not significantly, higher at baseline for students whose parents had less than a high school education (23%) compared with students whose parents had a high school education (20%). Cubbin and colleagues[63] found no associations between parental education (<9th grade/some high school, high school graduate/GED, some college, college graduate) and smoking within the last 30 days among adolescents ages 12 to 17 years in the Youth Assets Study.

Unger and colleagues[64] examined associations between various indicators of SES and having ever tried smoking among 1,847 8th-grade students in Los Angeles. Four measures of SES (ZIP code, median household income, parental education, and rooms per person) were combined into a summary score. Higher SES was associated with lower odds of lifetime smoking.

Finally, data from the National Survey on Drug Use and Health (NSDUH) show that among youth ages 12–17, those who had dropped out of high school were more likely to be current smokers (45.7% in 2006-2008; 46.4% in 2009-2010) than youth who remained in school, regardless of their grade level.[65]

Education and Current Smoking Among Adults (Nationally Representative Data)

Studies using nationally representative samples of the U.S. population include the NHIS, the Behavioral Risk Factor Surveillance System (BRFSS), the Tobacco Use Supplement to the Current Population Survey (TUS-CPS), the Midlife Development in the United States (MIDUS) survey, and the Health Information National Trends Survey (HINTS). Studies using these nationally representative samples reported a strong educational gradient in current smoking.[11,40,56,59,66–73] In the 2000 NHIS data, for example, 36.7% of respondents with less than a high school education reported smoking compared with 31.9% of those with a high school diploma and 24.2% of those with some college or an associate's degree; individuals with a GED had the highest rates of smoking (53.1%).[66] A college degree, in particular, was protective against current smoking compared to having a high school degree or some college.[11,59,66,74] For example, individuals with a college degree or higher had the lowest rates of current smoking (12.5%) in the 2000 NHIS.[66]

Several other studies have also documented an inverse association between years of education and the probability of current smoking.[40,68,69,71,73] Using data from the 1992-1993 TUS-CPS, Hersch reported that years of education were associated with decreased probability of smoking, but these associations were stronger among people with high incomes (top quartile, >$54,000) than those with middle and low incomes (bottom quartile, <$17,400).[72]

Lawrence and colleagues[75] reported that young adults not currently enrolled in school were more than twice as likely to report current and daily smoking compared with those currently enrolled in school.

Kandel and colleagues,[59] using data from the 2006 National Survey of Drug Use and Health, the National Longitudinal Survey of Adolescent Health (NLSAH) (Wave III, 2001-2002), and the 2005-2006 National Health and Nutrition Examination Survey (NHANES), reported that women with less than a high school education were less likely than all other education groups to have ever smoked, but women in this category who smoked were most likely to smoke currently and persistently.[59]

Education and Current Smoking Among Adults (Non-Nationally Representative Data)

Research using non-nationally representative populations also demonstrates a strong inverse gradient in the prevalence of current smoking from lowest to highest educational attainment.[60,61,76–80] Several of these studies also demonstrated markedly lower prevalence of smoking among the college educated compared with all other groups.[77,78,81] One study of 1,699 individuals in six Chicago neighborhoods (the Sinai Health System's Improving Community Health survey, 2002-2003) demonstrated that the educational gradient in smoking differed by neighborhood in Chicago, with some neighborhoods having a strong inverse gradient and others having no gradient or a positive gradient (i.e., a lower prevalence of smoking among individuals with lower educational attainment),[76] suggesting that neighborhood characteristics are also important to consider.

Education and Current Smoking During Pregnancy

Using data on 4,911 pregnancies in the National Longitudinal Survey of Youth between 1983 and 2004, Kandel and colleagues[59] found that 45.0% of women with less than a high school education smoked during pregnancy, compared with 34.1% of high school graduates, 17.4% of those with some college education, and 5.1% of college graduates. Kahn and colleagues[21] examined predictors of smoking during pregnancy in a national cohort study of pregnancy outcomes, the 1988 National Maternal and Infant Health Survey (NMIHS, n = 9,953). This study also demonstrated a strong educational gradient, with odds ratios for smoking during the 12 months prior to delivery increasing from 2.1 (95% CI 1.6–2.8) for women with some college education (compared to college graduates), to 3.2 (95% CI 2.5–4.2) for women with 12 years of education, to 4.1 (95% CI 3.0–5.6) for women with less than 12 years. Finally, using data from the Pregnancy Risk Assessment Monitoring System (PRAMS), Tong and colleagues[82] found that women who reported smoking before or during pregnancy or after delivery were more likely to have 12 or fewer years of education (24.9% vs. 16.9%) than non-smoking women.

Education and Current Smoking, by Race/Ethnicity

Eight studies examined whether associations between education and current smoking differed by race/ethnicity.[40,64,66,73,77,79,83,84] Using 2000 NHIS data, Barbeau and colleagues[66] reported that the education gradient in smoking was strongest among whites, followed by blacks, but was less evident in Hispanic and Asian subgroups; Malmstadt[77] reported similar findings from the Wisconsin BRFSS. Kimbro and colleagues[84] used data from the 2000–2006 NHIS to determine how the relationship between education and current smoking differs by race and nativity. Gradients were less steep among foreign-born compared to U.S.-born non-Hispanic blacks, Hispanics, and Asians.[84] In an analysis of trends in educational disparities in smoking using NHIS data from 1976 to 2006, Pampel[40] found that educational disparities in smoking prevalence have narrowed over time among Hispanics; the author suggests this is due to the influx of Hispanic immigrants with low levels of both smoking and education. In contrast, the study found that educational disparities in smoking among whites and blacks have not narrowed over time.[40]

Based on 2000–2008 NHIS data, Stoddard and Adler[73] reported that years of completed schooling were associated with reduced odds of smoking, but this association was weaker among foreign-born Hispanics compared with U.S.-born Hispanics; the association between education and smoking did not differ by nativity for Asians. In addition to nativity, the authors found that years of education were more strongly associated with reduced odds of smoking based on age at immigration. The association for Hispanics who immigrated to the United States when younger than 15 years of age was stronger

compared with those who immigrated after age 15. While nativity had no effect on the education and smoking association for Asian immigrants, this group showed a similar pattern to Hispanic populations in terms of age at immigration. However, three studies reported no difference in the educational gradient by race/ethnicity.[64,79,83]

Education and Current Smoking Among LGBT Populations

Four studies were identified that examined the association between education and current smoking among LGBT populations or that compared education gradients in smoking between LGBT and heterosexual populations.[52,53,85,86] Greenwood and colleagues[52] compared data from the Gay Men's Tobacco Study, a cross-sectional survey conducted in 1999, on 1,780 men who have sex with men (MSM) to 1999 NHIS data on men in the general population of similar age and geographic residence. At all levels of education, MSM had a higher prevalence of smoking than men overall in the NHIS, and a strong inverse gradient in prevalence from low to high education was observed. Approximately 39% of MSM with less than a college education were current smokers, compared with 31% of those with a college degree and 23% of those with an advanced degree.[52]

Hughes and colleagues[85] investigated correlates of current smoking among lesbian (n = 550) and heterosexual (n = 279) women from Chicago, New York City, and Minneapolis/St. Paul, Minnesota. An inverse educational gradient in current smoking prevalence was seen among both groups. Thirty-nine percent of lesbian women with a high school education or less were current smokers compared with 20% of women with a bachelor's degree or some college and 11% of women with an advanced degree. Heterosexual women with a high school education or less were more likely to be current smokers (43%) than lesbian women (39%) with the same education, but heterosexual women with an advanced degree were less likely to smoke (7%) than lesbians (11%).[85]

Tang and colleagues[53] used data from the 2001 California Health Interview Survey to examine sociodemographic predictors of smoking among self-identified gay males (n = 593), bisexual males (n = 282), lesbian females (n = 343), and bisexual females (n = 511). The prevalence of smoking among lesbian and bisexual women without a college degree (36.6% and 32.1%, respectively) was higher than the prevalence among heterosexual women without a college degree (17.3%) and that of lesbian, bisexual, and heterosexual women with a college degree (14.6%, 18.8%, and 9.0%, respectively). A similar pattern was seen among gay men compared with heterosexual men, although the prevalence of smoking by education among bisexual men was similar to that of heterosexual men.[53]

Matthews and colleagues[86] explored predictors of current smoking among women identifying as lesbian, gay, or bisexual, or women who reported having sex with women (n = 171). Education (high school or less and some college, compared with a college or graduate degree) was not significantly associated with smoking.

Education and Current Smoking: Efforts to Estimate Causal Association

Several authors have sought to determine whether the well-documented association between educational attainment and smoking is causal or due to unobservable (i.e., confounding) factors associated with both education and smoking. Three of these studies used the Vietnam War draft as an instrumental variable for college attendance.[11,69,71] Studies using data from the 1978–2000 NHIS,[11] the 1983–1995 NHIS,[69] and the 1992–2000 TUS-CPS[71] found evidence suggestive of a causal association between college attendance and reduced smoking. Gilman and colleagues[87] compared the sibling offspring of women

in the National Collaborative Perinatal Project (NCPP) born between 1959 and 1966 (n = 1,311) with different levels of education to adjust for the effects of familial vulnerabilities to smoking; these researchers also found evidence suggestive of a causal association between education and smoking. In contrast, Tenn and colleagues[88] did not find evidence of a causal effect of each additional year of education on current smoking using data from the TUS-CPS; they concluded that the strong relationship between education and smoking is likely due to other unobserved factors correlated with both variables.

Education and Intensity, Frequency, and Duration of Smoking

Eight studies examined educational attainment and patterns of smoking; of these, all but one[58] reported that individuals with lower levels of education smoked more heavily, more frequently, or for a longer duration.[59,72,78,87,89–91] A cross-sectional survey of 2,641 ever-smokers found that college graduates had higher odds of being intermittent rather than daily smokers compared with those with less than a high school education.[89] Gilman and colleagues[87] reported that individuals with less than a high school education smoked approximately 50% more pack-years than those with college degrees, even after adjusting for multiple childhood factors; however, this association was attenuated after controlling for sibling fixed effects, which controlled for familial vulnerability to smoking. Hersch[72] reported that years of education were inversely correlated with the number of cigarettes smoked per day, and this correlation was stronger among those with high incomes compared with those with middle and low incomes.

