

ASSESSING COVID-19 DEATHS BY OCCUPATION AND RACE: LOUISIANA 2020-2021

Anna Reilly¹, Brittany Babin¹, RaShanda Littles, and Susanne Straif-Bourgeois²

¹Louisiana Department of Health

²Louisiana State University Health Sciences Center-New Orleans



Background: The COVID-19 pandemic underscored significant health disparities, with social determinants such as living conditions and occupation amplifying the risk for severe outcomes in Black residents. This study examines the intersection of occupation, race, and COVID-19 mortality among Louisiana workers in 2020 and 2021, emphasizing the importance of integrating work-related information into public health surveillance.

Methods: Occupation and race were collected from the death certificates of Louisiana resident workforce participants aged 18-70 years with COVID-19 listed as a cause of death for 2020 and 2021. COVID-19 mortality rates per 100,000 workers were calculated and compared using rate ratios for occupational groups and stratified by race. The SARS-CoV-2-Occupational Exposure Matrix was used to assess exposure risk level for each occupation.

Results: COVID-19 disproportionately affected Black workers, with higher mortality rates compared to White workers across various occupational groups. Construction, Production, Transportation, and Service occupations exhibited the highest mortality rates. The SARS-CoV-2-Occupational Exposure Matrix highlighted disparities in exposure risk levels, with Black workers overrepresented in high-risk occupations.

Discussion: This study confirms known disparities in COVID-19 mortality by race and occupation, emphasizing the vulnerability of Black workers in high-risk occupations. Racial equity measures and targeted prevention strategies are crucial to address these disparities and protect vulnerable workers during public health crises.

Conclusion: Racial disparities persist in COVID-19 mortality among Louisiana workers, particularly in high-risk occupations. Integrating occupational data into public health surveillance can inform tailored prevention efforts and mitigate disparities, ensuring the safety and resilience of essential workers during pandemics.

KEYWORDS: COVID-19, Louisiana, Occupation, Mortality, Race

BACKGROUND

The COVID-19 pandemic exposed significant health disparities. Black communities experienced disproportionately higher infection and mortality rates compared to White communities.¹⁻⁶ In Louisiana, by April 2020, 70% of all COVID-19 deaths occurred among Black residents, who make up only 30% of the state's population. The New Orleans area, which was hit hardest early in the pandemic, has a disproportionately high number of Black residents compared to the rest of Louisiana.⁷ Some of the social determinants of health such as living in high-poverty (deprived) neighborhoods, relying on public transportation, living in crowded housing, having an underlying medical condition (e.g., diabetes, hypertension, or obesity), and working in vulnerable and low-paying jobs increases the risk for infection and more severe outcomes in Black residents.⁸⁻¹³ Of all COVID-19 deaths that occurred in Louisiana by April 2020, nearly 44% had diabetes, 66% had hypertension, and 25% were obese.⁷ Compared to White residents, Black residents have a higher prevalence of poverty (33.1% vs. 12.1%), diabetes (19.7% vs. 13.4%), hypertension (60.2% vs. 49.6%), and obesity (46.5% vs. 36.1%).¹⁴⁻¹⁶ For most of the first year of the pandemic, COVID-19 case rates in Louisiana were the highest in the most deprived neighborhoods in the state.⁹ The higher levels of stressors - social, economic, environmental, and health - experienced by Louisiana's Black communities compared to its White communities were found to have ultimately led to higher COVID-19 mortality rates for the Black communities.¹¹ A pilot analysis of 2020 COVID-19 mortality data determined that the Black worker COVID-19 mortality rate was significantly higher than the rate for all workers in Louisiana.¹⁷

Work is an important social determinant of health that affects nearly all aspects of

life, but is often overlooked. Work offers obvious economic benefits as well as personal/social benefits, but it can also expose workers to a hazardous environment, which may lead to injury, illness, or death.¹⁸ The risk of exposure to SARS-CoV-2 (the causative agent of COVID-19) while at work has been determined to be highest among those occupations that have regular interactions with the public, close working conditions, and/or work indoors.¹⁹ When stay-at-home orders were issued during the pandemic, many workers whose jobs were deemed essential and could not be performed remotely continued going to work. Occupational COVID-19 outbreaks that occurred in places such as long-term care facilities, food processing facilities, and construction sites highlighted the risk of disease transmission while at work as well as the need to have a better understanding of which occupations present an increased risk of exposure to SARS-CoV-2.^{10, 19-21} Black workers are more likely to be employed in occupations with a high risk of infections and occupations frequently requiring close proximity to others.^{4,10} Our pilot analysis shows significantly higher COVID-19 mortality rates in 2020 for workers in Community and Social Service; Farming, Fishing, and Forestry; Construction and Extraction; Service; Production; and Transportation and Material Moving occupational groups compared to the overall rate for all workers in Louisiana.¹⁷

This analysis elucidates the impact of occupation and race on the risk of COVID-19 mortality among Louisiana workers in 2020 and 2021; further, it demonstrates the importance of making the collection of work-related information part of all public health surveillance. By learning how different occupational and racial groups are affected, public health professionals are better informed and can leverage that knowledge to inform more timely, tailored, or targeted prevention and intervention

efforts during future outbreaks or pandemics of COVID-19 or similar respiratory illnesses.

