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## Review article

# Health care disparities during the COVID-19 pandemic <sup>☆</sup>



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## ARTICLE INFO

## ABSTRACT

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2, is a pandemic with more than 32 million cases and more than 500,000 deaths nationwide. With the significant health consequences seen secondary to COVID-19, health care disparities have been further exacerbated. Mechanisms that have been proposed to account for the increased disparity seen during the COVID-19 pandemic are multifactorial. This review of the literature outlines the unique barriers to health and disparities that are associated with vulnerable communities who have been most impacted by the COVID-19 pandemic in the United States.

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## 1. Introduction

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2, is a pandemic with more than 32 million cases and more than 500,000 deaths nationwide. With the significant health consequences seen secondary to COVID-19, health care disparities have been further exacerbated [1]. Not only are infection rates higher in BIPOC (Black, indigenous, and people of color) and marginalized populations, but consequences and complications after COVID-19 infection are significantly elevated as well. In fact,

the Centers for Disease Control and Prevention estimates that some BIPOC populations experience hospitalization after COVID-19 infection at a rate more than threefold higher than White populations [1].

The reasons that have been proposed for the differential morbidity and mortality seen during the COVID-19 pandemic are multifactorial. Social determinants of health play a central role in the disparities seen. Vulnerable BIPOC communities historically have experienced generations of systemic divestment, which has led to large gaps in infrastructure and resources.

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In this review of the literature, we outline the unique barriers to health care and highlight specific disparities that are associated with particular communities most impacted by the COVID-19 pandemic in the United States. Although this summary does not capture the totality of disparities affecting communities across the United States, it highlights trends in many vulnerable populations.

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## 2. BIPOC communities

The COVID-19 pandemic has disproportionately affected the Black population in the United States. Analysis of racial trends from the summer of 2020 suggest that infection and death rates in Black counties were three and six times those in predominantly White counties, respectively [2]. This trend is most pronounced in rural Black communities [3]. This is demonstrated in Louisiana, where at one point early in the pandemic, Black residents accounted for 72% of COVID-19 deaths, while comprising only 32% of the state's population [4].

The causes of this disparity are numerous, and underlying medical conditions and social determinants of health have a significant impact. Unfortunately, the health conditions that increase the risk for poor outcomes in COVID-19 are the same conditions already seen at higher rates in the Black population. Hypertension, cardiovascular disease, diabetes, chronic respiratory disease, liver disease, and autoimmune disease are underlying health conditions that disproportionately affect Black patients. In addition, minorities and low-income individuals are more likely to be essential workers and less likely to be able to work remotely [3], putting these individuals at increased risk. It is also worth noting that people in these communities are often subjected to higher-density living environments and experience poorer access to insurance and health care [3]. These issues are further compounded by the inherent mistrust of the medical field that exists in Black communities in response to decades of racist actions and policies that have negatively impacted marginalized groups. These factors have resulted in a community that is both medically vulnerable and skeptical of the medical system. This medical skepticism and lack of entrustment has resulted in limited testing and vaccination in the Black community, both of which are key components to improving outcomes in COVID-19.

With respect to vascular-specific manifestations, COVID-19 leads to a hypercoagulable state in many affected patients. Motaganahalli and colleagues [5] looked at deep venous thrombosis in patients with COVID-19, and although it did not reach significance, 61% of the patients studied who developed a deep venous thrombosis were African American. Similarly, in a study of patients at a New York City health care system, nearly one-third of patients with acute thrombotic manifestations of COVID-19 were African American [5]. Regrettably, many of the sources reviewed for this article did not report complete demographic information that included race. Even the data from the Centers for Disease Control and Prevention are incomplete, with race and ethnicity data available for only 51% of reported COVID cases [4,6]. These shortcomings in reporting demographic data highlight the need for mandated re-

porting of race and ethnicity as they relates to COVID-19 outcomes.