Kandel and colleagues[59] measured the prevalence of having ever smoked daily, number of cigarettes smoked per day, nicotine dependence (a binary variable created from the continuous Nicotine Dependence Syndrome Scale), and concentrations of cotinine per cigarette smoked among women across educational categories (less than high school, high school graduate, some college, and college graduate). All measures exhibited an inverse educational gradient, women with lower educational attainment being the heaviest and most dependent smokers. In adjusted analyses, people in the higher educational groups had lower odds of nicotine dependence than those with less than a high school education. Among pregnant women, the percentage of those smoking a pack of cigarettes or more per day decreased across education levels, from 13.6% among women with less than a high school education to 7.6% among women with a high school education, 3.6% among women with some college, and 0.3% among women with a college education.[59]

Solberg and colleagues[78] also reported that people with a high school education or less had a higher prevalence of daily smoking, smoking at least two packs of cigarettes per day, and smoking within 5 minutes of waking, compared with those who had 2 or 4 or more years of college. Siahpush and colleagues[91] analyzed data from the 2003, 2006, and 2007 TUS-CPS (n = 117,168) using survival analysis to predict the duration of smoking (in years). Individuals with less than a high school education smoked for approximately 50% longer than those with at least a bachelor's degree, whereas those with a high school diploma or some college education smoked for approximately 30% longer than those with at least a bachelor's degree.[91] McCaffery and colleagues,[58] on the other hand, found no association between education and nicotine dependence (measured using the Mental Health Diagnostic Interview Schedule, Version III, Revised).

A cross-sectional study of 3,360 Mexican American and non-Hispanic white adolescents 12 to 21 years old compared mean number of cigarettes smoked per day among high school dropouts, academically

at-risk students, or students with significantly lower grade point averages than controls, and in-school controls, and found that the association between education and the number of cigarettes differed by ethnicity. In both groups, dropouts smoked the highest mean number of cigarettes, followed by at-risk students and then controls. However, means were higher across all categories of education, and differences among categories were larger among non-Hispanic whites than Mexican American youths.[90]

Education and Quitting/Cessation

Many studies have documented a strong positive gradient from lowest to highest education in the percentage of former smokers or the probability of success in quitting. These include both studies using nationally representative data[11,59,66,68–71,74] and studies using data from special populations.[34,59,79,81,87,92–96] Again, a college education appeared to be strongly associated with the increased probability of quitting successfully.[11,56,69,81]

Gilman and colleagues[87] reported that those with less than a high school education had lower adjusted rates of short- and long-term quit attempts and lower adjusted odds of cessation compared with college graduates; this finding was, however, attenuated in sibling fixed-effects models. Barbeau and colleagues[66] also found no educational gradient in quit attempts but reported that the prevalence of former smokers increased across the educational gradient; this association was true overall and among all racial/ethnic groups.

Watson and colleagues[79] found that vocational/some college and college/post-college education were associated with higher odds of being a former smoker compared with high school or less education; this finding did not differ by race/ethnicity. Data from the 2003, 2006, and 2007 TUS-CPS showed that the prevalence of quitting was positively associated with educational attainment: Only 42.5% of ever-smokers with less than a high school education were former smokers, compared with 74.1% of those with a bachelor's degree or higher.[91]

Piper and colleagues[93] assessed differences in cessation rates and treatment response by education among participants in two smoking cessation trials evaluating quit aids in Wisconsin (n = 2,850). They reported an educational gradient (less than high school, high school, and greater than high school) in initial cessation and 8-week abstinence. After 6 months, there was no difference in abstinence between those with a high school or greater than high school education, but those with less than a high school education were still least likely to be abstinent. In another study, individuals in an outpatient smoking cessation program who had a bachelor's degree or higher had a statistically significant 81% increase in odds of remaining abstinent at a 4-week follow-up, compared to individuals with a high school education, GED, or less.[92] Businelle and colleagues[34] also examined associations between an SES latent variable, including education, income, insurance status, and employment status, and cessation and found that SES was both directly and indirectly associated with cessation. The significant indirect pathways included neighborhood disadvantages, social support, negative affect/stress, and agency as mediators.

In one longitudinal study, students from 30 California and Oregon schools were recruited in grade 7 and followed up in grade 12 and at ages 23 and 29 years (n = 360).[94] Tucker and colleagues[94] examined the predictors of quit attempts and 6-month abstinence for individuals between the ages of 23 and 29 and found that higher education (a categorical variable from 1 to 11, not further described) was not associated with quitting after controlling for income and other demographic variables. Kendzor and colleagues[97] analyzed individual- and neighborhood-level socioeconomic determinants of remaining quit

for 26 weeks among 379 African American smokers in a smoking cessation intervention study. These authors found that educational attainment was *not* associated with abstinence after controlling for individual income and unemployment status. Solberg and colleagues[78] did not find a difference in quit attempts over a 12-month period by education (high school or less, 2-year college, and 4-year college) but reported that those with 2 or more years of college had a higher prevalence of reporting quitting or reducing smoking compared with those with only a high school education.

Education and Quitting/Cessation During Pregnancy

Several studies examined educational differences in smoking during pregnancy, demonstrating strong educational gradients. The first, a clinical trial (n = 316) focused on cessation in pregnant women,[81] found that among women who reported being smokers at the time they learned of their pregnancy, women with either 12 years or more than 12 years of education had higher odds of being abstinent upon entering prenatal care, at the end of pregnancy, and 24 weeks post-partum, compared with women with less than 12 years of education. This study also found that women with more than 12 years of education had the highest odds of being abstinent at each time point.

Using data on pregnant women from the 1998 NHIS supplement on pregnancy and smoking (n = 5,288), Yu and colleagues[96] found that pregnant women with less than 12 years of education who had attempted to quit smoking had approximately 12 times the odds of being an unsuccessful quitter compared with women who had 16 or more years of education; women with 12 to 15 years of education had higher odds (at least 4.5) of unsuccessful quitting than those who had a college education, while those with less than 12 years of education had the highest odds of unsuccessful quitting (12.1) compared to the highest education group.[96] Women with 12 years of education had 4.4 times the odds of being abstinent at the end of pregnancy if they smoked when entering prenatal care compared to women with less than 12 years of education, although women with more than 12 years of education did not differ significantly from those with less.[81] Educational gradients in the odds of quitting during pregnancy and relapsing post-partum were also seen in the data from the NMIHS.[21]

Data from PRAMS also show the inverse relationship between education and smoking. Among women who quit smoking during pregnancy, 46.8% had more than 12 years of education, 37.2% had 12 years, and 16% had less than 12 years of education.[82] Businelle and colleagues[35] examined multiple mechanistic models explaining the relationship between SES and post-partum smoking relapse among 251 women in a randomized trial. This study found that SES influenced post-partum relapse via increased post-partum negative affect/stress, reduced sense of agency or self-efficacy, and increased cravings, with cravings identified as being a proximal determinant of relapse.[35]

Education and Quitting/Cessation Among LGBT Populations

Burkhalter and colleagues[98] examined predictors of intention to quit among 101 LGBT individuals recruited from an LGBT community center in Manhattan in 2005. There were no differences in intention to quit between LGBT respondents with a high school education or less compared with those with more than a high school education. Comparing proportions of current and former smokers to provide estimates of cessation, Greenwood and colleagues[52] found that education was significantly associated with current versus former smoking among urban MSM. A higher proportion of men without a college degree were current smokers (62%) compared with those with a college degree (55%) and those with an advanced degree (43%).[52]

Education and Cessation Treatment

Findings from three studies have documented educational differences in the use of some (but not all) treatment/cessation aids. Solberg and colleagues[78] found no educational differences in the reported use of nicotine replacement products, use of bupropion, or support from friends, books, or groups. However, a clear education gradient emerged in receiving advice from a physician to quit: 71% of those with some 4-year college experience reported being advised to quit compared with 61% of those with some 2-year college experience and 56% of those with a high school education or less. Piper and colleagues[93] reported an educational gradient in the success of quitting with bupropion after 6 months. The results of this trial also showed that those with less than a high school education benefited more from combination therapy for quitting compared to monotherapy. In a 3-year follow-up to the 1993 Massachusetts Tobacco Survey (n = 481), Honjo and colleagues[99] reported that educational attainment was positively associated with the use of resources such as printed materials, quitlines, nicotine replacement therapy, or quitting programs.

Education and Secondhand Smoke Exposure

Tong and colleagues[27] examined educational differences in exposure to SHS among 1,879 Chinese American and Korean American women in California in 2003, using self-reports of smoke-free policies at home and work and exposure to SHS at home and work. Although the study found no educational differences in smoke-free policies, a higher percentage of women with a high school education or less reported anyone smoking at home and exposure to SHS in the last 2 weeks in an indoor workplace, compared with women who had at least some post-high school education. The less-educated group of women also had a lower probability of setting the smoking policy in their home and had more household members who smoked.

Scarinci and colleagues[100] reported that among a community sample of black and white women who had never smoked (n = 416), those with a vocational education had the highest numbers of days per week of exposure to SHS, followed by those with a college education, those with a high school education, and finally, those with post-college education. There were no significant differences in these associations by race/ethnicity. Using data from the nationally representative Women's Determinants Study (n = 2,326 nonsmokers), Stamatakis and colleagues[25] reported that women who had 8 years of education or less or were high school graduates had the highest odds of exposure to SHS at home compared with those with at least a college degree, whereas those with some high school or some college were no different from those with a college degree. Some high school education or a high school diploma was associated with higher odds of SHS exposure at work compared with at least a college degree. Honjo and colleagues[99] also found that educational attainment in years was negatively associated with hours of SHS exposure at home and work as well as with the number of peers who smoke. Data from the 2007 National Survey of Children's Health (NSCH) (n = 90,853) showed that the adjusted prevalence of exposure to SHS inside the home for children younger than 18 was 16.4% in households where the highest education was less than 12 years; where it was 12 years, 12.7%; 13–15 years, 9.1%; and at least 16 years, only 2.0%.[24]

Education and Cancer Morbidity and Mortality

Using data from the Multiethnic Cohort Study in California and Hawaii, Haiman and colleagues[101] found that both vocational training and attending some college were associated with decreased risk of lung cancer, compared with completing no more than 8 years of education. Using pooled data from 37 studies examining associations between education and oral cancer, Conway[102] calculated that low

education was associated with 1.85 times higher odds of oral cancer compared to high education. Clegg and colleagues[103] used the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) data matched to the National Longitudinal Mortality Study (NLMS) to estimate age-adjusted incidence rates for lung cancer and found a strong inverse educational gradient (from 11 years or less, 12 years, 13–15 years, and 16 or more years) among both men and women.

