Section II
Intrapersonal/Individual Factors Associated with Tobacco-Related Health Disparities

Chapter 8
Occupation, the Work Environment, and Tobacco-Related Health Disparities

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Figures and Tables

Introduction

Occupation is an important indicator of socioeconomic status (SES) that independently affects health.[1–6] Occupation provides a measure of SES for those in the labor force, and is an important source of income and social status along with other benefits, such as a means to build social networks, social support, and self-esteem.[7–9] Occupation might also introduce threats to health through exposure to hazardous working conditions or harmful psychosocial experiences on the job.[7,10–16] Healthy People 2020 provides science-based, 10-year national objectives for improving the health of Americans, including objectives to address the social determinants of health and reduce tobacco use and secondhand smoke (SHS) exposure. Specific Healthy People 2020 goals aim to increase the proportion of individuals covered by indoor worksite policies that prohibit smoking.[17]

This chapter examines occupational disparities 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. This review also examines the contributions of the work environment and job experiences to disparities in tobacco use. Differential exposures to toxicants on the job are possible mediators through which the work environment and job experience, which are differentially patterned and imbued with advantages and disadvantages based on social class, are associated with tobacco-related health disparities (TRHD).

Disparities by occupation can interact with other indicators of social disadvantage so that workers who experience multiple sources of disadvantage could be at greater risk for tobacco use and tobacco-related diseases. Accordingly, this chapter explores the intersections between occupation and race/ethnicity, gender, age, and sexual orientation. Given the influence of the work environment, working conditions, and the social status that can be related to employment, employment status is also reviewed. Conclusions are based on a systematic review of the literature and may inform future research needs and steps to ameliorate TRHD.

Occupation as an Indicator of SES

Occupation connects two other key indicators of SES, education and income, because educational attainment provides the qualifications that often result in one's occupation, which in turn influences the level of income one is likely to earn.[1] The advantages of using occupation as a measure of SES include the fact that it reflects both income across the life span as well as job characteristics, such as power (authority and decision-making) and working conditions.[18] However, the use of occupational status as a unique SES measure in research has been criticized because of the potential for reverse causation with health (i.e., health status may influence occupational status); the potential for change across the life span; its inutility as a measure of SES for those outside the formal work sector; and its interplay with other demographic factors, such as race, ethnicity, and gender.[18] Nonetheless, although income and education have also been related to health across multiple studies, occupation has been shown to be an independent determinant of health status and health behaviors.[1–3,19–21]

Multiple plausible pathways link occupation to health. Occupational class can influence health by differential access to quality health care/health services and by varying levels of material deprivation and psychosocial resources.[18,22] Occupation can also cause poor health, by exposing workers to environmental, chemical, ergonomic, and psychosocial hazards. Workers in lower class jobs often have higher levels of exposure to some of these hazards, which can lead to the higher rates of mortality from cardiovascular disease and cancer.[22,23] Finally, occupation and the work context are associated with

health behaviors, including tobacco use. For example, blue-collar workers are more likely to smoke than white-collar workers.[1,24]

Occupation can affect tobacco use patterns and health outcomes in several ways. Some occupations involve risks of hazardous exposures and harmful psychosocial experiences on the job. The effects of working in occupations that pose health risks can interact with tobacco use either synergistically or additively, to substantively increase health risks.[7,10–12,25–28] For example, smoking and exposure to asbestos interact synergistically to increase the risk of lung cancer above what would have occurred from either exposure separately.[29,30] In addition, a study suggests workers exposed to hazards on the job are less likely to intend to quit smoking, perhaps in part because they perceive cessation as futile in the face of other health hazards posed by the work environment.[31] Much of the literature on the influence of the psychosocial work environment on tobacco use focuses on a stress-mediated pathway; smoking can represent a perceived means of coping with on-the-job stressors.

Some workplace benefits are differentially distributed by occupation and industry; for example, social norms supporting nonsmoking can be more prevalent among white-collar workers than blue-collar workers and more prevalent among some blue-collar workers than others. Additionally, white-collar workers are less likely to be exposed to SHS at their workplaces than blue-collar or service workers.[32,33] Yet occupation alone does not paint a full picture of tobacco-related disparities at worksites, as occupations can be dominated by a certain gender or race/ethnicity. For instance, whites and Asian Americans are more often in management or professional jobs compared with African Americans and American Indians/Alaska Natives.[34] Further exploration of these additional and interacting influences on tobacco-related disparities is needed.

Literature Search Strategy

Using the PubMed and Web of Science Social Science Citation Index (SSCI) databases, a literature search was conducted of articles published in English between 2005 and 2011, with some exceptions to the date limit, as noted below. The main search terms included "blue-collar," cessation, cigar, "electronic cigarettes," employment, job, occupation, quitting, "smokeless tobacco" (ST), smoking, "smoking initiation," "smoking and work," snus, tobacco, unemployment, and workers. Income and education, which also relate to occupation, are addressed in chapter 9.

The same search terms were used to search both databases. Most searches were conducted across all fields in PubMed and in the title, keyword, and abstract fields in SSCI. When search terms retrieved many irrelevant articles, the search was limited to certain fields only, such as title or keyword. If a search revealed few results, older articles were reviewed for relevance. Additional key references were added for the years 2012 to 2015. After a database search was completed, irrelevant and duplicate articles were removed, resulting in a total of 515 articles.

For purposes of this chapter, "occupational class" generally refers to blue-collar, white-collar, and service jobs. "Occupational profession and industry" represents a finer breakdown of occupational class by profession and industry, which tends to vary among studies. Examples of professions include construction workers, laborers, fabricators, food service personnel, health-diagnosing occupations, and teachers; examples of industries include construction, food service, retail trade, mining, finance, and educational services. "Employment status" describes the labor force participation of individuals.

Employed individuals are people who worked for pay in the last week, whereas unemployed individuals did not work in the last 4 weeks but are actively looking for jobs.

As this monograph focuses on documenting TRHD in the United States, the bulk of the studies reported here pertain to U.S. populations. To improve relevance to the overall U.S. population, this review focuses on studies using nationally representative data, with some exceptions, especially in areas with fewer studies and those that focus on morbidity and mortality. National surveys on health typically exclude the military in their sampling plans, so these populations are not necessarily represented in this review. Previous reviews of the literature are also used. Where available, reporting focuses on multivariate analyses as indicative of the most robust associations. Some studies are mentioned in more than one category because they analyzed multiple outcomes.

Disparities Across the Tobacco Use Continuum, by Occupational Characteristics

The purpose of this section is to describe disparities by occupational class, occupational profession and industry, and employment status across the tobacco use continuum of initiation, current use, quit attempts, cessation, and relapse. To the extent possible, information is included on the intersections between occupation and employment and other population characteristics, such as gender, age, race/ethnicity, and sexual orientation. Although most research focuses on cigarette use, research on use of other tobacco products and exposure to SHS are included as available. Gaps in the existing literature are noted.

This chapter reviews several main studies that used nationally representative data to investigate cigarette use by occupational class across the tobacco use continuum between 2004 and 2015; these studies are summarized in Table 8.1. This section focuses on cigarette use and occupational class because studies of these factors are the most robust and numerous and make use of comparable occupational groupings. Relatively few studies have addressed this area of research. As Table 8.1 shows, the reviewed studies found that blue-collar and service workers have significantly higher odds ratios of initiation and current cigarette use than white-collar workers. The literature is less consistent about differences in quit attempts and cessation by occupation, as fewer studies have reported multivariable regression findings by occupational class, and their definitions of quitting vary. The existing studies suggest that white-collar workers have somewhat higher odds of making a quit attempt and quitting successfully than blue-collar workers; the data on service workers are less clear. One study found that construction workers had significantly higher rates (53.3%) of persistent smoking compared to all other occupations combined (41.7%).[35] No studies looked at relapse by occupational class.