Amid marked visibility of anti-Asian violence and macroaggression spurred by the pandemic, Asian populations within the United States have also experienced health-related disparities with regard to morbidity, mortality, and access to care for COVID-19. The population described as Asian is diverse, making accurate tabulation difficult. According to the 2020 US Census, Asian Americans are any persons with origins in the "Far East," Southeast Asia, and the Indian Subcontinent (eg, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam). The Asian Pacific Institute on Gender-Based Violence uses the term *Asian or Pacific Islander* to denote people with Asian, Asian-American (as defined above) and Pacific-Islander ancestral roots who will be referred to here as Asian American or Asian American/Pacific Islander (AAPI) [7].

Basset et al [8] from the Harvard T.H. Chan School of Public Health, studied differences in COVID-19 mortality by race/ethnicity and age. The study provided compelling evidence that, compared to non-Hispanic white (NHW) populations, non-Hispanic Black (NHB), non-Hispanic American Indian/Alaskan Native (NHAIAN), and non-Hispanic Asian/Pacific Islander (NHAPI) populations had higher mortality in all studied age groups (note these abbreviations were used in the reference and do not necessarily correspond to acronyms in this review). They also calculated "years of potential life lost," which was significantly higher in NHB and Hispanic populations compared to NHW, indicating a prominent risk of premature death (younger than 65 years) in these groups [8]. The authors concluded that, as of July 2020, mortality rates from COVID-19 were higher in Hispanic, NHB, NHAIAN, and non-Hispanic Asian/Pacific Islander groups than in NHWs particularly in people older than 55 years [8]. Nationally, statistics on mortality from COVID-19 in the spring and summer of 2020 demonstrated slightly lower rates of death in the Asian American populations (4.4%) than their representation in the country (5.7%) [9]. However, rates varied from state to state. For example, in Nevada, Utah, and Nebraska, mortality rates in AAPI populations were almost double the population share (15.4% of deaths with 8.1% population; 5.5% of deaths with 2.4% of population; 5.9% with 2.4% of population, respectively) [9].

Others have corroborated state-to-state differences in disease severity and COVID-19-related mortality in AAPI populations [10]. Evaluating US national COVID-19 mortality data from the National Center for Health Statistics up to the end of 2020, Xu et al [10] calculated years of potential life lost in NHW, NHB, Hispanic, non-Hispanic Asian (NHA), non-Hispanic American Indian or Alaska native (NHAIAN), non-Hispanic Native Hawaiian or Other Pacific Islander, non-Hispanic two or more races, and unknown nationally and by state. NHA death rates were underrepresented in comparison to population share in 32 states, and overrepresented in Nevada. However, in Minnesota, Pennsylvania, and Wisconsin, NHA years of potential life lost were above the percentage of total deaths, indicating that NHAs were dying at earlier ages than other groups in a manner that was statistically detectable. In California and Nevada, the statistical analysis demonstrated the opposite finding; NHAs

were dying at statistically detectable older ages than other groups [10].

The causes for increased regional complications and mortality from COVID-19 in the AA/AAPI population is likely multifactorial. Asian-origin immigrant and refugee populations in the US comprise a significant percentage of the essential workforce in certain areas (including in health care), potentially increasing their exposure. For example, case-mortality rates in the San Francisco Bay area for Asian populations was 3%, which was much higher than that for White and other minority groups in the region [11]. Poverty, language barriers, and multigenerational living situations likely exacerbate the risk. One study evaluating refugees from Bhutan and Myanmar, representing 14% and 21%, respectively, of resettled refugee communities in the United States used questionnaires to determine COVID-19 incidence in essential and nonessential workers [12]. Not surprisingly, essential workers had higher self-reported infection, which might be underestimated, given the nature of the survey. Fear of anti-Asian violence and racist attacks might also prevent individuals from seeking care. Many AA/AAPI communities, including those that have been established for years, have experienced a significant amount of xenophobia targeting adults and even children [13] during the pandemic, which has exacerbated mental health issues associated with isolation, and increased the hesitancy to obtain needed medical treatment [12].

