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Prevalence of diagnosed diabetes among employed U.S. adults by demographic characteristics and occupation, 36 states, 2014–2018

Taylor M. Shockey, PhD[1], **Rebecca J. Tsai, PhD**[1], **Pyone Cho, MBBS**[2]

[1]Division of Field Studies and Engineering, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Cincinnati, OH

[2]Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA

Abstract

Objective: To assess the prevalence of diagnosed diabetes among employed U.S. adults from 36 states by occupation group using data from 2014–2018 Behavioral Risk Factor Surveillance System.

Methods: Prevalence of diabetes was calculated by 22 broad and 93 detailed occupation groups among a sample of 366,633 employed respondents. Wald chi-square values were used to determine the significance of associations between diabetes and occupation groups after adjusting for sex, age, and race/ethnicity.

Results: The prevalence of diabetes was 6.4% among employed U.S. adults. The three broad occupation groups with the highest adjusted prevalence of diabetes were protective services (8.9%), farming, fishing, and forestry (8.8%), and community and social services (8.4%).

Conclusions: Prevalence of diabetes differed by occupation. Work-related factors (e.g. shift work, job stress) should be further examined in relation to risk of developing diabetes.

Keywords

Diabetes; occupation; surveillance; workers; occupational safety and health

Corresponding Author: Taylor Shockey, PhD, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, R-17, Cincinnati, Ohio 45226; (513)841-4239; tshockey@cdc.gov.

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SUPPLEMENTAL DIGITAL CONTENT

Supplementary Table 1 (Word document – Supplementary Table 12.6.20.docx)

1. INTRODUCTION

In 2018, an estimated 26.8 million U.S. adults had been diagnosed with diabetes.[1] Approximately 15.3 million of them were aged 18–64 years (adults of working age).[1] Diabetes is a serious chronic health condition that increases risk of heart disease, stroke, lower-extremity amputation, blindness, and kidney disease, as well as infection-related mortality.[1–3] The prevalence of diabetes has risen over the past several decades, and more than 54 million Americans are expected to be diagnosed with diabetes by 2030.[4–6] Although many demographic characteristics associated with higher diabetes risk are known, the role of work has not been fully explored.

The prevalence of diabetes differs by demographic characteristics, including age, race/ethnicity, and educational attainment. Over the past several decades, the prevalence of diabetes has increased across all age-groups; however, older age groups (55–59 years, 60–64 years, and 65–69 years) have experienced the largest increases.[7,8] The prevalence of type 2 diabetes in the U.S. is also higher among racial and ethnic minorities than in non-Hispanic whites.[9–11] According to 2018 data, American Indians/Alaska Natives (14.7%), people of Hispanic origin (12.5%), and non-Hispanic blacks (11.7%) had the highest prevalence of diagnosed diabetes.[1] Adults with less than high school education were more likely to have diabetes compared to those with more education.[12]

1.1 Modifiable Risk Factors for Diabetes

Obesity is the leading risk factor for type 2 diabetes.[1] Past analyses of 1999–2006 National Health and Nutrition Examination Survey (NHANES) data support a strong association between obesity and diabetes; the prevalence of diabetes rose with increasing bodyweight classes from 8% for normal weight individuals (BMI between 18.5 and 24.9 kg/m^2) to 43% for individuals with class 3 obesity individuals (BMI ≥ 40 kg/m^2).[13] Among U.S. adults with diabetes, 89% were overweight (BMI ≥ 25 kg/m^2), and 61.3% had obesity (BMI ≥ 30 kg/m^2).[1]

Obesity and type 2 diabetes have many similar lifestyle risk factors, including smoking, short or poor-quality sleep, insufficient physical activity, and high calorie diet.[1,14,15] These modifiable risk factors can both directly and indirectly increase risk for type 2 diabetes.[16–18] A meta-analysis found that active smokers had a 30–40% increased risk of developing type 2 diabetes compared to non-smokers.[19] Short sleep has also been associated with increased risk for type 2 diabetes, with a meta-analysis finding that sleeping for fewer than six hours each night (compared to seven hours) increased risk of type 2 diabetes by approximately 30%.[20]

Physical activity is associated with a lower risk of type 2 diabetes. A recent meta-analysis found that higher levels of total physical activity, leisure-time activity, resistance exercise, and other forms of activity were associated with 25–40% significant reductions in type 2 diabetes.[21] Diabetes is multifactorial in etiology, with many interrelated risk factors on the causal pathway.

1.2 Work Characteristics that Influence Risk Factors for Diabetes

Work characteristics, such as shiftwork, long hours, sedentary job conditions, and work-related stress can potentially increase the risk for type 2 diabetes and its antecedent, obesity.[22–25] Shiftwork causes circadian misalignment and increases the risk of obesity and type 2 diabetes through the disruption of metabolic processes; this effect can be worsened by short and disruptive sleeping patterns.[26–28] A meta-analysis of 12 studies examining the relationship between shift work and the risk of diabetes mellitus indicated that rotating, irregular or unspecific, and night shift work schedules had a significantly higher risk of diabetes compared to normal, daytime schedules.[29]