Siegel and colleagues[104] estimated age-adjusted lung cancer death rates (ages 25–64 years) by educational attainment and race/ethnicity. Across all racial/ethnic groups, lower educational attainment (≤12 years and 13–15 years) was associated with higher cancer death rates compared with 16 or more years of education. Non-Hispanic African American men with 12 years of education or less had the highest death rates, followed by non-Hispanic white men with 12 years of education or less. The inverse gradient was more pronounced among men than women and among non-Hispanic African Americans and whites compared with Hispanics.

Steenland and colleagues[6] used data from two American Cancer Society cohort studies, each of which enrolled more than 1 million participants, to examine associations between education and mortality due to cancer and other causes: Cancer Prevention Study I (participants enrolled in 1959) and Cancer Prevention Study II (participants enrolled in 1982). These authors categorized educational attainment as grammar school, some high school, high school graduate, some college, and college graduate. They found that, for men in both cohorts, lung cancer death rates exhibited a gradient, with the highest rates among those with the lowest education. For women in the 1959 cohort, lung cancer death rates were similar across all educational levels, except that those with a college education had lower death rates than all other women. In the 1982 cohort, however, evidence of an educational gradient in lung cancer death rates emerged. In both men and women, those with some high school had higher death rates than those with only grammar school.[6] In another study using almost 1.5 million person-years of data from the NLMS cohort the authors also found higher mortality rates from lung cancer among those with less than a high school education compared with those with at least a high school diploma.[5] Additionally, a study examining the disparity in cancer incidence by composite SES score (which included an education index) according to racial/ethnic group for five major cancer sites found that lung cancer incidence increased with lower SES, except among Hispanics, who showed an inverse effect of SES.[105] In another study, which included a group area-level SES index (including an education variable) using data from the 2000 U.S. Census to estimate total cancer mortality, including mortality from lung cancer, cancer mortality was found to be 77% higher in the lowest SES areas compared with the highest.[106]

Education: Analyses of 2010 NHIS Cancer Control Supplement Data

Data from the 2010 NHIS Cancer Control Supplement (CCS) were analyzed to augment the literature review. Table 9.1 presents age-adjusted prevalence and means for behaviors on the tobacco use continuum, stratified by educational attainment, for the three largest racial/ethnic groups in the United States. Several patterns can be seen in these data. Compared with blacks and Hispanics, whites have the highest rates of current smoking, begin smoking at a younger age, and smoke the most cigarettes per day; stepwise education gradients in the expected direction were also generally found among all groups with few exceptions. In contrast, quit attempts are highest among blacks, but no clear educational gradient was evident. For whites, quit attempts increased with increased education, but for Hispanic/Latino adults, quit attempts decreased with increased education. Among former smokers, it appears that a threshold exists for number of years quit. For each racial/ethnic group, college graduates reported the highest number of years quit; mean years quit were roughly similar for respondents at all

other education levels. Among nonsmokers, blacks and whites reported more smoking inside the home than Hispanics/Latinos, and a clear gradient by education was seen in these two groups, whereas no education gradient was seen among Hispanics. No clear pattern by education was found for the use of any type of cessation treatment for any quit attempt, whether successful or not, or for smoking-related cancer among those age 60 and older. However, differential mortality by SES may have impacted the education-cancer relationship.

Table 9.1 Age-Adjusted Percentages and Means for Indicators on the Tobacco Use Continuum Among Adults, by Educational Attainment and Race/Ethnicity, 2010

Category	Black (non-Hispanic) (n = 3,103)	Hispanic/Latino (n = 3,861)	White (non-Hispanic) (n = 10,320)
Current smokers (%)			
<High school	38.0	15.0	52.7
High school graduate	28.9	16.9	38.4
Some college	22.5	13.6	28.7
College graduate	8.0	9.2	10.3
Age of initiation among ever-smokers (mean)			
<High school	18.1	17.4	16.0
High school graduate	19.2	18.8	17.0
Some college	19.6	18.9	17.7
College graduate	20.3	19.0	18.4
Number of cigarettes per day among current smokers (mean)			
<High school	11.0	7.9	18.4
High school graduate	9.9	8.6	15.1
Some college	8.8	7.4	14.2
College graduate	7.6	5.8	10.3
Quit attempt in past year among current smokers (%)			
<High school	56.0	52.4	36.6
High school graduate	54.7	50.2	43.1
Some college	57.5	49.6	48.6
College graduate	50.7	36.4	49.9
Years quit among former smokers (mean)			
<High school	8.6	10.9	10.2
High school graduate	9.0	11.1	10.2
Some college	8.1	10.5	10.7
College graduate	11.6	11.8	12.0

Table 9.1 continued

Category	Black (non-Hispanic) (n = 3,103)	Hispanic/Latino (n = 3,861)	White (non-Hispanic) (n = 10,320)
Use of any type of treatment* during any quit attempt, among current smokers with a quit attempt in the past year and former smokers who had ever used cessation treatment (%)			
<High school	22.0	15.0	41.6
High school graduate	17.3	19.4	35.4
Some college	27.1	19.5	39.0
College graduate	32.1	†	37.9
Smoking reported inside the home by nonsmokers (%)			
<High school	29.6	6.0	35.0
High school graduate	20.8	5.1	23.0
Some college	17.5	6.5	15.2
College graduate	4.9	2.1	4.6
Ever diagnosed with a smoking-related cancer, age 60 and over (%)‡			
<High school	1.7	1.3	3.2
High school graduate	2.4	1.1	2.9
Some college	3.9	5.8	3.3
College graduate	1.4	1.2	2.4

Notes: Participants in this study were ages 25–64 (n = 17,284) or 65 and over (n = 7,067).
*Treatments included nicotine patch, gum, lozenge, nasal spray, or inhaler; prescription drugs varenicline (Chantix), bupropion (Zyban, Wellbutrin); telephone quitlines, one-on-one counseling, and cessation clinics, classes, or support groups.
†Not enough data to estimate.
‡Cancer sites include bladder, cervix, blood or bone marrow, lung, mouth/tongue/lip, throat/pharynx, kidney, stomach, pancreas, esophagus, and larynx/windpipe (adapted from Fagan et al. 2007[56]).
Source: Created using data from the National Health Interview Survey Cancer Control Supplement 2010.[144]

Income and TRHD

The initial literature search identified 29 articles examining associations between income and the tobacco use continuum. Additional studies identified after the initial search, including studies of associations between income and tobacco outcomes within LGBT populations, were also included.

Income and Smoking Initiation

Only one national study examined associations between income and smoking initiation. Using BRFSS data from 1994 through 2007, and focusing on young adults ages 18–30 and people ages 31–50, this study found that the probability that individuals in both groups would start smoking decreased with increasing income.[107] Among study participants age 51 or older, however, initiation was similar across income groups, except that the lowest income group was most likely to have started smoking.

Income and Current Smoking

The majority of studies examined associations between income and current smoking.[56,66,68,70,72,74,75,79,99,108,109] Most studies examined either household income in dollars or household income as a percentage of the federal poverty level (FPL), which takes into account the number of people in the household. Studies using both nationally representative data and non-nationally representative populations consistently reported that lower income was associated with a higher prevalence of smoking.

Income and Current Smoking Among Young Adults

Using nationally representative data from the 1998-1999 TUS-CPS, Lawrence and colleagues[75] reported that young adults ages 18–24 with a household income of less than $20,000 had higher odds of being daily smokers than young adults with higher household income. Fagan and colleagues[74] also found decreasing prevalence of smoking with increasing income (under $25,000; $25,000–$49,999; $50,000 or more) among adults ages 18 to 30 in the 2003 TUS-CPS (n = 7,912). Cubbin and colleagues[63] reported that adolescents ages 12 to 17 from households with incomes between 301% and 400% of the federal poverty line had lower odds of smoking within the last 30 days compared with adolescents from households with incomes 401% or more of the FPL; adolescents from poorer households did not differ significantly from the top income group.

Income and Current Smoking Among Adults (Nationally Representative Data)

Barbeau and colleagues,[66] using data from the 2000 NHIS, found a clear income gradient in rates of current smoking, with smoking prevalence of 34.7% for those living in poverty (<100% of the FPL), 34.2% for those near poverty (100–199% of the FPL), 31.4% for those in the middle-income group (200–299% of FPL), and 20.7% for those in the highest income group (≥300% of FPL). Data from the 1994-2004 NHIS[56] and the 2007-2008 NHIS[67] showed that the prevalence of smoking among individuals with household incomes below the FPL was approximately 10% higher than the prevalence of those with household incomes at or above poverty. Data from the 2008 BRFSS collected in 13 states[110] also documented an income gradient in cigarette smoking: 28.8% of those earning less than $15,000 per year were current smokers, in contrast to 16% among those earning $50,000–$74,999 and 12% among those earning more than $75,000 per year. Hersch[72] reported that annual family earnings are negatively correlated with the probability of smoking, and this association is stronger among low-income families (bottom quartile, <$17,400) compared to middle- and high-income families (top quartile, >$54,000). Two of these studies also demonstrated inverse associations between income and current smoking after adjusting for education and other sociodemographic variables.[66,72] In the nationally representative Health Information National Trends Survey, 54% of individuals with less than $35,000 in household income were current smokers, compared with 32% of those with $35,000–$74,999 per year and 14% of those with $75,000 or more.[70]

In contrast, Chapman and colleagues[68] reported that household income was not significantly associated with current smoking after adjusting for education, wealth, and personality factors among 2,429 adults in the 1995 Midlife Development in the United States survey.

Using data from the TUS-CPS (years 1998-1999 and 2001-2002; n = 13,480), Fagan and colleagues[109] found that among unemployed adults, current smoking prevalence decreased with increasing family income, from under $25,000 to $25,000–$49,999 to $50,000 or more; associations were robust after adjustment for education and other sociodemographic variables.