Table 8.1 Cigarette Use Across the Tobacco Use Continuum, Nationally Representative Data, by Occupational Class

Continuum phase Author(s)	Data source, year, n, ages	Prevalence (%)				Odds ratio/relative risk (95% confidence interval)			
		White-collar	Blue-collar	Service	Other	White-collar	Blue-collar	Service	Other
Initiation (cigarette smoking prevalence)									
Ham et al. 2011[35]	TUS-CPS 2006-2007 n = 106,604 Ages 18–64	12	24	20	26*	1.00†	1.18 (1.15–1.22)	1.07 (1.04–1.10)	—
Current use (cigarette smoking prevalence)									
Barbeau et al. 2004[1]	NHIS 2000 n = 24,276 Ages 18–64	20	35	31	24‡	1.00	1.28 (1.15–1.41)	1.19 (1.05–1.36)	0.72 (0.55–0.94)
Ham et al. 2011[35]	TUS-CPS 2006-2007 n = 106,604 Ages 18–64	12	24	18	26*	1.00†	1.41 (1.34–1.49)	1.25 (1.18–1.32)	—
Fagan et al. 2007[43]	TUS-CPS 1998-1999, 2001-2002 n = 288,813 Ages 18–64	18	33	27	24‡§	1.00	1.31 (1.27–1.35)	1.15 (1.10–1.20)	—
Lawrence et al. 2007[45]	TUS-CPS 1998-1999 n = 15,394 Ages 18–24	23	35	32	21‖	1.00	1.50 (1.32–1.70)	1.62 (1.42–1.84)	1.11 (0.88–1.41)
Asfar et al. 2016[49]	NHIS 2010 n = 1,531 Ages 18–24	18	25	24	—	1.00	1.40	1.36	—
Quit attempts (stopped smoking for 1 day+ in last 12 months)									
Alexander et al. 2010[71]	TUS-CPS 2006-2007 n = 30,176 Ages ≥18¶	52	51	56	—	1.00	0.87 (0.73–1.10)	0.80 (0.69–0.94)	—
Barbeau et al. 2004[1]	NHIS 2000 n = 24,276 Ages 18–64	45	42	47	43	—	—	—	—
Ham et al. 2011[35]	TUS-CPS 2006-2007* n = 106,604 Ages 18–64	46	39	42	38*	1.00†	0.94 (0.88–1.01)	0.99 (0.92–1.06)	—
Asfar et al. 2016[49]	NHIS 2010 n = 1,531 Ages 18–24	58	58	54	—	1.00	0.70 (0.46–1.06)	0.85 (0.51–1.40)	—

Table 8.1 continued

Continuum phase / Author(s)	Data source, year, n, ages	Prevalence (%) White-collar	Blue-collar	Service	Other	Odds ratio/relative risk (95% confidence interval) White-collar	Blue-collar	Service	Other
Cessation (prevalence of former smokers)									
Barbeau et al. 2004[1]	NHIS 2000 n =,276 Ages 18–64	20	18	14	17‡	—	—	—	—
Fagan et al. 2007[43]	TUS-CPS 1998-1999, 2001-2002 n = 288,813 Ages 18–64	19	18	14	16‡§	1.00	0.80 (0.76–0.83)	0.81 (0.77–0.85)	—
Relapse									
None									

Notes: TUS-CPS = Tobacco Use Supplement to the Current Population Survey. NHIS = National Health Interview Survey. Em dash (—) = not applicable, or insufficient data.
*Other industry was construction.
†Relative risk presented.
‡Other industry was farming.
§Other industry was forestry and fishing.
‖Unknown or refused to answer.
¶Prevalence measured the intention to quit in the next 6 months.

Initiation of Tobacco Use

In general, blue-collar and service workers are more likely to initiate smoking at younger ages than white-collar workers.[34,36–39] Some evidence suggests that service workers may have initiation patterns similar to white-collar workers, as was observed in a trend analysis of pooled cross-sectional data from the Tobacco Use Supplement to the Current Population Survey (TUS-CPS) from 1993, 1999, 2001, and 2006-2007.[35] This analysis also found that construction workers began smoking at earlier ages than workers in other blue-collar occupations. Early initiation of tobacco use could also apply to smokeless tobacco use, as skilled laborers such as production, construction, farming, or transportation workers have reported beginning ST use before age 16.[40] No literature was found that examined the initiation of tobacco use by employment status or worksite exposure to SHS. The literature on occupational class, profession and industry, and employment status did not analyze initiation by gender, race/ethnicity, or sexual orientation.

Current Use and Intensity

Cigarette Use, by Occupational Class and by Occupational Profession and Industry

There is consistent agreement in the literature that overall, blue-collar and service workers are more likely to be ever-smokers, current daily smokers, and heavier smokers than white-collar workers.[1,34,35,38,41–48] In a cross-sectional analysis of the 2000 National Health Interview Survey (NHIS), Barbeau and colleagues[1] found that 35% of blue-collar and 31% of service workers currently smoked, compared with 20% of white-collar workers. A study that pooled cross-sections of the NHIS and compared trends between 1987 and 1994 with those between 1997 and 2004 reported that many

blue-collar and service worker occupational groups had larger declines in smoking rates between 1997 and 2004 than in the previous time period.[46] However, these authors and others have noted that the historical gap in smoking prevalence rates between blue- and white-collar workers persists and may be widening.[38,46,48,49]

Studies have found disparities in smoking prevalence by occupational profession and industry, although comparisons across studies are difficult because each study tends to define the industries in slightly different ways, with some providing more of a breakdown in categories than others.[35,46,50] For example, the prevalence of smoking is significantly higher among workers in the following industries: mining (30.0%; 95% confidence interval [CI] 24.6–35.4), accommodation and food service (30%; 95% CI 28.3–31.6), construction and extraction occupations (31.4%; 95% CI 29.7–33.1), and food preparation and serving-related occupations (30%; 95% CI 28.4–31.7) compared with workers in management (10.9%; 95% CI 3.3–18.4), the educational services industry (9.7%; 95% CI 9.1–10.4), and education, training, and library occupations (8.7%; 95% CI 7.9–9.5).[51] The message from the studies is generally consistent: Workers in food services and in construction and extraction trades (e.g., rotary drill operator) have the highest rates of smoking prevalence, whereas those in education and library services, legal, and some health occupations have the lowest rates.[35,46,50,51] Disparities along class lines within an industry are illustrated by two studies of health care providers.[52,53] Licensed practical nurses (LPNs), respiratory therapists, and nursing assistants (NAs) had much higher smoking prevalence rates than registered nurses (RNs), who had higher rates than physicians, dentists, and pharmacists.

Syamlal and colleagues[54] analyzed data from the 2004–2012 National Health Interview Study (NHIS) to determine smoking prevalence among working adults by industry and occupation. Between 2004 and 2012, cigarette smoking prevalence among working adults declined from 22.4% to 18.1%. Declines varied by industry and occupation; the highest smoking prevalence was found among adults ages 18 to 44, non-Hispanic whites, individuals with a high school education or less, people with annual household incomes below $35,000, and people who lacked health insurance. Similar to patterns found in earlier studies, the highest smoking prevalence was found among workers in accommodation and food services (28.9%), construction (28.7%), and mining (27.8%). The authors concluded that "although in a majority of industries and occupations the age-adjusted smoking prevalence declined significantly over time, the current decline rates indicate that the smoking prevalence in certain industries and occupations may not reach the 2020 Healthy People goal."[54,p.605] Using data from the 2006-2007 TUS-CPS, Ham and colleagues[35] found that blue-collar and construction workers were more likely than other workers to be ever-smokers and current smokers, and construction workers were particularly heavy smokers (>20 cigarettes per day).

Cigarette Use, by Occupational Class or Industry and Demographic Characteristics

Further disparities can be seen when tobacco use is examined in terms of both occupational class/industry and demographic characteristics such as age, gender, and race/ethnicity. In the overall U.S. population, men have higher smoking prevalence rates than women. Although few recent studies have specifically analyzed gender differences in smoking within occupational class or industry, there are a handful of exceptions. One report on the Asian American workforce analyzed a sample of Chinese, Filipinos, Vietnamese, and others (e.g., Japanese, Koreans, Cambodians, Laotians, and Indians) from the cross-sectional data of the National Latino and Asian American Study.[42] As in the overall U.S. population, this study found that in each occupational class men had higher rates of smoking prevalence than women, although the study did not analyze by each national origin group. For both men and

women, blue-collar and service workers had higher rates of smoking than white-collar workers. These differences were especially pronounced for women.

In an analysis using a nationally representative sample of U.S. adults from the 2000 NHIS, men in blue-collar occupations had higher rates of current smoking than women in the same occupations.[1] In another study, among health care workers, gender differences for smoking were not significant in adjusted models for RNs, LPNs, and NAs; other clinical staff members; nonclinical staff members; or wage-grade personnel.[53] The only significant difference by gender was for an occupational grouping of physicians, physician assistants, and nurse practitioners, with men having higher rates of smoking prevalence than women.

Most studies in the current review adjusted for age, analyzed adults age 18 and older, and did not examine occupational differences by age category. A cross-sectional study by Lawrence and colleagues[45] was an exception in that it analyzed adults ages 18–24 using data from the 1998-1999 TUS-CPS. Like the overall literature on adults, this study found that young adult blue-collar and service workers were more likely to smoke, smoke daily, and be heavy smokers than those who worked in white-collar occupations. Blue-collar and service workers were also less likely to be light smokers (smoking 1–9 cigarettes per day) than their white-collar counterparts. Service workers ages 18–24 had the highest likelihood of smoking (odds ratio [OR] 1.62; 95% CI 1.42–1.84) of all occupational groups.

As described in chapter 2, disparities exist in smoking prevalence rates by race/ethnicity, with American Indians/Alaska Natives having the highest rates of smoking, followed by whites and blacks, Hispanics, and Asian Americans.[55] For nearly all occupational groups, American Indians/Alaska Natives had the highest smoking rates and Asian Americans the lowest, while whites had the most pronounced differences in rates between occupational groups. In terms of smoking prevalence, Barbeau and colleagues[1] found that for whites, blacks, Hispanics, and Asian Americans, blue-collar workers had higher prevalence rates than white-collar workers. For American Indians/Alaska Natives this pattern was different: Service workers had the highest rates of smoking, followed by white-collar workers. In another study focused on health care workers, adjusted prevalence rates of smoking were higher for Hispanic than non-Hispanic physicians, physician assistants, and nurse practitioners.[53] Adjusted smoking rates were higher among whites than nonwhites among RNs, LPNs, NAs, and nonclinical staff members.

