

## Drug Overdose Mortality by Usual Occupation and Industry: 46 U.S. States and New York City, 2020

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### Abstract

**Objective**—This report describes deaths from drug overdoses in 2020 in U.S. residents in 46 states and New York City by usual occupation and industry.

**Methods**—Frequencies, death rates, and proportionate mortality ratios (PMRs) are presented using the 2020 National Vital Statistics System mortality data file. Data were restricted to decedents aged 16–64 for rates and 15–64 for PMRs with usual occupations and industries in the paid civilian workforce. Age-standardized drug overdose death rates were estimated for usual occupation and industry groups overall, and age-adjusted drug overdose PMRs were estimated for each usual occupation and industry group overall and by sex, race and Hispanic-origin group, type of drug, and drug overdose intent. Age-adjusted drug overdose PMRs were also estimated for individual occupations and industries.

**Results**—Drug overdose mortality varied by usual occupation and industry. Workers in the construction and extraction occupation group (162.6 deaths per 100,000 workers, 95% confidence interval: 155.8–169.4) and construction industry group (130.9, 126.0–135.8) had the highest drug overdose death rates. The highest group-level drug overdose PMRs were observed in decedents in the construction and extraction occupation group and the construction industry group (145.4, 143.6–147.1 and 144.9, 143.2–146.5, respectively). Differences in drug overdose PMRs by usual occupation and industry group were observed within each sex, within each race and Hispanic-origin group, by drug type, and by drug overdose intent. Among individual occupations and industries, the highest drug overdose PMRs were observed in decedents who worked as fishers and related fishing occupations and in fishing, hunting, and trapping industries (193.1, 166.8–222.4 and 186.5, 161.7–214.1, respectively).

**Conclusions**—Variation in drug overdose death rates and PMRs by usual occupation and industry in 2020 demonstrates the disproportionate burden of the ongoing drug overdose crisis on certain sectors of the U.S. workforce.

**Keywords:** worker health • proportionate mortality ratios • census codes • National Vital Statistics System

### Introduction

Deaths from drug overdoses are a major public health concern in the United States (1,2), particularly in the working-age population (1). The drug overdose death rate increased in most years from 1999 through 2020 (3). This trend intensified during the COVID-19 pandemic; the U.S. drug overdose death rate in 2021 was 50% higher than in 2019 (1). Increases in drug overdose deaths in 2020 and 2021 contributed to the overall rise in deaths involving drug overdose, suicide, or alcohol abuse during the pandemic (4).

Drug overdose mortality risks vary by occupation, industry, and work-related characteristics, including workplace injury, work-related psychosocial stress, precarious employment, employer-provided health insurance status, and access to paid sick leave (5–8). Workers in each occupation and industry also experienced unique stressors during the COVID-19 pandemic that impacted prevalence and management of substance use disorders (9–12). This report describes U.S. drug overdose mortality by usual occupation and industry for 2020 to expand on and update historical estimates (5). Drug overdose death rates and proportionate mortality ratios (PMRs) are estimated for each occupation and industry group overall. Drug overdose PMRs are also estimated for each individual occupation and industry and for each occupation and industry group within each sex, within each race and Hispanic-origin group, by drug type, and by drug overdose intent.



## Methods

### Data sources

Mortality data are drawn from the National Center for Health Statistics' National Vital Statistics System 2020 mortality file. Data on usual occupation and industry are available for 91% of decedents aged 15 and over and are reported by 46 states and New York City. Results are only representative of decedents in these 47 jurisdictions. Occupation and industry data were also missing for substantial portions of decedents (6%–11%) in two participating states (13). See Technical Notes for more information on participating jurisdictions and data availability.

The U.S. Standard Certificate of Death (14) records usual occupation and industry, or the occupation and industry in which the decedent spent most of their working life. Occupation is the type of work that a person performs, or their job (such as teacher or cashier), while industry is the type of business a person works in (such as an elementary school or grocery store). Usual occupation or industry may differ from current occupation and industry at death. However, usual occupation and industry have been shown to be reasonable surrogates for current occupation and industry among currently or recently employed workers (15). Occupation and industry narratives provided on death certificates were coded to standardized individual U.S. Census Bureau occupation and industry codes through a collaboration with the National Institute for Occupational Safety and Health (13). Census codes were then aggregated into broad groups using the National Health Interview Survey simple occupation and industry recodes (16) to minimize suppression of results due to small populations. This aggregation may smooth over contrasting results in some component occupations and industries. See Technical Notes for more information on occupation and industry coding.

Cause-of-death statistics presented in this report are classified using *International Classification of Diseases, 10th Revision* (ICD–10) codes. Drug overdose deaths were identified using the underlying cause of death, which is the disease or condition responsible for initiating the chain of events leading to death (17). Drug overdose deaths include unintentional (ICD–10 codes X40–X44), suicide (X60–X64), and homicide (X85) overdoses, as well as overdoses of undetermined intent (Y10–Y14). Type(s) of drugs involved in each overdose death were determined using multiple cause-of-death ICD–10 codes for heroin (T40.1), natural and semisynthetic opioids (T40.2), methadone (T40.3), synthetic opioids other than methadone (T40.4), cocaine (T40.5), and psychostimulants with abuse potential (T43.6).

Population estimates from the April 2020 Current Population Survey (CPS) were applied as denominators for the estimation of death rates. CPS estimates are weighted to represent the civilian noninstitutionalized population aged 16–64 in the 47 participating jurisdictions only (18). See Technical Notes for more information on the use of CPS estimates in the calculation of death rates.

## Statistical Methods

### Mortality measures

Drug overdose death rates and PMRs were estimated for working-age decedents in each occupation and industry group. Death rates may be applied to compare the number of deaths from drug overdoses per 100,000 workers between occupation and industry groups in a standardized way. In contrast, PMRs evaluate relative drug overdose mortality using a ratio of two proportions, estimated as the proportion of deaths from drug overdoses within each group of workers (numerator) compared with the proportion of deaths from drug overdoses in all workers (denominator), multiplied by 100 (19). For example, the unadjusted drug overdose PMR in decedents in construction and extraction occupations is estimated as:

$$\left( \frac{\frac{\text{Drug overdose deaths among construction and extraction workers}}{\text{Total deaths among construction and extraction workers}}}{\frac{\text{Drug overdose deaths among all workers}}{\text{Total deaths among all workers}}} \right) \cdot 100$$

In this report, a PMR over 100 indicates that drug overdose deaths in that occupation (or industry) comprise a greater proportion of deaths in that set of decedents than across decedents in all occupations (or industries) combined.

Death rates and PMRs often have similar patterns, but results may differ within working-age populations that experience particularly high or low overall mortality. PMRs are mutually dependent between causes of death because the percentages of deaths from all causes within a worker group must sum to 100 (19). For example, the proportion of deaths attributed to drug overdoses (and therefore the drug overdose PMR) may be lower in occupation groups with higher underlying mortality rates and higher baseline prevalence of competing causes of death. Because higher income is associated with longer life expectancy (20), if drug overdose death rates were equal within all occupation and industry groups, elevated drug overdose PMRs within high-income occupations and industries would be expected due to lower baseline prevalence of competing causes of death within these working-age populations. PMRs identify the worker populations with the highest proportions of deaths from drug overdoses, rather than the worker populations with the highest absolute risks of death from drug overdoses as estimated by death rates (19).

### Death rates

Data were restricted to U.S. resident decedents aged 16–64 in the paid civilian workforce. Decedents aged 15 were excluded because they are not represented in CPS workforce population denominator estimates (18). Decedents with unpaid or military occupations or industries were also excluded from estimation of drug overdose death rates by occupation or industry because population estimates for these groups are not available from CPS (18). People with unpaid occupations and industries include

homemakers, people with disabilities preventing work, people who are incarcerated, and students, among others. (13).

Age-standardized drug overdose death rates for the population aged 16–64 were computed based on age-specific death rates in each occupation and industry group and the 2000 U.S. standard population as deaths per 100,000 workers (Technical Notes). Direct age-standardization was performed using 10-year categories, excluding age 15 (16–24, 25–34, 35–44, 45–54, and 55–64). However, the traditional age groups of the 2000 U.S. standard population (15–24, 25–34, 35–44, 45–54, and 55–64) were used in applying the age-specific adjustment weights.

CPS is a population-based survey, and occupation and industry group-level denominators are estimates of worker population size (18). Sampling variance data are not available from CPS for the specific study populations. Parameters from a proxy series were applied to estimate approximate population denominator standard errors that account for sampling variance under the CPS design effect (21). No hypothesis tests were performed to compare death rates between worker populations given the large number of comparisons and the uncertainty in denominator sampling variance estimates. A higher rate within one worker population compared with another does not indicate a statistically significant difference. Death rates were not estimated for occupation and industry groups within demographic and geographic subpopulations because subpopulation denominator estimates may be unstable or for individual occupations and industries because denominator estimates are not available. See Technical Notes for more information on the estimation of age-standardized drug overdose death rates and confidence intervals (CIs).

## PMRs

Data were restricted to U.S. resident decedents aged 15–64 in the paid civilian workforce. Decedents with unpaid or military occupations or industries were excluded (13) to minimize any healthy worker effect (bias due to differences in underlying health among workers and nonworkers [13]) in comparative analyses.

Drug overdose PMRs were estimated for each usual occupation and industry group overall in reference to the proportion of deaths from drug overdoses in all decedents with paid civilian usual occupations or industries. PMRs were also estimated for all individual occupations and industries. PMRs were internally adjusted to the age distributions of U.S. resident decedents aged 15–64 who were identified in usual occupations and industries in the paid civilian workforce (13). Age adjustment was performed using 10-year age groups (15–24, 25–34, 35–44, 45–54, and 55–64).

Drug overdose mortality was further characterized by individual census occupation codes within the construction and extraction occupation group, which experienced particularly high drug overdose PMRs in 2020. Within the construction and extraction occupation group, individual census occupation codes with less than 500 total deaths from all causes were combined into an “all other construction occupations” category and an “extraction occupations” category to produce occupation-level PMRs with reasonable precision.

Drug overdose PMRs were also estimated by occupation and industry group in decedents of each sex and race and Hispanic-origin group in stratified analyses, calculated in reference to the proportion of deaths from drug overdoses in all decedents of that demographic group with paid civilian usual occupations or industries. PMRs within each demographic group were internally adjusted to the separate age distributions of decedents of that demographic group using the same 10-year age categories as described previously.

Finally, drug overdose PMRs were estimated by occupation and industry group for deaths involving each type of drug in stratified analyses, calculated in reference to the proportion of deaths from drug overdoses involving that type of drug in all decedents with paid civilian usual occupations or industries. Similar analyses were performed by occupation and industry group and drug overdose intent in stratified analyses, excluding homicidal overdoses from presentation due to small numbers across all worker populations. Age adjustment was performed as described previously for all drug overdose deaths.

PMRs are described in comparison with the total population for overall estimates or in comparison with the subpopulation for stratified estimates against a referent PMR value of 100.0 in each population. PMRs are considered elevated if the lower bound of the 95% CI is over 100.0. No hypothesis tests were performed to compare PMRs between worker populations, given the large number of comparisons, and a higher PMR within one worker population compared with another does not indicate a statistically significant difference. PMRs based on fewer than 20 deaths were suppressed. National Center for Health Statistics data presentation standards for proportions were applied to percentages shown in [Tables 1–6](#) and [I–1](#) through [I–10](#) (22). See Technical Notes for more information on estimation of age-adjusted PMRs and CIs.

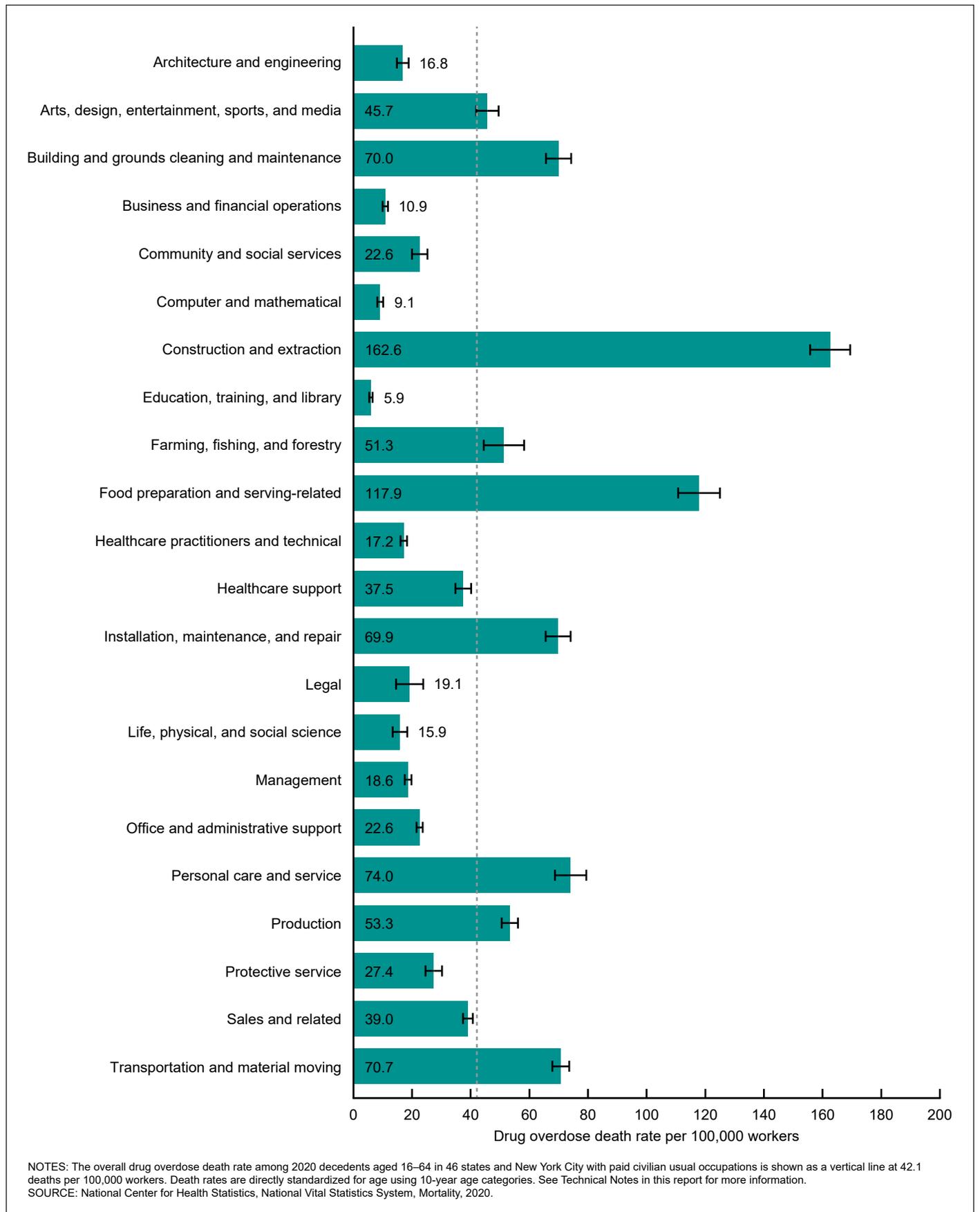
Race and Hispanic origin were classified according to the 1997 Office of Management and Budget standards (23) and differ from bridged-race groups used in National Center for Health Statistics reports before 2018. Groups presented are American Indian and Alaska Native non-Hispanic (subsequently, American Indian and Alaska Native), Asian non-Hispanic (subsequently, Asian), Black non-Hispanic (subsequently, Black), White non-Hispanic (subsequently, White), and Hispanic. PMRs for each usual occupation and industry group in Native Hawaiian or Other Pacific Islander non-Hispanic and multiple-race non-Hispanic workers are not presented due to small numbers. See Technical Notes for more information on the classification of race and Hispanic origin.