Access to vaccinations is also hampered by language barriers that might put some of the less obvious essential workers at risk for developing COVID-19. A recent news report highlighted a disparity in access affecting Sikh truck drivers, who make up an estimated 20% of the trucking workforce nationally (and 40% in California), and are critical to transporting pandemic-related supplies across the country. Many originally hail from Punjab (a state in northern India). Despite being considered essential workers, truck drivers are not prioritized for vaccination and are not afforded the guarantee of open rest stops or hazard pay. Furthermore, critical vaccination information is not provided in Punjabi, exacerbating the disparity in health care access [14] in this particular population.

Racial differences have also been noted in disease severity among hospitalized patients with COVID-19. In a report on racial and ethnic differences in presentation and outcomes published in *Circulation*, Rodriguez et al [15] reported that Black and Hispanic patients represented more than half of in-hospital COVID-19 deaths across the United States. However, Asians presented with the highest severity of cardiorespiratory disease [15]. One explanation for this difference could be that Asian populations, noted in other reports to underuse health services due in part to fear of racist attacks, delay seeking medical attention until symptoms are very severe [15]. Furthermore, the group make up a significant percentage of essential workers who often live in multigenerational homes and are deterred from seeking care by language barriers, racism, and fear. Special attention should be paid to attenuating these factors to reduce morbidity and mortality in these groups.

The Hispanic population in the United States has a significantly lower socioeconomic status than the NHW population, which directly becomes a barrier to receiving health care services of high quality that are timely and appropriate, which

has become a primary limitation in receiving treatment and testing for COVID-19 [16]. Other specific barriers include degree of acculturation, language, and immigration status. The jobs available to recent and undocumented immigrants who lack proficiency in English are unlikely to provide health insurance as a benefit. Hispanics are more likely to be employed as an essential worker in agriculture, construction, and food services. This puts them at increased risk of contracting COVID-19 and less likely to have the resources for testing and treatment. The lack of health insurance makes the costs of health care services prohibitive for many people, and is the most important barrier to adequate health care access in this population. Health care disparities among African Americans and Hispanics have cost the health care system an additional \$5.1 billion, this number is expected to rise to an astounding \$65 billion within a decade, as the number of Latinos and African Americans in the United States increases and these disparities persist [17]. Data from the US Department of Health and Human Services Office of Minority Health reveals that only 49% of the total amount of the Hispanic population has private insurance, compared with 75% of the non-Hispanic White population [18]. In terms of public insurance, 38% covered Hispanics and a total of 17.8% without any kind of insurance was reported by the US Census Bureau. Many initiatives have been implemented nationally to improve access to care and expand insurance coverage, the Affordable Care Act has given insurance coverage to approximately 10 million Latinos, unfortunately having access to health care is not enough, considering the high costs of copayments, prescriptions, and monthly premiums, as well as deductibles, which result in an ongoing barrier [19]. The COVID-19 pandemic has made these gaps even more prominent. As a result, the Latino community has been disproportionately affected by the pandemic, hospitalization rates are almost five times higher in Latinos than NHWs [20].

Other challenges hindering access to care that have been exacerbated during the pandemic include distance to medical care providers, fewer Hispanic physicians, cultural and language differences between provider and Hispanic patients, and unconscious bias toward Hispanic patients.

As in other marginalized communities in the United States, American Indian and Alaskan Native (AIAN) people have been disproportionately affected by COVID-19 infection in many regions. The causes are multifactorial and systemic. Using the COVID Tracking Project's Racial Data Tracker from the Center for Antiracist Research at Boston University, confirmed COVID-19 cases and related death were compiled by race and ethnicity to quantify potential disparities [21]. Cases and mortality were analyzed in relation to the relative population in the region and expressed as a representation quotient (% incidence / %population). Representation quotients for AIAN and Native Hawaiian/Pacific Islander (NHPI) were 1.303 and 1.115, indicating a 30% and 11% increase in cases relative to the representative population, respectively [21]. Not surprisingly, marked regional differences not only in incidence but also in mortality were seen in many BIPOC groups. In a recurrent theme, these regional differences in racial/ethnic disparities appeared to depend on the representation of essential workers [22].