Income and Current Smoking Among Adults (Non-Nationally Representative Data)

Watson and colleagues[79] reported a nonlinear association between income and smoking among women. Women from households earning $20,000–$40,000 annually had higher odds of current smoking than those from households earning more than $40,000 (even after adjusting for education), but those in the lowest income households were not statistically different from those in the highest income households. Dell and colleagues[76] found lower prevalences of smoking among individuals with incomes above $30,000 compared with those with incomes at or below $30,000.

Honjo and colleagues[99] found that household income did not have a direct relationship with smoking. Rather, the association between income and smoking was mediated by the use of resources to quit smoking and by restrictive home environments (i.e., home smoking bans).

Income and Current Smoking During Pregnancy

Adams and colleagues[108] reported that pregnant women with annual family incomes under $16,000 had a higher prevalence of smoking during pregnancy than those with family incomes of $16,000 or more (PRAMS, 2002; n = 34,346). Tong and colleagues[82] reported similar findings using PRAMS data from 2000 to 2005. Yu and colleagues[96] also reported that pregnant women with incomes below the poverty level had higher odds of continuing to smoke (versus not smoking) compared with women who had incomes above the poverty level. The 1988 NMIHS data revealed that women with household incomes under $35,000 were more likely to smoke during pregnancy than women with incomes over $50,000 or more; odds ratios were as follows: for women with incomes under $10,000, OR was 1.9 (95% CI 1.4–2.7); for women with incomes of $10,000–19,000, OR was 1.6 (95% CI 1.1–2.1); and for women with incomes of $20,000–34,999, the OR was 1.5 (95% CI 1.1–2.0).[21]

Income and Current Smoking, by Race/Ethnicity

Barbeau and colleagues[66] reported that the income gradient was strongest among whites and was relatively strong among blacks. Among Hispanics, however, only the lowest income group had higher rates of smoking than the other groups; no gradient was evident among Asians. In their study of 715 women (43% black, 57% white) recruited from the community between 1994 and 1997, Watson and colleagues[79] did not find an interaction between race/ethnicity and income in relation to current smoking among women.

Data from the TUS-CPS show that across all racial/ethnic groups, smoking prevalence is higher among people with an annual family income of less than $25,000, but disparities remain by racial/ethnic group. For example, in 2010, among low-income adults, about 36% of American Indian/Alaska Natives reported current smoking, compared with 28% of non-Hispanic whites, 22% of non-Hispanic blacks, 13% of Hispanics, and 11% of Asian Americans.[111]

Income and Current Smoking Among LGBT Populations

Tang and colleagues[53] found that, among both male and female LGBT individuals, annual household incomes under $30,000 were associated with higher odds of smoking than were incomes of $80,000 or more. A cross-sectional survey of 580 young MSM (ages 13–29 years) from the New York City metropolitan area by Storholm and colleagues[112] found that perceived low family SES was associated with lower odds of current smoking (OR = 0.56; 95% CI 0.36–0.88) than middle family SES. In contrast, Matthews and colleagues[86] found that income was not associated with current smoking among lesbian and bisexual women.

Income and Intensity, Frequency, and Duration of Smoking

Five studies reported greater intensity of smoking among lower income smokers than higher income smokers. Ackerson and Viswanath[89] demonstrated increasing odds of being an intermittent versus a daily smoker as annual household income increased. Individuals with less than $20,000 in annual household income also had higher odds of being daily or heavy smokers compared with people with more income.[75] Monthly income was negatively correlated with cigarettes smoked per day among 263 black female participants in a randomized trial of a sexual health risk reduction program.[113] However, Hersch[72] reported that annual family earnings were not correlated with the number of cigarettes smoked per day except among high-income (top quartile) women. Siahpush and colleagues[91] reported that, compared to individuals at or above 300% of the FPL, those at or below 100% of the FPL smoked approximately 40% longer (in years), those at 100–200% of the FPL smoked almost 25% longer, and those between 200 and 300% of the FPL smoked about 12% longer.

Income and Quitting/Cessation

Income and Quitting/Cessation (Nationally Representative Data)

Four studies using nationally representative data sets reported positive associations between income and smoking cessation or the probability of being a former smoker. Binkley[107] found that the probability of quitting rose steadily with increasing household income; this gradient was steeper in middle and older age groups compared with younger smokers. Barbeau and colleagues[66] analyzed data from the 2000 NHIS and documented a strong income gradient in the prevalence of former smoking. They found that 13.3% of poor survey participants, 13.9% of near-poor participants, 16.0% of middle-income participants, and 22.3% of higher income participants were former smokers; the overall percentage of survey participants who were former smokers was 18.6%. Data from the 2003, 2006, and 2007 TUS-CPS also showed that the percentage of those who had quit increased with income in relation to the FPL.[91] Alternatively, and similar to their findings for current smoking, Chapman and colleagues[68] reported no association between income and former smoking after adjusting for education and wealth.

Income and Quitting/Cessation (Non-Nationally Representative Data)

Among young adult smokers ages 18–30, incomes between $25,000 and $49,999 were associated with lower odds of a serious intention to quit compared with those with higher incomes.[74] Unemployed individuals with family incomes under $25,000 also had lower odds of being former smokers or successful quitters compared with those with higher incomes.[109] Results from two longitudinal smoking trials—one following 424 participants for 2 years[114] and one following 6,603 participants for 13 years[115]—demonstrated that increasing household income was associated with higher odds and probability of quitting. Cui and colleagues[116] analyzed data from 1999 to 2002 on participants in a

smoking cessation program for veterans in Tennessee (n = 189) and found that veterans with annual incomes above $10,000 had a lower hazard of relapse than those in the lowest income group. One study reported no association between income and quitting among women,[79] and a study among young adults (ages 18–24) reported no association between income and being a former smoker.[75] Tucker and colleagues[94] found that household income adjusted for the number of persons supported was not associated with quit attempts or 6-month abstinence among adults ages 23–29. In their study of African American smokers in a smoking cessation intervention, Kendzor and colleagues[97] found that participants with $30,000 or more in annual household income had 2.4-times higher odds of staying quit for 26 weeks than those with incomes less than $10,000; however, this association was not significant after controlling for other individual-level measures of SES, such as unemployment.

Income and Quitting/Cessation During Pregnancy

Yu and colleagues[96] reported that pregnant women with incomes below the FPL had lower odds of initiating a quit attempt compared with women with incomes above the FPL, although the odds of quitting successfully did not differ by poverty level. Analyzing data from the NMIHS, Kahn and colleagues[21] found that women with less than $50,000 in total household income had lower, but not significantly different, odds of quitting for at least a week during pregnancy compared to women with $50,000 or more in total household income. Women with total household incomes under $10,000 had significantly higher odds (OR 2.3; 95% CI 1.1–4.8) of relapsing by 17 months post-partum compared to women with incomes of $50,000 or more.[21] Tong and colleagues[82] found that women with annual incomes of $15,000 or more were more likely to quit smoking during pregnancy (67.0%) compared to women with lower annual incomes (47.8%).

Income and Quitting/Cessation Among LGBT Populations

Limited data were available on the relationship between income and quitting smoking among LGBT populations. Among 101 LGBT individuals in New York City, Burkhalter and colleagues[98] found no differences in intention to quit among individuals with less than $50,000 in annual income compared to those with more than $50,000 in annual income.

Income and Cessation Treatment

A study using data from the 2001 NHIS found that a higher percentage of current smokers with $20,000 or more in household income reported being offered assistance in quitting from a provider compared with lower income current smokers.[117] In a clinical trial (n = 619) Cooper and colleagues[118] found no association between income and adherence to transdermal nicotine treatment (nicotine patch). On the other hand, Honjo and colleagues[99] reported that income was positively associated with the probability of using resources (e.g., printed materials, quitlines, nicotine replacement therapy, smoking cessation programs) to quit smoking.

Income and Secondhand Smoke Exposure

A number of studies have found that higher income is associated with lower exposure to SHS. Honjo and colleagues[99] found that income was negatively correlated with SHS exposure at home and work as well as with peer smoking. Another study created a combined SES variable based on both income and education using data from the 2006 and 2007 International Tobacco Control Four-Country Survey (n = 8,245); this study found that high-SES smokers had increased odds of having bans on smoking in

the home compared with low-SES smokers.[26] No associations were found, however, between income and having bans on smoking in the workplace or at bars or restaurants in the participant's area of residence.

Pyle and colleagues,[22] using a sample of parents of pediatric patients (n = 1,770), found that parents in families with less than $41,000 in annual income had higher odds of allowing smoking in the home compared to parents with more than $41,000 in income. A higher percentage of lower income parents (compared with parents with income >$41,000) also allowed smoking in a car, reported sitting in smoking areas in restaurants and trains, and allowed smoking around children. Data from the 2007 NSCH (n = 90,853) showed that the adjusted prevalence of exposure to smoke inside the home for children younger than 18 was 14.5% in households below 100% of FPL, 10.6% for households at 100–199% of FPL, 6.3% in households at 200–399% of FPL, and 2.5% in households at or above 400% of FPL.[24]

Income and Tobacco-Related Cancer Morbidity and Mortality

Conway and colleagues[102] conducted a systematic review of case-control studies to examine the association between SES and risk of oral cancer; based on five studies, the authors calculated that low income was associated with 2.41 times higher odds of oral cancer compared with high income. Clegg and colleagues[103] found evidence of increasing rates of lung cancer incidence with a decreasing ratio of family income to FPL using SEER and NLMS matched data; however, this gradient was not as strong as the gradient for educational attainment. Using NLMS data, Lewis and colleagues[5] also found that income below $60,000 was associated with an increased risk of lung cancer mortality compared with income above that amount.

Income: Analyses of 2010 NHIS Cancer Control Supplement Data

Table 9.2 presents age-adjusted prevalence and means for behaviors on the tobacco use continuum, stratified by income, for the three largest racial/ethnic groups in the United States. Several patterns can be seen in these data. As with findings for education, the data for income show stepwise increases in the expected direction for current smoking among blacks and whites and a more moderate gradient among Hispanics/Latinos. An income gradient for cigarettes smoked per day was observed only among whites. An income gradient in quit attempts was observed only among Hispanics/Latinos, but quit attempts decreased as income increased. Among former smokers, the number of years quit generally increased with higher income among blacks and whites, but no gradient was observed among Hispanics/Latinos. Similarly, the percentage of nonsmokers reporting smoking inside the home generally decreased with increasing income among blacks and whites, whereas no gradient was seen among Hispanics/Latinos. No clear pattern by income was found for age of smoking initiation, use of any type of cessation treatment, or smoking-related cancer among those age 60 and older.