## Results

### Drug overdose death rates by usual occupation and industry group

Drug overdose death rates varied across usual occupation groups in 2020 ([Figure 1](#), [Table 1](#)). Workers in eight usual occupation groups, including construction and extraction (162.6 deaths per 100,000 workers, 95% CI: 155.8–169.4); food

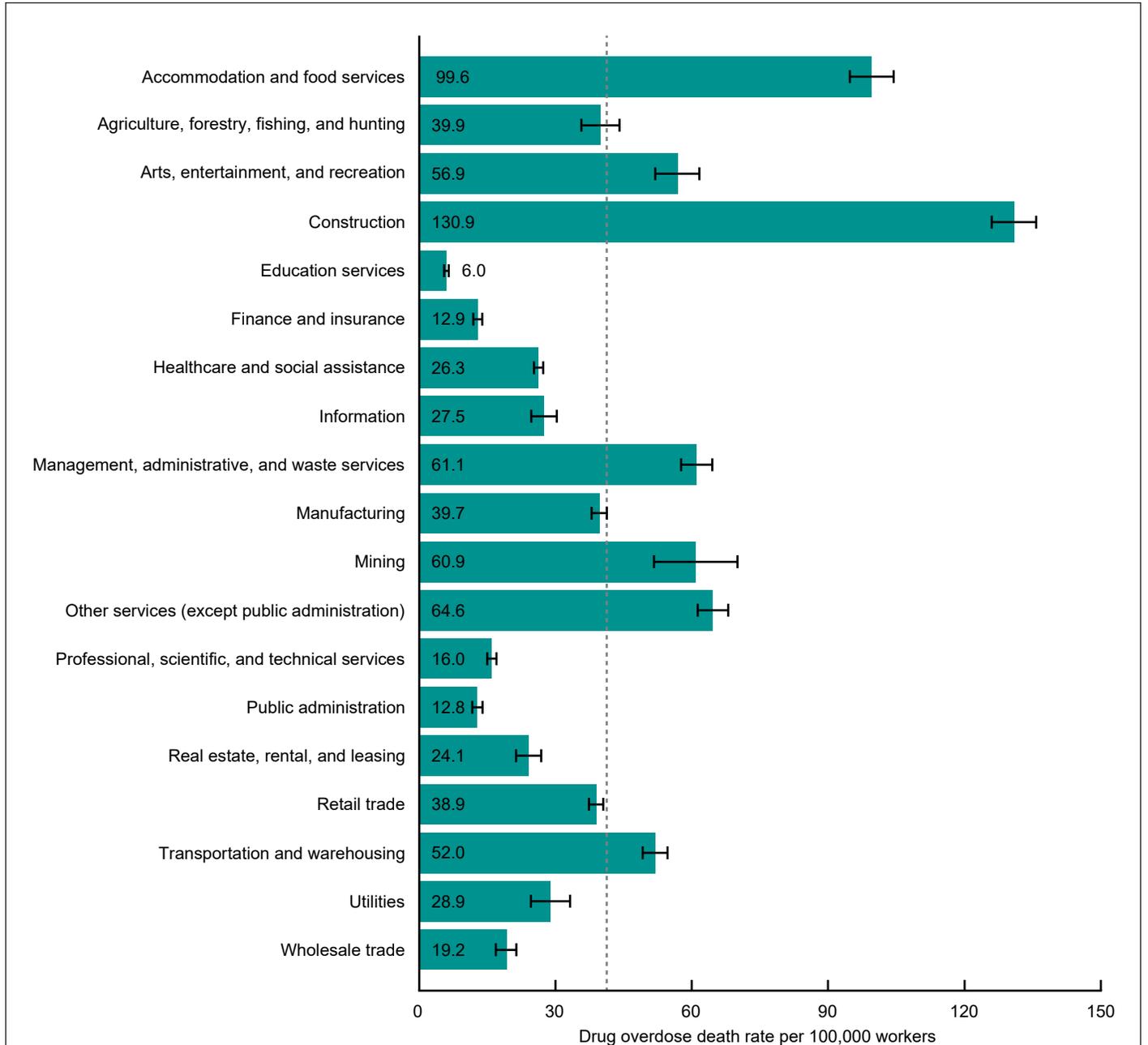
**Figure 1. Drug overdose death rates among U.S. decedents aged 16–64, by usual occupation group: 46 states and New York City, 2020**



preparation and serving-related (117.9, 110.8–125.0); personal care and service (74.0, 68.7–79.4); transportation and material moving (70.7, 67.9–73.6); building and grounds cleaning and maintenance (70.0, 65.7–74.3); installation, maintenance, and repair (69.9, 65.6–74.1); production (53.3, 50.6–56.1); and farming, fishing, and forestry (51.3, 44.4–58.2) experienced age-standardized drug overdose death rates with larger absolute values and CIs compared with the drug overdose death rate among workers in all occupations combined (42.1, 41.6–42.6).

Drug overdose death rates also differed by usual industry group in 2020 (Figure 2, Table 2). Workers in seven usual industry groups, including construction (130.9 deaths per 100,000 workers, 95% CI: 126.0–135.8); accommodation and food services (99.6, 94.8–104.4); other services (except public administration) (64.6, 61.3–68.0); management, administrative, and waste services (61.1, 57.7–64.5); mining (60.9, 51.7–70.1); arts, entertainment, and recreation (56.9, 52.0–61.7); and transportation and warehousing (52.0, 49.2–54.7) experienced

**Figure 2. Drug overdose death rates among U.S. decedents aged 16–64, by usual industry group: 46 states and New York City, 2020**



NOTES: The overall drug overdose death rate among 2020 decedents aged 16–64 in 46 states and New York City with paid civilian usual industries is shown as a vertical line at 41.3 deaths per 100,000 workers. Death rates are directly standardized for age using 10-year age categories. National Health Interview Survey administrative, support, and waste services and management of companies and enterprises industry groups are combined to align with the Current Population Survey’s management, administrative, and waste services industry category. See Technical Notes in this report for more information.  
 SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

age-standardized drug overdose death rates with larger absolute values and CIs compared with the drug overdose death rate among workers in all industries combined (41.3, 40.8–41.8).

## Drug overdose PMRs by usual occupation and industry

Drug overdose PMRs—the proportion of deaths from drug overdoses within each group compared with the proportion of deaths from drug overdoses among all workers—varied across usual occupation groups in 2020 (Figure 3, Table 3). Decedents in five usual occupation groups, including construction and extraction (145.4, 95% CI: 143.6–147.1); food preparation and serving-related (130.4, 128.1–132.8); building and grounds cleaning and maintenance (108.3, 105.3–111.4); personal care and service (108.1, 104.5–111.7); and installation, maintenance, and repair (106.0, 102.9–109.1) experienced PMRs with the lower bound of the 95% CI over 100.0 (the PMR among decedents in all occupations combined).

Drug overdose PMRs also differed by usual industry group and showed similar patterns as those observed within occupation groups in 2020 (Figure 4, Table 4). Decedents in four usual industry groups, including construction (144.9, 95% CI: 143.2–146.5); accommodation and food services (123.9, 121.8–125.9); administrative, support, and waste services (111.2, 108.2–114.2); and other services (except public administration) (107.9, 105.1–110.6) experienced PMRs with the lower bound of the 95% CI over 100.0.

Individual census occupations and industries showed variation in drug overdose PMRs. Among individual occupations, the highest PMR was observed among decedents who worked as fishers and related fishing workers (193.1, 95% CI: 166.8–222.4), followed by sailors and marine oilers (179.3, 138.3–228.5); roofers (177.4, 163.6–192.0); forest and conservation workers (177.1, 114.6–261.4); and drywall installers, ceiling tile installers, and tapers (175.1, 149.0–204.4) (Figure 5, Table I–1). Among individual industries, the highest PMR was observed in decedents who worked in fishing, hunting, and trapping (186.5, 161.7–214.1), followed by water transportation (157.4, 126.3–194.0), barber shops (150.8, 130.7–173.1), and construction (144.9, 143.2–146.5) industries (Figure 6, Table I–2).

## Drug overdose PMRs within construction and extraction occupations

Decedents in the construction and extraction occupation group and the construction industry group experienced elevated group-level drug overdose PMRs, as discussed previously (Figures 3 and 4), and 5 of the 10 individual occupations with the highest drug overdose PMRs are in the construction and extraction occupation group (Figure 5, Table I–1). Construction and extraction occupations encompass a wide range of job duties and working environments; PMRs are presented for the component census occupations to show occupation-level variation in drug overdose PMRs within this group. The construction industry group includes a single industry (census

industry code 0770), so more detailed estimates cannot be presented by industry.

Among construction and extraction occupations, the highest PMRs were observed among decedents who worked as roofers (177.4, 95% CI: 163.6–192.0); drywall installers, ceiling tile installers, and tapers (175.1, 149.0–204.4); painters, construction, and maintenance (162.1, 150.9–174.0); brickmasons, blockmasons, and stonemasons (159.5, 141.4–179.2); and structural iron and steel workers (159.5, 132.4–190.4) (Figure 7, Table 5).

Decedents in construction and extraction occupations were nearly all male (98.3%) and often were identified as White (66.9%) (Table 6). Compared with all deaths in decedents in construction and extraction occupations, deaths from drug overdoses within this population tended to occur more often in decedents who resided in the Midwest (20.5% compared with 18.9%) and Northeast (21.3% compared with 15.6%), were White (75.1% compared with 66.9%) and aged 25–34 (23.9% compared with 9.7%) and 35–44 (29.7% compared with 14.4%).

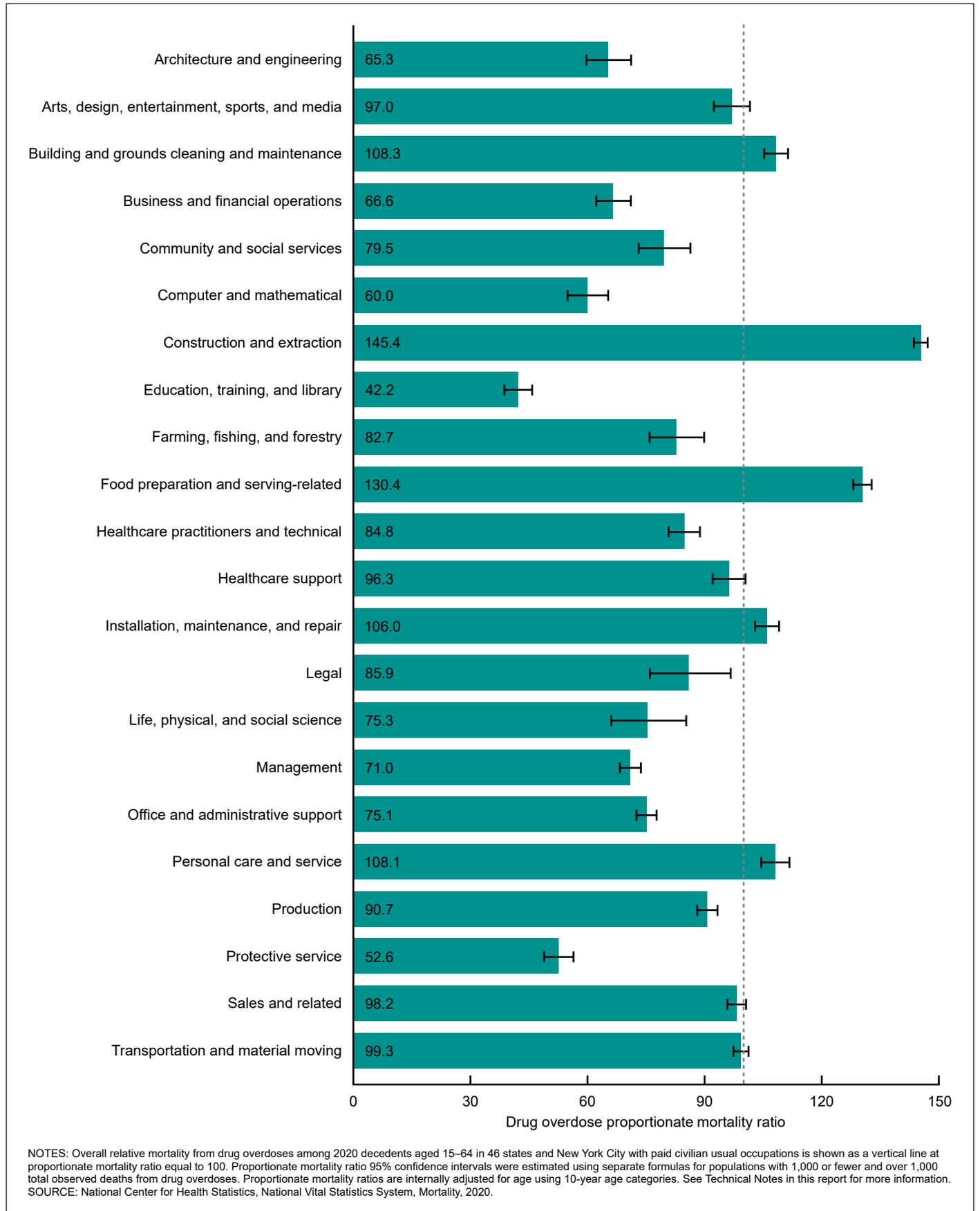
## Drug overdose PMRs by usual occupation and industry group and sex

Most occupation and industry groups showed similar patterns in drug overdose death frequencies (Tables I–3 and I–4) and PMRs among decedents of each sex, although slight differences were observed between male and female decedents. The highest PMRs in male decedents were observed in those in construction and extraction occupations (137.7, 95% CI: 136.0–139.3) (Table 7) and in construction industries (138.1, 136.5–139.6) (Table 8). The highest PMRs in female decedents were seen in those in construction and extraction (153.8, 132.3–177.7) and food preparation and serving-related (153.4, 149.4–157.5) (Table 7) occupations and in accommodation and food services (145.6, 142.1–149.0) industries (Table 8).