Social determinants of health defined by the World Health Organization as “the social, physical and economic conditions

that impact upon health” [22] add greatly to COVID-19–related disparities in indigenous communities in the United States. Factors contributing to disparate COVID-19 infection, morbidity and mortality in AIANs and NHPs include lack of indoor plumbing, language barriers, multigenerational living, and unreliable internet access to help disseminate information [22]. Disturbingly, lack of federal recognition of certain tribes due to technical oversights and disputes over historical treaties render some AIAN communities unable to access federally funded testing and vaccination initiatives. For example, the \$31 billion infusion into tribal communities by the COVID-19 relief bill does not benefit members of unrecognized tribes, such as the Chinook Nation in Southwest Washington State, which has been forced to ask neighboring tribes for access to vaccines. Indeed, such tribal nations cannot benefit from resources provided to the Indian Health Service, exacerbating treatment opportunities if infection is present [23].

Some of the risk factors that put AIAN communities at risk for COVID-19 infection are more indirect. Food insecurity in many Native communities has been shown to correlate with type 2 diabetes, obesity, and hypertension [24], putting individuals at increased risk from COVID-19–related complications. Food insecurity, defined as unreliable and unpredictable access to nutrient-dense foods, is exacerbated by poverty and so-called “food deserts” [25]. One group of researchers estimated food insecurity in AIAN communities nationally by evaluating data from the Current Population Survey Food Security Supplement, a survey distributed to approximately 50,000 households. AIANs had 20% greater odds of food insecurity than their White counterparts; not surprisingly, poverty correlated strongly with experiences of food insecurity across race and ethnicity. AIAN communities in the Pacific states, Southern Plains, and Alaska had the highest rates of food insecurity, highlighting marked regional differences in reliable access to nutrient-rich foods [26]. In addition, the COVID-19 pandemic exacerbated food insecurity across almost all demographics in the United States, and for those communities already experiencing nutritional disparities, the strain has been amplified [27]. To decrease the morbidity and mortality of COVID-19 in AIAN and NHP groups, the approach must address not only basic provisions but also systemic injustice. These would include easy access to nutritionally dense food, health information in tribal-specific languages, clean water, and internet. In addition, barriers that exist to recognizing tribal people need to be removed to facilitate delivery services from the Indian Health Service, as well as COVID-19 monies earmarked for American Indian communities.

### 3. Rural communities

Census 2010 estimated that nearly 60 million individuals live in rural locations that encompass 95% of the nation’s land mass and nearly 20% of the US population [28]. Compared to urban populations, rural residents tend to be older, have more comorbidities and higher rates of high-risk behaviors, lower income, and are often uninsured or underinsured [28–30]. Counties with a higher proportion of rural residents tend to have fewer primary care providers and surgeons

[30,31], and have long suffered after the closure of more than 120 rural hospitals in the last decade [32]. Many of the remaining rural hospitals do not have the infrastructure, resources, capacity, or sufficient number of critical care beds to stand in the face of the COVID-19 pandemic [32].

Paul et al [33] performed a spatiotemporal analysis of COVID-19 prevalence rates in urban and rural locations and found a rapid progression of spread from urban to rural areas within a 21-day period. Multiple reports document worse adoption of prevention strategies, such as donning a face mask and social distancing, lower testing rates, and higher infection rates in those aged 25 to 49 years in rural areas, which likely contributed to increased spread of the virus in these locations [33–35]. When hospitalized for COVID-19, rural residents were less likely to be enrolled in a clinical trial testing the effectiveness of therapeutics [36]. Overall, mortality rates due to COVID-19 are higher in urban areas; however, mortality rates in numerous rural counties, metropolitan small areas, and nonmetropolitan areas surpassed those of large cities [33]. Vaccine hesitancy exists throughout the nation; however, particularly in rural populations; a recent study found that only 31% of rural respondents say they will “definitely get” a COVID-19 vaccine [37]. Some posit this might be secondary to the social determinants of health, such as education level and resident segregation [38]. The intersection of race, ethnicity, and rurality must be addressed in parallel. Multiple reports from across the country demonstrated higher rates of infection, hospitalization, and death among BIPOC populations [39]. These findings hold true in rural populations with higher death rates among rural BIPOC residents [40,41].