Shift work has been linked to increased risk of diabetes in conjunction with other work organization characteristics. A recent study found shift workers who worked long hours (≥45 hours per week) had nearly 2.5 times the risk of diabetes compared to shift workers who worked 35–44 hours per week.[30] Insufficient sleep and lack of access to healthy food options may cause shift workers to overeat or choose nutrient poor and energy dense (e.g., high fat and sugar) foods during and following their work shifts.[31–33] Sedentary job conditions (e.g., prolonged sitting at work) and lack of physical activity also contribute to diabetes risk,[34] while occupational activity has been found to be associated with a 15% reduction in the risk of type 2 diabetes.[21] Work-related stress has been associated with work characteristics such as shiftwork, long work hours, high job demands, low job controls, and job insecurity, but associations between work-related stress and type 2 diabetes vary by study.[24,35–37]

Work characteristics are often determined by job type, but occupation has rarely been examined as a key factor in diabetes-related studies. A study on incident diabetes among California residents found an increased risk for diabetes among workers in blue collar occupations.[38] A Japanese study found differences in relative risk of diabetes based on type of occupation, with transportation workers having nearly four times the risk observed among laborers.[39]

The current study examined the prevalence of diagnosed diabetes among working (employed for wages or self-employed at the time of survey) U.S. adults in 22 broad and 93 detailed occupation groups from 36 states. To our knowledge, this is the first multi-state study to examine self-reported, diagnosed diabetes among multiple, comprehensive occupation groups. Information about the relationship between diabetes and occupation can enhance the development and targeting of diabetes interventions and prevention programs to specific, at-risk occupations.

2. RESEARCH DESIGN AND METHODS

2.1 Study Sample

The Behavioral Risk Factor Surveillance System (BRFSS) is an annual, random-digit dial landline and cellular telephone survey of the noninstitutionalized, U.S. adult residents (aged 18 years and older) conducted by all states, the District of Columbia, and territories, with support from the Centers for Disease Control and Prevention (CDC). The purpose of BRFSS is to collect state-specific population-based information on health risk behaviors,

chronic illnesses, and use of preventative care services. The questionnaire is composed of a standard core set of questions administered annually or biannually. In addition, states and jurisdictions can elect to include optional modules and state-added questions. Beginning in 2013, CDC's National Institute for Occupational Safety and Health (NIOSH) sponsored an optional industry and occupation (I&O) module to collect employed respondents' industry and occupation. From 2014 through 2018, 36 states administered the I&O module at least once.

The BRFSS weighted, median response rate for all participating states and territories from 2014 through 2018 ranged from 45.9% in 2017 to 49.9% in 2018.[40] The combined 2014–2018 BRFSS dataset of 36 states that administered the I&O module (541,350 respondents) was restricted only to those respondents who were "employed for wages" or "self-employed". The study sample comprised the 392,751 employed for wages or self-employed respondents at the time of survey from states that administered the I&O module for at least one year between 2014 – 2018 (known henceforth as workers or employed adults or respondents).

2.2 Measures

The I&O module includes a question on occupation ["What kind of work do you do? (for example, registered nurse, janitor, cashier, auto mechanic)"] that is asked of BRFSS respondents who report their employment status as "employed for wages," "self-employed", or "out of work for less than one year,".[41] The interviewer records responses to the question as free-text, and NIOSH codes the text responses to 2010 U.S. Census Bureau codes. To protect respondents' privacy and for analytical purposes, the 539 U.S. Census Bureau codes were grouped into 93 two-digit detailed occupation groups used by CDC's National Center for Health Statistics (NCHS), which fall under 23 broad occupations grouped according to the 2010 Standard Occupational Classification (SOC). BRFSS does not include military barracks in its sampling frame, so those military members captured in the survey are not representative of the active armed forces. Respondents with non-codable occupation information (n=24,662), enlisted in active duty military (n=970), or who reported retired, unpaid, disabled (n=486) as their occupation were excluded, resulting in a final sample of 366,633 respondents.

To obtain information on diabetes status, BRFSS respondents are asked, "Has a doctor, nurse, or other health professional ever told you that you have diabetes?".[41] For the purpose of this study, respondents reporting gestational diabetes, borderline, or prediabetes were classified as not having diagnosed diabetes. The BRFSS question does not differentiate the type of diabetes, so both type 1 and 2 were included in the analyses. For the purposes of this study, age was divided into six groups: 1) 18–24 years; 2) 25–34 years; 3) 35–44 years; 4) 45–54 years; 5) 55–64 years; and 6) 65 years or older. BMI was categorized into two groups: 1) < 30 kg/m^2 which includes underweight, normal weight, and overweight; and 2) ≥ 30 kg/m^2 which includes all classes of obesity.

2.3 Statistical Analysis

Several demographic characteristics were first evaluated in univariate analyses using the Wald chi-square: sex, age, race/ethnicity, education attainment, body mass index, health insurance coverage, and physical activity level. Multivariable modeling was used to calculate adjusted diabetes prevalence estimates and 95% confidence intervals (CI) by broad and detailed occupation group. Characteristics that were statistically significant in univariate modeling were considered for inclusion in multivariable models for calculation of adjusted diabetes prevalence estimates and their 95% confidence intervals (CI) by broad and detailed occupation group. Education attainment, physical activity level, and health insurance coverage were statistically significant in univariate models; however, inclusion of these variables in the multivariate model minimally altered the prevalence estimates, so they were removed for parsimony. Sex, age, and race/ethnicity were also statistically significant and had greater effects on the prevalence estimates, so they were included in the final adjusted models. When the BRFSS data standards for reportability were not met, estimates were not shown in the tables and noted as unreliable in the footnote (See Table 2).