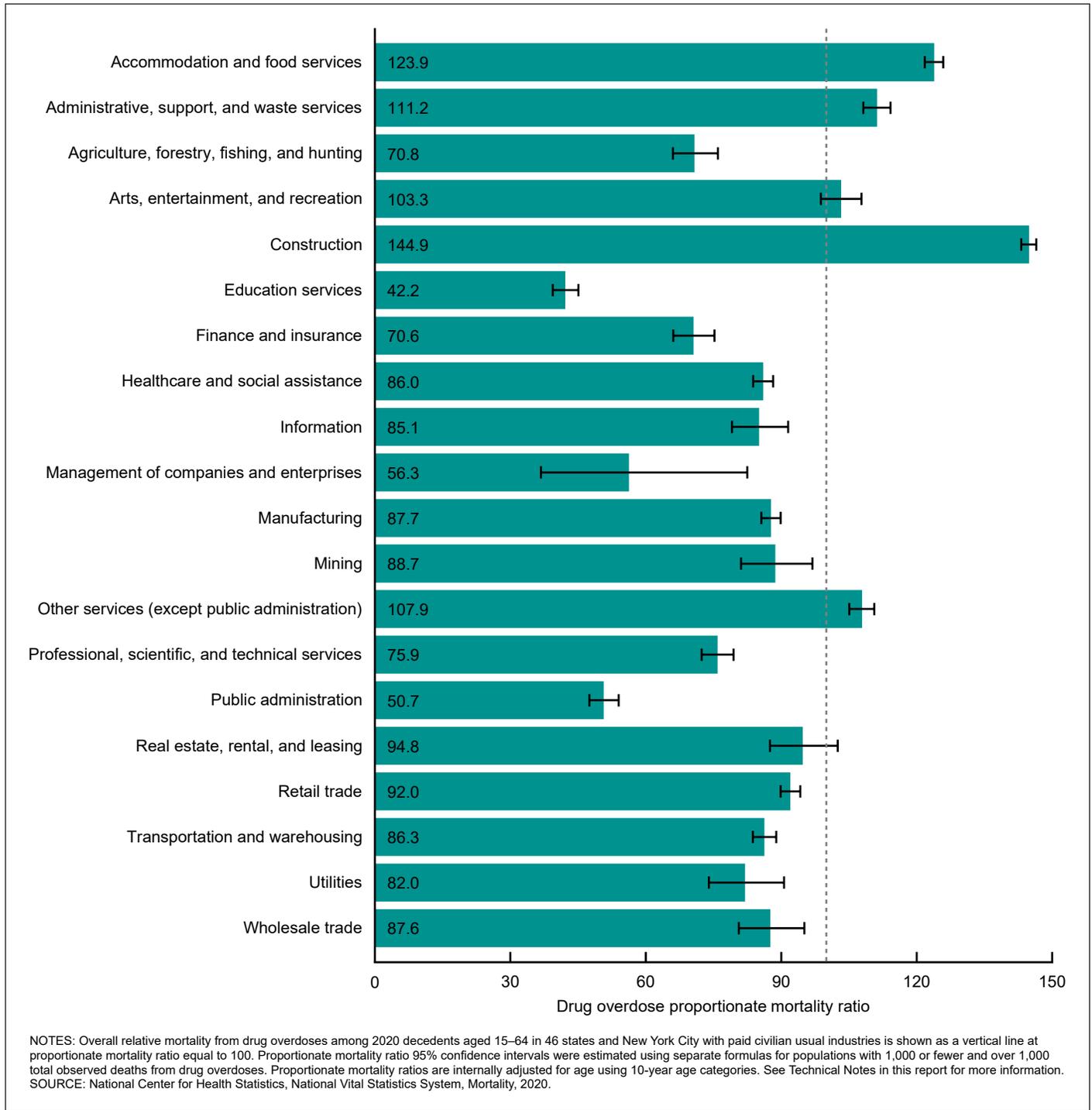
## Drug overdose PMRs by usual occupation and industry group and race and Hispanic origin

Decedents in construction and extraction occupations and construction industries experienced among the highest drug overdose death frequencies (Tables I–5 and I–6) and PMRs in all race and Hispanic-origin groups. The highest drug overdose PMRs among Asian, Black, and White decedents were observed in those in construction and extraction occupations (208.4, 95% CI: 151.4–279.8; 154.0, 147.6–160.3; and 143.2, 141.2–145.1, respectively) (Table 9) and in construction industries (195.1, 144.3–257.9; 160.4, 154.2–166.6; and 141.2, 139.4–143.0, respectively) (Table 10). The highest drug overdose PMRs among Hispanic decedents were observed in those in personal care and service occupations (122.2, 108.6–137.1) and in arts, entertainment, and recreation industries (124.0, 105.9–144.2). The highest drug overdose PMRs among American Indian and Alaska Native decedents were seen in those in farming, fishing, and forestry occupations (129.1, 78.8–199.4) and in manufacturing industries (123.9, 90.0–166.3).

**Figure 3. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by usual occupation group: 46 states and New York City, 2020**



**Figure 4. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by usual industry group: 46 states and New York City, 2020**

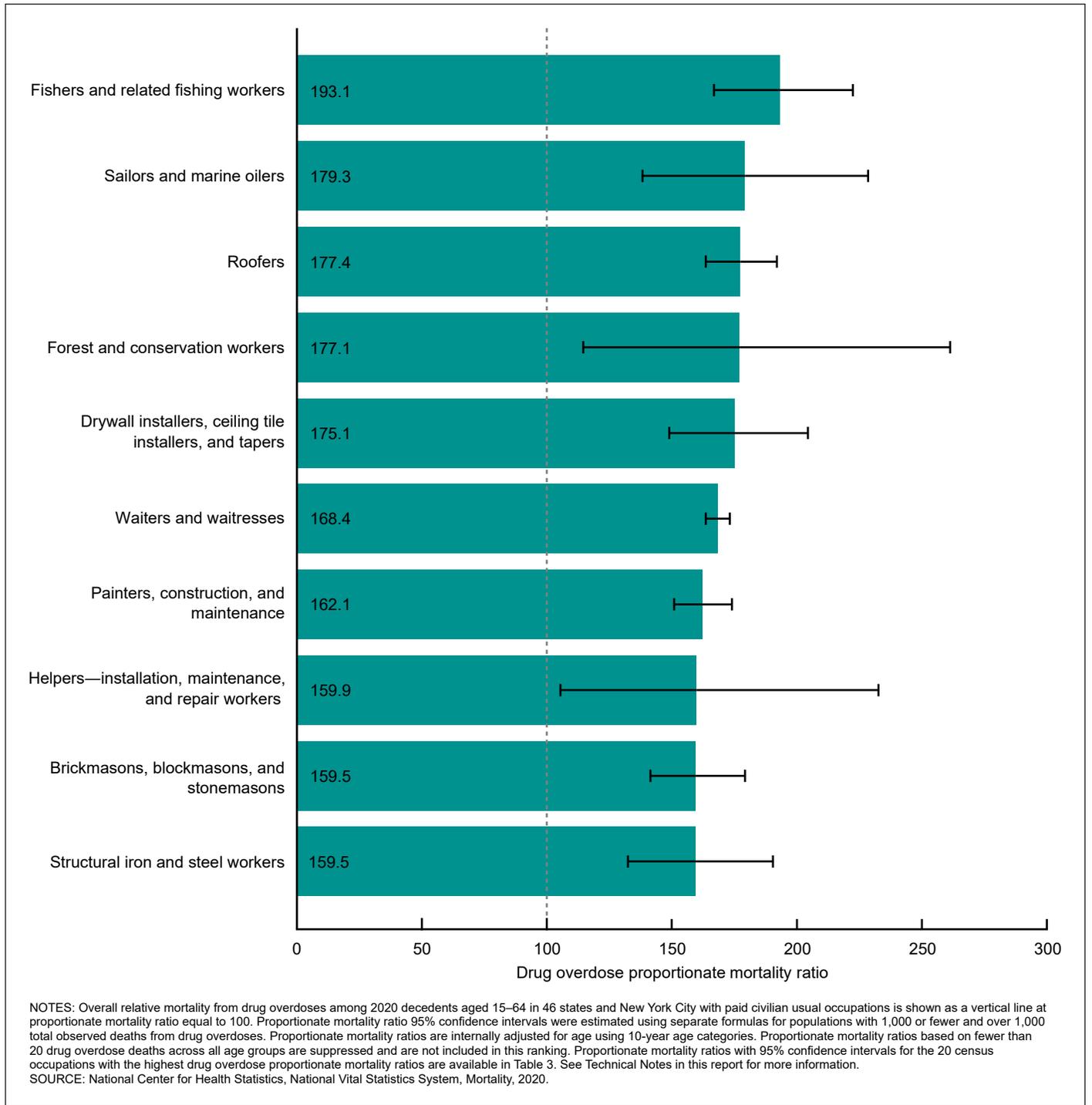


### Drug overdose deaths by usual occupation and industry group and drug type

Deaths from drug overdoses involving specific drug type(s) showed some variation across usual occupation (Table I-7) and industry (Table I-8) groups. Synthetic opioids other than methadone (including fentanyl, fentanyl analogs, and tramadol) were involved in 64.0% of deaths from drug overdoses in decedents with paid civilian usual occupations and industries.

This drug class comprised the largest proportion of drug overdose deaths within every occupation and industry group. Decedents in construction and extraction occupations experienced the highest PMRs from drug overdoses involving psychostimulants with abuse potential (169.7, 95% CI: 165.9–173.4), heroin (166.4, 161.4–171.3), synthetic opioids other than methadone (151.5, 149.2–153.7), and methadone (141.3, 128.0–155.5) (Table 11). Decedents in food preparation and serving-related occupations experienced the highest PMR from drug overdoses involving

**Figure 5. Ten individual census occupations with the highest drug overdose proportionate mortality ratios among U.S. decedents aged 15–64: 46 states and New York City, 2020**

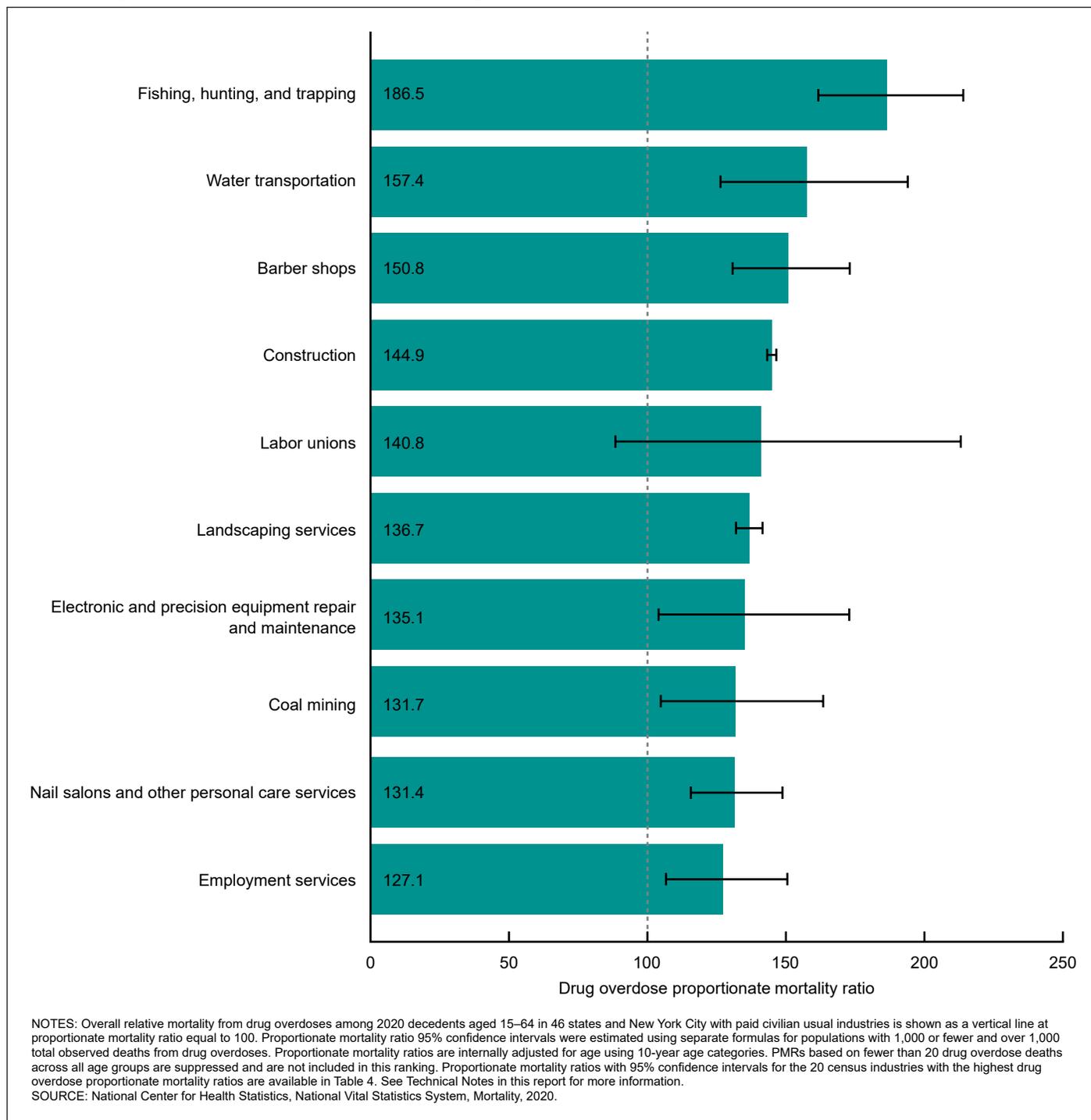


cocaine (144.6, 138.9–150.3), and decedents in healthcare practitioner and technical occupations experienced the highest PMR from drug overdoses involving natural and semisynthetic opioids (139.3, 126.1–153.6). When evaluated by industry, decedents in construction industries experienced the highest PMRs from drug overdoses involving each drug type (Table 12).