METHODS

Study Population Case Definition

Death certificates for 2020 and 2021 were obtained from the Louisiana Department of Health's (LDH) Bureau of Vital Records and Statistics. Records were selected based on the following inclusion criteria: Louisiana resident, aged 18-70 years old, ICD-10 code U07.1 for COVID-19 listed as the primary or a contributing cause of death, and a workforce participant. An individual was considered a workforce participant based on the presence of a valid industry and occupation response listed on their death certificate. A record was excluded if these fields were blank, or the responses indicated the decedent was not in the workforce (e.g., student, retired, unemployed, disabled, or homemaker). COVID-19 deaths were identified using the Council of State and Territorial Epidemiologists (CSTE) Revised COVID-19-associated Death Classification Guidance for Public Health Surveillance Programs.²²

The National Occupational Mortality Surveillance (NOMS), a collaboration between the National Institute for Occupational Safety and Health (NIOSH), the National Center for Health Statistics, and jurisdictions, coded the occupation (a free-text field) on each death certificate into a 2010 Census Occupation Code (COC).²³⁻²⁴ The 2010 COCs were then cross-walked to the most recent 2018 COC scheme using a publicly available U.S. Census Bureau file and then categorized into one of 12 major occupational groups (Figure 2).²⁴ The NOMS-coded data was updated to the 2018 COC so that it would match the coding scheme of the denominator estimates used to calculate rates. Records labeled as 'Insufficient Information' or 'Military Specific' were excluded due to the

unavailability of population estimates for rate calculations.

Population Denominators

Population estimates for rate calculations were obtained from NIOSH's Employed Labor Force (ELF) query system, which provides state-level worker population estimates based on a subset of the Bureau of Labor Statistics (BLS) Current Population Survey (CPS) public access data files. The CPS is a monthly household survey of the U.S. civilian non-institutionalized population that measures national labor force participation and employment.²⁵ Estimates for workers aged 18-70 years were obtained from ELF for four distinct groups: 1) all Louisiana workers, 2) Louisiana workers stratified by race (Black and White only due to low numbers for other races), 3) Louisiana workers stratified by the 12 major occupational groups, and 4) Louisiana workers stratified by occupational group and race.

Data Analysis

Distribution of COVID-19 Deaths, 2020 and 2021: To provide an overview of the impact of COVID-19 deaths on the working-age population over the first two years of the pandemic, we stratified the number of deaths by month and year for 2020 and 2021.

Rate Calculations and Comparisons by Occupational Group and Race: Mortality rates per 100,000 workers in Louisiana with 95% CIs were calculated for each occupational group by year and each occupational group by year and race. Rate ratios (RRs) and 95% CIs were calculated to compare the 2021 COVID-19 mortality rate for each occupational group to the 2020 rate. The rates for occupational groups within race (e.g., Black 2021: Black 2020) and between races (Black 2020: White 2020) were also compared. A rate is considered to be significantly different from the comparison

population's rate if the 95% CI for the RR does not contain 1.0. Due to small numbers, the Farming, Forestry, and Fishing occupational group was excluded from occupation-by-race analysis. All rates and rate ratios were calculated in SAS Enterprise Guide statistical software v8.3 (SAS Institute, Inc., Cary, North Carolina) using Poisson regression.

SARS-CoV-2-Occupational Exposure Matrix (SOEM): The SOEM, created by CSTE, is a tool for epidemiologists to understand how work-related factors influence the impact of COVID-19 and any observed disparities in their jurisdictions.¹⁹ It combines information from three factors that increase the risk of exposure to SARS-CoV-2 while at work into one assessment: high-, medium-, or low-risk. The three factors are whether an occupation involves: routine in-person interaction with the public (Public Facing), working indoors (Working Indoors), and working in close physical proximity to others, either co-workers or the public (Close Proximity). High-risk occupations have at least two out of three of these risk factors. Low-risk occupations are not public-facing and not close proximity regardless of whether work occurs primarily indoors or outdoors, and all other occupations are classified as medium-risk. Although the SOEM does not classify healthcare occupations, we classified them as high-risk due to the universal recognition of these occupations as having a high risk for exposure to the virus while at work.¹⁹ We used the SOEM to determine the distribution of exposure risk levels among Louisiana workers who died of COVID-19 in 2020 and 2021. We also examined the 20 occupations most frequently listed on these workers' death certificates by race and SOEM classification.