All analyses were conducted using SAS (version 9.4) and SAS-callable SUDAAN (version 11.0.1) to account for the complex sampling design of BRFSS. Survey weights were included in all analyses. NIOSH created survey weights for the years 2014–2018 combined to account for differences in the number of years that states might have administered the I&O module based on procedures set forth by the CDC.[40] There were 17 states that administered the I&O module every year from 2014 through 2018, while 19 administered it at least one year (Supplementary Table 1).

3. RESULTS

The prevalence of diagnosed diabetes among this group of employed U.S. adults was 6.4%. Men (7.0%) were more likely than women (5.6%) to have the disease (Table 1). In the working-age population (18–64 years), diabetes prevalence rose more than 11-fold, increasing from 1.1% in the youngest workers (18–24 years) to 12.7% in the older workers (55–64 years). The prevalence was the highest among working adults aged 65 years or older (17.8%) (Table 1). Among the racial/ethnicity groups, American Indian/Alaska Natives had the highest prevalence of diabetes (10.6%), followed by non-Hispanic blacks (7.7%), and Asians (7.7%). Employed respondents who had obesity (BMI ≥ 30 kg/m^2) were nearly three times as likely to have diabetes (11.8%) than those who did not have obesity (4.1%). In addition, the prevalence was higher among workers who did not graduate from high school (9.1%) compared to those with a college degree (5.0%).

Among the broad occupation groups (Table 2), farming, fishing, and forestry (9.4%) had the highest unadjusted prevalence of diagnosed diabetes; followed by protective services (8.9%); community and social services (8.3%); transportation and material moving (8.2%); and building and grounds cleaning and maintenance (8.2%) groups. The highest adjusted (by sex, race/ethnicity, age) prevalences of diagnosed diabetes were seen in protective services (8.9%); farming, fishing, and forestry (8.8%); community and social services (8.4%); and healthcare support (7.9%) (Table 2). The lowest adjusted prevalences were observed in the

life, physical, and social science (3.5%); legal (3.7%); arts, design, entertainment, sports, and media (3.8%); and construction and extraction (4.8%) broad occupation groups.

Among the detailed occupation groups (Table 2), the adjusted prevalence of diagnosed diabetes was highest among law enforcement workers (10.5%); textile, apparel, and furnishings workers (9.9%); agricultural workers (9.8%); other protective service workers (9.0%); other personal care and service workers (8.9%); religious workers (8.7%); and nursing, psychiatric, and home health aides (8.7%) (Table 2). Physical scientists (2.8%); lawyers, judges, and related workers (3.3%); and social scientists and related workers (3.5%) had the lowest adjusted prevalences of diagnosed diabetes.

4. DISCUSSION

Diabetes currently affects nearly 7% of the U.S. workforce and is projected to increase markedly.[6,42] In the United States, the total estimated cost of diagnosed diabetes in 2017 was $327 billion, with 1 in 4 health care dollars going toward care for people diagnosed with diabetes.[43] The indirect costs of diabetes among U.S. workers include increased absenteeism ($3.3 billion) and reduced productivity ($26.9 billion).[43] Indirect costs among U.S. adults not in the labor force include the inability to work due to disease-related disability ($37.5 billion) and lost productivity due to the 277,000 premature diabetes-attributable deaths ($19.9 billion).[43]

Workers with diabetes are more likely to be disabled, absent from work, less productive, and retire early from the workforce.[44,45] Workers with diabetes may need to leave the workforce early to manage their health.[44,46] Diabetes reduces the absolute likelihood of working by approximately 7.1% among men and 4.4% among women.[44,47] Employed adults with diabetes are likely to encounter workplace discrimination, including a higher likelihood of discipline, suspension, and unlawful discharge.[46] Certain industries or occupations have placed work restrictions on individuals with diabetes who require specialized medical treatment. For example, the Federal Motor Carrier Safety Administration (FMCSA) requires truck drivers who receive insulin therapy to obtain a medical exemption in order to drive.[48]

The prevalence of diagnosed diabetes among employed U.S. adults in this study (6.4%) was nearly 40% less than the prevalence of diagnosed diabetes among the general adult U.S. population (10.2%).[1] The relative distribution of diagnosed diabetes by demographic characteristic among the employed adults in this study was aligned with diabetes prevalence estimates among the general adult population. Employed American Indian/Alaska natives were nearly two times more likely to have the disease than their non-Hispanic white counterparts. In addition, advancing age was associated with increasing diabetes prevalence, and lower educational attainment was associated with higher prevalence of diabetes.[1,5,12]