### Drug overdose deaths by usual occupation and industry group and drug overdose intent

Drug overdose intent also differed across usual occupation (Table I–9) and industry (Table I–10) groups. Most deaths from drug overdoses across all occupation groups were attributed to unintentional overdoses (91.8%), followed by overdoses of undetermined (4.2%) and suicidal (3.8%) intent. A similar distribution of drug overdose intents was observed among

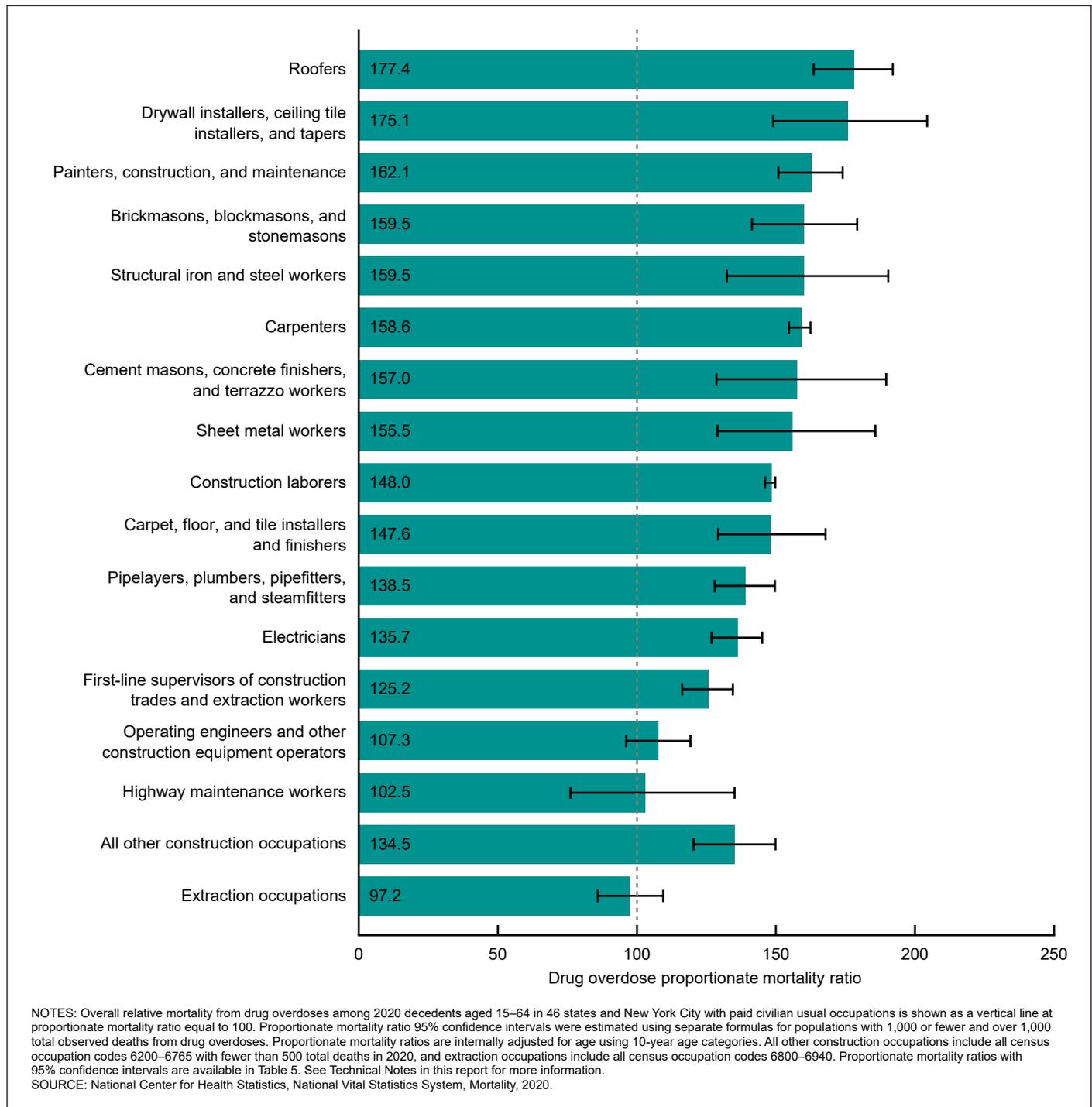
**Figure 6. Ten individual census industries with the highest drug overdose proportionate mortality ratios among U.S. decedents aged 15–64: 46 states and New York City, 2020**



deaths from drug overdoses across all industry groups. The largest proportions of drug overdose deaths attributed to suicidal intent were seen in decedents in education, training, and library occupations (18.1%) and education services industries (14.1%). Decedents in construction and extraction occupations experienced the highest PMRs from overdoses of undetermined intent (148.9, 136.6–162.0) and unintentional drug overdoses (148.4, 146.6–150.3) (Table 13). Decedents with healthcare practitioner and technical occupations experienced the highest

PMR from overdoses with suicidal intent (248.6, 215.0–286.1). When evaluated by industry, decedents in construction industries experienced the highest PMRs from overdoses of undetermined intent (151.1, 139.2–163.7) and unintentional drug overdoses (147.7, 146.0–149.5), while decedents in professional, scientific, and technical services industries had the highest PMR from overdoses with suicidal intent (183.5, 157.4–212.6) (Table 14).

**Figure 7. Drug overdose proportionate mortality ratios for construction and extraction usual occupations among U.S. decedents aged 15–64: 46 states and New York City, 2020**



## Discussion

Deaths from drug overdoses differentially impact some worker groups in the United States. Death rates and PMRs from drug overdoses in 2020 varied across usual occupation and industry groups, and PMRs varied across individual occupations and industries. PMRs for drug overdoses involving each type of drug and drug overdose intent also differed by usual occupation and industry group. Patterns in drug overdose deaths in 2020

were similar to those observed in previous analyses of drug overdose mortality from 2007 through 2012 by occupation (5) but reflect the increasing availability of and mortality from synthetic opioids other than methadone—a category that includes fentanyl and fentanyl analogs more importantly, but also, less significantly, tramadol and others—in the intervening period (1).

Differences in drug overdose deaths across occupations and industries are hypothesized to result from two intersecting

pathways: physical pain due to acute injury or cumulative physical trauma at work and work-related psychosocial stress (8). Physical work tasks, repetitive motions, ergonomic stress, other physical workplace exposures, and precarious employment are common risk factors for injury at work (24). Work-related injuries are frequently treated with prescription pain medication, including prescription opioids, and increasing opioid doses prescribed for work-related injuries are associated with higher incidence of death in workers' compensation data (25). Job insecurity and lack of paid sick leave have been shown to increase the likelihood that an injured worker returns to work prematurely or works through an injury due to financial pressures, potentially increasing the likelihood of prescription medication misuse and nonprescription substance use to manage pain (26). Work-related psychosocial stressors are also associated with increased prevalence of mental health conditions that may worsen substance use disorders (8) and contribute to deaths from drug overdoses.

Workers in construction and extraction occupations and the construction industry experienced elevated drug overdose death rates and PMRs in 2020. Construction and extraction workers are more likely to report recent drug use than workers in many other occupations and industries (27,28) and have been repeatedly found to experience high mortality from drug overdoses (5–7,26,29). Drug overdose mortality in these workers has been partially attributed to work-related injuries and subsequent pain management practices (30). Workers in these occupations and industries may be required to work at heights; climb ladders, scaffolds, or poles; make repetitive motions; and work in awkward postures (31), increasing risk of both acute and chronic work-related injuries (32). Construction workers who have experienced work-related injuries are nearly four times more likely than uninjured workers to use prescription opioids (30), and workers in construction and mining industries are more likely to be prescribed opioids after a work-related injury than workers in other industries (33). Many workers in individual occupations and industries with elevated PMRs share elements of risk profiles with these worker groups. For example, fishers and related fishing workers, sailors and marine oilers, and forest and conservation workers may carry out similarly physical job tasks (31).

Although decedents in construction and extraction occupations and construction industries experienced some of the highest drug overdose PMRs in all race and Hispanic-origin groups, the highest PMRs in Hispanic and American Indian and Alaska Native decedents were observed in other occupation and industry groups. Hispanic construction workers are less likely to use prescription opioid and nonopioid analgesics (measured by filled outpatient prescriptions) than White construction workers (30). Hispanic construction workers are more likely to be uninsured than non-Hispanic construction workers, impairing health care and prescription access in this population (34). Overrepresentation of some demographic groups in selected occupations and industries may also contribute to observed differences in drug overdose PMR patterns across race and Hispanic-origin groups.

Workers in food preparation and serving-related occupations and accommodation and food services industries also experienced elevated drug overdose death rates and PMRs in group-level analyses, including PMR analyses stratified by sex and race and Hispanic origin. Many workers in these occupations and industries spend much of their workday standing, walking, running, and making repetitive motions (31) that may contribute to work-related injuries (32). Job instability, lack of paid sick leave, and lack of health insurance are also common (8,27). Work-related stress, particularly among workers who interact with customers, and comparatively relaxed workplace norms around substance use that have been shown in some accommodation and food services workplaces are associated with heightened prevalence of substance use (35,36). Workers in accommodation and food services industries report the highest rates of both illegal drug use and substance use disorders among all workers (28).

Most occupation and industry groups with elevated drug overdose death rates compared with all occupations and industries combined also displayed elevated drug overdose PMRs. However, some worker groups showed differences in effect direction or magnitude across the two measures, likely due to differences in baseline mortality that impact PMRs. One exception occurred among workers in farming, fishing, and forestry occupations, who experienced an elevated drug overdose death rate but had a drug overdose PMR below the PMR among decedents in all occupations combined. High drug overdose death rates and comparatively lower drug overdose PMRs may reflect high mortality from other causes in these worker populations, reducing the proportions of deaths from drug overdose. These results are consistent with the nature of PMRs, which vary according to the distribution of causes of deaths within a given population and provide insight only into differences in the proportion of deaths from the cause of interest, rather than absolute risk (19).

Rates of drug overdose deaths involving synthetic opioids other than methadone have increased each year since 2013 (1). This drug class was involved in nearly two-thirds of drug overdose deaths in working-age decedents with paid civilian usual occupations and industries in 2020, comprising the largest proportion of drug overdose deaths within every occupation and industry group. In contrast, from 2007 through 2012, overdose deaths involving synthetic opioids other than methadone comprised only 6.9% of all deaths from drug overdoses identified in occupational mortality surveillance (5). Synthetic opioids other than methadone such as fentanyl and fentanyl analogs may be mixed into other drug supplies or pressed and sold as counterfeit prescription pills. This contributes to drug overdose deaths involving synthetic opioids other than methadone across all populations (37,38).

The broad occupation and industry groups primarily assessed in this report contain diverse ranges of individual occupations, industries, and workforces. For example, decedents in the farming, fishing, and forestry occupation group experienced a drug overdose PMR below 100. However, fishers and related fishing workers and forest and conservation workers experienced elevated drug overdose PMRs when assessed

as individual occupations relative to all drug overdose deaths. Similarly, decedents in the transportation and warehousing industry group experienced a drug overdose PMR below 100, while decedents in water transportation industries experienced an elevated drug overdose PMR when assessed as an individual industry. Further variation within each individual occupation and industry is likely.

Overall death rates and PMRs were standardized or adjusted for age but were not adjusted for other factors that may impact the likelihood of death from drug overdose because this report aims to describe drug overdose mortality across worker populations, rather than infer causal relationships between work and drug overdose mortality. Stratified analyses highlight variations in drug overdose PMRs within each sex and race and Hispanic-origin group by occupation and industry group. PMRs measure relative cause-specific mortality. If decedents within some demographic populations experience heightened death rates from competing causes of death, including COVID-19, and are overrepresented within specific occupations or industries, drug overdose PMRs within these worker populations may be correspondingly suppressed. A higher PMR within one population compared with another does not indicate greater risk of drug overdose mortality, nor many deaths from drug overdoses, because PMR is estimated relative to the number and distribution of all deaths within a given population (19). These results may not be representative of drug overdose deaths in other years, given large numbers of deaths in some worker populations due to COVID-19 in 2020 (12). Drug overdose death rates and PMRs as estimated here combine the prevalence of drug use, likelihood of drug overdose, and likelihood of fatal drug overdose, each of which may vary across occupation and industry groups. Low numbers of deaths also produced wide CIs for some populations. Additionally, individual characteristics not captured on death certificates may vary differentially across occupations and industries and influence observed deaths from drug overdoses. Such characteristics include personal and employer use of injury prevention strategies, socioeconomic status, and substance use disorder treatment accessibility.

Usual occupation and industry were only available for decedents in 46 states and New York City, and estimates are only representative of those jurisdictions. Death certificates record usual occupation and industry, rather than current occupation and industry (13). This report restricted drug overdose analyses to working-age decedents to minimize this limitation (15). However, many decedents aged 65 and over may have been working at the time of overdose or initiation of substance use or abuse, and many decedents aged 15–64 may not have been working or may have been working in other occupations and industries, particularly because of unprecedented shifts in employment during COVID-19-related shutdowns (39). Death rate and PMR estimates may be biased due to differential misclassification for occupations and industries with large employment changes in spring 2020. Death rates and PMRs as estimated here are not causal measures and effect estimates should be interpreted as hypothesis-generating only, given the large number of comparisons and lack of hypothesis testing performed in this report.

The variation observed in drug overdose death rates and PMRs by usual occupation and industry during 2020 highlights the uneven burden of drug overdose deaths on subsets of the U.S. workforce as a significant health equity issue. Findings in this report may inform the strategic priority to monitor, analyze, and communicate trends in drug overdoses within the framework for preventing overdoses and substance use-related harms (40,41).

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**Table 1. Drug overdose death rates among U.S. residents aged 16–64, by usual occupation group: 46 states and New York City, 2020**

Usual occupation group	Number of drug overdose deaths (percent)	Age-standardized drug overdose death rate per 100,000 workers (95% confidence interval)
Total	60,123 (100.0)	42.1 (41.6–42.6)
Architecture and engineering	503 (0.8)	16.8 (14.8–18.8)
Arts, design, entertainment, sports, and media	1,370 (2.3)	45.7 (41.9–49.5)
Building and grounds cleaning and maintenance	3,387 (5.6)	70.0 (65.7–74.3)
Business and financial operations	900 (1.5)	10.9 (10.0–11.8)
Community and social services	563 (0.9)	22.6 (20.0–25.2)
Computer and mathematical	519 (0.9)	9.1 (8.1–10.1)
Construction and extraction	12,660 (21.1)	162.6 (155.8–169.4)
Education, training, and library	547 (0.9)	5.9 (5.4–6.5)
Farming, fishing, and forestry	542 (0.9)	51.3 (44.4–58.2)
Food preparation and serving-related	6,459 (10.7)	117.9 (110.8–125.0)
Healthcare practitioners and technical	1,637 (2.7)	17.2 (16.1–18.3)
Healthcare support	1,674 (2.8)	37.5 (34.8–40.1)
Installation, maintenance, and repair	3,314 (5.5)	69.9 (65.6–74.1)
Legal	271 (0.5)	19.1 (14.5–23.8)
Life, physical, and social science	244 (0.4)	15.9 (13.4–18.4)
Management	2,922 (4.9)	18.6 (17.5–19.8)
Office and administrative support	3,277 (5.5)	22.6 (21.5–23.6)
Personal care and service	2,479 (4.1)	74.0 (68.7–79.4)
Production	3,843 (6.4)	53.3 (50.6–56.1)
Protective service	755 (1.3)	27.4 (24.6–30.2)
Sales and related	4,902 (8.2)	39.0 (37.4–40.7)
Transportation and material moving	7,355 (12.2)	70.7 (67.9–73.6)

NOTES: Death rates are directly standardized for age using 10-year age categories. Occupation group drug overdose death rates are estimated among workers aged 16–64 in 46 states and New York City with paid civilian usual occupations. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 2. Drug overdose death rates among U.S. residents aged 16–64, by usual industry group: 46 states and New York City, 2020**

Usual industry group	Number of drug overdose deaths (percent)	Age-standardized drug overdose death rate per 100,000 workers (95% confidence interval)
Total	58,917 (100.0)	41.3 (40.8–41.8)
Accommodation and food services	7,846 (13.3)	99.6 (94.8–104.4)
Agriculture, forestry, fishing, and hunting	787 (1.3)	39.9 (35.7–44.1)
Arts, entertainment, and recreation	1,547 (2.6)	56.9 (52.0–61.7)
Construction	13,645 (23.2)	130.9 (126.0–135.8)
Education services	841 (1.4)	6.0 (5.5–6.5)
Finance and insurance	948 (1.6)	12.9 (11.9–13.9)
Healthcare and social assistance	5,168 (8.8)	26.3 (25.3–27.3)
Information	739 (1.3)	27.5 (24.7–30.3)
Management, administrative, and waste services	3,667 (6.2)	61.1 (57.7–64.5)
Manufacturing	5,486 (9.3)	39.7 (38.0–41.3)
Mining	494 (0.8)	60.9 (51.7–70.1)
Other services (except public administration)	4,243 (7.2)	64.6 (61.3–68.0)
Professional, scientific, and technical services	1,855 (3.1)	16.0 (15.0–17.0)
Public administration	956 (1.6)	12.8 (11.7–14.0)
Real estate, rental, and leasing	626 (1.1)	24.1 (21.3–26.9)
Retail trade	5,432 (9.2)	38.9 (37.4–40.5)
Transportation and warehousing	3,682 (6.2)	52.0 (49.2–54.7)
Utilities	383 (0.7)	28.9 (24.6–33.2)
Wholesale trade	572 (1.0)	19.2 (16.9–21.4)