Similarly, in multivariate logistic regression analyses of a nationally representative sample of employed U.S. adults ages 18–64 from the 1998-1999 TUS-CPS, occupational class was significantly associated with current smoking for non-Hispanic whites and American Indians/Alaska Natives but not for African Americans, Asian Americans/Pacific Islanders, or Hispanics.[47] For American Indians/Alaska Natives, workers in sales and administrative support were less likely to be current smokers (24.9%) than those in professional and managerial occupations (26.7%). For non-Hispanic whites, laborers (32.9%) and service workers (36.4%) were more likely to be smokers than those in professional or managerial occupations (16.7%). This study also examined racial/ethnic differences in smoking by industry and found significant differences by industry for all racial/ethnic groups except African Americans. Among non-Hispanic whites, workers in nearly all other industries had significantly higher odds of current smoking (odds range from OR 1.31 to 1.66; 95% CI) when compared with those in professional and related services. Asian Americans/Pacific Islanders working in agriculture, forestry, farming, and fishing (OR 1.81; 95% CI 1.01–3.25); wholesale and retail trades (1.62; 95% CI 1.11–2.37); finance, insurance, and real estate (1.61; 95% CI 1.00–2.58); and other service professions (2.05; 95% CI 1.37–3.07) had

higher odds of current smoking than Asian American/Pacific Islander workers in professional and related services. Hispanics working in transportation and common public utilities (1.50; 95% CI 1.09–2.07) and American Indians/Alaska Natives working in finance, insurance, and real estate (2.64; 95% CI 1.20–5.80) had significantly higher odds of smoking compared with professional and related service industries for these race/ethnicities. In adjusted models, Shavers and colleagues[47] reported that work performed in labor and/or service occupations was associated with lower odds of occasional (i.e., non-daily) smoking among African Americans, Hispanics, and non-Hispanic whites when compared with professional groups; however, occasional smoking did not vary significantly by occupation for American Indians/Alaska Natives or Asian Americans/Pacific Islanders.

Occasional smoking varied by industry for African Americans, American Indians/Alaska Natives, and non-Hispanic whites, but it did not vary by either occupation or industry for Asian Americans/Pacific Islanders. African American and non-Hispanic white service workers had higher odds of heavy smoking (i.e., more than 20 cigarettes per day) than those working in professional or managerial occupations—the only significant differences by occupation and race/ethnicity.[47] Heavy smoking did not vary by industry and race/ethnicity, except for Hispanic private or household services workers and non-Hispanic whites working in public administration, who were more likely to be heavy smokers than Hispanics and non-Hispanic whites working in the professional and related services industry. The authors noted that the reasons for this lack of consistency in smoking patterns by industry, occupation, and race/ethnicity are not clear, and they suggested that differential job experiences, such as job demand and stress by race/ethnicity, could account for some of these findings.[47]

In an analysis that added multiple levels of social deprivation (having less than a 4-year college degree, working in a blue-collar occupation, and having an income below 200% of the federal poverty level), Barbeau and colleagues[1] found higher prevalence of current smoking among white males with all three levels of social deprivation (52%) than for white males with less than a college degree (35%). A similar comparison showed that experiencing multiple levels of social deprivation increased smoking prevalence among white and black women by 12–13%. Multiple levels of deprivation were not associated with an increase in smoking prevalence for black and Hispanic men or Hispanic women.[1]

In summary, disparities in patterns of smoking vary by occupation and industry in the United States. Generally, compared with white-collar workers, blue-collar and service workers are more likely to initiate smoking earlier and to be ever-smokers, current daily smokers, and heavier smokers. The highest prevalence rates are found among workers in the construction and extraction and food preparation and service industries, whereas those in education and library services had the lowest rates. Overall, the finding that men have higher smoking rates than women generally holds for all racial/ethnic and occupational groups. Although there is consistent evidence for an association between occupational class and smoking by race/ethnicity for non-Hispanic whites and Asian Americans/Pacific Islanders, evidence for Hispanics, African Americans, and American Indians/Alaska Natives is less consistent. The existing literature has only begun to highlight where disparities exist and where they do not. Augmenting this largely epidemiologic and quantitative literature with qualitative studies could shed light on how gender, age, and race/ethnicity could act as barriers to and protect against smoking. No literature was found on patterns of smoking by occupation/industry and sexual orientation.

Cigarette Use, by Employment Status

Little recent research comparing smoking patterns by employment status is available for the United States. The few nationally representative studies that have focused on employed versus unemployed status have not generally compared tobacco use rates.

Cigarette Use, by Employment Status and Demographic Characteristics

A literature review on smoking patterns by employment status as it interacts with demographic characteristics (such as age, gender, race/ethnicity, and sexual orientation) found no clear pattern in relationships between smoking, employment, and gender. Fagan and colleagues[56] used cross-sectional data from the 1998-1999 and 2001-2002 TUS-CPS and found that unemployed men had increased odds for smoking compared to unemployed women. By contrast, a 19-year longitudinal study using data from the 1979–1998 National Longitudinal Survey of Youth (participants were ages 14–21 in 1979) found that joblessness was more strongly associated with smoking among adolescent/young adult women than men.[57]

Although most studies controlled for age, two studies focused separately on age group categories and employment status. Falba and colleagues[58] conducted a longitudinal study of smoking intensity using data from two waves (1992 and 1994) of the Longitudinal Health and Retirement Survey on individuals ages 52–62 who had suffered an involuntary job loss, defined as loss of a job due to layoff or to a business or plant closing. Older adults who had suffered an involuntary job loss and who remained unemployed at wave 2 reported a significantly higher daily cigarette consumption (about seven more cigarettes per day) compared with those who had not suffered a job loss. There was no significant difference by occupation. The cross-sectional study by Lawrence and colleagues[45] investigating cigarette smoking patterns among young adults ages 18–24 found that those who were unemployed (in the labor force but not currently working) were more likely than those not in the labor force to be current, daily, and heavy smokers.

Race/ethnicity may also interact with employment status to affect smoking behavior. Fagan and colleagues[56] reported that unemployed whites and American Indians/Alaska Natives had nearly three times the odds of current smoking compared with unemployed Asian Americans/Pacific Islanders. Unemployed Hispanics were about 33% less likely to be current smokers than unemployed Asian Americans/Pacific Islanders. Unemployed blue-collar and service workers had slightly greater odds ratios of current smoking compared with unemployed white-collar workers. De Castro and colleagues,[42] in multivariate analyses, found that unemployed Asian Americans had greater odds of smoking than their employed counterparts. Braun and colleagues[57] used employment and occupational prestige scores as outcomes rather than smoking, based on five waves of data (1985–1995) from the longitudinal Coronary Artery Risk Development in Young Adults (CARDIA) Study conducted on a sample of black and white men and women in four major U.S. cities (Birmingham, Alabama; Chicago, Illinois; Minneapolis, Minnesota; and Oakland, California). These researchers found that among blacks (but not whites), current smokers were less likely to be employed as professionals than nonsmokers.

Use of Other Tobacco Products, by Occupational Class or Industry and Employment Status

Cigarettes are the main tobacco product used in the United States, but ST, cigars, and pipe tobacco have also been used for many decades. Other forms of tobacco use, including clove cigarettes, bidis (small hand-rolled cigarettes), waterpipes, and, more recently, e-cigarettes, have entered the U.S. market.

Studies on these newer products continue to emerge, and many were published after the initial literature search for this chapter was conducted. For example, a Centers for Disease Control and Prevention (CDC) study used data from the 2014 NHIS to examine e-cigarette use among working adults by industry and occupation. Overall, for working adults age ≥18 years, an estimated 3.8% were current (every day or some days) e-cigarette users. By industry, e-cigarette use was highest in the accommodation and food services industry (6.9%) and lowest among education services workers (1.8%). By occupation, prevalence was highest among food preparation and serving-related occupations (6.8%) and lowest among architecture/engineering/computer/mathematical workers (1.9%).[60]

As described in chapter 2, ST use is low overall in the United States. However, data from the National Survey on Drug Use and Health (2003–2008) indicates that although most ST users are white males, ST users vary more in terms of education, occupation, and place of residency than is commonly thought.[40] Additionally, a study estimating ST use among employed workers age 18 and older from the 1987–2005 NHIS found that about 3.5% used an ST product, with no statistically significant overall upward or downward trend in use during the time period.[61] When the authors investigated pooled prevalence rates, they found significant differences by occupation: Farm workers had the highest rates (11%), followed by blue-collar (7%), service (2%), and white-collar (2%) workers.[61]

Few disparities-focused studies have looked at individuals who used more than one tobacco product (called dual users or poly-tobacco users). A nationally representative study that looked at concurrent tobacco use in the United States by occupation, employment, and other sociodemographic characteristics was conducted by Backinger and colleagues[62] using data from the 1995-1996, 1998, 2000, and 2001-2002 TUS-CPS. Concurrent users were predominantly white males. Generally, blue-collar workers had higher prevalence rates of concurrent use of tobacco products, ranging from about 6% to 11% over the years studied. In a breakdown by type of concurrent use, blue-collar workers generally had higher prevalence rates of pipe smoking, cigar smoking, and use of chewing tobacco and snuff than white-collar and service workers. In multivariate analyses, occupation was not a significant predictor of current and daily smokers' concurrent tobacco use, although blue-collar workers who were intermittent smokers had a 22% increased risk of concurrent use compared with white-collar workers.[62]

Backinger and colleagues[62] also found that concurrent use of tobacco products was similar among the employed and the unemployed and was slightly lower for those not in the labor force. Pipe use among smokers was similar by employment status, and cigar use among smokers was somewhat lower for those not in the labor force compared with the employed and unemployed. This latter pattern also held for smokers who used chewing tobacco and snuff, both separately and together. Multivariate models showed no significant difference by employment status for concurrent tobacco use.