While the scarcity of studies on diabetes by occupation precludes comparison of our findings with those of other studies, the occupation groups identified as having high prevalences of diagnosed diabetes in this study (protective services; farming, fishing, and forestry; healthcare support; and transportation and material moving) have been reported to have higher prevalences of diabetes risk factors (obesity, short sleep, and lack of

physical activity) in other studies.[42,49–53] Prior analyses of 2013–2014 BRFSS industry and occupation data found that transportation and material moving, protective service, and healthcare support had among the highest prevalences of obesity and short sleep (< 7 hours sleep/day) out of 22 broad occupation groups.[50] Additionally, farming, fishing, and forestry had the highest prevalence of no leisure time physical activity.[50] Researchers using National Health Interview Survey (NHIS) data also found that protective services; community and social services; healthcare support, and personal care and service occupations were in the top six out of 22 occupation groups for obesity and morbid obesity.[49,52]

Other research has found that shiftwork is common among occupations that had among the highest prevalences of diagnosed diabetes in this study, with at least 40% of workers in protective service, personal care and service, and healthcare support, working a schedule other than a regular daytime shift.[54] Of the detailed occupation groups, law enforcement workers (10.5%) and other protective service employees (9.0%) within the protective service broad occupation group were found to have among the highest adjusted prevalence of diagnosed diabetes. Results from the Buffalo Cardio-Metabolic Occupational Police Stress Study showed that poor sleep quality was 70% more prevalent among night-shift police officers and, among male police officers who worked the midnight shift, working longer hours (>40 hours/week) was significantly associated with higher BMI and larger waist circumference.[55,56] Protective service and healthcare support workers have also been identified as having a high prevalence of insufficient sleep.[50,51,53] These factors likely influence the risk of diabetes among these occupation groups.

In addition to requiring shift work, occupations such as protective services and healthcare support may be intrinsically more stressful than other occupations, which may contribute to higher prevalence of diabetes in these occupations. Potential stressors include dealing with hostile and angry people, involvement in conflict situations, and pressure to meet deadlines (police patrol officers, sheriffs, and correctional officers),[57] and stress due to daily work tasks involving substantial human contact and rapid-decision making (healthcare workers, counselors, and social workers).[58] Nursing, psychiatric, and home health aides (8.7%) had among the highest adjusted prevalence of diabetes among detailed occupation groups. This group of healthcare workers is commonly low-income and has been reported to have high prevalences for multiple health outcomes such as high blood pressure, high cholesterol, and COPD, as well as lack of health insurance and access to healthcare,[59] and some are also shift workers.[60]

The construction and extraction broad occupation group (4.8%) and the construction trade workers detailed occupation group (4.7%) had among the lowest adjusted prevalences of diagnosed diabetes in this study. The physically demanding characteristics of their job may be associated with those findings.[42,52,61–64] Construction workers are consistently found to have a lower prevalence of diabetes in comparison to other workers.[42,62–64] However, construction workers are also more likely than most other workers to smoke, choose/eat unhealthy food, and engage in low leisure-time physical activity, putting them at risk for developing diabetes.[42,50] The construction industry also has a higher proportion of undocumented workers (15.5% vs. 9.1%), who are more likely than their counterparts to be uninsured.[65–68] The high prevalence of diabetes risk factors, along with limited access to

health care, may suggest a higher prevalence of undiagnosed diabetes among construction workers.[66,69,70]

The farming, fishing, and forestry broad occupation and the agricultural workers detailed occupation groups were found to have among the highest adjusted prevalences of diagnosed diabetes in this study. Despite their physically demanding jobs, diabetes findings are inconsistent among workers in farming, fishing, and forestry occupations; some studies reported a higher prevalence of diabetes among agricultural workers compared to other workers[42,62,63] while other studies found a lower prevalence of diabetes in the former group.[64,71] Work roles and settings (e.g. farm mangers, migrant farmers, family farmers) may be factors related to the differences in diabetes prevalence found within this occupation group. Differences in these findings could reflect demographic differences within the occupational group (over 80% of migrant and seasonal agricultural workers have incomes that are at or below the federal poverty level). In addition, exposures to different pesticides, with varying effects on glucose homeostasis, and differences in work arrangements among farms by size and product, might play a role in the discrepancies.[72–75]

Successful diabetes interventions have been created for specific workplaces and occupations. In healthcare settings, developing effective diabetes interventions involves management participation and staff engagement and needs.[76] For nurses, interventions that target diet, body composition, physical activity, or stress were found to be more effective when organizational changes (e.g., work environment) were also made.[77] Effective interventions include stress reduction sessions, workplace nutrition and physical activity competitions, and designating a local wellness champion who develops activities based on interests and needs.[76]

Truck drivers have a unique work environment, with most of their work time spent driving. Because trucking is a highly sedentary and stressful job with strict deadlines, a balanced diet with adequate physical activity is crucial, but access to fitness facilities and wellness programs is available at fewer than 30% of truck stops, trucking terminals, and warehouses.[78,79] Due to factors such as work constraints, operational demands, lack of healthcare access, and personal beliefs, it can be difficult to engage truck drivers in health promotion programs.[78,80] Therefore, a tailored health intervention approach is vital for addressing the needs of truckers. One study found that motivational interviewing, a form of behavioral therapy, was effective in changing truckers' behaviors for weigh loss.[81] A multi-component life-style program called a Structured Health Intervention for Truckers (SHIFT) has also showed promising results in a pilot study.[82] The SHIFT program includes one-on-one counseling, health coaching, cab-workouts, group-based educational workshop, step count challenges, access to subsidized healthy lunches, and free gym membership.[82,83] Interventions developed for specific occupation groups, such as the SHIFT program for truckers, are likely to be most successful at reducing the burden of diabetes.