NOTES: Death rates are directly standardized for age using 10-year age categories. Industry group drug overdose death rates are estimated among workers aged 16–64 in 46 states and New York City with paid civilian usual industries. National Health Interview Survey administrative, support, and waste services and management of companies and enterprises industries are combined to align with the Current Population Survey's management, administrative, and waste services industry category. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 3. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by usual occupation group: 46 states and New York City, 2020**

Usual occupation group	Total deaths	Drug overdose deaths N (percent)	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)
Total	605,947	60,126 (9.9)	100.0 ...
Architecture and engineering	9,732	503 (5.2)	65.3 (59.7–71.2)
Arts, design, entertainment, sports, and media	12,402	1,370 (11.0)	97.0 (92.4–101.6)
Building and grounds cleaning and maintenance	32,051	3,388 (10.6)	108.3 (105.3–111.4)
Business and financial operations	15,208	900 (5.9)	66.6 (62.3–71.1)
Community and social services	8,152	563 (6.9)	79.5 (73.1–86.4)
Computer and mathematical	8,816	519 (5.9)	60.0 (54.9–65.3)
Construction and extraction	81,546	12,660 (15.5)	145.4 (143.6–147.1)
Education, training, and library	15,259	547 (3.6)	42.2 (38.7–45.8)
Farming, fishing, and forestry	6,554	542 (8.3)	82.7 (75.9–89.9)
Food preparation and serving-related	37,954	6,461 (17.0)	130.4 (128.1–132.8)
Healthcare practitioners and technical	22,710	1,637 (7.2)	84.8 (80.8–88.8)
Healthcare support	17,166	1,674 (9.8)	96.3 (92.1–100.5)
Installation, maintenance, and repair	32,763	3,314 (10.1)	106.0 (102.9–109.1)
Legal	3,687	271 (7.4)	85.9 (76.0–96.7)
Life, physical, and social science	3,337	244 (7.3)	75.3 (66.1–85.3)
Management	47,822	2,922 (6.1)	71.0 (68.3–73.7)
Office and administrative support	46,362	3,277 (7.1)	75.1 (72.5–77.7)
Personal care and service	21,208	2,479 (11.7)	108.1 (104.5–111.7)
Production	47,066	3,843 (8.2)	90.7 (88.1–93.3)
Protective service	15,121	755 (5.0)	52.6 (48.9–56.4)
Sales and related	47,605	4,902 (10.3)	98.2 (95.8–100.6)
Transportation and material moving	73,426	7,355 (10.0)	99.3 (97.4–101.3)

... Category not applicable.

NOTES: Proportionate mortality ratios are internally adjusted to the age distribution of all U.S. resident decedents aged 15–64 with paid civilian usual occupations using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 4. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by usual industry group: 46 states and New York City, 2020**

Usual industry group	Total deaths	Drug overdose deaths N (percent)	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)
Total	597,865	58,920 (9.9)	100.0 ...
Accommodation and food services	48,730	7,848 (16.1)	123.9 (121.8–125.9)
Administrative, support, and waste services	29,733	3,642 (12.2)	111.2 (108.2–114.2)
Agriculture, forestry, fishing, and hunting	12,161	787 (6.5)	70.8 (66.0–76.0)
Arts, entertainment, and recreation	13,086	1,547 (11.8)	103.3 (98.8–107.8)
Construction	89,123	13,645 (15.3)	144.9 (143.2–146.5)
Education services	25,321	841 (3.3)	42.2 (39.4–45.1)
Finance and insurance	14,981	948 (6.3)	70.6 (66.1–75.2)
Healthcare and social assistance	66,589	5,168 (7.8)	86.0 (83.8–88.2)
Information	9,027	739 (8.2)	85.1 (79.1–91.5)
Management of companies and enterprises	556	26 (4.7)	56.3 (36.8–82.5)
Manufacturing	70,876	5,486 (7.7)	87.7 (85.6–89.9)
Mining	5,578	494 (8.9)	88.7 (81.1–96.9)
Other services (except public administration)	39,836	4,243 (10.7)	107.9 (105.1–110.6)
Professional, scientific, and technical services	25,815	1,855 (7.2)	75.9 (72.4–79.4)
Public administration	24,426	956 (3.9)	50.7 (47.5–54.0)
Real estate, rental, and leasing	7,628	626 (8.2)	94.8 (87.5–102.5)
Retail trade	55,420	5,432 (9.8)	92.0 (89.9–94.2)
Transportation and warehousing	46,665	3,682 (7.9)	86.3 (83.7–88.9)
Utilities	5,462	383 (7.0)	82.0 (74.0–90.6)
Wholesale trade	6,852	572 (8.3)	87.6 (80.6–95.1)

... Category not applicable.

NOTES: Proportionate mortality ratios are internally adjusted to the age distribution of all U.S. resident decedents aged 15–64 with paid civilian usual industries using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 5. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by usual occupation in the construction and extraction occupation group: 46 states and New York City, 2020**

Usual occupation	Total deaths	Drug overdose deaths N (percent)	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)
All construction and extraction occupations	81,546	12,660 (15.5)	145.4 (143.6–147.1)
Roofers	2,977	609 (20.5)	177.4 (163.6–192.0)
Drywall installers, ceiling tile installers, and tapers	983	160 (16.3)	175.1 (149.0–204.4)
Painters, construction, and maintenance	4,990	768 (15.4)	162.1 (150.9–174.0)
Brickmasons, blockmasons, and stonemasons	1,979	283 (14.3)	159.5 (141.4–179.2)
Structural iron and steel workers	748	122 (16.3)	159.5 (132.4–190.4)
Carpenters	12,003	1,821 (15.2)	158.6 (154.7–162.4)
Cement masons, concrete finishers, and terrazzo workers	703	107 (15.2)	157.0 (128.6–189.7)
Sheet metal workers	793	121 (15.3)	155.5 (129.0–185.8)
Construction laborers	28,898	5,205 (18.0)	148.0 (146.1–149.8)
Carpet, floor, and tile installers and finishers	1,449	232 (16.0)	147.6 (129.2–167.9)
Pipelayers, plumbers, pipefitters, and steamfitters	4,439	637 (14.4)	138.5 (128.0–149.7)
Electricians	6,074	860 (14.2)	135.7 (126.8–145.1)
First-line supervisors of construction trades and extraction workers	6,493	747 (11.5)	125.2 (116.3–134.5)
Operating engineers and other construction equipment operators	3,398	341 (10.0)	107.3 (96.2–119.3)
Highway maintenance workers	577	50 (8.7)	102.5 (76.1–135.1)
All other construction occupations	2,388	328 (13.7)	134.5 (120.4–149.9)
Extraction occupations	2,654	269 (10.1)	97.2 (85.9–109.5)

NOTES: Proportionate mortality ratios are internally adjusted to the age distribution of all U.S. resident decedents aged 15–64 with paid civilian usual occupations using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses. All other construction occupations include census occupation codes 6200–6765 with fewer than 500 total deaths, and extraction occupations include all census occupation codes 6800–6940. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 6. Demographic characteristics of decedents with all paid civilian usual occupations and construction and extraction occupations among U.S. decedents aged 15–64: 46 states and New York City, 2020**

Demographic characteristic	Total deaths <i>N</i> (percent)	Drug overdose deaths <i>N</i> (percent)	Construction and extraction deaths <i>N</i> (percent)	Construction and extraction drug overdose deaths <i>N</i> (percent)
Total .....	605,947	60,126	81,546	12,660
Age group (years)				
15–24 .....	17,147 (2.8)	3,954 (6.6)	2,585 (3.2)	593 (4.7)
25–34 .....	51,684 (8.5)	15,792 (26.3)	7,945 (9.7)	3,027 (23.9)
35–44 .....	74,898 (12.4)	16,483 (27.4)	11,769 (14.4)	3,764 (29.7)
45–54 .....	137,761 (22.7)	13,151 (21.9)	18,167 (22.3)	2,937 (23.2)
55–64 .....	324,457 (53.5)	10,746 (17.9)	41,080 (50.4)	2,339 (18.5)
Sex				
Female .....	193,403 (31.9)	15,188 (25.3)	1,403 (1.7)	183 (1.4)
Male .....	412,544 (68.1)	44,938 (74.7)	80,143 (98.3)	12,477 (98.6)
Race and Hispanic origin				
Hispanic <sup>1</sup> .....	80,181 (13.2)	6,981 (11.6)	14,308 (17.5)	1,666 (13.2)
Non-Hispanic, single race:				
American Indian and Alaska Native .....	7,027 (1.2)	548 (0.9)	1,252 (1.5)	115 (0.9)
Asian .....	15,071 (2.5)	595 (1.0)	549 (0.7)	44 (0.3)
Black .....	118,234 (19.5)	9,315 (15.5)	10,115 (12.4)	1,205 (9.5)
Native Hawaiian or Other Pacific Islander .....	1,530 (0.3)	64 (0.1)	151 (0.2)	12 (0.1)
White .....	379,121 (62.6)	41,926 (69.7)	54,537 (66.9)	9,503 (75.1)
Non-Hispanic, two or more races .....	4,783 (0.8)	697 (1.2)	634 (0.8)	115 (0.9)
Census region				
Midwest .....	133,359 (22.0)	13,388 (22.3)	15,406 (18.9)	2,598 (20.5)
Northeast .....	101,663 (16.8)	12,675 (21.1)	12,724 (15.6)	2,691 (21.3)
South .....	249,684 (41.2)	22,936 (38.1)	37,513 (46.0)	5,344 (42.2)
West .....	121,241 (20.0)	11,127 (18.5)	15,903 (19.5)	2,027 (16.0)

<sup>1</sup>People of Hispanic origin may be of any race.

NOTES: Percentages may not add to 100 due to rounding. Death counts for Asian, American Indian and Alaska Native, and Hispanic people might be affected by misclassification of race and Hispanic origin on death certificates; see Technical Notes in this report for more information. Midwest is Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; Northeast is Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Vermont; South is Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia; West is Alaska, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 7. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by sex and usual occupation group: 46 states and New York City, 2020**

Usual occupation group	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)	
	Female	Male
Total . . . . .	100.0 ...	100.0 ...
Architecture and engineering . . . . .	74.3 (54.4–99.1)	61.2 (55.8–67.1)
Arts, design, entertainment, sports, and media . . . . .	102.6 (92.2–113.8)	95.1 (89.8–100.4)
Building and grounds cleaning and maintenance . . . . .	110.1 (102.0–118.7)	106.7 (103.3–110.1)
Business and financial operations . . . . .	68.0 (61.3–75.3)	70.5 (64.6–76.7)
Community and social services . . . . .	89.6 (79.4–100.8)	78.0 (69.2–87.7)
Computer and mathematical . . . . .	54.0 (42.5–67.7)	59.4 (54.0–65.2)
Construction and extraction . . . . .	153.8 (132.3–177.7)	137.7 (136.0–139.3)
Education, training, and library . . . . .	43.8 (39.1–48.8)	49.7 (43.3–56.7)
Farming, fishing, and forestry . . . . .	60.8 (42.4–84.6)	81.5 (74.6–88.9)
Food preparation and serving-related . . . . .	153.4 (149.4–157.5)	121.6 (118.6–124.5)
Healthcare practitioners and technical . . . . .	101.8 (96.6–106.9)	76.7 (69.9–84.0)
Healthcare support . . . . .	113.0 (108.2–117.8)	85.0 (74.6–96.4)
Installation, maintenance, and repair . . . . .	106.6 (83.2–134.4)	100.2 (97.2–103.2)
Legal . . . . .	100.9 (85.0–119.0)	80.8 (67.5–95.9)
Life, physical, and social science . . . . .	66.6 (50.6–86.1)	78.7 (67.8–90.9)
Management . . . . .	68.0 (63.1–73.2)	72.0 (68.9–75.1)
Office and administrative support . . . . .	84.1 (80.6–87.7)	75.8 (71.9–79.8)
Personal care and service . . . . .	116.9 (112.1–121.7)	114.0 (108.3–119.8)
Production . . . . .	87.8 (80.6–95.5)	88.8 (86.0–91.5)
Protective service . . . . .	64.2 (54.2–75.5)	48.9 (45.1–52.9)
Sales and related . . . . .	108.7 (104.8–112.6)	94.8 (91.8–97.9)
Transportation and material moving . . . . .	102.1 (94.8–109.9)	95.2 (93.3–97.2)

... Category not applicable.

NOTES: Proportionate mortality ratios are internally adjusted to the separate age distributions of all U.S. resident decedents of each sex aged 15–64 with paid civilian usual occupations using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses. Proportionate mortality ratios based on fewer than 20 deaths across all age groups within that sex group are suppressed. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 8. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by sex and usual industry group: 46 states and New York City, 2020**

Usual industry group	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)	
	Female	Male
Total . . . . .	100.0 ...	100.0 ...
Accommodation and food services . . . . .	145.6 (142.1–149.0)	115.1 (112.5–117.6)
Administrative, support, and waste services . . . . .	109.1 (100.3–118.4)	109.2 (106.0–112.4)
Agriculture, forestry, fishing, and hunting . . . . .	66.1 (51.8–83.1)	68.6 (63.7–73.8)
Arts, entertainment, and recreation . . . . .	108.8 (98.0–120.4)	100.9 (95.9–106.0)
Construction . . . . .	126.5 (112.2–142.1)	138.1 (136.5–139.6)
Education services . . . . .	42.3 (38.4–46.5)	48.7 (44.0–53.6)
Finance and insurance . . . . .	75.1 (68.2–82.5)	72.8 (66.7–79.4)
Healthcare and social assistance . . . . .	99.5 (96.9–102.0)	82.9 (78.7–87.1)
Information . . . . .	81.8 (70.4–94.4)	86.5 (79.5–94.0)
Management of companies and enterprises . . . . .	* ...	* ...
Manufacturing . . . . .	85.8 (80.0–91.9)	85.8 (83.5–88.0)
Mining . . . . .	* ...	84.6 (77.2–92.5)
Other services (except public administration) . . . . .	120.2 (114.7–125.7)	103.5 (100.3–106.6)
Professional, scientific, and technical services . . . . .	85.6 (79.0–92.6)	72.8 (68.6–77.0)
Public administration . . . . .	60.7 (54.4–67.6)	47.2 (43.5–51.0)
Real estate, rental, and leasing . . . . .	97.7 (84.3–112.7)	95.0 (86.3–104.3)
Retail trade . . . . .	102.7 (99.0–106.5)	88.6 (85.9–91.3)
Transportation and warehousing . . . . .	89.9 (81.7–98.8)	82.7 (80.0–85.4)
Utilities . . . . .	68.3 (46.4–96.9)	80.1 (72.0–89.0)
Wholesale trade . . . . .	70.8 (53.9–91.3)	87.3 (79.9–95.2)

... Category not applicable.

\* Estimate does not meet National Center for Health Statistics standards of reliability or precision.