RESULTS

COVID-19 was listed as a primary or secondary cause of death for about 12%

(6,946) and 11% (6,662) of the deaths that occurred among Louisiana residents in 2020 (58,074) and 2021 (59,096), respectively. Further restricting the COVID-19 deaths to those that occurred in working-age workforce participants resulted in 1,952 deaths in 2020 and 2,891 deaths in 2021. Removing records coded as 'Insufficient Information' (n=35 in 2020; n=98 in 2021) or 'Military Specific' (n=18 in 2020; n=19 in 2021) resulted in 1,899 and 2,774 COVID-19 deaths for 2020 and 2021, respectively that could be analyzed by both occupation and race.

Distribution of COVID-19 deaths by month and year

Figure 1 presents COVID-19 deaths by month over the first two years of the pandemic. Overall, there were more deaths in 2021 than in 2020. The highest number of deaths in 2020 occurred at the beginning of the pandemic in April (n=438), followed by smaller peaks in July/August (n=211/239) and December (n=272). The December peak of 2020 continued into January/February of 2021 (n=367/201). A very large spike in COVID-19 deaths occurred from July to October (n=211, 871, 602, 202, respectively for each month), which corresponds with when the delta variant of the virus was circulating in Louisiana.

Deaths by occupation and year

The COVID-19 mortality rate for all workers in 2020 was 103.8 per 100,000. In 2020, the rates for the Farming, Fishing, and Forestry (Farming); Construction and Extraction (Construction); Production; Transportation and Material Moving (Transportation); and Service occupational groups were significantly higher than the rate for all workers. In 2021, the COVID-19 mortality rate for all workers increased to 147.8 per 100,000. The COVID-19 mortality rates for the same occupational groups listed for 2020 as well as the Installation,

Fig 1. Number of COVID-19 Deaths by Month among Working-Age (18-70 Years) Louisiana Residents, 2020-2021