4.1 Limitations

This study is subject to several limitations. Because BRFSS data are cross-sectional, causal inferences are not possible; for example, whether people with risk factors for diabetes self-select for more sedentary occupation or whether sedentary jobs contribute the bulk

of the risk of developing diabetes cannot be established from these data. BRFSS data are also self-reported, introducing the potential for recall and other types of bias. Research has indicated that diabetes is underdiagnosed and also underreported in self-reported surveys when compared to claims-based data.[1,84] The BRFSS I&O module is optional and not administered by every state, so the results are not nationally representative. The BRFSS questionnaire does not capture diabetes type (type 1 or type 2). These two types commonly affect different populations and have different risk factors and etiologies; however, since 90–95% of diabetes cases in the U.S. are type 2, the results likely reflect that population.

4.2 Conclusions

The current research found significant differences in the prevalence of diabetes by broad and detailed occupation groups. Targeting occupations with a high prevalence of diabetes will concentrate intervention efforts to those occupations with the greatest need. To reduce the impact and economic burden of diabetes, a major focus should be on preventing obesity which is one of the most significant risk factors for type 2 diabetes. Since obesity is a modifiable risk factor, interventions aimed at loss of excess weight are important preventative measures for type 2 diabetes. To maximize the effectiveness of worksite interventions, health promotion, and educational programs aimed to reduce risky or unhealthy behaviors should be tailored to specific occupation and work-related characteristics (e.g. shift work, sedentary jobs, job-related stress). For example, targeted diabetes interventions for shift workers include controlling light exposure to promote adaptation to night work, adjusting shift schedule to improve sleep quality, and providing weight management and physical activity programs.[85]

Previous research also emphasized the importance of removing barriers to managing diabetes which will help to prevent further disease complications and enable employees to continue working. A meta-analysis found that interventions supporting diabetes self-management can be effective in lowering HbA1c and fasting blood glucose, especially when used in conjunction with individual level interventions.[86] Social support from employers and co-workers can also help workers manage their diabetic symptoms and improve their medication adherence.[87,88] Workers with managed diabetes can continue to be highly productive members of the workforce.[89,90] Designing and disseminating appropriate interventions to prevent the development of and to manage diabetes is necessary to ensure a healthier workforce.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Prevalence of diagnosed diabetes among employed U.S. adults from 36 participating states* by selected sociodemographic characteristic, Behavioral Risk Factor Surveillance System, 2014–2018

Sociodemographic Characteristic	Frequency	Weighted Frequency	Unadjusted prevalence, weighted % (95% CI)
Employed adults	541,350	118,253,182	6.4 (6.2 – 6.6)
Sex			
Male	271,463	65,310,219	7.0 (6.7 – 7.3)
Female	269,605	52,834,188	5.6 (5.3 – 5.9)
Age Group (Years)			
18–24	33,414	13,200,358	1.1 (0.8 – 1.3)
25–34	83,416	26,885,403	1.5 (1.3 – 1.7)
35–44	98,187	26,132,577	4.2 (3.8 – 4.7)
45–54	129,384	25,774,274	8.6 (8.1 – 9.1)
55–64	137,578	19,598,217	12.7 (12.0 – 13.4)
65 or older	59,371	6,662,353	17.8 (16.6 – 19.0)
Race/Ethnicity			
White, NH	409,439	70,963,827	5.8 (5.6 – 6.0)
Black, NH	39,980	13,355,017	7.7 (7.1 – 8.3)
American Indian/Alaska Native, NH	7,501	936,033	10.6 (8.1 – 13.0)
Asian, NH	15,167	6,994,916	7.7 (6.2 – 9.3)
Native Hawaiian/Pacific Islander, NH	1,837	274,431	7.0 (4.1 – 9.9)
Other/Multi-Race, NH	13,020	2,159,429	6.4 (5.3 – 7.5)
Hispanic	45,399	21,418,946	7.0 (6.3 – 7.6)
Education Attainment			
Less than high school	25,166	12,136,335	9.1 (8.2 – 10.0)
High school graduate	125,899	29,643,808	6.7 (6.3 – 7.1)
Attended college or technical school	146,812	36,086,515	6.7 (6.3 – 7.1)
College or technical school graduate	242,053	40,065,871	5.0 (4.7 – 5.3)
Body Mass Index			
< 30 kg/m^2	349,886	76,428,216	4.1 (3.9 – 4.4)
≥ 30 kg/m^2	147,333	31,686,255	11.8 (11.2 – 12.3)
Health Insurance Coverage			
Had health insurance	490,596	101,980,646	6.5 (6.3 – 6.7)
Did not have health insurance	49,085	15,747,167	5.6 (4.9 – 6.2)
Leisure-time Physical Activity			
Participated in physical activity outside of work	420,928	91,331,787	5.6 (5.4 – 5.8)
Did not participate in physical activity outside of work	103,789	23,033,577	9.5 (8.9 – 10.1)

Abbreviations: No. = Number; CI = Confidence Interval; NH = Non-Hispanic

[*] Alaska, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Washington, West Virginia, Wisconsin

Table 2.