NOTES: Proportionate mortality ratios are internally adjusted to the separate age distributions of all U.S. resident decedents of each sex aged 15–64 with paid civilian usual industries using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses. Proportionate mortality ratios based on fewer than 20 deaths across all age groups within that sex group are suppressed. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 9. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by race and Hispanic origin and usual occupation group: 46 states and New York City, 2020**

Usual occupation group	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)				
	Hispanic <sup>1</sup>	Non-Hispanic, single race			
		American Indian and Alaska Native	Asian	Black	White
Total . . . . .	100.0 ...	100.0 ...	100.0 ...	100.0 ...	100.0 ...
Architecture and engineering . . . . .	60.2 (41.4–84.5)	* ...	* ...	43.6 (28.7–63.4)	65.1 (59.1–71.6)
Arts, design, entertainment, sports, and media . . . . .	120.6 (101.7–141.9)	* ...	130.0 (81.4–196.8)	94.1 (81.2–108.5)	91.8 (86.1–97.8)
Building and grounds cleaning and maintenance . . . . .	92.3 (84.0–101.1)	101.0 (71.4–138.6)	* ...	114.1 (105.9–122.8)	116.4 (112.5–120.3)
Business and financial operations . . . . .	81.2 (64.5–101.0)	* ...	* ...	51.5 (41.7–63.0)	65.6 (60.8–70.7)
Community and social services . . . . .	82.3 (60.9–108.7)	* ...	* ...	71.0 (59.3–84.4)	85.5 (77.0–94.7)
Computer and mathematical . . . . .	83.5 (58.5–115.6)	* ...	* ...	58.5 (43.8–76.5)	58.6 (53.0–64.5)
Construction and extraction . . . . .	120.7 (116.4–125.0)	117.3 (96.8–140.8)	208.4 (151.4–279.8)	154.0 (147.6–160.3)	143.2 (141.2–145.1)
Education, training, and library . . . . .	31.8 (22.0–44.5)	* ...	* ...	29.2 (22.6–37.3)	44.6 (40.5–49.1)
Farming, fishing, and forestry . . . . .	55.5 (45.3–67.3)	129.1 (78.8–199.4)	* ...	64.1 (41.9–93.9)	98.1 (88.4–108.6)
Food preparation and serving-related . . . . .	111.4 (103.4–119.8)	104.8 (78.3–137.5)	159.5 (126.9–198.0)	139.6 (133.3–146.0)	132.6 (129.9–135.4)
Healthcare practitioners and technical . . . . .	78.7 (63.6–96.3)	* ...	70.5 (46.8–101.9)	58.7 (50.1–68.4)	87.8 (83.4–92.2)
Healthcare support . . . . .	104.8 (89.0–122.6)	* ...	* ...	90.0 (81.7–98.9)	104.0 (98.7–109.4)
Installation, maintenance, and repair . . . . .	117.2 (106.1–129.1)	* ...	108.7 (67.3–166.1)	112.6 (100.5–125.8)	97.2 (93.9–100.5)
Legal . . . . .	* ...	* ...	* ...	71.0 (43.9–108.5)	81.0 (70.6–92.4)
Life, physical, and social science . . . . .	98.7 (61.1–150.9)	* ...	* ...	* ...	68.7 (59.4–79.1)
Management . . . . .	78.6 (69.7–88.2)	* ...	93.4 (71.3–120.2)	61.6 (54.6–69.2)	68.4 (65.4–71.3)
Office and administrative support . . . . .	84.1 (75.9–93.1)	86.9 (59.4–122.7)	69.3 (47.1–98.4)	68.3 (62.6–74.5)	76.4 (73.3–79.5)
Personal care and service . . . . .	122.2 (108.6–137.1)	121.6 (87.6–164.4)	136.9 (100.9–181.5)	109.8 (100.4–119.8)	110.1 (105.6–114.6)
Production . . . . .	87.8 (79.7–96.6)	112.9 (78.7–157.1)	55.6 (35.3–83.4)	100.3 (92.7–108.3)	89.4 (86.3–92.4)
Protective service . . . . .	73.3 (60.0–88.7)	* ...	* ...	59.1 (51.4–67.6)	50.9 (46.0–56.1)
Sales and related . . . . .	93.3 (85.1–102.1)	72.0 (46.6–106.3)	127.0 (100.7–158.1)	90.2 (82.8–98.1)	97.3 (94.7–100.0)
Transportation and material moving . . . . .	106.3 (99.8–113.1)	113.5 (88.0–144.2)	119.1 (91.1–153.0)	117.2 (113.3–121.2)	101.5 (98.9–104.1)

... Category not applicable.

\* Estimate does not meet National Center for Health Statistics standards of reliability or precision.

<sup>1</sup>People of Hispanic origin may be of any race.

NOTES: Proportionate mortality ratios are internally adjusted to the separate age distributions of U.S. resident decedents in each race and Hispanic-origin group aged 15–64 with paid civilian usual occupations using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses. Proportionate mortality ratios based on fewer than 20 deaths across all age groups are suppressed. Death counts for Asian, American Indian and Alaska Native, and Hispanic people might be affected by misclassification of race and Hispanic origin on death certificates. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 10. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by race and Hispanic origin and usual industry group: 46 states and New York City, 2020**

Usual industry group	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)				
	Non-Hispanic, single race				
	Hispanic <sup>1</sup>	American Indian and Alaska Native	Asian	Black	White
Total . . . . .	100.0 ...	100.0 ...	100.0 ...	100.0 ...	100.0 ...
Accommodation and food services . . . . .	104.9 (98.1–112.2)	107.1 (82.7–136.5)	149.9 (123.6–180.0)	142.4 (136.8–148.1)	125.5 (123.1–127.9)
Administrative, support, and waste services . . . . .	103.6 (94.8–112.9)	114.0 (75.8–164.8)	* ...	116.8 (108.2–125.9)	117.2 (113.5–120.9)
Agriculture, forestry, fishing, and hunting . . . . .	55.6 (46.6–65.7)	91.1 (56.4–139.3)	* ...	64.8 (46.5–88.0)	74.4 (68.4–80.8)
Arts, entertainment, and recreation . . . . .	124.0 (105.9–144.2)	102.8 (73.4–140.0)	144.5 (90.6–218.8)	102.9 (90.1–117.0)	100.3 (95.1–105.5)
Construction . . . . .	121.7 (117.5–125.9)	120.2 (99.4–144.1)	195.1 (144.3–257.9)	160.4 (154.2–166.6)	141.2 (139.4–143.0)
Education services . . . . .	42.0 (32.8–52.9)	* ...	* ...	35.3 (29.7–41.8)	44.1 (40.7–47.8)
Finance and insurance . . . . .	67.9 (52.9–85.8)	* ...	* ...	47.6 (37.9–59.0)	71.5 (66.5–76.8)
Healthcare and social assistance . . . . .	91.3 (82.9–100.3)	89.8 (66.9–118.1)	78.3 (59.4–101.2)	79.9 (75.2–84.6)	89.8 (87.2–92.5)
Information . . . . .	112.5 (88.8–140.6)	* ...	* ...	73.8 (59.7–90.3)	82.6 (75.8–89.9)
Management of companies and enterprises . . . . .	* ...	* ...	* ...	* ...	* ...
Manufacturing . . . . .	91.9 (84.5–99.8)	123.9 (90.0–166.3)	65.2 (46.8–88.5)	99.4 (93.2–106.0)	84.8 (82.3–87.2)
Mining . . . . .	72.9 (54.7–95.1)	* ...	* ...	87.4 (57.6–127.2)	85.1 (77.0–93.9)
Other services (except public administration) . . . . .	115.2 (105.9–125.1)	122.1 (86.4–167.6)	134.0 (101.0–174.5)	115.6 (107.2–124.5)	105.3 (102.1–108.5)
Professional, scientific, and technical services . . . . .	90.9 (77.2–106.4)	* ...	49.5 (34.1–69.5)	69.4 (59.1–81.0)	73.1 (69.4–76.9)
Public administration . . . . .	58.6 (46.7–72.6)	79.4 (54.3–112.1)	* ...	50.0 (43.2–57.7)	49.7 (45.9–53.7)
Real estate, rental, and leasing . . . . .	92.0 (70.5–117.9)	* ...	* ...	89.0 (70.3–111.1)	95.7 (87.2–104.8)
Retail trade . . . . .	94.4 (87.1–102.2)	64.5 (43.2–92.7)	116.8 (92.6–145.3)	94.1 (87.3–101.3)	90.1 (87.7–92.6)
Transportation and warehousing . . . . .	100.5 (92.2–109.4)	121.1 (78.4–178.8)	97.4 (69.9–132.1)	91.6 (85.5–98.0)	89.8 (86.4–93.2)
Utilities . . . . .	72.9 (49.5–103.5)	* ...	* ...	76.2 (53.9–104.6)	78.7 (70.1–88.0)
Wholesale trade . . . . .	86.5 (68.2–108.3)	* ...	* ...	82.7 (63.4–106.0)	88.9 (80.6–97.8)

... Category not applicable.

\* Estimate does not meet National Center for Health Statistics standards of reliability or precision.

<sup>1</sup>People of Hispanic origin may be of any race.

NOTES: Proportionate mortality ratios are internally adjusted to the separate age distributions of U.S. resident decedents in each race and Hispanic-origin group aged 15–64 with paid civilian usual industries using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses. Proportionate mortality ratios based on fewer than 20 deaths across all age groups are suppressed. Death counts for Asian, American Indian and Alaska Native, and Hispanic people might be affected by misclassification of race and Hispanic origin on death certificates. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 11. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64 for deaths involving specific types of drugs, by usual occupation group: 46 states and New York City, 2020**

Usual occupation group	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)					
	Cocaine	Heroin	Metadone	Natural and semisynthetic opioids	Psychostimulants with abuse potential	Synthetic opioids other than methadone
Total	100.0 ...	100.0 ...	100.0 ...	100.0 ...	100.0 ...	100.0 ...
Architecture and engineering	58.5 (47.6–71.2)	64.2 (50.3–80.7)	*	83.4 (67.7–101.7)	53.5 (43.9–64.7)	61.6 (54.8–69.1)
Arts, design, entertainment, sports, and media	90.2 (79.8–101.6)	89.7 (77.4–103.5)	83.7 (59.5–114.4)	97.8 (84.6–112.3)	103.3 (93.2–114.3)	88.9 (82.9–95.2)
Building and grounds cleaning and maintenance	121.5 (113.3–130.1)	112.3 (102.8–122.3)	116.5 (97.0–138.8)	89.0 (80.6–98.1)	116.3 (109.0–124.0)	113.3 (109.3–117.3)
Business and financial operations	63.7 (54.9–73.4)	50.9 (41.5–61.8)	57.5 (38.2–83.2)	98.9 (85.7–113.5)	53.5 (46.1–61.7)	59.3 (54.2–64.8)
Community and social services	76.8 (63.6–91.9)	90.8 (73.5–111.0)	89.5 (56.7–134.3)	85.2 (68.6–104.6)	60.5 (49.8–72.8)	74.7 (66.8–83.2)
Computer and mathematical	49.0 (39.5–60.1)	53.4 (41.6–67.6)	*	54.4 (42.4–68.8)	50.7 (41.8–60.8)	50.6 (44.8–56.9)
Construction and extraction	144.0 (139.9–148.2)	166.4 (161.4–171.3)	141.3 (128.0–155.5)	129.4 (124.4–134.4)	169.7 (165.9–173.4)	151.5 (149.2–153.7)
Education, training, and library	31.3 (25.1–38.5)	22.5 (16.3–30.3)	*	57.1 (47.0–68.6)	26.0 (20.8–32.0)	33.2 (29.3–37.4)
Farming, fishing, and forestry	84.6 (70.0–101.3)	78.9 (62.1–98.7)	*	78.6 (61.8–98.5)	123.0 (106.8–141.0)	76.4 (68.3–85.2)
Food preparation and serving-related	144.6 (138.9–150.3)	130.6 (122.5–139.2)	136.3 (118.6–155.9)	114.3 (106.5–122.5)	134.7 (129.6–139.8)	130.9 (127.9–133.9)
Healthcare practitioners and technical	56.0 (49.1–63.6)	57.5 (49.0–67.0)	86.8 (66.4–111.6)	139.3 (126.1–153.6)	62.3 (55.6–69.6)	67.3 (62.7–72.1)
Healthcare support	98.4 (88.6–109.0)	80.4 (69.9–92.1)	138.5 (110.3–171.7)	124.3 (111.1–138.8)	85.9 (77.6–94.9)	89.3 (83.8–95.0)
Installation, maintenance, and repair	101.1 (93.7–109.0)	108.7 (99.4–118.7)	113.9 (94.6–135.9)	98.2 (89.4–107.7)	119.9 (112.5–127.7)	107.1 (103.1–111.1)
Legal	63.4 (46.1–85.1)	74.9 (52.2–104.1)	*	129.4 (99.2–165.9)	68.7 (52.1–89.0)	72.9 (61.4–86.0)
Life, physical, and social science	64.4 (47.0–86.2)	80.6 (57.3–110.2)	*	108.5 (81.0–142.2)	71.3 (54.4–91.8)	71.7 (60.6–84.2)
Management	76.8 (71.2–82.8)	60.5 (54.4–67.0)	52.3 (41.3–65.3)	79.7 (72.8–87.1)	61.1 (56.5–65.9)	69.5 (66.0–73.0)
Office and administrative support	67.1 (61.9–72.5)	63.4 (57.3–69.8)	80.9 (67.1–96.5)	87.9 (80.8–95.5)	61.6 (57.1–66.4)	71.2 (67.9–74.6)
Personal care and service	107.0 (98.1–116.6)	102.6 (92.2–113.9)	138.1 (113.1–166.8)	126.3 (114.5–139.0)	104.7 (96.7–113.3)	101.5 (96.8–106.1)
Production	84.9 (79.0–91.1)	88.1 (80.9–95.8)	82.8 (68.8–98.9)	87.5 (80.4–95.2)	90.3 (84.7–96.1)	94.7 (91.3–98.1)
Protective service	45.5 (38.3–53.6)	44.4 (35.9–54.3)	*	65.5 (55.1–77.4)	46.4 (39.7–53.9)	50.9 (46.4–55.7)
Sales and related	92.1 (86.4–98.0)	90.0 (83.3–97.1)	104.5 (89.6–121.2)	109.5 (102.1–117.4)	92.4 (87.3–97.5)	96.8 (93.7–99.9)
Transportation and material moving	115.4 (110.9–120.0)	113.0 (107.5–118.4)	100.6 (88.5–113.8)	81.0 (75.7–86.5)	93.2 (89.1–97.3)	103.8 (101.3–106.2)

... Category not applicable.

\* Estimate does not meet National Center for Health Statistics standards of reliability or precision.