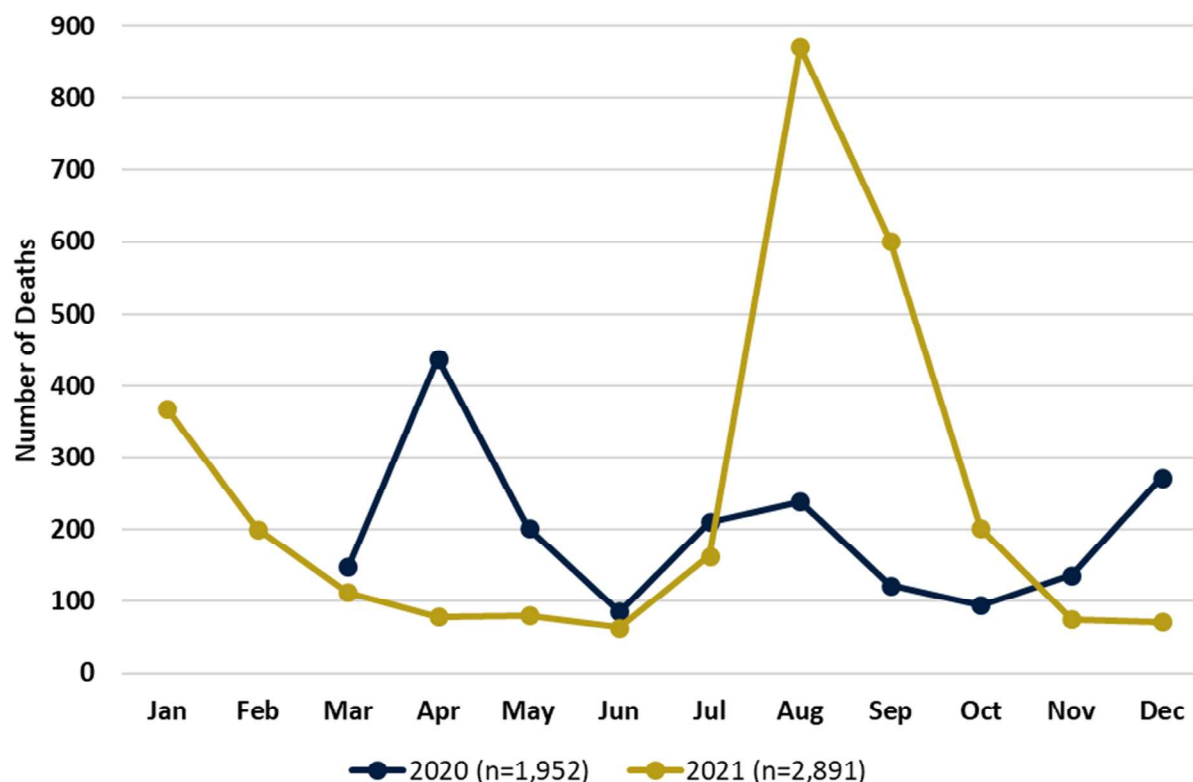
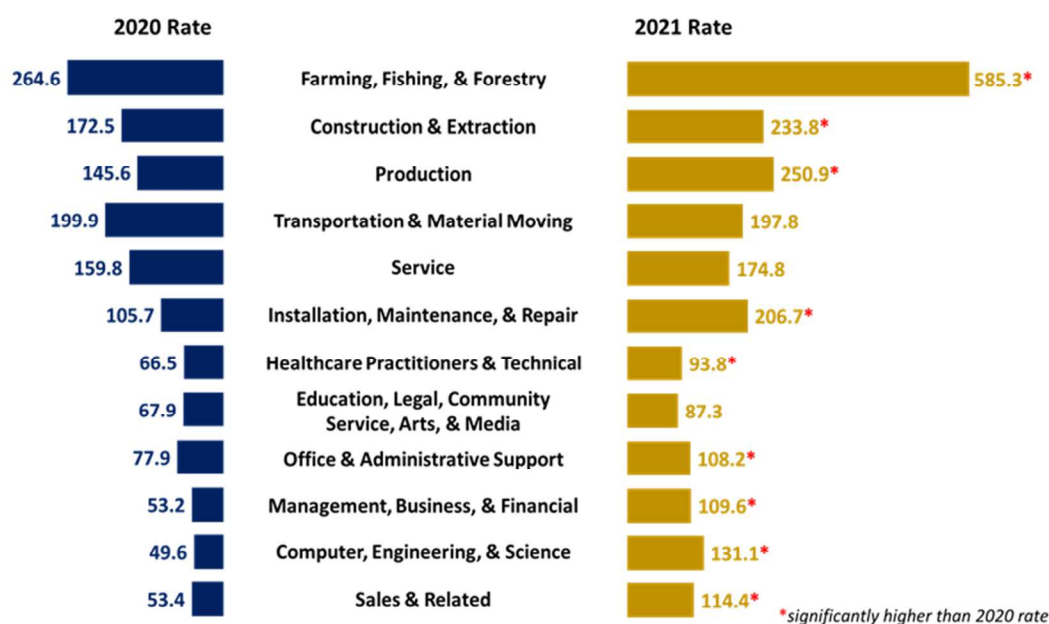


Fig 2. COVID-19 Mortality Rate per 100,000 Louisiana Workers by Occupational Group, 2020 (n=1,899) – 2021 (n=2,774)



Maintenance, and Repair (Installation) group were significantly higher than the rate for all workers in 2021. In addition, the 2021 rates for nearly all occupational groups significantly increased, except Transportation; Service; and Education, Legal, Community Service, Arts, and Media (Education, etc.) (Figure 2).

Deaths by occupation, year, and race

In 2020, COVID-19 mortality rates in Black workers were 1.9 to 3.8 times higher than White worker rates for every occupational group (Figure 3A). The rate for all Black workers in 2020 was 202.6 per 100,000. The COVID-19 mortality rates for Black workers in the Construction, Production, Transportation, Service, and Installation occupational groups were higher than the rate for all Black workers in 2020. The White worker mortality rate in 2020 was 86.5 per 100,000, and workers in only two occupational groups, Construction and Transportation, had higher mortality rates than the rate for all White workers in 2020.

Overall, in 2021, the Black worker COVID-19 mortality rate decreased and the White worker mortality rate increased. Comparing occupational groups by race in 2021, the mortality rate in the Black working population was only significantly higher than the White rate for the Education, etc. and Service groups (Figure 3B). The COVID-19 mortality rate for Black workers in 2021 decreased to 174.3 per 100,000 compared to 202.6 per 100,000 in 2020. Despite this decrease, the occupational groups with the highest mortality rates were the same as in 2020 for Black workers. Compared to 2020, the mortality rates for Black workers in 2021 decreased for most occupational groups, and increased for three others; however, one group, Construction, had a particularly large rate decrease (from 409.5 per 100,000 to 263.1 per 100,000). The White worker mortality rate in 2021 increased to 138.4 per 100,000. In 2021, the

rate for White workers in every occupational group increased, but the rates for the Construction, Production, Transportation, Installation, and Computer, Engineering, and Science (Computer) occupational groups exceeded the rate for all White workers in 2021.