Prevalence of diagnosed diabetes among employed U.S. adults from 36 participating states[*] by broad[†] and detailed[‡] occupation group, Behavioral Risk Factor Surveillance System, 2014–2018

Occupation Group	Frequency	Weighted Frequency	Unadjusted Prevalence % (95 % CI)	Adjusted Prevalence % (95% CI)
Protective Service	**7,099**	**1,348,531**	**8.9 (5.7 – 12.1)**	**8.9 (6.4 – 12.2)**
Law enforcement workers	3,314	588,727	[¶]10.4 (3.6 – 17.3)	[¶]10.5 (5.9 – 18.1)
Other protective service workers	2,280	481,515	9.6 (7.2 – 12.0)	9.0 (7.0 – 11.4)
First-line supervisors and managers, and protective service workers	499	76,820	[¶]9.3 (5.1 – 13.6)	[¶]7.4 (4.4 – 12.2)
Firefighting and prevention workers	1,006	201,469	[§]	[§]
Farming, Fishing, and Forestry	**3,504**	**583,507**	**9.4 (5.6 – 13.3)**	**8.8 (5.9 – 13.0)**
Agricultural workers	2,774	469,019	[¶]10.4 (5.6 – 15.1)	[¶]9.8 (6.3 – 15.0)
Forest, conservation, and logging workers	366	53,901	[§]	[§]
Fishing and hunting workers	244	35,529	[§]	[§]
Supervisors, farming, fishing, and forestry workers	120	25,058	[§]	[§]
Community and Social Services	**8,661**	**1,042,716**	**8.3 (7.0 – 9.5)**	**8.4 (7.2 – 9.8)**
Religious workers	1,911	202,937	12.4 (8.7 – 16.1)	8.7 (6.5 – 11.7)
Counselors, social workers, and other community and social service specialists	6,750	839,779	7.3 (5.9 – 8.6)	8.4 (7.0 – 10.0)
Healthcare Support	**8,821**	**1,572,014**	**6.2 (5.3 – 7.2)**	**7.9 (6.7 – 9.1)**
Nursing, psychiatric, and home health aides	5,246	902,276	7.6 (6.1 – 9.0)	8.7 (7.2 – 10.5)
Other healthcare support occupations	3,330	626,573	4.6 (3.5 – 5.7)	6.9 (5.5 – 8.7)
Occupational and physical therapist assistants and aides	245	43,165	[§]	[§]
Personal Care and Service	**11,935**	**2,150,089**	**6.8 (5.8 – 7.8)**	**7.7 (6.7 – 8.9)**
Other personal care and service workers	7,860	1,382,997	7.9 (6.5 – 9.3)	8.9 (7.5 – 10.6)
Personal appearance workers	2,227	443,187	4.6 (3.1 – 6.0)	5.5 (3.9 – 7.5)
Animal care and service workers	583	100,532	[§]	[§]
Entertainment attendants and related workers	468	87,130	[§]	[§]
Transportation, tourism, and lodging attendants	474	89,341	[§]	[§]
Supervisors, personal care and service workers	289	41,394	[§]	[§]
Funeral service workers	34	5,507	[§]	[§]
Transportation and Material Moving	**17,688**	**3,512,467**	**8.2 (7.4 – 9.1)**	**7.3 (6.6 – 8.1)**
Motor vehicle operators	10,618	1,993,056	10.8 (9.4 – 12.1)	8.4 (7.4 – 9.5)
Material moving workers	5,283	1,196,874	4.9 (4.0 – 5.9)	5.4 (4.4 – 6.5)
Air transportation workers	514	70,494	[§]	[§]
Rail transportation workers	423	68,273	[§]	[§]