NOTES: Proportionate mortality ratios are internally adjusted to the age distribution of all U.S. resident decedents aged 15–64 with paid civilian usual occupations using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses involving the specified drug type. Proportionate mortality ratios based on fewer than 20 deaths from drug overdoses involving the specified drug type across all age groups are suppressed. Types of drugs involved in each overdose death were determined using multiple cause-of-death *International Classification of Diseases, 10th Revision* codes for heroin (T40.1), natural and semisynthetic opioids (T40.2), methadone (T40.3), synthetic opioids other than methadone (T40.4), cocaine (T40.5), and psychostimulants with abuse potential (T43.6). Types of drugs involved in each overdose death are not mutually exclusive. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 12. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64 for deaths involving specific types of drugs, by usual industry group: 46 states and New York City, 2020**

Usual industry group	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)					
	Cocaine	Heroin	Metadone	Natural and semisynthetic opioids	Psychostimulants with abuse potential	Synthetic opioids other than methadone
Total . . . . .	100.0 ...	100.0 ...	100.0 ...	100.0 ...	100.0 ...	100.0 ...
Accommodation and food services . . . . .	138.1 (133.1–143.1)	123.1 (117.2–129.0)	130.3 (114.9–147.3)	109.5 (102.8–116.6)	126.2 (121.7–130.6)	123.9 (121.3–126.5)
Administrative, support, and waste services . . . . .	125.2 (117.0–133.9)	122.0 (112.3–132.2)	114.3 (95.0–136.4)	97.0 (88.3–106.2)	116.8 (109.6–124.3)	115.2 (111.4–119.1)
Agriculture, forestry, fishing, and hunting . . . . .	64.4 (54.6–75.5)	58.4 (47.2–71.5)	* ...	64.3 (52.6–77.8)	103.6 (92.1–116.1)	64.8 (59.0–71.0)
Arts, entertainment, and recreation . . . . .	95.7 (85.2–107.2)	98.2 (85.6–112.2)	88.9 (64.4–119.8)	102.3 (89.3–116.8)	111.5 (101.2–122.5)	96.8 (90.8–103.2)
Construction . . . . .	147.9 (143.9–151.8)	166.7 (161.9–171.4)	143.3 (130.4–157.2)	127.0 (122.2–131.8)	165.3 (161.7–168.8)	151.4 (149.3–153.6)
Education services . . . . .	36.6 (31.1–42.7)	28.9 (23.0–35.8)	44.2 (30.2–62.4)	52.8 (45.0–61.6)	30.0 (25.5–35.1)	36.2 (32.9–39.8)
Finance and insurance . . . . .	67.1 (58.0–77.2)	53.4 (43.7–64.7)	61.2 (41.0–87.9)	104.8 (91.2–119.9)	52.1 (44.8–60.1)	63.2 (58.0–68.8)
Healthcare and social assistance . . . . .	76.8 (72.1–81.7)	71.3 (65.8–77.1)	107.0 (93.4–121.9)	114.3 (108.2–120.3)	70.0 (65.5–74.6)	76.5 (73.6–79.3)
Information . . . . .	80.8 (68.4–94.8)	80.9 (66.0–98.1)	97.4 (65.2–139.9)	99.0 (82.6–117.7)	75.4 (64.6–87.6)	80.7 (73.4–88.6)
Management of companies and enterprises . . . . .	* ...	* ...	* ...	* ...	* ...	* ...
Manufacturing . . . . .	84.4 (79.4–89.4)	83.3 (77.5–89.5)	74.8 (63.7–87.3)	86.0 (80.2–92.1)	80.6 (76.1–85.1)	92.6 (89.9–95.4)
Mining . . . . .	53.3 (41.0–68.2)	78.0 (60.0–99.6)	* ...	120.1 (97.6–146.3)	141.4 (122.7–162.1)	68.0 (59.8–77.2)
Other services (except public administration) . . . . .	112.0 (105.0–119.4)	111.6 (103.1–120.6)	123.9 (105.7–144.3)	102.4 (94.3–111.0)	118.0 (112.2–123.8)	107.4 (103.9–111.0)
Professional, scientific, and technical services . . . . .	70.6 (63.6–78.2)	72.9 (64.3–82.3)	62.4 (46.7–81.6)	91.7 (82.1–102.0)	66.0 (59.9–72.6)	69.0 (64.4–73.5)
Public administration . . . . .	40.4 (34.5–47.0)	39.0 (32.0–47.2)	48.3 (33.2–67.8)	74.7 (65.1–85.3)	38.8 (33.5–44.7)	45.1 (41.3–49.2)
Real estate, rental, and leasing . . . . .	108.7 (92.2–127.2)	87.3 (69.7–108.1)	* ...	109.0 (89.5–131.5)	75.9 (63.4–90.1)	86.2 (77.5–95.7)
Retail trade . . . . .	85.9 (80.7–91.1)	82.2 (76.3–88.5)	100.8 (87.2–116.0)	96.6 (90.1–103.4)	84.1 (79.4–88.7)	91.2 (88.4–94.0)
Transportation and warehousing . . . . .	97.0 (90.7–103.6)	92.8 (85.4–100.7)	78.7 (65.0–94.5)	78.5 (71.8–85.7)	81.1 (75.8–86.5)	89.5 (86.1–92.9)
Utilities . . . . .	61.9 (47.4–79.3)	88.4 (67.5–113.8)	* ...	88.0 (67.5–112.8)	66.9 (53.1–83.1)	82.7 (72.6–93.8)
Wholesale trade . . . . .	81.3 (67.0–97.8)	78.7 (61.9–98.6)	* ...	92.0 (73.9–113.2)	82.3 (69.2–97.2)	89.8 (80.9–99.4)

... Category not applicable.

\* Estimate does not meet National Center for Health Statistics standards of reliability or precision.

NOTES: Proportionate mortality ratios are internally adjusted to the age distribution of all U.S. resident decedents aged 15–64 with paid civilian usual industries using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses involving the specified drug type. Proportionate mortality ratios based on fewer than 20 deaths from drug overdoses involving the specified drug type across all age groups are suppressed. Types of drugs involved in each overdose death were determined using multiple cause-of-death *International Classification of Diseases, 10th Revision* codes for heroin (T40.1), natural and semisynthetic opioids (T40.2), methadone (T40.3), synthetic opioids other than methadone (T40.4), cocaine (T40.5), and psychostimulants with abuse potential (T43.6). Types of drugs involved in each overdose death are not mutually exclusive. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 13. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by overdose intent and usual occupation group: 46 states and New York City, 2020**

Usual occupation group	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)		
	Unintentional	Suicide	Undetermined
Total	100.0 ...	100.0 ...	100.0 ...
Architecture and engineering	63.7 (58.0–69.9)	87.8 (58.3–126.8)	76.0 (49.2–112.2)
Arts, design, entertainment, sports, and media	94.8 (89.9–99.6)	160.6 (127.7–199.3)	88.7 (66.3–116.3)
Building and grounds cleaning and maintenance	110.2 (107.0–113.5)	48.4 (36.8–62.6)	122.1 (103.9–142.6)
Business and financial operations	63.1 (58.7–67.7)	159.3 (127.4–196.7)	57.6 (39.6–80.9)
Community and social services	74.2 (67.7–81.1)	164.4 (120.8–218.6)	113.1 (78.4–158.1)
Computer and mathematical	54.9 (49.9–60.3)	189.1 (145.3–241.9)	* ...
Construction and extraction	148.4 (146.6–150.3)	61.8 (53.5–71.0)	148.9 (136.6–162.0)
Education, training, and library	35.6 (32.3–39.2)	186.8 (151.8–227.4)	45.3 (29.3–66.9)
Farming, fishing, and forestry	85.2 (78.0–92.9)	* ...	* ...
Food preparation and serving-related	132.2 (129.7–134.7)	98.9 (84.6–115.0)	118.1 (103.6–134.0)
Healthcare practitioners and technical	76.8 (72.6–81.1)	248.6 (215.0–286.1)	99.9 (79.5–124.0)
Healthcare support	94.2 (89.8–98.6)	129.1 (103.1–159.7)	112.6 (89.5–139.7)
Installation, maintenance, and repair	107.6 (104.3–110.8)	63.0 (49.6–78.9)	114.3 (96.7–134.1)
Legal	79.3 (69.4–90.3)	241.7 (164.2–343.0)	* ...
Life, physical, and social science	70.6 (61.4–80.8)	177.6 (111.3–268.9)	* ...
Management	70.6 (67.8–73.5)	85.7 (72.2–101.0)	66.4 (54.9–79.6)
Office and administrative support	72.6 (69.9–75.3)	131.5 (114.8–149.9)	78.1 (65.8–92.0)
Personal care and service	105.2 (101.4–109.0)	148.4 (123.6–176.6)	139.0 (116.4–164.7)
Production	92.3 (89.5–95.1)	64.2 (52.6–77.5)	79.6 (67.1–93.8)
Protective service	51.1 (47.4–55.2)	64.2 (44.9–88.8)	72.9 (52.9–97.8)
Sales and related	97.3 (94.8–99.8)	128.7 (112.9–146.1)	93.3 (80.7–107.4)
Transportation and material moving	101.6 (99.6–103.6)	59.1 (50.5–68.8)	85.1 (75.2–96.1)

... Category not applicable.

\* Estimate does not meet National Center for Health Statistics standards of reliability or precision.

NOTES: Proportionate mortality ratios are internally adjusted to the age distribution of all U.S. resident decedents aged 15–64 with paid civilian usual occupations using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses due to each overdose intent. Proportionate mortality ratios based on fewer than 20 deaths from drug overdoses under the specified intent across all age groups are suppressed. Overdose intent was determined using the underlying cause-of-death *International Classification of Diseases, 10th Revision* codes for unintentional (X40–X44), suicidal (X60–X64), and homicidal (X85) overdoses, as well as overdoses of undetermined intent (Y10–Y14). Homicidal overdoses are not presented due to small cell counts. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

**Table 14. Drug overdose proportionate mortality ratios among U.S. decedents aged 15–64, by overdose intent and usual industry group: 46 states and New York City, 2020**

Usual industry group	Age-adjusted drug overdose proportionate mortality ratio (95% confidence interval)		
	Unintentional	Suicide	Undetermined
Total	100.0 ...	100.0 ...	100.0 ...
Accommodation and food services	125.9 (123.7–128.0)	91.7 (79.6–105.2)	106.9 (94.7–120.2)
Administrative, support, and waste services	112.6 (109.4–115.7)	68.1 (54.2–84.4)	122.0 (104.2–142.0)
Agriculture, forestry, fishing, and hunting	72.4 (67.3–77.8)	58.9 (38.4–86.2)	46.9 (29.4–71.1)
Arts, entertainment, and recreation	102.0 (97.3–106.7)	140.5 (110.9–175.6)	96.3 (73.5–123.9)
Construction	147.7 (146.0–149.5)	65.4 (57.2–74.3)	151.1 (139.2–163.7)
Education services	37.6 (34.8–40.5)	139.7 (115.8–167.2)	44.3 (31.4–60.9)
Finance and insurance	67.3 (62.7–72.0)	156.1 (124.7–193.0)	61.1 (42.6–85.0)
Healthcare and social assistance	81.9 (79.6–84.2)	164.0 (148.3–181.0)	100.3 (88.4–113.3)
Information	84.7 (78.4–91.3)	126.4 (91.4–170.2)	59.9 (37.6–90.8)
Management of companies and enterprises	52.1 (32.7–78.9)	* ...	* ...
Manufacturing	88.8 (86.6–91.1)	71.8 (61.7–83.1)	77.3 (67.1–88.6)
Mining	90.8 (82.7–99.4)	* ...	85.4 (52.2–131.9)
Other services (except public administration)	108.1 (105.2–110.9)	84.6 (70.6–100.5)	127.9 (111.2–146.3)
Professional, scientific, and technical services	71.0 (67.3–74.8)	183.5 (157.4–212.6)	83.0 (66.4–102.5)
Public administration	47.9 (44.7–51.3)	93.8 (73.9–117.4)	66.6 (50.0–86.8)
Real estate, rental, and leasing	94.3 (86.7–102.4)	129.4 (90.1–180.0)	74.5 (46.1–113.9)
Retail trade	91.0 (88.7–93.2)	117.8 (104.0–133.0)	95.4 (83.6–108.4)
Transportation and warehousing	87.5 (84.8–90.3)	66.2 (54.5–79.5)	76.4 (64.2–90.3)
Utilities	84.5 (76.0–93.6)	* ...	* ...
Wholesale trade	87.8 (80.5–95.7)	85.8 (53.8–129.9)	87.1 (55.8–129.6)

... Category not applicable.

\* Estimate does not meet National Center for Health Statistics standards of reliability or precision.

NOTES: Proportionate mortality ratios are internally adjusted to the age distribution of all U.S. resident decedents aged 15–64 with paid civilian usual industries using 10-year age categories. Proportionate mortality ratio 95% confidence intervals are estimated using separate formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from drug overdoses due to each overdose intent. Proportionate mortality ratios based on fewer than 20 deaths from drug overdoses under the specified intent across all age groups are suppressed. Overdose intent was determined using the underlying cause-of-death *International Classification of Diseases, 10th Revision* codes for unintentional (X40–X44), suicidal (X60–X64), and homicidal (X85) overdoses, as well as overdoses of undetermined intent (Y10–Y14). Homicidal overdoses are not presented due to small cell counts. See Technical Notes in this report for more information.

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality, 2020.

## Technical Notes

### Nature and sources of data

Data in this report are based on information submitted by jurisdictions and coded by the National Center for Health Statistics through the Vital Statistics Cooperative Program. For the 2020 data year, all states, the District of Columbia, and New York City submitted mortality medical and demographic data in electronic data files to the National Center for Health Statistics. Usual occupation and industry codes are available for decedents from 46 states and New York City. These data are coded through an agreement between the National Center for Health Statistics and the National Institute for Occupational Safety and Health (13). For more information on the variables that convey the decedent's usual occupation and industry for the 2020 data year, see "Classification of decedent's usual occupation and industry."

Death certificates are completed by funeral directors, attending physicians, medical examiners, coroners, or other people legally authorized to certify deaths. Data for 2020 are based on records of deaths that occurred during 2020 and were received as of July 27, 2021. Data for earlier years, excluding data on usual occupation and industry, can be obtained via the Centers for Disease Control and Prevention's Wide-ranging Online Data for Epidemiologic Research or WONDER (42).

### U.S. Standard Certificate of Death and how it relates to race and Hispanic-origin classification

The U.S. Standard Certificate of Death, which states use as a model, was revised in 2003 (14). Before 2003, the U.S. Standard Certificate of Death had not been revised since 1989 (21,43,44). The 2003 revision of the U.S. Standard Certificate of Death allows the reporting of more than one race (14). This change was implemented to reflect the increasing diversity of the U.S. population and to be consistent with the decennial census and the 1997 "Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity" issued by the Office of Management and Budget (23). This revision replaced standards that were issued in 1977 (44). The new standards mandate the collection of more than one race, where applicable, for federal data (14) and require the collection of information on a minimum set of five races. More than the minimum number of race categories are reported on death certificates (14).

Multiple races in this report includes people with any combination of White, Black or African American, American Indian or Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander races. However, estimates for non-Hispanic multiple race and non-Hispanic Native Hawaiian or Other Pacific Islander workers in each occupation and industry group are not presented due to small counts. Records are classified within a single category (rather than as multiple races) if two or more specific selections within a standard category, such as Korean and Chinese, are reported.

*Quality of race and Hispanic-origin data*—Estimates for Hispanic, American Indian and Alaska Native, Asian, and Native

Hawaiian or Other Pacific Islander populations may be affected by inconsistencies in reporting Hispanic origin and race on the death certificate compared with censuses, surveys, and birth certificates. Studies have shown underreporting on death certificates of Hispanic, American Indian and Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander decedents, as well as undercounts of these groups in censuses (45–49).