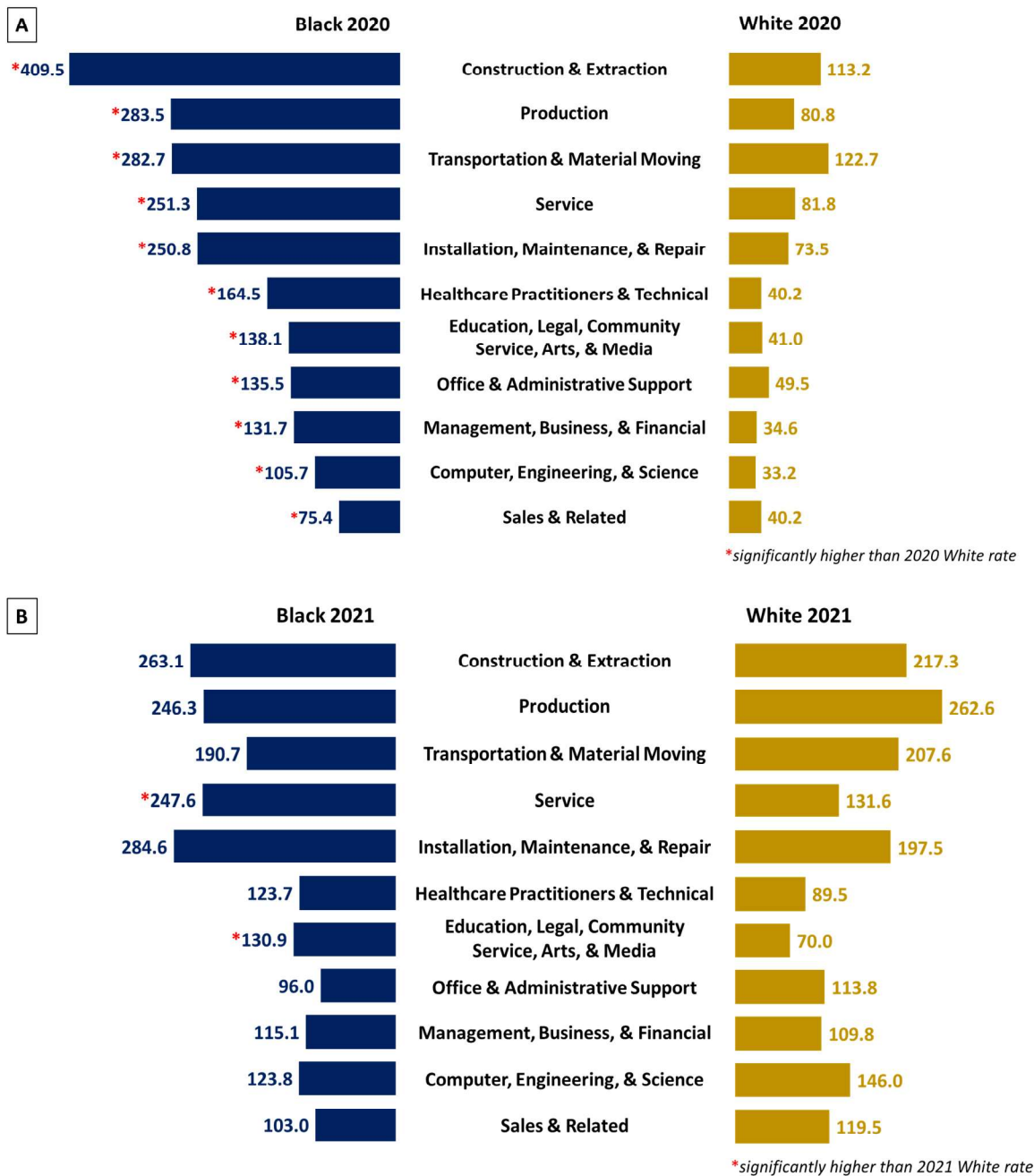
SARS-CoV-2-Occupational Exposure Matrix (SOEM)

The SOEM classified 2020 COVID-19 mortality data into exposure risk levels made up of about 60% Black and 40% White workers. In 2020, the percentage of Black worker deaths with a high-risk occupation was almost twice as high as the percentage of White high-risk worker deaths, and the percentage of COVID-19 deaths was higher for Black workers than it was for White workers at the medium- and low-risk levels as well (Figure 4). Among Black COVID-19 worker deaths in 2020, about 57% had a high-risk occupation, 31% a medium-risk occupation, and 12% a low-risk occupation. About 44% of White COVID-19 worker deaths in 2020 had a high-risk occupation, 39% a medium-risk, and 17% a low-risk occupation. In 2021, COVID-19 deaths were made up of about 36% Black and 64% White workers. The proportion of COVID-19 deaths was higher for White workers than for Black workers at every risk level (Figure 4). Although the percentage of the total number of COVID-19 deaths for White workers in 2021 exceeded that of Black workers, about 58% of all Black workers had a high-risk occupation compared to about 39% of all White workers.