Occupation Group	Frequency	Weighted Frequency	Unadjusted Prevalence % (95 % CI)	Adjusted Prevalence % (95% CI)
Supervisors, transportation and material moving workers	332	58,612	*§*	*§*
Other transportation workers	277	74,992	*§*	*§*
Water transportation workers	241	50,165	*§*	*§*
Production	**15,753**	**2,907,889**	**7.8 (6.9 – 8.7)**	**7.3 (6.5 – 8.2)**
Textile, apparel, and furnishings workers	1,183	208,842	11.6 (7.6 – 15.6)	9.9 (7.1 – 13.7)
Assemblers and fabricators	1,742	312,801	8.0 (5.6 – 10.4)	8.3 (6.2 – 11.1)
Food processing workers	1,150	209,922	¶ 7.7 (4.0 – 11.4)	¶ 8.1 (5.3 – 12.3)
Metal workers and plastic workers	3,034	554,070	8.3 (5.5 – 11.0)	7.6 (5.5 – 10.3)
Plant and system operators	1,024	161,344	¶ 7.7 (4.7 – 10.7)	¶ 6.9 (4.6 – 10.1)
Supervisors, production workers	1,131	187,821	6.3 (4.0 – 8.6)	6.3 (4.5 – 8.7)
Other production occupations	5,621	1,114,094	6.7 (5.6 – 7.8)	6.2 (5.2 – 7.5)
Printing workers	491	84,783	*§*	*§*
Woodworkers	377	74,211	*§*	*§*
Food Preparation and Serving	**11,689**	**2,562,108**	**5.1 (4.3 – 5.9)**	**7.3 (6.3 – 8.5)**
Food and beverage serving workers	3,941	848,491	4.6 (3.3 – 5.9)	8.5 (6.5 – 11.0)
Cooks and food preparation workers	4,721	983,994	6.3 (4.9 – 7.8)	8.0 (6.2 – 10.2)
Other food preparation and serving related workers	1,047	268,742	¶ 4.7 (2.4 – 6.9)	¶ 7.4 (4.8 – 11.3)
Building and Grounds Cleaning and Maintenance	**13,553**	**2,635,885**	**8.2 (7.0 – 9.3)**	**7.1 (6.2 – 8.2)**
Building cleaning and pest control workers	10,033	1,878,056	8.5 (7.1 – 9.9)	7.3 (6.3 – 8.6)
Grounds maintenance workers	2,644	629,969	7.4 (4.8 – 9.9)	6.8 (4.7 – 9.7)
Supervisors, building and grounds cleaning and maintenance workers	876	127,859	¶ 7.2 (4.3 – 10.1)	¶ 5.9 (3.9 – 8.9)
Supervisors, food preparation and serving workers	1,980	460,880	3.7 (2.7 – 4.8)	4.5 (3.4 – 6.1)
Office and Administrative Support	**39,754**	**6,293,340**	**6.5 (5.8 – 7.1)**	**7.0 (6.3 – 7.7)**
Secretaries and administrative support workers	6,936	1,020,843	8.2 (5.2 – 11.3)	8.4 (5.7 – 12.1)
Information and record clerks	8,379	1,512,645	5.8 (4.8 – 6.8)	7.9 (6.7 – 9.2)
Material recording, scheduling, dispatching, and distributing workers	5,129	952,032	6.9 (5.4 – 8.4)	7.1 (5.8 – 8.6)
Financial clerks	6,303	893,338	6.4 (5.2 – 7.6)	6.5 (5.4 – 7.7)
Other office and administrative support workers	8,494	1,242,683	6.0 (5.1 – 6.8)	6.2 (5.3 – 7.2)
Supervisors, office and administrative support workers	4,320	636,040	5.6 (4.3 – 7.0)	5.7 (4.5 – 8.0)
Communications equipment operators	193	35,759	*§*	*§*
Education, Training, and Library	**29,545**	**3,543,237**	**5.9 (4.8 – 7.1)**	**6.2 (5.1 – 7.5)**
Librarians, curators, and archivists	1,133	121,157	8.3 (5.2 – 11.4)	8.3 (5.7 – 11.8)

Occupation Group	Frequency	Weighted Frequency	Unadjusted Prevalence % (95 % CI)	Adjusted Prevalence % (95% CI)
Primary, secondary, and special education schoolteachers	18,801	2,269,142	5.9 (4.2 – 7.6)	6.8 (5.2 – 9.0)
Other teachers and instructors	1,641	206,056	6.0 (3.8 – 8.3)	6.2 (4.5 – 8.4)
Other education, training, and library occupations	3,231	433,638	5.8 (3.7 – 8.0)	6.0 (4.2 – 8.6)
Postsecondary teachers	4,739	513,245	5.6 (4.4 – 6.8)	4.3 (3.5 – 5.3)
Healthcare and Technical	**30,896**	**4,300,200**	**5.8 (4.5 – 7.0)**	**6.0 (4.9 – 7.4)**
Health technologists and technicians	6,530	1,052,479	5.0 (4.0 – 5.9)	6.4 (5.3 – 7.7)
Health diagnosing and treating practitioners	24,010	3,187,116	6.1 (4.4 – 7.7)	6.0 (4.7 – 7.8)
Other healthcare practitioners and technical occupations	356	60,606	§	§
Computer and Mathematical	**11,272**	**2,120,266**	**6.1 (4.9 – 7.3)**	**5.9 (4.8 – 7.3)**
Computer specialists	10,783	2,038,330	6.0 (4.7 – 7.2)	5.8 (4.7 – 7.1)
Mathematical and science occupations	489	81,936	§	§
Sales and Related	**34,411**	**5,999,173**	**5.3 (4.8 – 5.8)**	**5.8 (5.3 – 6.4)**
Supervisors, sales workers	7,079	1,077,053	6.4 (4.5 – 8.3)	6.5 (4.8 – 8.8)
Retail sales workers	15,270	2,959,441	4.8 (4.2 – 5.4)	6.5 (5.8 – 7.3)
Sales representatives, wholesale and manufacturing	2,598	409,415	7.0 (5.1 – 8.9)	6.0 (4.5 – 8.0)
Sales representatives, services	4,496	752,234	5.2 (4.2 – 6.3)	4.9 (3.9 – 6.0)
Other sales and related workers	4,968	801,029	4.6 (3.6 – 5.6)	4.0 (3.2 – 4.9)
Management	**45,063**	**6,099,960**	**6.3 (5.4 – 7.1)**	**5.5 (4.8 – 6.4)**
Other management occupations	31,010	3,919,933	6.7 (5.4 – 7.9)	5.7 (4.7 – 6.9)
Advertising, marketing, promotions, public relations, and sales managers	2,433	417,076	¶ 4.5 (2.3 – 6.6)	¶ 5.2 (3.2 – 8.3)
Chief executives, general and operations managers, legislators	5,023	721,835	6.6 (4.7 – 8.5)	5.1 (3.8 – 6.9)
Operations specialties managers	6,597	1,041,126	5.2 (4.1 – 6.3)	5.1 (4.2 – 6.2)
Installation, Maintenance, and Repair	**11,778**	**2,386,499**	**5.8 (4.8 – 6.7)**	**5.4 (4.6 – 6.4)**
Other installation, maintenance, and repair occupations	4,406	905,105	7.2 (5.1 – 9.2)	6.0 (4.5 – 8.0)
Vehicle and mobile equipment mechanics, installers, and repairers	5,406	1,089,435	4.5 (3.6 – 5.4)	4.9 (4.0 – 5.9)
Electrical and electronic equipment mechanics, installers, and repairers	1,520	318,922	¶ 5.0 (2.9 – 7.2)	¶ 4.6 (2.9 – 7.4)
Supervisors, installation, maintenance, and repair workers	446	73,037	§	§
Architecture and Engineering	**9,940**	**1,547,657**	**6.2 (4.8 – 7.7)**	**5.3 (4.3 – 6.6)**
Engineers	7,525	1,150,478	6.3 (4.5 – 8.2)	5.4 (4.1 – 7.1)
Drafters, engineering, and mapping technicians	1,482	251,983	5.9 (4.1 – 7.8)	5.1 (3.6 – 7.0)
Architects, surveyors, and cartographers	933	145,196	¶ 5.9 (2.7 – 9.0)	¶ 5.0 (2.9 – 8.4)
Business and Financial Operations	**15,014**	**2,289,046**	**5.4 (4.4 – 6.3)**	**5.1 (4.3 – 6.2)**