Table 9.2 Age-Adjusted Percentages and Means for Indicators on the Tobacco Use Continuum Among Adults, by Poverty Level and Race/Ethnicity, 2010

Category	Black (non-Hispanic) (n = 3,103)	Hispanic/Latino (n = 3,861)	White (non-Hispanic) (n = 10,320)
Current smokers among all adults (%)			
<100%	33.9	15.9	46.1
100–<200	28.8	16.0	39.2
200–<400	18.9	14.2	28.0
400+	12.3	10.5	15.3
Age of initiation among ever-smokers (mean)			
<100%	19.1	18.4	17.2
100–<200	19.3	18.0	17.1
200–<400	19.3	18.4	17.6
400+	19.1	18.9	17.7
Number cigarettes per day among current smokers (mean)			
<100%	9.5	8.4	16.9
100–<200	10.2	8.1	15.6
200–<400	9.6	7.5	14.2
400+	9.8	7.6	12.6
Quit attempt in past year among current smokers (%)			
<100%	54.9	53.6	44.9
100–<200	58.8	50.5	43.1
200–<400	57.7	49.2	45.7
400+	55.1	33.2	46.3
Years quit among former smokers (mean)			
<100%	7.0	9.4	8.6
100–<200	9.8	11.5	9.8
200–<400	8.9	9.8	10.7
400+	10.7	12.4	11.8
Use of any type of treatment* during any quit attempt, among current smokers with a quit attempt in the past year and former smokers who had ever used cessation treatment (%)			
<100%	18.5	13.7	37.0
100–<200	22.9	20.3	30.9
200–<400	24.2	19.3	38.1
400+	23.8	13.7	42.4

Table 9.2 continued

Category	Black (non-Hispanic) (n = 3,103)	Hispanic/Latino (n = 3,861)	White (non-Hispanic) (n = 10,320)
Smoking reported inside the home by nonsmokers (%)			
<100%	7.0	1.7	6.4
100–<200	6.7	2.3	7.7
200–<400	4.1	2.6	3.2
400+	3.2	1.8	2.6
Ever diagnosed with a smoking-related cancer, age 60 and over (%)†			
<100%	3.4	1.9	2.2
100–<200	1.3	0.8	5.1
200–<400	2.7	3.0	3.5
400+	2.8	3.4	2.8

Notes: Participants in this study were ages 25–64 (n = 17,284) or 65 and over (n = 7,067).
*Treatments include nicotine patch, gum, lozenge, nasal spray, or inhaler; prescription drugs: varenicline (Chantix), bupropion (Zyban, Wellbutrin); telephone quitlines, one-on-one counseling, and cessation clinics, classes, or support groups.
†Cancer sites include bladder, cervix, blood or bone marrow, lung, mouth/tongue/lip, throat/pharynx, kidney, stomach, pancreas, esophagus, and larynx/windpipe (from Fagan et al. 2017[56]).
Source: Created using data from the National Health Interview Survey Cancer Control Supplement 2010.[145]

Wealth and TRHD

The initial literature search identified seven articles examining associations between measures of wealth, which varied from study to study, and the tobacco use continuum (specifically, current smoking as well as quitting and cessation); one additional study was later identified. No studies were identified that examined relationships between wealth and smoking initiation, intensity and frequency, treatment, SHS exposure, or cancer morbidity and mortality, nor were studies found that examined relationships between wealth and the tobacco use continuum by race/ethnicity or LGBT status.

Wealth and Current Smoking

Of the seven studies that examined measures of wealth and current smoking, four reported that higher levels of wealth were associated with lower risks of current smoking, and three did not find associations between wealth and smoking.

Wealth and Current Smoking Among Adolescents

Cubbin and colleagues[63] used data from the Youth Assets Study to examine associations between family wealth (i.e., ownership of home; savings, checking, or money market accounts or savings bonds; IRAs; tax-deferred plans [e.g., 401K]; CDs; personal loans to others; held mortgages; and stocks, bonds, or mutual funds) and smoking by adolescents ages 12–17 in the last 30 days. Wealth was not associated with smoking after adjusting for age, race/ethnicity, family structure, parents' and grandparents' education, and parents' occupation. Unger and colleagues[64] found that adolescents' self-reported possession of large amounts of personal spending money was associated with increased odds of lifetime smoking among 1,847 8th-grade students in a Los Angeles study; however, perceived ability to afford

basic necessities, family wealth relative to others, and family wealth relative to last year were not associated with smoking.[64]

Wealth and Current Smoking Among Adults

Data on 2,249 adults from the MIDUS survey (1995) demonstrated that wealth (assets minus debts) was associated with a 1% increase in the relative risk of never (versus current) smoking after adjusting for household income, education, and personality traits.[68] Cubbin and colleagues[64] examined associations between net worth and current smoking, using data from the 2004 Survey of Consumer Finances (respondents ages 25–64 years) and the 2004 Health and Retirement Survey (respondents age 50 years and older) and found an inverse gradient between net worth (measured in quartiles) and smoking after adjusting for education and income.

Grafova[119] used data from the 1999–2005 waves of the Panel Study of Income Dynamics (PSID) (n = 19,389) to examine associations between smoking and financial strain, using three measures to reflect the availability of financial resources when income is interrupted—assets, the availability of emergency funds, and financial solvency. Individuals in households without access to emergency funds were more likely to smoke than those in households with adequate emergency funds; the association between smoking and financial strain was stronger in lower income quartiles than in the top income quartile. Men and women in households without at least 3 months of income in liquid assets or at least 6 months of income in non-pension financial assets were, on average, 10% more likely to smoke than adults in families who had emergency funds available. Financial insolvency (i.e., having more debt than assets) was not associated with smoking after adjusting for individual and family characteristics. Among men only, the onset of financial strain was associated with an increase in the probability of smoking.[119]

Using data from the 1999, 2001, 2003, and 2005 PSID (not weighted to be nationally representative in this analysis), Hajat and colleagues[120] examined associations between family wealth (i.e., total assets minus debt) and current smoking. The risk of smoking declined as wealth increased; the risk for those with debt or no wealth was 2.1 times greater than the risk for those in the highest quintile of wealth. Being in the two lowest wealth quintiles was also significantly associated with an increased risk of smoking compared with being in the highest wealth quintile, after adjusting for education and income.

Wealth and Quitting/Cessation

Chapman and colleagues[68] found that wealth was associated with a 1% increase in the relative risk of former (versus current) smoking in the MIDUS survey. Grafova[119] reported that the onset of household financial strain was associated with relapse after quitting, although only among men.

Neighborhood SES and TRHD

Twelve articles were identified examining associations between neighborhood SES and the tobacco use continuum. No studies were identified that examined relationships between neighborhood SES and cessation treatment or cancer morbidity and mortality or between neighborhood SES and the tobacco use continuum by LGBT status. Individual and neighborhood SES are known to be highly correlated, so individual SES represents an important confounder in studies of neighborhood SES and tobacco outcomes. Therefore, studies that controlled for individual-level SES are noted. This review includes multilevel studies only; ecological studies were not examined. One of the primary pathways through which neighborhood SES is thought to influence tobacco use is through access to goods and services; in

general, low-SES neighborhoods have greater access to tobacco and less access to cessation resources than higher income neighborhoods. For this reason, U.S. studies that examined the built environment of neighborhoods in relation to the tobacco use continuum were reviewed.

Neighborhood SES and Smoking Initiation

Reardon and colleagues[121] analyzed data from the Project on Human Development in Chicago Neighborhoods, a multilevel, prospective, longitudinal study of children living in 79 neighborhoods. The authors conducted a multilevel event history analysis to examine the age of cigarette use initiation among 1,979 youths ages 11 to 18 years. Neighborhood poverty was not associated with age of initiation; no individual-level measure of SES was controlled for in these analyses.

Neighborhood SES and Current Smoking

Most studies examining neighborhood SES and variables along the tobacco use continuum focused on current smoking. Results were inconsistent across studies; some studies found no association between neighborhood measures of SES and current smoking, whereas others found that individuals in lower SES neighborhoods had higher risks or odds of current smoking. Associations between neighborhood SES and current smoking were also found to differ by gender and race/ethnicity, although these differences were not consistent across studies.

Neighborhood SES and Current Smoking Among Adolescents (Nationally Representative Data)

Lee and Cubbin[122] examined data on 8,165 youths ages 12 to 21 in the 1992 Youth Risk Behavior Survey, which included children from households in the nationally representative NHIS. Neighborhood SES variables—median family income at the 1990 census tract level, proportion of residents below 175% of the FPL, proportion of adults with less than a high school education, median value of owner-occupied housing, proportion of housing with more than one person per room, and proportion of people employed in blue-collar occupations—were not associated with youth smoking after adjusting for parental education.

Neighborhood SES and Current Smoking Among Adults (Non-Nationally Representative Data)

Baseline data from 1995 on 41,726 women in the Black Women's Health Study were used to examine associations between neighborhood poverty (percentage of poverty in the census tract, based on the 1990 Census) and current smoking.[123] In multilevel models adjusting for individual education and occupation as well as state-level poverty rates, increasing neighborhood poverty was associated with increasing odds of current smoking. Galea and colleagues[124] examined associations between neighborhood income and income distribution and current smoking using data from a cross-sectional survey of New York City residents in 2002 (n = 1,355). Neighborhood median household income was based on the 2000 U.S. Census and was used to calculate the Gini coefficient to measure income inequality; neither of these measures was associated with cigarette smoking after adjusting for individual income and education. Ross[125] examined associations between current smoking and SES variables including neighborhood (census tract, based on the 1990 Census), poverty (percentage of households in poverty), and education (percentage of population older than 25 with a college degree) using the 1995 Community, Crime, and Health survey, a probability sample of Illinois households. For men, neighborhood poverty was significantly associated with an increased likelihood of smoking, whereas there was no association between neighborhood poverty and smoking for women after adjusting for

education, household income, and poverty. Neighborhood education level was not associated with smoking for either gender.