Most Common Occupations by SOEM Risk Level

The 20 most frequently listed occupations on COVID-19 death certificates from 2020-2021 in Table 1 represent 42% of the total number of death certificates analyzed (n=2,032). There were a total of nine high-risk, eight medium-risk, and three low-risk occupations on the list; 63% were

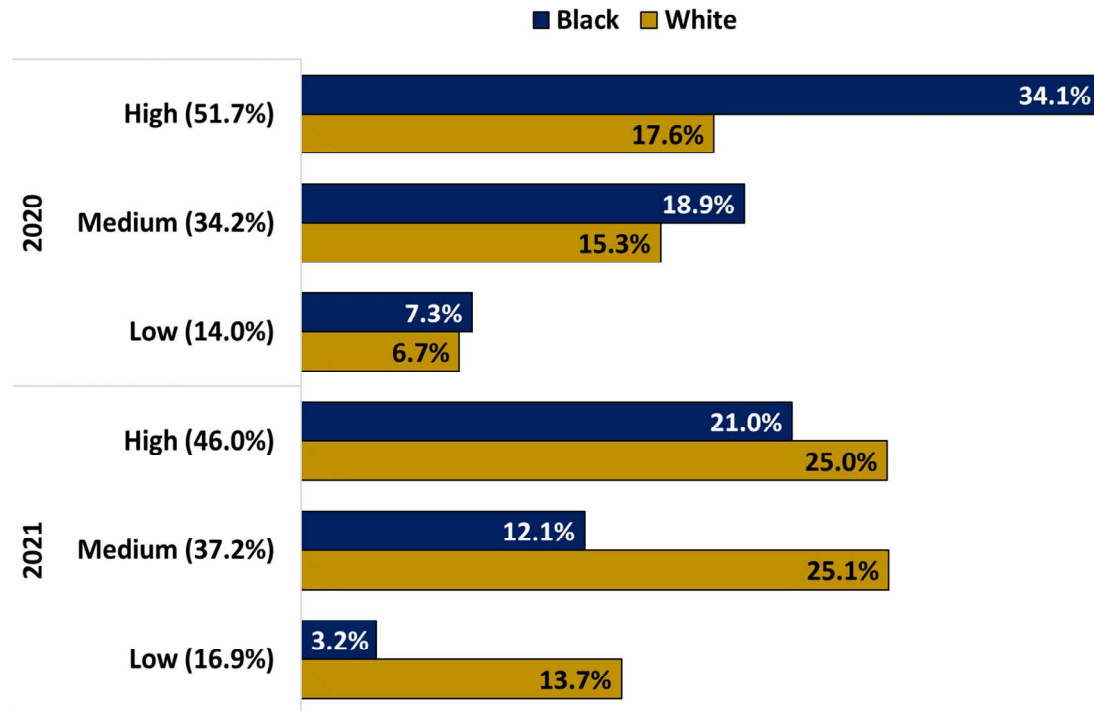
Fig 3. COVID-19 Mortality Rate per 100,000 Louisiana Workers by Occupational Group, Race and Year, 2020 (A) and 2021 (B)



Farming, Fishing, & Forestry is suppressed due to group size.

**Indicates significant difference from White rate*

Fig 4. Percentage of COVID-19 Deaths by Occupational Risk Level of Exposure to SARS-CoV-2 in the Workplace by Year and Race, 2020 and 2021



Black workers (n=1,282) and 56% were White workers (n=1,143). Twenty-five percent of the top 20 most frequently listed occupations were from the Service group, specifically, Cooks (Food Preparation and Serving Related; Food Preparation); Nursing, Psychiatric, and Home Health Aides (Healthcare Support); Personal care aides (Personal Care and Service); Janitors and Building Cleaners, Maids and Housekeeping Cleaners (Building and Grounds Cleaning and Maintenance). All of these Service occupations were classified as high-risk by the SOEM. The percentage of Black worker deaths (range: 66% - 88%) for each of these occupations was at least double the percentage of White worker deaths (range: 12% - 32%). Half of the medium-risk level jobs in Table 1 were Construction jobs. Three were skilled labor (e.g., carpenter) and were represented by a higher percentage of White deaths; one job, general construction laborer, was represented by a higher

percentage of Black worker deaths. There was a higher percentage of Black worker deaths for the medium-risk Transportation group jobs listed in Table 1, which included drivers, laborers, and movers.