The effects of the pandemic affected those who did not contract COVID-19, but have a chronic disease. Although the use of telehealth helped reduce exposure for patients and health care workers alike, poor internet connectivity, device operability, regulatory restrictions, state reimbursement, geographic constraints, quality of care, and provider, as well as patient acceptance barriers, were exposed, which limit adoption of telehealth solutions. These concerns remained despite sweeping regulatory flexibility made possible after various policy changes in response to the pandemic [42,43]. A study reviewing telehealth utilization among surgeons in Michigan demonstrated 34-fold increase in telehealth utilization soon after the start of the pandemic, with a sharp drop to near pre-pandemic levels thereafter [44,45]. Furthermore, this study found that patients in rural areas were significantly less likely to use telehealth visits.

### 4. LGBTQ+ communities

Within the lesbian, gay, bisexual, transgender, and queer or questioning (LGBTQ+) community, COVID-19 has exacerbated the health consequences of an already marginalized patient population. With regard to the COVID pandemic, LGBTQ+ people face unique health challenges that put them at compounded risk. In addition, LGBTQ+ people are historically excluded from policy-level responses to large-scale disasters, making the intervention and resolution of these disparities difficult to perform.



The LGBTQ+ population has greater rates of chronic disease compared to their non-LGBTQ+ counterparts. Rates of diabetes, coronary artery disease, cancer, human immunodeficiency virus, and asthma have all been reported to be higher in LGBTQ+ populations [46,47]. As such, LGBTQ+ individuals are more likely to be immunocompromised and more vulnerable to infection. Access to appropriate medical care is also compromised in the COVID pandemic. In an analysis of 1,051 online surveys distributed during the pandemic to men who have sex with men, Sanchez et al [48] found that respondents reported increased challenges in accessing human immunodeficiency virus testing, prevention, and treatment services. These access problems are compounded by the fact that LGBTQ+ populations experience reduced access to health care at baseline, with 17% of LGBTQ+ people without any health care coverage compared with 12% in non-LGBTQ+ individuals [49]. In addition, before the pandemic, LGBTQ+ individuals reported inadequate care due to previous stigmatizing experiences in health care settings and lack of provider knowledge on health care needs [48]. Overall, this suggests that these the COVID pandemic has resulted in multiple intersecting disparities that has further disadvantaged the LGBTQ community.

In addition to chronic physical conditions, mental health is much more prevalent in LGBTQ+ populations [49,50]. In fact, LGBTQ+ populations report increased risk of violence, discrimination, exclusion, loneliness, depression, anxiety, substance abuse, and suicide [51]. Community engagement has been shown to allow for a strong sense of identity and self-acceptance among LGBTQ+ youth [50]. Social distancing has removed important coping resources from these individuals, such as school and college organizations, coaches, counselors, teachers and professors, and peers. Removing these strategies could result in increased risk of violence, discrimination, exclusion, loneliness, depression, anxiety, substance abuse, and suicide [51]. LGBTQ+ elders are two times more likely to be single and living alone, four times less likely to have children, and more likely to be estranged from biological families, further exacerbating social isolation and loneliness [50]. The COVID-19 pandemic has already resulted in increased psychological stress in general; this lack of support within LGBTQ+ populations further predisposes these individuals to the deleterious psychological consequences of the pandemic.

Social distancing measures also contribute to exacerbated psychological concerns. School closings, virtual college courses, and virtual work has resulted in many LGBTQ+ youth to be confined in unsupportive homes. In fact, one-third of LGBTQ youth report family rejection and another one-third report that they came out to family as adults [52]. Suicide is eight times higher in LGBTQ+ young persons who have unsupportive family and depression is six times higher [50]. Isolating these individuals with unsupportive family members could be unsafe. Gonzales et al [53] distributed 477 online surveys to LGBT-identifying college students during the COVID pandemic and found that 45.7% have immediate families that do not know or support their LGBT identify and 60% said they were experiencing psychological stress, anxiety, or depression. Social isolation in unsafe environments could have deleterious effects. To combat this, some have promoted use of online chat platforms to re-establish a sense of community.