Influence of Worksite Smoking Bans or Restrictions on Smoking, by Occupation, Industry, and Employment Status

Exposure to SHS has been causally linked to a wide variety of adverse health effects in both adults and children and is estimated to account for more than 41,000 deaths in the United States annually.[63] Reviews of the evidence have concluded that worksite smoking restrictions, especially those that ban smoking everywhere on the worksite, reduce the number of cigarettes workers smoke per day.[64–67] National Cancer Institute (NCI) Tobacco Control Monograph 21, *The Economics of Tobacco and Tobacco Control*, concluded that "comprehensive smoke-free policies in workplaces reduce active smoking behaviors including cigarette consumption and smoking prevalence."[68,p.12]

Although state and local laws prohibiting smoking in workplaces and public places are now common, employees in some worksites, especially those in the hospitality industry (casinos, bars, restaurants, and hotels) continue to be exposed to SHS.[69] Compared with white-collar workers, blue-collar and service workers were less likely to report having a smoking ban in place where they work,[32–35,46] a trend that has continued over time.[35] Occupational class and exposure to SHS have been shown to be inversely related.[34,44]

Shopland and colleagues[33] found that smoking bans are associated with a reduction in the use of cigarettes, but these reductions have been found more in white-collar professions than in the service industry. A study analyzing data from the National Health Interview Survey (1987–2005) found no evidence that worksite smoking restrictions prompted workers to substitute ST products for cigarettes; the prevalence of ST use was stable over this period, despite substantial increases in worksite smoking restrictions.[61] Additionally, the authors found that ST use was lower among workers employed in workplaces where smoking was banned, suggesting that smoking restrictions contribute to lower ST use.[61]

No studies were found that investigated the association between exposure to SHS and tobacco use by occupation and by gender, age, race/ethnicity, or sexual orientation.

Use of Other Tobacco Products, by Occupation, Industry, and Employment Status and by Demographic Characteristics

The study by Dietz and colleagues[61] reported that for all occupational classes and racial/ethnic groups, men had higher rates of ST use than women. Among both black and white men, the rates of ST use varied by occupation and were highest among farm workers (black: 14.65%; white: 12.70%). Black women had relatively high rates of ST use among farm (9.01%) and blue-collar workers (3.07%). No national data were found by industry/employment status and demographic group.

Quit Attempts and Intentions to Quit Smoking

This section examines the literature on quit attempts and intentions to quit smoking by occupational class or industry and employment status. Relatively few studies have examined quit attempts and intentions to quit by occupation. Although the studies reviewed in this chapter use various definitions of quit attempts (ranging from stopping smoking for 1 day to stopping for longer periods), this chapter defines a quit attempt as stopping smoking for 3 months or less, and successful cessation as stopping smoking for a period longer than 3 months.

Attempts and Intentions to Quit Smoking, by Occupational Class or Industry

Before becoming a former smoker, most smokers make multiple quit attempts.[70] Given the differences in smoking prevalence by occupation, it is important to understand whether cessation varies by occupation. Most studies conclude that quit attempts and intentions to quit smoking did not vary by occupational class—that is, there were no significant differences in attempts to quit smoking among white-collar, blue-collar, or service workers.[1,34,35,43]

Barbeau and colleagues[1] found that typically between 40% and 50% of smokers in each occupational class, including farm workers, had attempted to quit at least once in the past year, although these data were not from multivariate regression models. Two studies reported some differences in quit attempts by

occupational class or industry,[35,71] but the differences found in one of these studies[35] were no longer significant in multivariate models. Alexander and colleagues[71] performed a cross-sectional analysis of the 2006 TUS-CPS to investigate the relationships between smoking mentholated cigarettes, occupational class, and quit attempts; using multivariate models that controlled for menthol use, they found that service workers were significantly less likely to make a quit attempt than white-collar workers (OR 0.8; 95% CI 0.69–0.94). These authors noted that service employees are less likely to be protected by smoke-free laws or regulations, which could contribute to fewer quit attempts.

Attempts and Intentions to Quit Smoking, by Occupational and Demographic Characteristics

One study provided descriptive data on the percentages of members of different occupational classes and racial/ethnic groups who attempted to quit, which generally ranged from about 40% to 50%.[1] The authors found no social patterning in quit attempts by SES and racial/ethnic group or, among whites, by occupational class. Among Hispanic workers, service workers had the highest percentage of quit attempts (51%), farm workers the lowest (37%). Among Asian Americans, service workers had the highest percentage of quit attempts (52%), white-collar workers the lowest (43%). Among blacks, white-collar workers had the highest percentage of quit attempts (51%) and farm workers the lowest (42%).[1] Reports of quit attempts by occupational class or industry and by age, gender, or sexual orientation were not located.

Attempts and Intentions to Quit Smoking, by Employment Status and by Demographic Characteristics

NCI Tobacco Control Monograph 12, *Population Based Smoking Cessation*, concluded that as restrictions on workplace smoking are implemented, they increase the rate at which smokers attempt to quit.[72] Similarly, a review of workplace smoking restrictions conducted by Brownson and colleagues[65] concluded that smokers who are employed in workplaces with smoking bans are more likely to consider quitting than smokers employed in workplaces with weaker policies or no policies at all. No studies were found on smoking restrictions and quit attempts by occupation; quit attempts by differential employment status or by employment status intersected with age, gender, race/ethnicity, and sexual orientation; or quitting the use of other forms of tobacco, by occupation.

Cessation

Cessation, by Occupational Class

Research has consistently shown that white-collar workers are more successful at quitting smoking than blue-collar and service workers,[1,34,43,56,73] with multivariate analyses finding lower odds of former smoking among blue-collar and service workers than among their white-collar counterparts.[43,71]

For example, in an analysis of secondary data from a nationally representative sample of employed adults, Fagan and colleagues[43] found that former smokers made up about 19% of white-collar workers; 18% of blue-collar workers; 16% of workers in farming, forestry, and fishing; and 14% of service workers. Barbeau and colleagues[1] reported similar prevalence rates for these categories. Using multivariate analyses, Fagan and colleagues[43] reported that the odds of being a former smoker were about 20% lower for workers in blue-collar (OR 1.31; 95% CI 1.27–1.35) and service occupations (OR 1.15; 95% CI 1.10–1.20) than in white-collar occupations. Former smokers were defined as people who had smoked at least 100 cigarettes in a lifetime and responded “not at all” to the survey question “Do you now smoke every day, some days, or not at all?” Former smokers were asked how long it had been since they had quit smoking, and “successful quitters” were those who had not smoked for at least

12 months. In multivariate analyses, occupational class was not associated with successful quitting of 12 months or more.

Cessation, by Occupational Class or Industry and by Demographic Characteristics

Only one of the studies discussed in the preceding section also reported smoking cessation results by occupation and by gender and race/ethnicity. The study by Barbeau and colleagues[1] detailed prevalence rates of former smoking (defined as not currently smoking) by occupational class and race/ethnicity. White-collar workers had the highest rates of former smoking of any occupational group for whites, Hispanics, and Asian Americans. Among blacks, blue-collar workers had the highest prevalence rates of former smoking; white-collar and service workers had similar rates of former smoking. Barbeau and colleagues'[1] previously described analysis using increasing levels of social deprivation also analyzed gender and racial/ethnic group (white, black, and Hispanic) differences. This analysis found that the pattern of former smoking by gender and race/ethnicity followed the inverse gradient found in the overall population: White, black, and Hispanic women and men who had higher levels of social deprivation were less likely to be former smokers. The authors noted that this pattern was especially pronounced among white men and among women in all three racial/ethnic groups. Of women at the most socially deprived level, only 3% of Hispanics and 4% of blacks were former smokers.