DISCUSSION

This study confirms known disparities in COVID-19 mortality by race and contributes additional insight into the impact of occupation and COVID-19 mortality in Louisiana's working population. Although Black workers represented 45% of all COVID-19 deaths from 2020-2021 in Louisiana, they make up only 30% of Louisiana's workforce. In comparison, 52% of White workers died from COVID-19, but they make up 65% of Louisiana's workforce.²⁵ In general, workers of both races in the Construction, Production, Transportation, and Installation occupational groups experienced the highest COVID-19 mortality from 2020-2021.

Table 1. Top 20 Occupations of COVID-19 Deaths by Race and Work Exposure Risk Level, 2020-2021

Detailed Occupation (<i>Occupational Group</i>)	Deaths (#)	Black (%)	White (%)	Risk-Level
Cooks (<i>Service</i>)	143	78%	20%	High
Nursing, psychiatric, and home health aides (<i>Service</i>)	128	88%	12%	High
Personal care aides (<i>Service</i>)	118	76%	21%	High
Janitors and building cleaners (<i>Service</i>)	116	66%	32%	High
Elementary and middle school teachers (<i>Education, Legal, Community Service, Arts, & Media</i>)	101	49%	50%	High
Registered nurses (<i>Healthcare Practitioners & Technical</i>)	93	39%	59%	High
Retail salespersons (<i>Sales & Related</i>)	88	34%	63%	High
First-line supervisors of retail sales workers (<i>Sales & Related</i>)	86	28%	65%	High
Maids and housekeeping cleaners (<i>Service</i>)	79	75%	20%	High
Driver/sales workers and truck drivers (<i>Transportation & Material Moving</i>)	267	55%	44%	Medium
Laborers and freight, stock, and material movers, hand (<i>Transportation & Material Moving</i>)	136	75%	21%	Medium
Construction laborers (<i>Construction & Extraction</i>)	119	59%	29%	Medium
Carpenters (<i>Construction & Extraction</i>)	80	24%	74%	Medium
First-line supervisors of construction trades and extraction workers (<i>Construction & Extraction</i>)	67	19%	78%	Medium
Secretaries and administrative assistants (<i>Office & Administrative Support</i>)	66	33%	64%	Medium
Automotive service technicians and mechanics (<i>Installation, Maintenance, & Repair</i>)	60	35%	58%	Medium
Electricians (<i>Construction & Extraction</i>)	59	14%	86%	Medium
Managers, all other (<i>Management, Business, and Financial</i>)	92	26%	71%	Low
Production workers, all other (<i>Production</i>)	72	51%	47%	Low
Welding, soldering, and brazing workers (<i>Production</i>)	62	37%	60%	Low

Additionally, the application of the SOEM highlights how exposure risk level knowledge about occupation and race may be useful in preparedness for future pandemics. Overall, 57% of Black workers who died from COVID-19 from 2020-2021 had an occupation categorized as high-risk, which supports current knowledge about the tendency of Black workers to be employed in high-risk exposure jobs.¹⁰

Mortality rates in Service occupations, which tend to be high exposure-risk, were much higher for Black workers in Louisiana. In Louisiana, the Service occupational group, which is 46% Black and 54% White, stands as the largest employer of Black

workers. However, while about 25% of all Black workers have a Service occupation, only about 14% of all White workers have a similar job.²⁵ The Service group contains a wide variety of subgroups, including Healthcare Support, Protective Service, Food Preparation, Building and Grounds Cleaning and Maintenance, and Personal Care and Service. Even though Service subgroups were not analyzed because of sample size issues, data show that a large number of Black Louisiana Service workers have either Healthcare Support or Food Preparation jobs (about 26%, each). Although the COVID-19 mortality rate for Black Construction workers remained high, it did

decrease by nearly 36% in 2021, while the rate for White Construction workers increased by about 92%. The Construction occupation workforce in Louisiana is about 21% Black and 79% White, and about 5% of all Black workers in Louisiana have a Construction occupation compared to about 9% of all White workers.²⁵ In Table 1, the percentage of COVID-19 deaths for skilled labor or supervisor Construction jobs was three to six times higher for White workers, while the percentage of COVID-19 deaths for general Construction laborers was two times higher for Black workers. This suggests that there are more Black workers than White workers employed in less-skilled Construction jobs. The 2021 trend toward reducing the racial disparities in mortality rates within occupational groups is linked to a significant increase in the COVID-19 mortality rate among White workers, bringing their rates closer to those of Black workers across different occupational groups. These results are comparable to findings that disparities in COVID-19 age-adjusted mortality rates in the U.S. decreased over time during 2020-2021 for most racial groups.²⁶