Fish et al [54] evaluated transcripts from 31 online chat platforms and found that consistent feelings of isolation, mental health, unsupportive families, and loss of in-person identity-based socialization and support. Online platforms will continue to emerge as important recourses during the pandemic, especially for marginalized populations.

Although there are established physical and mental health consequences to the COVID-18 pandemic, these can be further compounded by lack of policy-level response. Historically, there has been discrimination in accessing emergency government services because of LGBTQ+ status. Sexual orientation and/or identity are rarely collected in epidemiological surveillance [50]. Furthermore, LGBTQ+ individuals experience higher levels of poverty, food insecurity, homelessness, lack of health insurance, and unemployment compared to non-LGBTQ+ populations [55,56]. Forty percent of LGBTQ+ people work in the service industry, compared with 22% in non-LGBTQ+ populations, putting them at even higher risk of unemployment during the pandemic [51]. Due to the lack of responsiveness in the past to marginalized populations and lack of epidemiological surveillance, it is hard to quantify the impact of a pandemic in this population. Addressing and quantifying these unique challenges and disparities will be essential to properly care for the health consequences imposed on this population by a pandemic.

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## 5. Incarcerated/detained populations

Incarcerated persons are uniquely vulnerable to the health consequences of the COVID-19 pandemic. The case rate for COVID-19 for incarcerated individuals is 5.5 times higher than the nonincarcerated population and death rate is 3 times higher than the nonincarcerated population [57]. These populations are predisposed to poor outcomes, given higher rates of pre-existing health conditions, overcrowded environment, and lack of autonomy.

The high rates of pre-existing conditions in incarcerated persons can lead to detrimental consequences of COVID-19 infection. In fact, 60% of all incarcerated individuals have at least one chronic disease [57]. Also, there are many diseases, such as hypertension and liver disease, that have a higher incidence in incarcerated individuals [57]. As stated previously, chronic conditions such as these put people infected with COVID-19 at an increased risk for a complicated course and mortality. Incarcerated individuals, therefore, are at increased risk of being negatively impacted by the pandemic.

Social distancing is next to impossible in correctional facilities. As a congregate living facility, transmission is rapid and unavoidable. There are programs for “decarcerating” individuals of low offense crimes [58]; however, due to the lack of space, limited staff, and shared spaces, there remain high rates of transmission in correctional facilities [59]. Similar trends have been seen with other infectious diseases, such as tuberculosis, influenza, pneumonia, and human immunodeficiency virus [57]. Higher rates of transmission and infection leave this population vulnerable and amplify the effects of the pandemic in these facilities.

Lack of autonomy and freedoms puts incarcerated populations at increased risk. They are often tasked with high-

risk jobs that increases their risk. For example, in November 2020, incarcerated persons worked in morgues [60]. Situations such as these leave these populations vulnerable and without adequate protections. Furthermore, with their inability to vote, they do not have a voice in resisting these measures. As with imprisoned populations, there are other detained persons who face similar adversities. Immigrant detention centers pose similar risks with regard to lack of social distancing and lack of autonomy. It is imperative to address these populations pragmatically and diligently to avoid the untoward affects the heightened risks create.

## 6. Conclusions

The COVID-19 pandemic has exacerbated known disparities in already vulnerable communities. The intersections of pre-existing health disparities, as well as chronic divestment in specific communities such as those outlined here, has resulted in not only higher rates of infection and complications, but has accentuated the barriers to health that many Americans face. Addressing these disparities will require changes on multiple levels of society. Including variables such as race and socioeconomic factors in datasets reporting incidence and outcomes of COVID-19 is an important initial step to better study and quantify the impact the COVID-19 pandemic has had. On a physician level, population-based action plans are needed to protect our nation's vulnerable residents. Increasing the number of medical students who identify with any of the preceding communities will allow for a more diverse physician pool that reflects the patient population that it treats and increases the volume and distribution of the provider workforce. However, a sustainable response requires changes at the policy level, including improving access to care by expanding programs such as Medicaid and improving strength in infrastructure and resources for vulnerable communities and hospitals.