Cessation, by Employment Status

Reviews of the evidence conclude that worksite smoking restrictions significantly increased cessation rates (defined as 3 months or more without smoking), although the effects by occupation status were not discussed.[65–67,72] A few studies have investigated whether employment status influences cessation; most studies adjust for employment status or include only employed workers. In a study of smoking and quitting behaviors among the unemployed, Fagan and colleagues[56] found that unemployed workers whose last or usual job was in blue-collar or service work had lower odds of being former smokers (defined as not currently smoking) compared with unemployed white-collar workers. However, unemployed blue-collar workers were 1.83 times as likely (95% CI 1.17–2.87) to be successful quitters (defined as former smokers who stopped smoking completely for at least 12 months) compared with unemployed white-collar workers. The authors note that "contrary to expectations, unemployed blue-collar workers were more likely than white-collar workers to quit successfully."[56,p.245] The authors suggest that unemployed blue-collar workers may no longer have worksite social influences to smoke, and may be able to develop better coping strategies for quitting when removed from the worksite.

Cessation, by Employment Status and by Demographic Characteristics

One study investigated the relationship of employment status to cessation among different age groups using longitudinal data. Weden and colleagues[57] analyzed a nationally representative sample of young men and women who were 14–21 years old when first surveyed in 1979 and who were interviewed annually or biannually for about 20 years. Cessation was defined as the age at which respondents stopped smoking daily. (Note that this definition of cessation cannot distinguish between smokers who have quit completely and those who now smoke on only some days or intermittently.) The authors found that European American women who were unemployed or out of the labor force were significantly less likely to quit smoking than their employed counterparts, but that employment status and cessation had no significant relationship for African American or Hispanic women. Although there were no significant associations between employment status and cessation among European American and Hispanic men, unemployed African American men were more likely to quit smoking than employed African American

men. The authors speculate that these gender and racial/ethnic differences in smoking and quitting patterns by employment status may be related to differences in smoking and quitting patterns by occupation, and by differential exposures to worksite stresses and demands.[57]

No studies were found that looked at employment status and cessation by sexual orientation or compared quitting use of other tobacco products by different occupational classes.

Relapse

No nationally representative studies were found that directly addressed relapse in terms of occupational class, industry, or employment status. No studies were found that addressed relapse in relation to use of other tobacco products by different occupational classes, or the impact of worksite smoking restrictions on relapse by occupational class.

Effect of Occupation and Tobacco Smoking on Cancer Risk

Tobacco use, exposure to SHS, and occupation have each been found to be related to cancer incidence and mortality and to other diseases.[24,38,74–79] Howard[38] identified six interactions between tobacco smoking and occupational exposures that can produce cancer and other negative health effects:

1. Chemicals contained in tobacco smoke (e.g., carbon monoxide, benzene, acetone, formaldehyde) can also be present in work processes, thereby increasing a worker's cumulative exposure and risk for disease.
2. A workplace toxicant combined with tobacco smoking can produce negative health effects that neither produces alone.
3. If the surface of a cigarette is contaminated with an occupational substance such as lead, the substance can enter the body through ingestion, inhalation, or absorption through the skin.
4. Tobacco smoke and exposure to workplace toxicants can have additive health effects on the body.
5. Tobacco smoke and occupational toxicants could have multiplicative or synergistic effects. For example, research has documented that the combined risk of smoking and exposure to asbestos is greater than the sum of the independent risks of either factor (see Box 8.1)
6. Tobacco smoking has been associated with traumatic occupational injuries. Possible explanations include distraction associated with the act of smoking, the impact of smoking on human performance, and confounding by higher rates of use of alcohol and other drugs among smokers compared with nonsmokers.

By these mechanisms, workers who smoke or are exposed to SHS and are also exposed to workplace toxicants may experience greater cancer risks than those not exposed to workplace toxicants. Box 8.1, on asbestos-related cancer, and the sections on radon and diesel fuels and lung cancer, illustrate that these agents and tobacco smoke have independent and strong effects on cancer risks, and the workplace exposure can interact with tobacco smoke exposure in complex ways to affect cancer risks.

Box 8.1 Asbestos, Smoking, and Cancer Risk

Asbestos has been mined and used commercially in North America since the late 1800s. Its use increased greatly during World War II, and since then, asbestos has been used in many industries. Millions of American workers have been exposed to asbestos since the 1940s, and health hazards from asbestos fibers have been recognized in workers exposed in the shipbuilding trades, asbestos mining and milling, manufacturing of asbestos textiles and other asbestos products, insulation work in the construction and building trades, and a variety of other trades. Demolition workers, dry wall removers, asbestos removal workers, firefighters, and automobile workers also may be exposed to asbestos fibers. As a result of government regulations and improved work practices, today's workers who have no previous asbestos exposure are likely to face smaller risks from asbestos than workers in previous decades.[180]

Asbestos and all commercial forms of asbestos are known to be human carcinogens, based on sufficient evidence of carcinogenicity in humans.[30] The International Agency for Research on Cancer (IARC) has concluded that there is sufficient evidence for the carcinogenicity of asbestos in humans.[181–183] Many studies have shown that the combination of smoking and asbestos exposure is particularly hazardous. Interactions on both the additive and multiplicative scale have been suggested from co-exposure to asbestos and tobacco and subsequent risk of lung cancer.[184] There is also evidence that quitting smoking will reduce the risk of lung cancer among asbestos-exposed workers.

Studies Investigating the Interactions Between Occupation and Smoking and Lung Cancer

Some studies have tested possible interactions between exposures to occupational hazards and tobacco smoking. This section discusses studies that examined interactions between occupational lung carcinogens (radon and diesel engine exhaust) and smoking and risk of lung cancer. The data from these different occupational settings suggest that the observed interactions with smoking and known occupational carcinogens are not the same for all agents, and thus, detailed studies with combined information are needed to understand the health impacts of these co-exposures.

Radon

Miners may be exposed to radon via inhalation in uranium or other mines. A number of studies have assessed the association of radon decay products (known as radon progeny or radon daughters) and lung cancer, and have considered the effects of smoking.[80] Additionally, a report of the National Research Council's Committee on the Biological Effects of Ionizing Radiation provided an in-depth review of the combined effect of smoking and radon on lung cancer risk and detailed evidence from the epidemiologic studies of underground miners showing differing patterns of the effect of exposure to radon progeny on never-smokers and ever-smokers.[81] Relative to the overall effect of exposure to radon progeny on lung cancer risk, the risk estimate in ever-smokers was proportionally lower by a factor of 0.9, whereas the relative effect in never-smokers was proportionally higher by 1.9, a sub-multiplicative interaction.

Diesel Engine Exhaust

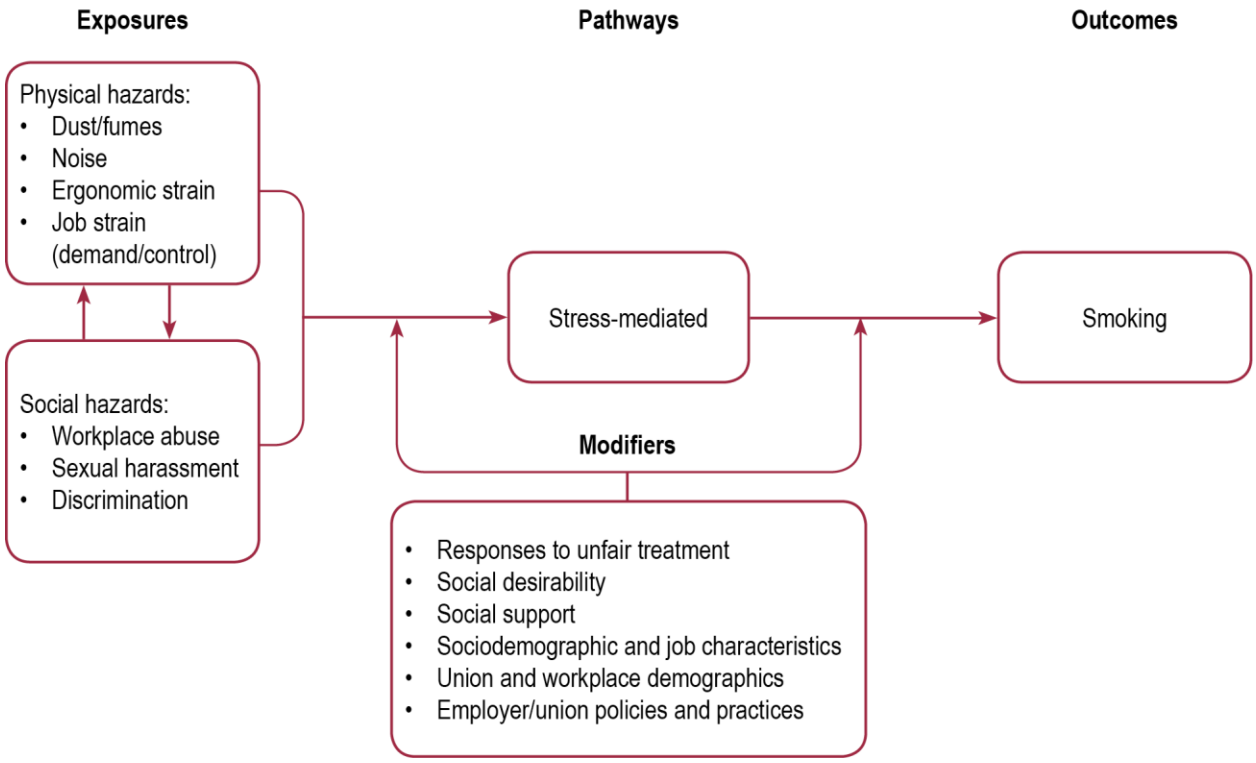
Studies of non-metal miners from the United States have demonstrated a relationship between diesel engine exhaust and lung cancer.[82] In this large cohort of 12,315 workers, the combined effect of diesel exposure and intensity of cigarette smoking was also evaluated. The authors observed that risk associated with smoking intensity was modified by diesel exposure. Among workers in the lowest third

of cumulative respirable elemental carbon exposure, smokers of at least two packs per day had a risk 27 times that of nonsmokers, whereas among those in the highest third of cumulative respirable elemental carbon exposure, heavy smokers had about 2.5-fold the risk of nonsmokers.