Data from control participants in the Carolina Breast Cancer Study (1993–1996, n = 648) were used to assess associations between area-level characteristics from census block groups (based on the 1990 Census), including education, poverty, unemployment, vehicle ownership, home ownership, and crowding.[126] The odds of current smoking did not differ by area-level characteristics after adjusting for individual-level education. A study using data from the Black Women's Health Study (n = 41,726) linked to census tract data found that the prevalence of smoking increased as neighborhood poverty increased, even after adjustment for individual-level education, marital status, age, and occupation.[123]

Neighborhood SES and Current Smoking, by Race/Ethnicity

Cubbin and colleagues[127] examined data from NHANES III (1988–1994) linked to a neighborhood deprivation index (from 1990 Census tract variables) to examine associations with current smoking among black, Mexican American, and white women and men ages 25–64. After adjusting for education and income, they found increased odds of current smoking with each unit increase in neighborhood deprivation among black women, black men, and white women but not among Mexican Americans or white men.

In 1995-1996 Diez Roux and colleagues[128] examined associations between current smoking and six neighborhood variables at both the census tract and census block level using data from the 10-year follow-up to the Coronary Artery Disease Risk Development in Young Adults Study (CARDIA). Among whites, the following area SES variables were all significantly associated with higher odds of smoking even after adjusting for individual-level variables: lower median house value; lower percentage of college graduates; lower percentage in executive, managerial, and professional occupations; and a lower neighborhood summary score, which combined six area variables (median household income; median value of housing units; percentage of households receiving interest, dividend, or net rental income; percentage of adults who completed high school; percentage of adults who completed college; and percentage of persons in managerial or professional specialty occupations). For example, whites living in areas in the lowest quartile of median house value had 1.8 times higher odds of smoking compared to those living in the highest quartile. Among blacks, however, the odds of smoking did not differ by area characteristics after adjusting for individual variables.[128]

Scarinci and colleagues[23] used data from the 1994 baseline survey of the Memphis Health Project, a prospective study of risk factors for cigarette smoking, to examine associations between ZIP code–level educational attainment, income, and current smoking among 3,813 white and African American adolescents ages 11 to 19. No measures of individual-level SES were included in this study. Associations between neighborhood SES and smoking differed by race/ethnicity and SES indicator. African American youths living in high-income neighborhoods (above $26,500 per year) had 2.1 times higher odds of smoking than those in moderate-income neighborhoods ($20,001 to $26,500 per year) and 3.1 times higher odds of smoking than those in low-income neighborhoods ($20,000 or less per year). The authors did not find an association between neighborhood income and smoking among white youth. Overall, high neighborhood education (some college or more) was associated with reduced odds of smoking (0.60) compared to low neighborhood education (high school degree or less).[23]

Tseng and colleagues[126] analyzed a sample (n = 648) using data from the Carolina Breast Cancer Study (1993–1996) and found that area-level low education and poverty were associated with increased odds of smoking among white but not black women. Area-level low education was defined as more than 25% of residents with less than a high school education, and high education as 25% or less of residents without a high school diploma; area-level poverty was defined as more than 20% of residents having household incomes below the FPL, versus 20% or fewer having incomes below the FPL.[126]

Neighborhood SES and Intensity and Frequency of Smoking

Chuang and colleagues[129] assessed associations between neighborhood SES and cigarettes smoked per day using data from the Stanford Heart Disease Prevention Program, a cross-sectional survey of four cities in California from 1979 to 1990. Neighborhood SES was a summary score of five variables from the 1980 and 1990 Censuses: (1) percentage with less than a high school education, (2) percentage in blue-collar occupations, (3) percentage unemployed, (4) median annual family income, and (5) median housing value. Lower neighborhood SES was associated with higher levels of individual smoking, after adjusting for individual SES (based on educational attainment and household income). The results also demonstrated that the reduction in cigarettes per day associated with high individual SES was weaker in low-SES neighborhoods than in high-SES neighborhoods.

In a study using structural equation modeling to examine mediators between neighborhood SES and adolescent cigarette smoking, Chuang and colleagues[130] analyzed data on 959 adolescents ages 12 to 14 years in a nationwide randomized trial targeting family risk factors for alcohol and tobacco use through informational mailings. Adolescent smoking was measured using a scale assessing the number of cigarettes ever smoked. Low neighborhood SES was measured by the proportion of residents with family income under $12,500, proportion of unemployed males, and proportion of residents below the poverty line; high neighborhood SES was measured by the proportion of residents with family income greater than $75,000, proportion of residents in managerial occupations, and proportion of residents with more than 12 years of education. Low neighborhood SES was associated with increased parental monitoring, which was associated with decreased levels of smoking; high neighborhood SES had no direct or indirect effects on adolescent smoking.[130]

In a study of adolescents younger than age 18 in the National Longitudinal Survey of Adolescent to Adult Health (Add Health, n = 9,463), high levels of neighborhood poverty were associated with moderate increases in smoking frequency and quantity for white, but not black, adolescents.[131] In longitudinal follow-up analyses at 1 and 6 years, however, neighborhood poverty was not a strong predictor of adolescent smoking. Neighborhood poverty was measured using a combined score of the proportion of families below the FPL, median family income, and the proportion of single-parent families; analyses controlled for family income.

Stimpson and colleagues[132] assessed associations between neighborhood deprivation and cotinine levels using data from NHANES III (n = 20,050). Neighborhood deprivation, based on the Singh composite index[133] of indicators in the U.S. Census, was associated with increased odds of cotinine concentrations greater than 14ng/mL, indicative of smoking; a gradient in odds of more than 14ng/mL of cotinine was shown across increasing quartiles of deprivation. The analyses controlled for individual-level education, income, and employment status.

Neighborhood SES and Quitting/Cessation

Tseng and colleagues[126] used data from the Carolina Breast Cancer Study to examine associations between census block group characteristics and former smoking. Neighborhood-level characteristics were not associated with former smoking after controlling for individual-level education. Kendzor and colleagues[97] found that the percentage of unemployment at the census tract level was significantly negatively associated with staying quit for 26 weeks in a smoking cessation intervention.

Neighborhood SES and Secondhand Smoke Exposure

In a sample of 416 never-smokers from a large 2-year prospective evaluation of the determinants of weight gain among black and white women, Scarinci and colleagues[100] reported that women living in ZIP codes with a median income of less than $21,152 and between $21,152 and $35,377 reported approximately 4.5 days per week of SHS exposure compared with 3.7 days per week for those living in ZIP codes with incomes above $35,377, but these differences were not statistically significant. These associations also did not differ significantly by race/ethnicity.

Neighborhood: The Built Environment and the Tobacco Use Continuum

Literature on neighborhood socioeconomic status and the tobacco use continuum hypothesizes that the built environment can represent a primary pathway through which neighborhood SES affects tobacco outcomes. The built environment has been defined as the human-made space in which people live, work, and recreate on a day-to-day basis.[134] Features of the built environment that could be relevant for tobacco outcomes include the density and accessibility of tobacco outlets, availability and accessibility of cessation resources, and prevalence of pro-tobacco advertising and anti-tobacco messaging.

The study by Chuang and colleagues[129] examining interactions between individual and neighborhood SES and cigarettes smoked per day sought to understand the role of convenience store concentration, an indicator of cigarette availability, on smoking prevalence. The authors examined the concentration of convenience stores within a participant's census tract, distance between participants' households and the nearest convenience store, and number of convenience stores within a 1-mile radius of a participant's home. Higher convenience store density and shorter distance to a convenience store were associated with higher average cigarettes per day after adjusting for individual characteristics. Furthermore, an interaction was found between density and neighborhood SES; convenience store density was positively associated with cigarettes per day in high-SES neighborhoods but not in low-SES neighborhoods.

Novak and colleagues[135] also examined tobacco outlet density and smoking among a sample of 2,116 youths in Chicago. Youths living in neighborhoods in the highest quartile in terms of tobacco outlet density had 13% higher odds of smoking in the past month compared with those in the lowest quartile. The authors used propensity score matching to account for potential neighborhood-level confounders.

Reitzel and colleagues[136] examined associations between tobacco outlet density and residential proximity to tobacco outlets on smoking abstinence at 6 months in a longitudinal cohort study of smoking cessation in Houston. Density and proximity were measured using spatial analysis tools, and individual-level characteristics were controlled for in the models. Study participants living less than 250 meters or less than 500 meters from the closest tobacco outlet were less likely to remain abstinent than those living farther away. The density of tobacco outlets, however, was not associated with abstinence.

Life-Course SES and TRHD

The initial literature search identified four articles examining associations between socioeconomic status over the life course and the tobacco use continuum, and one additional article was identified in the Fagan review.[56] No studies were identified that examined relationships between life-course SES and cessation treatment or between life-course SES and tobacco use outcomes by race/ethnicity or LGBT status.

Life-Course SES and Smoking Initiation

To investigate associations between childhood SES and smoking in adulthood, Gilman and colleagues[137] used data on the offspring of mothers enrolled in the Providence, Rhode Island–Brown University site of the National Collaborative Perinatal Project (NCPP) (n = 1,057); the subjects were between the ages of 30 and 39 years at the time of this follow-up study. Childhood SES was measured at the time of the offspring's birth and at age 7 (combined scores were created) using maternal education in years, parental occupation (defined as either manual or non-manual according to 1960 U.S. Census categories), and household poverty status. In multivariable models, childhood parental occupation and household poverty were associated with smoking initiation (not adjusting for adult SES variables). Specifically, parental manual occupation was associated with a 49% increase in the risk of initiation, and household poverty was associated with a 33% increase in the risk of initiation. Childhood maternal education was also associated with progressing to regular smoking at an earlier age (adjusting for adult educational attainment).

Life-Course SES and Current Smoking (Nationally Representative Data)

In a prospective study of 10,142 young adults from the Add Health study, McDade and colleagues[138] found that higher parental education (highest level of either mother or father, categorized as less than high school, high school graduate, some college, college graduate, and more than college), as assessed when the child was in the 7th through 12th grades, was associated with reduced likelihood of smoking between ages 18 and 26. This study did not control for participants' current (adult) education.[138]

Life-Course SES and Current Smoking (Non-Nationally Representative Data)

Fagan and colleagues[139] analyzed data from a longitudinal study of 603 adults first interviewed around age 5 in 1975 and followed to a mean age of 27 in 1997 to examine associations between parental education/occupation and later life smoking. Smoking was measured along a scale from never smoked, former smoker, less than daily smoker, 1–5 cigarettes per day, about half a pack per day, about 1 pack per day, and 1½ or more packs per day. In structural equation models, higher parental education (a latent variable based on continuous measures of both maternal and paternal education) was directly associated with lower levels of smoking in adulthood and was indirectly associated with adult smoking via improved parent-child relationships and lower levels of adolescent smoking. Parental occupation was associated with adult smoking only through these mediated pathways. No measures of the respondent's educational attainment in adulthood were included in the models.