## REFERENCES

- [1] COVID-19 data tracker Centers for Disease Control and Prevention; 2021. Accessed May 2 Available at <https://covid.cdc.gov/covid-data-tracker>.
- [2] Thebault R, Andrew Ba Tran VW. The coronavirus is infecting and killing black Americans at an alarmingly high rate. Washington Post 2020. Published April 7 Accessed August 15, 2021 <https://www.washingtonpost.com/nation/2020/04/07/coronavirus-is-infecting-killing-black-americans-an-alarmingly-high-rate-post-analysis-shows/>.
- [3] Moore JT, Pilkington W, Kumar D. Diseases with health disparities as drivers of COVID-19 outcome. *J Cell Mol Med* 2020;24:11038–45.
- [4] Racial disparities in Louisiana's COVID-19 death rate reflect systemic problems. 4WWL. Published April 7, 2020. Accessed April 24, 2021. Available at: <https://www.wwltv.com/article/news/health/coronavirus/racial-disparities-in-louisianas-covid-19-death-rate-reflect-systemic-problems/289-bd36c4b1-1bdf-4d07-baad-6c3d207172f2>.
- [5] Motaganahalli RL, Kapoor R, Timsina LR, et al. Clinical and laboratory characteristics of patients with novel coronavirus disease-2019 infection and deep venous thrombosis. *J Vasc Surg Venous Lymphat Disord* 2021;9:605–14 e2.
- [6] Ilonzo N, Rao A, Safir S, et al. Acute thrombotic manifestations of coronavirus disease 2019 infection: experience at a large New York City health care system. *J Vasc Surg* 2021;73:789–96.
- [7] Census data and API identities 2017 Asian Pacific Institute on Gender-Based Violence; 2021. Accessed April 28 Available at <https://www.api-gbv.org/resources/census-data-api-identities/>.
- [8] Bassett MT, Chen JT, Krieger N. Variation in racial/ethnic disparities in COVID-19 mortality by age in the United States: a cross-sectional study. *PLoS Med* 2020;17(10):e1003402.
- [9] Wang D, Gee GC, Bahiru E, et al. Asian-Americans and Pacific Islanders in COVID-19: emerging disparities amid discrimination. *J Gen Intern Med* 2020;35:3685–8.
- [10] Xu JJ, Chen JT, Belin TR, et al. Racial and ethnic disparities in years of potential life lost attributable to COVID-19 in the United States: an analysis of 45 states and the District of Columbia. *Int J Environ Res Public Health* 2021;18:2921.
- [11] della Cava M. Asian Americans in San Francisco are dying at alarming rates from COVID-19: Racism is to blame. USA Today. Accessed XXXX. Available at: <https://www.usatoday.com/in-depth/news/nation/2020/10/18/coronavirus-asian-americans-racism-death-rates-san-francisco/5799617002/>.
- [12] Zhang M, Gurung A, Anglewicz P, et al. Discrimination and stress among asian refugee populations during the COVID-19 pandemic: evidence from Bhutanese and Burmese refugees in the USA [published online ahead of print March 2, 2021]. *J Racial Ethn Heal Disparities* 2021. doi:10.1007/s40615-021-00992-y.
- [13] Cheah CSL, Wang C, Ren H, et al. COVID-19 racism and mental health in Chinese American families. *Pediatrics* 2020;146(5):e2020021816.
- [14] Klein K. Punjabi truckers are essential, but little COVID information is available in their native language. Valley Public Radio News. Accessed May 3, 2021. Available at: <https://www.kvpr.org/post/punjabi-truckers-are-essential-little-covid-information-available-their-native-language#stream/0>.
- [15] Rodriguez F, Solomon N, de Lemos JA, et al. Racial and ethnic differences in presentation and outcomes for patients hospitalized with COVID-19: findings from the American Heart Association's COVID-19 Cardiovascular Disease Registry. *Circulation* 2021;143:2332–42.
- [16] Minority Health.
- [17] Morrissey NJ, Giacobelli J, Egorova N, et al. Disparities in the treatment and outcomes of vascular disease in Hispanic patients. *J Vasc Surg* 2007;46(5):971–8.
- [18] Health Insurance Coverage in the United States: 2017. US Census Bureau. Available at: [https://www.census.gov/library/publications/2018/demo/p60-264.html#:~:text=The percentage of people with,in 2016 \(91.2 percent\),&text=In 2017%2C private health insurance,percent and 37.7 percent%2C respectively](https://www.census.gov/library/publications/2018/demo/p60-264.html#:~:text=The%20percentage%20of%20people%20with,in%202016%20(91.2%20percent),&text=In%202017%2C%20private%20health%20insurance,percent%20and%2037.7%20percent%2C%20respectively).
- [19] Rodriguez FS, Aranda MP, Lloyd DA, Vega WA. Racial and ethnic disparities in dementia risk among individuals with low education. *Am J Geriatr Psychiatry* 2018;26:966–76.
- [20] Calo WA, Murray A, Francis E, et al. Reaching the Hispanic community about COVID-19 through existing chronic disease prevention programs. *Prev Chronic Dis* 2020;17:E49.
- [21] Raine S, Liu A, Mintz J, et al. Racial and ethnic disparities in COVID-19 outcomes: social determination of health. *Int J Environ Res Public Health* 2020;17(21):8115.
- [22] Rogers TN, Rogers CR, VanSant-Webb E, et al. Racial disparities in COVID-19 mortality among essential workers in the United States [published online ahead of print August 5, 2020]. *World Med Health Policy* 2020. doi:10.1002/wmh3.358.
- [23] Social determinants of health. World Health Organization. Accessed May 3, 2021. Available at: [https://www.who.int/health-topics/social-determinants-of-health#tab=tab\\_1](https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1).