Occupation Group	Frequency	Weighted Frequency	Unadjusted Prevalence % (95 % CI)	Adjusted Prevalence % (95% CI)
Business operations specialists	6,777	1,090,167	5.7 (3.8 – 7.5)	5.7 (4.2 – 7.8)
Financial specialists	8,237	1,198,878	5.1 (4.2 – 6.0)	4.6 (3.9 – 5.5)
Construction and Extraction	**20,408**	**4,193,324**	**4.8 (4.1 – 5.6)**	**4.8 (4.1 – 5.5)**
Other construction and related workers	993	149,453	¶ 7.4 (4.3 – 10.5)	¶ 6.2 (4.2 – 9.2)
Construction trades workers	16,111	3,519,291	4.7 (3.8 – 5.6)	4.7 (3.9– 5.6)
Supervisors, construction and extraction workers	2,441	405,003	4.9 (3.3 – 6.5)	4.1 (2.9 – 5.6)
Extraction workers	826	112,148	§	§
Helpers, construction trades	37	7,429	§	§
Arts, Design, Entertainment, Sports & Media	**8,146**	**1,313,925**	**3.9 (3.1 – 4.8)**	**3.8 (3.1 – 4.7)**
Art and design workers	3,100	485,283	3.7 (2.5 – 5.0)	3.6 (2.6 – 5.1)
Entertainers and performers, sports and related workers	1,685	327,393	¶ 3.9 (2.1 – 5.7)	¶ 4.1 (2.5 – 6.5)
Media and communication workers	2,516	318,158	5.1 (3.4 – 6.8)	4.2 (2.8 – 6.1)
Media and communication equipment workers	845	183,091	§	§
Legal	**5,280**	**778,875**	**4.3 (3.4 – 5.2)**	**3.7 (3.0 – 4.7)**
Legal support workers	1,450	232,194	4.7 (3.1 – 6.3)	5.3 (3.8 – 7.5)
Lawyers, judges, and related workers	3,830	546,681	4.1 (3.1 – 5.2)	3.3 (2.5 – 4.3)
Life, Physical, and Social Science	**6,423**	**872,708**	**3.5 (2.7 – 4.4)**	**3.5 (2.8 – 4.4)**
Life scientists	1,566	206,047	¶ 4.3 (1.8 – 6.8)	¶ 4.1 (2.4 – 6.9)
Life, physical, and social science technicians	1,163	186,958	3.3 (1.9 – 4.6)	3.6 (2.4 – 5.4)
Social scientists and related workers	2,086	274,131	3.4 (2.3 – 4.6)	3.5 (2.5 – 5.0)
Physical scientists	1,608	205,573	¶ 3.0 (1.5 – 4.6)	¶ 2.8 (1.7 – 4.7)

Abbreviations: No. = Number; CI = Confidence Interval

* Alaska, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Washington, West Virginia, Wisconsin

† Standard Occupational Classification (SOC) System broad occupation groups (those bolded groups in the table)

‡ 93 detailed occupation groups are based on National Health Interview Survey recodes which rely on Bureau of Census occupation codes (those non-bolded groups in the table)

‡ Adjusted for sex, race/ethnicity, and age

¶ Estimates preceded by this symbol have a relative standard error > 20% but ≤ 30%, therefore, they should be interpreted with caution based on BRFSS standards of reliability/precision.

§ Estimates are not shown because the relative standard error is > 30%, or the cell size is less than 50, and do not meet BRFSS standards of reportability.