### Cause-of-death classification

The mortality statistics presented in this report were compiled following World Health Organization regulations, which specify that member countries classify and code causes of death under the current revision of the *International Classification of Diseases* (ICD). ICD provides the basic guidance used in almost all countries to code and classify causes of death. Effective with deaths occurring in 1999, the United States began using the *International Classification of Diseases, 10th Revision* (ICD–10) (50).

The National Center for Health Statistics publishes its own volumes of ICD–10 to include modifications in use (51). Effective with data year 2020, ICD–10 code U07.1, COVID-19, was added as a new underlying cause-of-death code. No other codes were added to or deleted from the list of valid underlying cause-of-death codes in 2020. Information on the addition of U07.1, as well as codes added or deleted in previous years, is available from NCHS' "Instruction Manual, Part 9, ICD–10 Cause-of-death Lists for Tabulating Mortality Statistics" (17).

### Quality of reporting and processing cause of death

The quality of mortality data is largely dependent on proper and thorough completion of death certificates by certifiers. Accuracy and completeness of information entered on death certificates can vary by state and over time.

One index of the quality of reporting causes of death is the proportion of death certificates coded to Chapter XVIII—Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (ICD–10 codes R00–R99). Although determining which of these deaths actually occurred within each underlying cause is not possible, the total proportion coded to R00–R99 indicates the consideration given to the cause-of-death statement by medical certifiers. This proportion also may be used as a rough measure of the specificity of medical diagnoses. The percentage of all reported deaths in the United States assigned to Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified decreased from 1.14% in 2019 to 1.01% in 2020.

Details on coding and classification of causes of death can be found in NCHS' Instruction Manual, Part 2 (51).

### Classification of decedent's usual occupation and industry

Occupation and industry information provided on death certificates was processed and coded through a collaboration with the National Institute for Occupational Safety and Health

(13). Occupation is the type of work that a person performs, or their job (such as teacher or cashier), while industry is the type of business in which a person works (such as an elementary school or grocery store). Some occupation groups primarily occur within a single industry group (for example, production workers primarily work in manufacturing industries, and healthcare support workers primarily work in healthcare and social assistance industries). Other occupation groups occur across most or all industry groups (for example, management, business and financial operations, and office and administrative support occupations).

Data on usual occupation and industry are available for 91.0% of decedents aged at least 15 years in the 2020 National Vital Statistics System mortality files. Occupation and industry narratives were not coded for deaths that occurred in Arizona, North Carolina, Rhode Island, and the District of Columbia because these jurisdictions did not participate in the industry and occupation coding program in 2020. Iowa did participate, but because of their data collection method, data were inconsistent with other states' data and are excluded from the 2020 National Vital Statistics System mortality files (13). Occupation and industry data were also missing for large percentages of records from decedents who resided in Ohio (11.0%) and Texas (5.8%) (13).

The U.S. Census Bureau categorizes occupations and industries into standardized codes and titles for analysis of survey responses. Occupation and industry narratives from death certificates were coded to the standardized Census 2012 Occupation Codes and the Census 2012 Industry Codes. Narratives with insufficient information for coding, military occupations or industries, and narratives that indicated unpaid work (homemakers, students, and volunteers, among others) were coded to National Institute for Occupational Safety and Health and NCHS non-Census codes to capture all available information (13).

Census 2012 Occupation Codes and Census 2012 Industry Codes were then collapsed into broad groups using the National Health Interview Survey simple occupation and industry recodes (16). Additional information on occupation and industry coding within the National Vital Statistics System is available in "Industry and Occupation (I&O) Data as Applicable to Mortality Vital Statistics, 2020: History, Background, and Control Tables" (13).

## Population denominator data from the Current Population Survey

Population denominator data for estimation of death rates were drawn from the Current Population Survey, a large monthly survey by the U.S. Census Bureau that collects data on the U.S. labor force (18). Each month, a probability sample is applied to select about 60,000 U.S. households for voluntary participation. CPS participants must be noninstitutionalized civilians aged 15 and over, although employment data are largely restricted to those aged 16 and over. U.S. military members and people in institutions, including prisons, long-term medical care, and nursing homes, are not eligible. One survey participant in each household provides all responses for any eligible household

members. Survey data are then weighted to represent the U.S. civilian noninstitutionalized population (18).

NCHS uses population denominator data from April for census years and July for all other years (51). All denominator data applied in this report were estimated using the April 2020 vintage and the CPS Basic Monthly data set in the U.S. Census Bureau's Microdata Access Tool (52). Within the microdata sample, data were restricted to jurisdictions that participated in the National Occupational Mortality Surveillance Modernization program in 2020 (excluding Arizona, the District of Columbia, Iowa, North Carolina, and Rhode Island) and to people aged 16–64. Weighted CPS data applied in this report are representative of civilian noninstitutionalized populations within this restricted data universe.

Population estimates were generated for the cross-tabulations of either industry or occupation group and age group, coded as 16–24, 25–34, 35–44, 45–54, and 55–64. CPS industry categories durable goods manufacturing and nondurable goods manufacturing were combined to align with the National Health Interview Survey's manufacturing industry category. Private households and other services were combined to align with the National Health Interview Survey's other services (except public administration) industry category for the estimation of death rates. Conversely, two National Health Interview Survey industry categories—administrative, support, and waste services and management of companies and enterprises—were combined to align with CPS' management, administrative, and waste services industry category.

## Computing death rates and 95% confidence intervals

Drug overdose deaths for estimation of death rates were restricted to decedents aged 16–64 because deaths from drug overdoses in 2020 were acute and because usual occupation and industry may serve as reasonable proxies for current occupation and industry among those of working age (15). Decedents aged 15 are excluded from estimation of death rates because they are not represented in CPS workforce population denominator estimates.

Death rates are estimated as the number of deaths from drug overdoses in 2020 in workers aged 16–64 in a specified occupation or industry group residing in participating jurisdictions per 100,000 estimated population. Age-adjusted death rates ( $R'$ ) are used to compare mortality risks between groups and over time. However, they should be viewed as relative indices rather than as absolute measures of mortality risk (53). Age-adjusted death rates were computed via direct standardization—that is, by applying age-specific death rates ( $R_i$ ) to the age distribution of the 2000 U.S. standard population aged 15–64 (Table I) (53).

$$R' = \sum_i \frac{P_{si}}{P_s} R_i$$

$P_{si}$  is the standard population in age group  $i$  and  $P_s$  is the total standard population (all age groups combined). Direct age standardization was performed using 10-year categories,

excluding age 15 (16–24, 25–34, 35–44, 45–54, and 55–64), to account for potential bias introduced by differential age structures in populations of workers.

**Table I. 2000 U.S. standard population aged 15–64**

Age group (years)	Population <i>N</i> (percent)
Total	180,961,023 (100.0)
15–24	38,076,743 (21.0)
25–34	37,233,437 (20.6)
35–44	44,659,185 (24.7)
45–54	37,030,152 (20.5)
55–64	23,961,506 (13.2)

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality.

Sampling variance data are not available from CPS for the specific study populations. Parameters from a proxy series were applied to estimate population denominator standard errors that account for sampling variance under the survey design effect (21).  $\alpha$  and  $\beta$  parameters were drawn from the parameters for the civilian labor force aged 16 and over (54). A level-to-level conversion estimated  $b$  as  $b = (\alpha + \beta N)$ , where  $N$  is the universe total (civilian noninstitutionalized population aged 16 and over in April 2020) (55). These parameters were then applied to estimate the approximate standard error of the estimated population in each age group in each occupation and industry group [ $SE(P_i)$ ] as:

$$SE(P_i) = \sqrt{b \left( x_{new} - \frac{x_{new}^2}{N} \right)}$$

where  $x_{new}$  is the estimated population and  $N$  is the universe total (21).

These approximate population denominator standard errors were then applied to estimate standard errors for each death rate, accounting for sampling variability in the denominator ( $P_i$ ) as well as random variability in the numerator ( $D_i$ ). Standard errors for age-standardized death rates ( $R'$ ) were estimated as:

$$SE(R') = \sqrt{\sum_i \left( \frac{P_{si}}{P_s} \right)^2 R_i^2 \left( \frac{1}{D_i} + \left( \frac{SE(P_i)}{P_i} \right)^2 \right)}$$

$R_i$  is the age-specific death rate within a single age group–occupation or industry pair.  $D_i$  is the number of deaths from drug overdoses in the age group–occupation or industry pair. All other parameters are defined as above (53).

The 95% confidence interval (CI) is then estimated as:

$$R' - 1.96 \cdot SE(R')$$

$$R' + 1.96 \cdot SE(R')$$

CIs are approximate and should be interpreted with caution (21). No hypothesis tests were performed to compare death rates between worker populations, given the large number of comparisons and the uncertainty in denominator sampling variance estimates. A higher absolute rate within one worker

population compared with another does not indicate a statistically significant difference.

## Computing proportionate mortality ratios and 95% CIs

A proportionate mortality ratio (PMR) is estimated as the ratio of two proportions, or the proportion of deaths from the cause of interest within an exposed (for example, occupation or industry) group or subgroup divided by the proportion of deaths from the cause of interest within the full population, multiplied by 100 for ease of interpretation (19). It can also be conceptualized as the observed number of deaths from the cause of interest within an exposed population divided by the expected number of deaths from the cause of interest within the exposed population, multiplied by 100. A PMR over 100 indicates a higher proportion of deaths from the cause of interest within the exposed population than in all decedents combined (that is, deaths from drug overdoses in decedents in a specific occupation group comprise a greater proportion of all deaths in that group than in decedents in all occupation groups combined). PMRs are often applied to identify potential associations between exposures and cause(s) of death when inadequate population data are available for estimation of rates (19).

PMRs in this report were estimated applying deaths from drug overdoses overall and deaths from drug overdoses associated with each individual drug type identified using multiple cause-of-death codes as the cause of interest in separate analyses.

PMRs were internally adjusted for age to account for potential bias introduced by differential age structures in populations of workers. Table II shows the data structure applied to estimate age-adjusted PMRs for single occupation or industry groups. The subscript  $i$  represents the  $i$ th age group (10-year age categories 15–24, 25–34, and so on).  $A_i$  is the observed number of deaths in workers in an occupation or industry group from the cause of death of interest (cause X) within the  $i$ th age category, with all other values calculated similarly.

**Table II. Data structure applied to estimate age-adjusted proportionate mortality ratios for single occupation or industry groups**

Occupation (or industry) group	Cause of death		
	Cause X	All other causes	All causes
Occupation Y	$A_i$	$B_i$	$N_{1i}$
All other occupations	$C_i$	$D_i$	$N_{2i}$
All occupations	$M_{1i}$	$M_{2i}$	$T_i$

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality.

The expected number of deaths from the cause of interest within a single occupation or industry group and age category is estimated as:

$$E(A_i) = N_{1i} \left( \frac{M_{1i}}{T_i} \right)$$

$M_{1i}$  is the observed number of deaths in all occupation or industry groups with the cause of death of interest (cause X) within the  $i$ th age category.

$T_i$  is the observed number of deaths in workers in all occupation or industry groups from all causes of death within the  $i$ th age category.

Observed and expected numbers of deaths from the cause of interest within a single occupation or industry group are then summed across all age categories, and PMR is estimated as:

$$PMR = \frac{\sum_i A_i}{\sum_i E(A_i)} \cdot 100$$

A simplified example of estimation of an age-adjusted PMR for cause X in occupation Y for a population with two age groups (A and B) (Table III) is:

Age group A

$$E(A_A) = N_{1A} \left( \frac{M_{1A}}{T_A} \right)$$

$$E(A_A) = 100 \left( \frac{200}{1000} \right) = 20$$

Age group B

$$E(A_B) = N_{1B} \left( \frac{M_{1B}}{T_B} \right)$$

$$E(A_B) = 400 \left( \frac{200}{2000} \right) = 40$$

**Table III. Example data for estimation of an age-adjusted proportionate mortality ratio for cause X in occupation Y for a population with two age groups (A and B)**

Occupation	Cause of death		
	Cause X	All other causes	All causes
Age group A			
Occupation Y . . . . .	50	50	100
All other occupations . . . . .	150	750	900
All occupations . . . . .	200	800	1,000
Age group B			
Occupation Y . . . . .	100	300	400
All other occupations . . . . .	100	1,500	1,600
All occupations . . . . .	200	1,800	2,000

SOURCE: National Center for Health Statistics, National Vital Statistics System, Mortality.

Age-adjusted PMR

$$PMR = \frac{\sum_i A_i}{\sum_i E(A_i)} \cdot 100$$

$$PMR = \frac{A_A + A_B}{E(A_A) + E(A_B)} \cdot 100$$

$$PMR = \frac{50 + 100}{20 + 40} \cdot 100 = 250$$

PMR 95% CIs are estimated using previously published formulas for populations with 1,000 or fewer and over 1,000 total observed deaths from the cause of interest (56). For PMRs with

$$\sum_i (A_i)$$

over 1,000 from the cause of interest, the upper and lower 95% CIs were estimated as:

$$CI = PMR \pm 196 \frac{\sqrt{\sum_i \frac{M_{1i} M_{2i} N_{1i} N_{2i}}{T_i^2 (T_i - 1)}}}{\sum_i \frac{M_{1i} N_{1i}}{T_i}}$$

For PMRs with

$$\sum_i (A_i) \leq 1,000$$

from the cause of interest, exact 95% CIs are estimated assuming Poisson distribution of the data (56). As observed deaths from a cause of death within each occupation or industry group and age category are distributed approximately as Poisson random variables, the total numbers of observed deaths from a cause of death within each occupation or industry group are also distributed as Poisson random variables. The mean of

$$\sum_i (A_i)$$

is denoted as  $\lambda$  and PMR can be written as

$$\frac{\lambda}{\sum_i E(A_i)} \cdot 100$$

The 95% CIs are estimated by obtaining exact confidence limits for  $\lambda$  and dividing the resulting end points by

$$\sum_i E(A_i)$$

The lower limit of  $\lambda$  is denoted as  $L$  and the upper limit is denoted as  $U$ .  $L$  and  $U$  may be estimated in SAS using the gaminv function or in R using the qgamma function (57).

The 95% CI is then estimated as:

$$\frac{L}{\sum_i E(A_i)} \cdot 100$$

$$\frac{U}{\sum_i E(A_i)} \cdot 100$$

Occupation and industry group-level PMRs are described in comparison with the total population for overall estimates or in comparison with the total demographic subpopulation for stratified estimates against a referent PMR value of 100.0 in each population. PMRs are considered elevated in this report if the lower bound of the 95% CI is over 100.0. No hypothesis tests were performed to compare PMRs between worker populations, given the large number of comparisons, and a higher absolute PMR within one worker population compared with another does not indicate a statistically significant difference.

*Suppression of unreliable estimates*—An asterisk is shown in place of a crude or age-specific PMR based on fewer than 20 deaths. The limit of 20 deaths is a convenient, if somewhat arbitrary, benchmark, below which estimates are considered too statistically unreliable for presentation. For age-adjusted PMRs, the estimate is suppressed if the sum of the age-specific deaths is fewer than 20 (53). NCHS data presentation standards for proportions were applied to assess the statistical reliability of percentages (22). An asterisk is shown in place of a percentage for estimates that did not meet the standards (22).

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