Tehranifar and colleagues[140] examined a sample of female participants in the NCPP for associations between parental education and occupation during the participants' early childhood and the participants' education measured during adolescence and early adulthood, controlling for income in adulthood. Participants were born in New York City between 1959 and 1974 and were followed into adulthood between 2001 and 2006 (n = 262). Having a parent in a blue-collar occupation when the child was born

was associated with 2.7 greater odds of the child being a current smoker during adulthood compared with having a parent in a white-collar occupation; other childhood and adolescent measures of SES were not associated with current smoking.

Life-Course SES and Intensity and Frequency of Smoking

McDade and colleagues[138] also found that higher parental education (highest education of either mother or father), as assessed when the child was in the 7th through 12th grades, was associated with reduced numbers of cigarettes smoked per day between ages 18 and 26. For example, young adults whose parents were college graduates smoked 0.94 fewer cigarettes per day compared with those whose parents were high school graduates.

Life-Course SES and Quitting/Cessation

Gilman and colleagues[137] also examined NCPP data on smoking cessation and found that maternal education and parental occupation in childhood were not associated with odds of quitting for at least 1 year, after adjusting for adult educational attainment and occupation.

Life-Course SES and Cancer Morbidity and Mortality

Singh and colleagues[141] used data from the National Cancer Institute's SEER database combined with area-level poverty rates from the U.S. Census to investigate associations between census tract poverty rates and lung cancer incidence by race. Age-adjusted lung cancer incidence rates increased with increasing neighborhood poverty (<10%, 10–20%, and ≥20% poverty) among men but not women. When stratified by race/ethnicity, this gradient was observed among both non-Hispanic white men and women and black men and women and, to a lesser extent, among Asian/Pacific Islander men. However, lung cancer incidence was lowest in the highest poverty census tracts for American Indian/Alaska Native men and women, and a moderate inverse gradient was observed among Hispanic men and women.

Evidence Summary

A summary of the findings of studies reviewed in this chapter is provided in Table 9.3.

Table 9.3 Summary of Findings on SES Measures, Stage of the Tobacco Use Continuum, and TRHD 2000–2011

Measure/Stage	Lower SES, less severe TRHD*	Lower SES, more severe TRHD†	Null findings
Education			
Current smoking			
Nationally representative – adults		Barbeau et al. 2004[66]; CDC 2009[67]; Chapman et al. 2009[68]; de Walque 2004,[11] 2007[69]; Fagan et al. 2007[56]; Grimard & Parent 2007[71]; Hersch 2000[72]; Kandel et al. 2009[59]; Kimbro et al. 2008[84]; Pampel 2009[40]; Stoddard & Adler 2011[73]	Tenn et al. 2010[88]
Non-nationally representative – adults		Dell et al. 2005[76]; Gilman et al. 2008[87]; Higgins et al. 2009[81]; Kahn et al. 2002[21]; Karter et al. 2008[83]; Malmstadt et al. 2001[77]; Solberg et al. 2007[78]; Tong et al. 2009[82]; Watson et al. 2003[79]; Wetter et al. 2005[80]	
Adolescents		Johnston et al. 2012[62]; Soteriades & DiFranza 2003[61]; Unger et al. 2007[64]; Garrett et al. 2013[65]	Cubbin et al. 2011[63]; Gritz et al. 2003[60]
Smoking initiation	Gritz et al. 2003[60]	Gritz et al. 2003[60]; McCaffery et al. 2008[58]	
Age of initiation		Kandel et al. 2009[59]; McCaffery et al. 2008[58]	
Heaviness/frequency/ duration of smoking		Ackerson & Viswanath 2009[89]; Aloise-Young et al. 2002[90]; Gilman et al. 2008[87]; Hersch 2000[72]; Kandel et al. 2009[59]; Siahpush et al. 2010[91]; Solberg et al. 2007[78]; Webb & Carey 2008[113]	McCaffery et al. 2008[58]
Quitting/cessation			
Nationally representative – adults		Barbeau et al. 2004[66]; Chapman et al. 2009[68]; de Walque 2004,[11] 2007[69]; Fagan et al. 2007[74]; Finney Rutten et al. 2005[70]; Grimard & Parent 2007[71]; Kandel et al. 2009[59]; Siahpush et al. 2010[91]	
Non-nationally representative – adults		Businelle et al. 2010[34]; Foulds et al. 2006[92]; Gilman et al. 2008[87]; Higgins et al. 2009[81]; Piper et al. 2010[93]; Tucker et al. 2005[94]; Watson et al. 2003[79]; Wetter et al. 2005[95]; Yu et al. 2002[96]	Kendzor et al. 2012[97]
Treatment		Honjo et al. 2006[99]; Piper et al. 2010[93]; Solberg et al. 2007[78]	Solberg et al. 2007[78]
Exposure to SHS		Honjo et al. 2006[99]; Scarinci et al. 2000[100]; Singh et al. 2010[24]; Stamatakis et al. 2002[25]; Tong et al. 2009[27]	
Cancer morbidity/ mortality		Clegg et al. 2009[103]; Conway et al. 2008[102]; Haiman et al. 2006[101]; Lewis et al. 2009[5]; Siegel et al. 2011[104]; Steenland et al. 2002[6]	
Income			
Current smoking			
Nationally representative – adults		Barbeau et al. 2004[66]; Fagan et al. 2007,[74] 2007,[56] 2007[109]; Finney Rutten et al. 2005[70]; Hersch 2000[72]; Kahn et al. 2002[21]; Tong et al. 2009[82]	Chapman et al. 2009[68]

Table 9.3 continued

Measure/Stage	Lower SES, less severe TRHD*	Lower SES, more severe TRHD†	Null findings
Non-nationally representative – adults		Adams et al. 2008[108]; Dell et al. 2005[76]; Fagan et al. 2007[56]; Malmstadt et al. 2001[77]; Watson et al. 2003[79]; Yu et al. 2002[96]	Honjo et al. 2006[99]
Young adults		Cubbin et al. 2011[63]; Lawrence et al. 2007[75]	
Initiation		Binkley 2010[107]	
Heaviness/frequency/ duration of smoking		Ackerson & Viswanath 2009[89]; Hersch 2000[72]; Lawrence et al. 2007[75]; Siahpush et al. 2010[91]; Webb & Carey 2008[113]	
Quitting/cessation			
Nationally representative – adults		Binkley 2010[107]; Barbeau et al. 2004[66]; Fagan et al. 2007,[74] 2007[109]; Siahpush et al. 2010[91]	Chapman et al. 2009[68]; Lawrence et al. 2007[75]
Non-nationally representative – adults		Burkhalter et al. 2009[98]; Cui et al. 2006[116]; Fagan et al. 2007[56]; Hyland et al. 2004[115]; Kahn et al. 2002[21]; Kendzor et al. 2010[114]; Tong et al. 2009[82]; Yu et al. 2002[96]	Kendzor et al. 2012[97]; Tucker et al. 2005[94]; Watson et al. 2003[79]; Yu et al. 2002[96]
Treatment		Browning et al. 2008[117]; Honjo et al. 2006[99]	Cooper et al. 2004[118]
Exposure to SHS		Honjo et al. 2006[99]; King et al. 2011[26]; Pyle et al. 2005[22]; Singh et al. 2010[24]	
Cancer morbidity/ mortality		Conway et al. 2008[102]; Lewis et al. 2009[5]	
Wealth			
Current smoking			
Nationally representative – adults		Chapman et al. 2009[68]; Cubbin et al. 2011[44]; Grafova 2011[119]	
Non-nationally representative – adults		Hajat et al. 2010[120]	
Adolescents			Cubbin et al. 2011[63]; Unger et al. 2007[64]
Quitting/cessation		Chapman et al. 2009[68]; Grafova 2011[119]	
Neighborhood SES			
Current smoking			
Nationally representative – adults		Cubbin et al. 2001[127]	Cubbin et al. 2001[127]; Lee & Cubbin 2002[122]
Non-nationally representative – adults		Diez Roux et al. 2003[128]; Datta et al. 2006[123]; Ross 2000[125]	Diez Roux et al. 2003[128]; Galea et al. 2007[124]; Ross 2000[125]; Tseng et al. 2001[126]
Adolescents	Scarinci et al. 2002[23]	Scarinci et al. 2002[23]	Lee & Cubbin 2002[122]; Scarinci et al. 2002[23]
Initiation			Reardon et al. 2002[121]

Table 9.3 continued

Measure/Stage	Lower SES, less severe TRHD*	Lower SES, more severe TRHD†	Null findings
Heaviness/frequency/ duration of smoking	Chuang et al. 2005[130]	Chuang et al. 2005[129]; Nowlin & Colder 2007[131]; Stimpson et al. 2007[132]	Chuang et al. 2005[130]; Nowlin & Colder 2007[131]
Quitting/cessation			Tseng et al. 2001[126]
Exposure to SHS			Scarinci et al. 2000[100]
Life-Course SES			
Current smoking			
Nationally representative – adults		McDade et al. 2011[138]	
Non-nationally representative – adults		Fagan et al. 2005[139]; Tehranifar et al. 2009[140]	
Adolescents			
Initiation		Gilman et al. 2003[137]	
Heaviness/frequency/ duration of smoking		McDade et al. 2011[138]	
Quitting/cessation			Gilman et al. 2003[137]

Notes: Some publications are listed in multiple columns due to findings differing by specific population characteristics. SES = socioeconomic status. TRHD = tobacco-related health disparities. SHS = secondhand smoke exposure.
*Finding indicates that a lower level of SES is associated with a better tobacco-related outcome in terms of health, such as lower levels of smoking, older age of initiation, higher levels of quitting or using treatment, and lower levels of exposure to secondhand smoke or cancer.
†Finding indicates that a lower level of SES is associated with a worse tobacco-related outcome in terms of health, such as higher levels of smoking, younger age of initiation, lower levels of quitting or using treatment, and higher levels of exposure to secondhand smoke or cancer.