Contributions of the Work Environment to Disparities Along the Tobacco Use Continuum

Empirical and theoretical evidence suggests that work environments influence on-the-job and off-the-job health behaviors and may contribute to disparities along the tobacco use continuum.[31,83,84] The link between occupational exposures and smoking is attenuated but remains after controlling for education.[83] Most research studies on the influence of the work environment on tobacco use posit a stress-mediated pathway from exposures in the work environment to tobacco use (Figure 8.1).[85] Evidence from the larger literature on stress and health shows that one mechanism through which stress can influence health is its contributions to changes in health behavior.[86–89] As discussed in chapter 5, low-SES individuals experience multiple sources of stress, and smoking is well known as a source of perceived stress relief.[90,91]

Figure 8.1 Conceptual Model of Stress-Mediated Pathways to Smoking



Source: Adapted with permission from Barbeau et al. 2007.[85]

The work environment can also influence smoking in ways that do not involve stress. Work-related discrimination can influence health via stress, but it can also influence health behaviors through other pathways. Job discrimination can lead to lower wages, which may be associated with an increased use of substances such as cigarettes. Job discrimination can also affect job assignment and, hence, exposure to workplace hazards that may increase the risk of smoking initiation, continuation, and/or the severity of its consequences.[92] Another theory is that self-selection plays a role: smoking may be associated with

lower occupational aspirations, which may increase the likelihood of working in more hazardous jobs.[59] This theory has been hard to evaluate, given that many of the social disparities associated with smoking disproportionately occur early among less advantaged members of societies, who also have fewer career opportunities. A longitudinal study of occupational attainment and smoking found evidence that smoking was associated with less occupational attainment but only among African American workers.[59]

The growing body of work on occupational health disparities shows that socially disadvantaged workers—such as less educated groups; racial/ethnic, gender, and lesbian, gay, bisexual, and transgender (LGBT) groups; immigrants; migrants; and blue-collar and service workers—bear a disproportionate burden of adverse work conditions.[23,93–98] This unequal distribution of working conditions means that any association between adverse work environments and smoking is likely to translate into disparities across the tobacco use continuum. The following sections explore the current evidence for the contribution of adverse work environments to tobacco use. The contribution of these factors to disparities in the tobacco use continuum is also discussed.

Psychosocial Work Environment

Job Control and Effort–Reward Imbalance

Most studies of the relationship between the psychosocial work environment and smoking have used either Karasek's demand–control model or the effort–reward imbalance model to define the psychosocial work environment.

According to the demand–control model, work environments can be categorized into one of four quadrants, based on whether they are high or low in physical and psychological demands and in decision latitude/control.[99] The most stressful working condition—high demands and low control (job strain)—has consistently been shown to be detrimental to health.[99–101] The literature on psychosocial work environments has established that there are occupational disparities in these job characteristics and that socially disadvantaged populations are more likely to have jobs with either or both low control or high demands.[101,102] Studies have yielded inconsistent results, with some studies finding positive associations between job strain and smoking,[11,103–108] and others finding no significant association.[13,106,109–115]

Most of the early studies on job strain and smoking focused on men. For example, using a U.S. sample of 389 male chemical plant workers, Green and Johnson[11] found that those who experienced job strain were more likely to smoke cigarettes. They also found that the proportion of heavy smokers increased with increasing job strain. Most of their study participants were white men (93%), and thus they were unable to examine gender or racial differences in the association. A study of 46,190 public sector workers (81% female) in Finland, found that job strain, as defined by high effort–reward imbalance, was associated with smoking among both women and men, but the association was significant only among women (1.28; 95% CI 1.19–1.39).[105]

Some studies have examined associations with other quadrants of the job demand–control model. Brisson and colleagues[110] found that smoking prevalence was highest among men and women whose working conditions were high in both psychological demands and control. Another study did not find an association between job strain and smoking status but found that smoking status was associated with demands but not control.[111]

Other studies and reviews of the literature have found that the strongest evidence on the influence of the psychosocial work environment on smoking comes from studies of the effect of psychological and physical job demands on increased smoking intensity.[83,116]

Some studies have examined the association between the psychosocial work environment and smoking cessation, but with inconsistent results.[13,117] Of the 4,928 public sector workers (77% female) who were smokers at baseline in 2000–2002, Kouvonen and colleagues[105] found that, at the level of the work unit, low job strain (1.43; 95% CI 1.17–1.75) and high job control (1.61; 95% CI 1.31–1.96) were associated with greater likelihood of smoking cessation at follow-up in 2004-2005.[105] Other studies and reports on occupational disparities have shown that racial and ethnic minority and immigrant workers are more likely to work in units with higher job strain.[7,118,119]

Another model examining job stress is the effort–reward imbalance model, which evaluates jobs based on the degree to which workers are rewarded (in terms of income, opportunities, and prestige) for the physical and psychological efforts required for their jobs.[84,120] Kouvonen and colleagues[105] examined this model in addition to job strain and smoking intensity, as described above. They found that effort–reward imbalance was significantly associated with both smoking intensity and the prevalence of smoking. (The odds of smoking were 1.28 higher for women with a high effort–reward imbalance and 1.13 higher for men with a high effort–reward imbalance compared with female and male employees with low effort–reward imbalance.) A report from the United Kingdom explains that socially disadvantaged populations may be more likely to have jobs in which there is an imbalance in terms of efforts and rewards.[118]

How these working conditions might differentially influence smoking cessation attempts and success among socially disadvantaged workers has received scant empirical attention. One study, which prospectively examined working conditions and smoking among 654 transit operators in San Francisco across 10 years, found that scoring high on an index of job problems (including aspects of psychological demands along with conflict with customers) predicted initiating, maintaining, or increasing smoking.[121] The study also found that black workers were more likely than workers in other racial/ethnic groups to initiate, maintain, or increase their smoking, even after controlling for gender, age, occupational factors, and alcohol use. In this study, black workers had a higher prevalence of smoking than any other racial/ethnic group. The study did not have sufficient power to examine interactions between race and existing job problems.

Job-Related Social Norms, Social Support, and Social Capital

Work-related social norms, social support, and social capital have all been linked to disparities in tobacco use behaviors. As noted previously, studies consistently find that blue-collar workers have higher smoking rates than workers in other occupational classes.[1] Blue-collar workers also reported less pressure to quit and lower support for smoking cessation, both of which were associated with less motivation to quit in this group.[16,122,123] Blue-collar workers also reported receiving less support for smoking cessation from their work environments.[124] A systematic review of the literature on the studies addressing the impact of the work environment on smoking behavior concluded that workplace social support increases cessation and decreases relapse and the amount smoked.[83] The role of workplace social capital may be to act as a buffer between the psychosocial work environment and smoking.[125] In addition, organized labor groups may assist in making smoking cessation programs more relevant and effective for their members.[126]

Job Insecurity

Job insecurity, generally defined in the studies referenced as work status (temporary or permanent), has been established as a source of stress among workers and a source of social inequalities in health.[127,128] Using a cross-sectional community sample of U.S. workers, Muntaner and colleagues[129] found an association between job insecurity and smoking status. Two studies did not find any associations with job security and smoking: a study conducted in Turkey, which defined job insecurity as having temporary employment,[130] and a longitudinal examination of job security and change in smoking behavior among the Whitehall II study cohort in England.[127]

Job loss, another aspect of job insecurity, has potential implications for disparities in tobacco use. As explained earlier, studies have generally found a higher proportion of smokers among the unemployed compared to employed individuals[131,132] and compared to students or participants in labor market programs (e.g., job training, assistance finding a job).[132] Studies of the implications of job loss for tobacco use have shown inconsistent results. Some studies found associations between job loss and smoking,[58,133] whereas others did not.[134,135] Two of these studies were longitudinal observations of workers who had lost their jobs versus those who had not.[133,135] Both studies reported that participants who later experienced job loss had significantly higher levels of smoking at the beginning of the study, but only one study found that job loss preceded increased smoking.[133] Both studies were of British men and did not examine their findings by markers of social disadvantage.

One study found that unemployment was more strongly associated with smoking among young adult women than among young adult men.[57] Further analyses found that the influence of joblessness for women was related to fewer social and economic resources; after adjusting for reductions in resources, the significant association of joblessness with smoking was eliminated for African American and Hispanic women.