COVID-19 vaccines first became available in December 2020 for high-risk populations such as the elderly and essential workers, before later becoming more widely available for all Louisiana residents. Vaccination and efforts to provide equitable vaccine access may partially explain the improvement in the Black worker COVID-19 mortality rate in 2021.²⁷ Additionally, there may have been racial differences in vaccine uptake. There is evidence that vaccine hesitancy decreased in Black people faster than it did in White people.²⁷⁻²⁸ We obtained percentages of the number of Louisiana residents with at least one dose of COVID-19 vaccine aged 18-74 in 2021 stratified by race and sex from LDH's Immunization Program. Vaccination coverage in Louisiana of Black (65%) and

White (64%) residents was equal in 2021 (personal communication with Dr. Arundhati Bakshi, Immunization Data Analytics Program Manager). In the U.S., White adults had the highest COVID-19 vaccination coverage by the end of April 2021 (59.0%) compared to Black adults (46.3%); however, by November 2021 the coverage rates had increased for both groups and became nearly equal (78.7% vs. 78.2%, White vs. Black).²⁷ It may be that Louisiana's data followed a similar pattern; however, we did not do a more in-depth examination of Louisiana's vaccination data as it is beyond the scope of this analysis.

The pandemic highlighted work as a source of transmission and the need to consider job-associated exposure risk in addition to other risk factors. The Louisiana Occupational Health and Injury Surveillance Program promotes worker safety and health by analyzing, interpreting, and utilizing surveillance information. We have provided a retrospective review of death certificate data, but industry and occupation variables are not available in most data sources. Collection of complete industry and occupation data on case report forms from the outset of future disease outbreaks or pandemics could help identify vulnerable worker populations that are not as readily apparent. When available, occupational data could be leveraged to better inform or expand public health messaging or other types of outreach in a more actionable amount of time rather than retrospectively.

Limitations

The study has several limitations. COVID-19-associated deaths were selected according to the CSTE Guidance, which includes all death certificates where COVID-19 is listed as a primary or contributing cause of death.²² The manner of death variable was not included in the initial study design; therefore, no death certificates were excluded based on the manner of death. In

cases where a death is ruled an accident, homicide, or suicide and COVID-19 is listed as a contributing or secondary cause of death, it may be argued that the death is not COVID-19-associated. Whether or not deaths such as these should be counted as COVID-19-associated deaths should be considered before performing any future analyses. Death certificates list a decedent's usual occupation; however, this can be outdated information or completed incorrectly resulting in misclassification bias. When comparing pandemic years (Figure 1), it is important to remember many factors at play are beyond the scope of this article. The pandemic did not start until March 2020; therefore, we are comparing 10 months of 2020 to 2021 (unequal periods). Differences in rates for the entire population including workers were affected by circulating variants, personal medical history, mitigation measures in place, and the availability and uptake of vaccines. Having one or more comorbidities such as diabetes, obesity, and hypertension increases a person's risk for COVID-19 hospitalization and death.¹²⁻¹³ Comorbidities are strong confounders for COVID-19 mortality; however, they are not listed on death certificates and therefore could not be analyzed. Furthermore, we did not have access to individual vaccination data and did not know if prevention measures were in place at work. The data are also not age-adjusted. Cases of COVID-19 morbidity and mortality from 2020-2021 were more numerous in those of older age (ages 60+ years) and the prognosis was more serious due to their tendency to have underlying conditions.²⁹ Moreover, we cannot assess where SARS-CoV-2 exposure occurred. Working in a high-risk occupation does not necessarily mean that work is the source of exposure and infection; exposure could have been at home or in the community.

CONCLUSION

Our study shows that Black workers in certain occupation groups had a higher mortality rate compared to white workers. The results of this study highlight the need for racial equity in Louisiana's working population during a pandemic. Occupational data linked with morbidity and mortality data during pandemics can provide additional knowledge of disease transmission and necessary control measures. Establishing specific prevention measures for workers with high-risk occupations is important. Workers need to be protected from disease and death not only to keep them and their families safe but also to ensure their ability to continue essential work during a public health crisis.

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CORRESPONDING AUTHOR

Anna Reilly
anna.reilly@la.gov