Among SES factors, the evidence is strongest for an association between adult educational attainment and indicators along the tobacco use continuum: current smoking, quantity smoked, quitting, SHS exposure, and tobacco-related cancer. There were strong, consistent educational gradients overall and among blacks and whites for current smoking; gradients were less pronounced among Hispanics/Latinos, Asian/Pacific Islanders, and American Indians/Alaska Natives, although small sample sizes make these analyses less certain. In addition to overall gradients, with each increasing year or degree of education being associated with a lower prevalence or likelihood of smoking, a college education appears to confer a particularly protective benefit in terms of current smoking.

Associations between education and tobacco use were found in data from both nationally representative and non-nationally representative samples. The majority of the studies, however, employed cross-sectional designs. Prospective designs were found largely among studies examining initiation,[60] quitting and cessation,[78,81,93–95] and cancer mortality.[6,101] Studies also find that higher maternal education is linked to a much lower likelihood of smoking during pregnancy.[21,59,81,82]

Findings on the relationship between education and current smoking among adolescents were mixed; three studies found an inverse association between education and smoking, while two found no association. The limited evidence on the association between education and smoking initiation also had mixed findings. Three studies found that higher education was protective against initiation or was

associated with an older age of initiation, while one study found that among black adolescents, higher parental educational attainment was associated with higher odds of initiation. An analysis of NHIS 2010 data conducted for this chapter revealed differences as large as 40 percentage points (unadjusted, except for age) in the prevalence of current smoking among respondents who did not complete high school compared to those who graduated from college. The findings were also mixed for cessation treatment; the inconsistency could be due to the variety of ways in which treatment (e.g., health professional advice, quitlines, prescription drugs) is measured.

One proposed causal pathway linking education and tobacco use suggests that people with less education have fewer resources or are less able to take advantage of the resources they do have to quit smoking.[14] The literature reviewed in this chapter, which demonstrates that higher education is associated with a higher rate of receiving advice about quitting from health professionals and greater use of quitting resources, is consistent with this hypothesis. The normative behavior of peers may also have a role; individuals with higher education may be less likely to have peers who smoke or less likely to be exposed to SHS in the workplace.

Studies on the relationship between income and the tobacco use continuum most commonly examined current smoking (overall and within racial/ethnic groups), quantity smoked, quitting, or SHS exposure. Except for quitting, most of the studies suggest an inverse association with income, regardless of the measure of income that is used. For quitting, nine studies found an inverse association (three based on nationally representative data), but five studies suggested a null association (one based on nationally representative data). More variables were used to measure income than were used to measure education, which could account for the mixed findings. Most of the studies were based on cross-sectional designs, except for three prospective studies of quitting[94,115,142] and one study of treatment.[118] Only one study examined smoking initiation, and the findings on treatment were mixed. Three studies found an inverse association between income and cancer outcomes. Prevalence rates of current smoking did not vary as dramatically across income groups as they did for levels of education. For example, in the 2000 NHIS, the prevalence of smoking in the group with the lowest income was only 14% higher than that in the group with the highest income.[66]

Seven studies were identified on the relationship between wealth and indicators along the tobacco use continuum. Four of the five studies among adults found inverse associations between wealth and current smoking, with two of these studies reporting modest or strong associations. Two studies also found that wealth was inversely related to quitting smoking. Two studies among adolescents reported no association between family wealth and current smoking. Three of the seven studies on wealth used prospective study designs, and all studies adjusted for other measures of SES (e.g., education, income). Similar to income, there are theoretically plausible links between wealth and tobacco-related outcomes; low levels of wealth may be associated with psychosocial stress, pro-tobacco peer or community norms, increased exposure to tobacco advertising, less availability of tobacco dependence treatment, and other factors.

Although 13 studies were identified which examined measures of neighborhood SES and indicators along the tobacco use continuum, few consistent findings emerged. In nationally representative data sets, two studies found no association between neighborhood deprivation and current smoking, whereas one found an inverse association. Findings from studies using non-nationally representative data on adolescent smoking were also mixed, and findings within studies differed by race/ethnicity and gender.

Only one study examined the initiation of smoking, reporting no association.[121] Studies looking at quitting[126] and SHS exposure[100] both reported null associations.

Findings from the four studies examining neighborhood SES and intensity of smoking were mixed. One study found that although neighborhood SES was associated with smoking frequency and quantity in the cross-sectional sample, the association was not present in a longitudinal design.[131] This finding highlights a challenge with the literature: It is difficult to determine whether neighborhood SES is positively correlated with tobacco outcomes or whether the selection of individuals into neighborhoods introduces bias. The inconsistency of findings in the literature on neighborhood SES might be attributable to the variety of measures of neighborhood SES; different definitions of neighborhoods (e.g., census tracts, ZIP codes); and different control variables, including individual SES measures, in the models. The strength of association between neighborhood SES variables and outcomes on the tobacco use continuum was generally modest. Neighborhood SES could theoretically be a causal determinant of tobacco-related outcomes because such factors as the availability of tobacco, tobacco advertising, cultural norms, and stress could differ by neighborhood SES. In light of the different methods used and inherent selection and measurement issues in neighborhood effects research, it might be best to consider the magnitude of an observed neighborhood effect as representing a range, with the true value lying somewhere between the crude and adjusted association.[143]

Only four studies were identified that examined associations between life-course SES measures and outcomes on the tobacco use continuum. These studies reported associations between parental education in childhood and smoking in adulthood in both nationally representative and non-nationally representative data. Studies also reported associations between parental occupation in childhood and adult smoking in non-nationally representative data. Parental education and occupation were also found to be associated with initiation of smoking, progression to regular smoking, and intensity of smoking, but not with quitting. Although all studies were prospective designs, only two of four studies controlled for adult measures of SES. These two studies reported strong associations between life-course measures of SES and adult smoking and initiation, but associations between parents' education and the number of cigarettes smoked were more modest.

Few studies examined the tobacco use continuum by race/ethnicity or sexual orientation, and most of these examined current smoking. Little evidence on socioeconomic disparities by race/ethnicity or LGBT status exists for other indicators across the tobacco use continuum. Although LGBT populations have higher rates of current smoking than heterosexual populations, the evidence is insufficient to determine whether SES has a differential impact on current smoking or other tobacco-related indicators in the LGBT population.

Several limitations in this review and in the literature should be noted. The search, although thorough, might not have identified every relevant study. Most of the studies identified were based on self-reported data and cross-sectional study designs. Because of the nature of SES, it is difficult to firmly establish a high degree of internal validity. Despite these limitations, the majority of studies examined, for all socioeconomic factors across the tobacco use continuum, found that people of low SES have more negative outcomes, suggesting that these factors contribute to TRHD.

Chapter Summary

As described by Healthy People 2020 "social determinants of health are conditions in the environments in which people are born, live, learn, work, play, worship and age, that affect a wide range of health, functioning and quality-of-life outcomes and risks."[3] Socioeconomic status, the focus of this chapter, relates to each of the five Healthy People 2020 areas of social determinants of health: economic stability; education; social and community context; health and health care; and neighborhood and built environment.

As the chapter describes, there is very strong evidence showing that educational attainment is closely linked with tobacco use across the continuum; this evidence is strongest for white and black populations. Small sample sizes and lack of focus on acculturation and nativity make conclusions regarding the relationship between education and tobacco use for other racial/ethnic groups less firm. Educational gradients appear to exist among LGBT populations as well, although fewer studies have examined this population group. Education is closely associated with cognition and social capital and also helps determine other socioeconomic factors, such as occupation, income and wealth, and type of neighborhood. As Link and Phelan have said, "social factors such as socioeconomic status…are likely 'fundamental causes' of disease."[14,p.80] Given the consistent association with tobacco use, and strong theoretical plausibility, this statement may be extended to say that social factors such as low educational attainment may be a "fundamental cause" of tobacco use.

Diverse efforts to increase educational attainment within and across different racial/ethnic groups may contribute to reducing tobacco use. Population-wide strategies that increase educational attainment may have considerable multiplier effects for improving population health and reducing TRHD over the long term. These efforts will be especially important for individuals and population groups with lower overall levels of educational attainment. As of 2015, adults with a 4-year college degree or greater were the only educational group to have reached the Healthy People 2020 target of reducing cigarette smoking by adults to 12%. To reach the Healthy People 2020 target, smoking must decrease among all educational groups, but at a faster rate among individuals with lower educational levels. Policy interventions that broadly improve educational attainment may contribute to this effort.

Many studies also show a strong inverse association with income, regardless of the measure of income used. Income could be linked to tobacco-related outcomes through a variety of indirect pathways. For example, lower income might be associated with higher levels of psychosocial stress, leading to tobacco use as a perceived coping behavior, or with occupational exposure to SHS. Those with less income may live in communities where smoking is more normative or where tobacco advertising or the availability of tobacco products is more prevalent than in other communities.

Studies that examine tobacco use along the life course tend to find an association between parental education and occupation, and tobacco use among the offspring in adulthood. Causal pathways between life-course SES and measures along the tobacco use continuum in adulthood are inherently indirect and therefore difficult to measure. Parental education could affect many factors, such as parent–child relationships, which influence adolescent smoking and in turn adult smoking. Early-life SES could also influence trajectories for later-life education, occupation, income, wealth, and neighborhood SES and could subsequently influence tobacco outcomes through the pathways previously described for these measures.

Research Needs

The research described in this chapter, and in other studies, calls attention to the many health challenges faced by population groups with low levels of education and income, both primary social determinants of health. Identifying mechanisms through which socioeconomic status influences tobacco use may result in new potential targets for interventions that could ultimately reduce TRHD. Research to examine factors that contribute to low smoking rates among some groups despite their low educational attainment, such as Hispanics/Latinos, would also be informative. Research to identify other effective strategies targeted toward individuals with low levels of education are needed; these may include strategies to change pro-smoking social norms, promote cessation, reduce SHS exposure, and others. Interventions to improve educational attainment may also play a role in reducing disparities in relation to the tobacco use continuum, and research studies should address this possibility. As this chapter has identified, there remain gaps in the evidence base regarding socioeconomic status and TRHD, including studies to examine neighborhood SES and life-course SES and TRHD, as well as gaps focused on specific understudied population groups, such as LGBT individuals.

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