Organizational and Physical Work Environment

Work Hours and Schedule

Work hours and schedule can play a role in smoking and smoking cessation. A longitudinal study of Norwegian nursing assistants found a tiered association between work hours and smoking cessation at follow-up;[136] the lowest odds of smoking cessation occurred among those who worked more than 36 hours per week, followed by those who worked 19–36 hours per week, and then by those who worked 1–9 hours per week. A cross-sectional study, which used an Australian sample, found that among men, working 50 or more hours per week was associated with an increased likelihood of smoking, compared with working 35 or fewer hours per week.[137] Another longitudinal study found that those who did not work day shifts were less likely to report smoking cessation than those who did.[104] This study also found that those who worked variable shifts had decreased odds of smoking cessation compared with those who worked only day shifts. The one U.S. study on this issue analyzed nationally representative, cross-sectional data from the 1998-1999 and 2001-2002 TUS-CPS and used multivariate analyses controlling for occupational class; this study found that individuals who worked variable hours were more likely to be smokers than those who worked part time.[43]

With one exception, the studies on work hours and schedules used European and Australian samples and were not able to examine the role of race/ethnicity, immigration status, and social advantages. Studies using nationally representative samples from the United States have shown that socially disadvantaged workers, especially those with low education and income and those who are black and Hispanic, are less

likely to have control over their work hours and schedules.[138,139] As a result, they are likely to be most at risk for any negative influences of work hours and schedules on smoking behaviors.

Discrimination, Workplace Bullying, Abuse, and Harassment

Key sources of workplace stress are experiences such as workplace discrimination, bullying, abuse, and harassment.[118,119,140] Of these, discrimination has received the most attention in the research literature and is discussed further in chapter 5. Meta-analytic reviews indicated that racial discrimination was associated with unhealthy behaviors, especially among racial/ethnic minority groups,[141,142] but this association has received less attention in the workplace literature, and the few studies on the topic have been cross-sectional. Some of these studies used instruments that included questions specifically about having experienced racial discrimination on the job.[140,143–147] Okechukwu and colleagues[148] analyzed a cross-sectional, multiethnic lower class worker sample and reported an association between exposure to workplace racial discrimination and smoking that was strongest for black workers; these authors did not find significant effects for either sexual harassment or workplace bullying.

Workplace discrimination, bullying, abuse, and harassment could play important roles in disparities in tobacco use behaviors. These exposures are significant sources of stress, and they are often specifically targeted toward socially disadvantaged groups, whether based on SES, race/ethnicity, or sexual orientation. The scant workplace-based literature on this topic suggests the need for further research, using prospective designs and improved methods to determine whether these factors contribute to disparities along the tobacco use continuum.

Occupational Hazards

The broader literature on occupational disparities has found that racial/ethnic minority groups, immigrants, migrants, and workers with low wages and/or low education can face more occupational hazards than other workers.[93,95,96,98] Exposure to these hazards does not appear to be directly associated with smoking prevalence. A cross-sectional study of blue-collar and service workers from several workplaces did not find any associations between exposure to occupational hazards and smoking.[148] Other studies, which did include a multivariable analysis of the association, have found a higher prevalence of smoking among workers exposed to occupational hazards.[31] One study found higher smoking prevalence in occupations in which workers were exposed to irritating dust and fumes,[149] and one Japanese and two U.S. studies found a relationship between smoking and exposure to noise.[150–152] A multivariable analysis of more than 7,000 Swedish workers found that shift work and piece work were associated with higher odds of smoking in men, while physical load and a greater ability to interact with co-workers were associated with higher odds of smoking in women.[12]

There is evidence for an association between exposure to occupational hazards and smoking cessation and relapse. As Sorensen has noted, "workers may perceive changes in their individual health behaviors to be futile in the face of significant occupational exposure."[153,p.S197] Indeed, workers' exposure to job-related hazards has been shown to be associated with diminished interest in quitting smoking.[31,154] Results from a longitudinal study of 3,606 smokers found that, controlling for social class, the probability of smoking cessation decreased with exposure to occupational hazards.[116] A study of Norwegian nursing assistants found that a poor workplace social climate and workplace violence predicted smoking relapse.[155] However, evidence suggests that workplace health programs can be effective in improving cessation rates. For example, the WellWorks 2 study reported a doubling of smoking cessation rates among blue-collar workers in manufacturing worksites that were randomly

assigned to an intervention consisting of health promotion and occupational health protection compared with blue-collar workers in worksites that received only health promotion.[154]

Management efforts to support a healthy work environment can bolster workers' motivations to quit and can increase receptivity to messages from management about worker health.[156] This principle of integrating worksite health protection with worksite health promotion has been adopted as a research to practice priority by the National Institute for Occupational Safety and Health in its Total Worker Health™ Program.[157] To date, studies of this integrated approach have focused particularly on manufacturing workers; innovative approaches are needed that address the hazards presented in other industries. Such integrated approaches have been endorsed by the American Heart Association for cardiovascular health promotion,[158] the American College of Occupational Medicine,[159] the International Association for Worksite Health Promotion,[160] and the National Research Council.[156]

Workplace Policies

Policies that restrict smoking in the workplace have been shown to decrease exposure to SHS and produce population-wide reductions in smoking prevalence.[65,161–163] More than half of all states now provide comprehensive protection (100% smoke-free workplaces) to workers.[164] Generally, Hispanics are less likely to work in places that have formal policies banning smoking.[165–167] The gender inequality in coverage by workplace policies that restrict smoking is more complex. Overall, women are more likely than men to be covered by a comprehensive ban on smoking in the workplace,[168,169] but the coverage rate differs within female-dominated occupations. For example, in 1999, 91% of teachers were covered by such policies, compared with only 43% of food service employees.[33] Compared with white-collar workers, blue-collar and service workers are less likely to be covered by smoke-free policies that restrict or ban smoking in workplaces.[32,65,71]

Health insurance coverage for smoking cessation has been shown to increase the odds of long-term abstinence from smoking,[170,171] but health insurance coverage for smoking cessation is unequally distributed by occupational class. Historically, blue-collar workers were less likely than other occupational categories to have health insurance that includes coverage for smoking cessation.[172] A study found that, after controlling for worksite smoking policies and programs, the higher cessation rate among white-collar workers was significant when compared to the cessation rate among service workers but was not significant compared to the cessation rate for blue-collar workers.[71] The literature search did not locate studies that examined whether the Affordable Care Act has influenced insurance coverage for smoking cessation based on occupation.

Intersections of Work, Family, and Neighborhood

Although the work and family environments may be significant sources of stress for many workers, no empirical evidence associates the combination of environments with smoking.[173] However, there are indications that the disparities that exist in the tobacco use continuum by occupational class also exist in workers' households. A study of a community-based sample of blue-collar construction workers found that those who smoked were 13 times more likely to have partners who smoked.[174] Also, having a blue-collar head of household or parent has been shown to be associated with increases in the risk of smoking among adolescents and the risk of later smoking in a cohort study of U.S. women.[175,176] A study using data from the Health Behaviour in School-aged Children study (collected in 2002), found that compared with high parental occupational status, low parental occupational status was associated with a higher risk of adolescent smoking in 14 of 28 countries.[177]

In a study of public sector workers in Helsinki, Finland, higher smoking prevalence was found among women residing in areas with high levels of unemployment, single households, and single-parent families.[178] Adjusted smoking rates were between 21% and 35% higher in these areas. Smoking was more prevalent in the area where the highest percentage of manual workers lived. This study highlights the potential impact of neighborhood on smoking, and especially how neighborhood could intersect with occupation, gender, and other demographics.

Evidence Summary

This section summarizes the evidence (overall and by subgroup) on associations between occupational class, industry, or profession; employment status; the work environment; and indicators along the tobacco use continuum. The consistency and strength of results across studies were considered, along with the strength of the study designs and methodologies used, and gaps in the evidence are discussed.

Some U.S. studies and studies from other countries have found higher rates of smoking and lower rates of quitting among the unemployed compared to the employed. Apart from one study on poly-tobacco use, nationally representative studies among adults ages 18–65 in the United States did not compare associations between employment status, occupation, and tobacco use along the tobacco use continuum.

Initiation

Evidence from nationally representative studies indicates that blue-collar and service workers initiate smoking at younger ages than white-collar workers, and they may also begin using ST at younger ages. The evidence suggests that service workers might be more like white-collar workers than blue-collar workers with regard to initiation of smoking. No nationally representative studies were found that analyzed smoking initiation by race/ethnicity, gender, occupation, or exposure to SHS.

Current Use and Intensity

The evidence across nationally representative studies suggests that blue-collar and service workers are more likely to be ever-smokers, current daily smokers, and heavier smokers compared with white-collar workers. There also appear to be disparities by industry, with construction and extraction trades having the highest rates of smoking, and education and some health professions having the lowest rates. Although only two cross-sectional studies reported an interaction between occupation and gender, these studies suggested that males have higher rates of smoking than females among both blue-collar and service workers. The evidence consistently indicates an inverse association between smoking level and occupation level by race/ethnicity for non-Hispanic whites and Asian Americans/Pacific Islanders. The evidence for tobacco use by occupation among Hispanics, African Americans, and American Indians/Alaska Natives is more mixed; the evidence regarding the intensity of use by occupation and race/ethnicity is also mixed.

Few studies investigated the use of other tobacco products by occupation. Although overall use of ST is relatively low, studies show that blue-collar and farm workers have much higher rates of ST use than white-collar and service workers. In one methodologically strong study of poly-use of multiple tobacco products, no significant relationship was found between occupation or employment status and poly-tobacco use among current cigarette smokers in multivariable models.[62]

Disparities in the use of ST by occupational class and by gender and race/ethnicity have been reported, with white men having higher rates of use in all occupational classes except farm workers, where black men have the highest rates of use. Among female blue-collar and farm workers, black women were found to have higher prevalence rates than white women.

Little research was found that investigated differences by occupational class in the relationship between SHS exposure and current tobacco use. Evidence suggests that reductions in the number and use of cigarettes related to the presence of smoking restrictions were stronger among white-collar workers compared with service workers. However, no studies explored exposure to SHS and tobacco use by occupation and by gender or race/ethnicity.

The strongest evidence for the impact of the psychosocial work environment on smoking is found for the influence of job strain and physical demands on smoking intensity; those with more job strain and physical demands are more likely to be heavier smokers compared with those with less job strain. Those in lower occupational classes have more job strain and physical demands, but the literature has not examined job strain in relation to smoking by different occupational classes or industries. Evidence on the relationship between job strain and smoking by gender, age, race/ethnicity, or sexual orientation is also inadequate. The literature was inconsistent about the relationship of job insecurity to tobacco use and did not analyze the data by occupational class.

In terms of organizational factors in the work environment, the strongest evidence was found for a positive relationship between worksite racial discrimination and smoking; this relationship was not analyzed by different occupational levels.

Quit Attempts

The evidence suggests that the number of quit attempts does not differ significantly by occupational class; however, additional nationally representative studies spanning more than 1 year are needed to determine whether the rate of quit attempts varies by occupation and gender or race/ethnicity. The evidence is insufficient to draw conclusions about quit attempts by exposure to SHS or use of other tobacco products by occupation. Similarly, few studies have looked at how the psychosocial work environment affects quit attempts, and the studies that exist do not compare by different occupations.

Cessation

The evidence suggests that white-collar workers are more successful in quitting than blue-collar and service workers; this might be particularly true of quitting for 12 months or less. More nationally representative studies are needed to conclude whether quitting varies by occupational class and by gender and race/ethnicity. Studies reviewing cessation related to smoke-free policies did not discuss differences by occupation.

Exposures to occupational hazards at the worksite have been associated with decreased quitting. Workers who have higher exposures to workplace hazards have been found less likely to be successful at quitting smoking compared with those with lower exposures. No conclusions can be drawn about the relationship of job strain to cessation by occupational class or industry. There is evidence to suggest that blue-collar workers experience less pressure to quit smoking and lower social support for smoking cessation than white-collar workers. Working in jobs with greater imbalance between effort and reward is significantly associated with higher rates of smoking.

Morbidity and Mortality

Tobacco use and SHS exposure can interact with occupation to influence the risk of cancer and other diseases in a variety of ways. Research has established that the combination of cigarette smoking and exposure to asbestos is particularly hazardous. Additionally, studies have focused on the interaction of tobacco use with exposure to radon and diesel exhaust (both occupational lung carcinogens). These studies demonstrate that the interactions of occupational toxicant exposure with tobacco use are complex, and likely to differ among occupational carcinogens.

Study Design and Methodological Issues

The literature on occupational disparities across the tobacco use continuum often relied on small cell sizes in some populations, particularly when making comparisons across occupational classes or industries within demographic subgroups, such as racial/ethnic groups. Information about interactions between occupation and other markers of social disadvantage, such as low SES or sexual orientation, was not consistently available. Many studies were conducted with either one or multiple cross-sections of data. Some case-control or cohort studies have focused on specific subgroups of workers; the generalizability of findings based on subsets of a population is limited. Analyses of cessation used inconsistent definitions of quit attempts, quitting, successful quitting, and cessation.

Similarly, several issues pose challenges to understanding the contribution of the psychosocial work environment to disparities in the tobacco use continuum. Further study of measurement and operationalization of concepts of the psychosocial work environment (e.g., social norms) that remain stable across different industries and occupational classes could be valuable.[179] Also, most studies have been cross-sectional, making causal inferences difficult. Most studies of associations between the psychosocial work environment and tobacco use have examined only cigarette smoking and no other tobacco products. Finally, most of the studies were conducted in Europe or with non-diverse samples; few studies assessed the potential implications of the results for health disparities in the United States.

Chapter Summary

The 1985 Surgeon General's report, *The Health Consequences of Smoking: Cancer and Chronic Lung Disease in the Workplace*, focused on the interaction between occupation and tobacco use.[39] More than 30 years after the report's publication, significant disparities in tobacco use persist across the tobacco use continuum by occupation. Blue-collar and service workers are more likely to be ever-smokers, current daily smokers, and heavier smokers than white-collar workers, and are less likely to quit successfully, although intentions to quit and quit attempts do not differ by occupation. Tobacco use is especially prevalent in certain industries, notably construction and extraction, mining, and hospitality and food services—settings that offer few worksite cessation programs and often lack comprehensive smoke-free policies. The work environment influences patterns of tobacco use prevalence, intensity, and cessation by occupation. Plausible pathways mediating this relationship include work-related stress, work hours, racial discrimination, pro-tobacco social norms, and lack of social support for cessation. Workers' exposure to job-related hazards appears to be associated with lower interest in quitting and less likelihood of quitting.

Worksite smoke-free policies and tobacco control programs can play a protective role in influencing workers' tobacco use patterns and their potential for SHS exposure. Workers in certain industries are less likely to be covered by smoke-free policies on the job, including construction workers who are

employed outdoors, and service workers who are employed in restaurants, bars, and casinos. Enacting and implementing smoke-free laws with no exemptions for construction sites and hospitality and gaming venues would both support workers' cessation efforts and ensure all indoor workers are protected from secondhand smoke. In addition, worksite tobacco use cessation programs can help ensure that all workers have access to such programs. Labor unions, which have a long-standing commitment to worker health and safety, may be effective partners in efforts to reduce tobacco use among workers.

Research Needs

As this chapter has explained, the relationships between occupation, demographic factors (including gender, age, race/ethnicity, and sexual orientation), and tobacco initiation, prevalence, and cessation are complex and warrant further study. Much of the literature on occupational disparities in tobacco use has examined differences by occupational category, with little attention to interactions by other sociodemographic characteristics. Future qualitative and quantitative research could examine interactions between occupation and race/ethnicity, gender, and sexual orientation to assess the extent to which occupational disparities in tobacco use, quit attempts, and cessation differ across these groups.

Qualitative and quantitative research on differences in tobacco use patterns by specific industry, in addition to broad occupational categories, can provide a more nuanced view of the impact of work experiences on tobacco use in specific settings. To facilitate accurate comparisons across industries, consistent categories of industries should be used (e.g., by Standard Industrialization Classification code). Occupation is an important social determinant of health and TRHD; inclusion of occupation in national health surveys would facilitate research.

In general, studies of populations occupationally exposed to toxicants that have the potential to increase cancer risks have focused on men. There are fewer studies of women occupationally exposed to toxicants, and limited or no studies of interactions between tobacco smoking, occupational toxicant exposures, gender, race, ethnicity, and sexual orientation as they may affect cancer risk; understanding these potentially complex interactions is a research need.

This review highlights the importance of the work environment in helping to shape patterns of tobacco use by occupation. Whenever possible, it is important that investigations examine the pathways by which occupation and on-the-job experiences influence tobacco use patterns. Research is needed to explore the potential impact of the changing nature of work, including increasing contract and contingent work as well as work performed remotely, on patterns of tobacco use and TRHD. Changes in how and where work is performed may modify the impact of the work experience on tobacco use.

This review revealed that most of the research on occupation and smoking in the United States has focused on cigarette smoking; future research could explore the use of other tobacco products by occupation, industry, and employment status. Explorations of the use of other tobacco products in the United States are particularly important given increased poly-tobacco use and the marketing and use of new and emerging tobacco products such as electronic cigarettes.

Research to develop and test multilevel interventions (i.e., at the individual, interpersonal, organization/worksite, community, and policy levels) to address occupation, the work environment, and TRHD is important. It will also be helpful to design and test the feasibility of interventions aimed at ameliorating working conditions (e.g., job strain) that may contribute to TRHD, taking worksite size into account.

Research can explore the extent to which changes in the work environment interact with supports for tobacco control and contribute to reductions in smoking. Future research can build on the successes of programs integrating tobacco control into occupational health and safety initiatives. To date, studies of this integrated approach have focused particularly on manufacturing workers; innovative strategies and studies are needed that address the hazards present in other industries.

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