- [24] Moore JT, Ricaldi JN, Rose CE, et al. Disparities in incidence of COVID-19 among underrepresented racial/ethnic groups in counties identified as hotspots during June 5-18, 2020 - 22 States, February-June 2020. *MMWR Morb Mortal Wkly Rep* 2020;69:1122-6.
- [25] Rodriguez-Lonebear D, Barceló NE, Akee R, et al. American Indian Reservations and COVID-19: correlates of early infection rates in the pandemic. *J Public Health Manag Pract* 2020;26:371-7.
- [26] O'neill E. Unrecognized Tribes Struggle Without Federal Aid During Pandemic [Internet]. National Public Radio; 2021. [cited May 3] Available from: <https://www.npr.org/2021/04/17/988123599/unrecognized-tribes-struggle-without-federal-aid-during-pandemic#:~:text=Unrecognized Tribes Struggle Without Federal Aid During Pandemic,-Listen%3A40&text=O'Neill%2FKUOW-,Tony Johnson is chair of the,Nation%2C a federally unrecognized tribe.&text=And%2C during the pandemic%2C no,testing supplies or vaccine allocations.>
- [27] Jernigan VBB, Huyser KR, Valdes J, et al. Food Insecurity among American Indians and Alaska Natives: a national profile using the Current Population Survey-Food Security Supplement. *J Hunger Environ Nutr* 2017;12(1):1-10.
- [28] Population by Urban and Rural and Size of Place: 2000 and 2010. US Census Bureau. Accessed March 4, 2021. Available at: <https://www.census.gov/prod/cen2010/cph-2-1.pdf>.
- [29] Jensen L, Monnat SM, Green JJ, et al. Rural population health and aging: toward a multilevel and multidimensional research agenda for the 2020s. *Am J Public Health* 2020;110:1328-31.
- [30] Zhang CH, Schwartz GG. Spatial disparities in coronavirus incidence and mortality in the United States: an ecological analysis as of May 2020. *J Rural Health* 2020;36:433-45.
- [31] Germack HD, Kandrack R, Martsof GR. When rural hospitals close, the physician workforce goes. *Health Aff (Millwood)* 2019;38:2086-94.
- [32] Stringer B, Thacker C, Reyes J, et al. Trouble on the horizon: an evaluation of the general surgeon shortage in rural and frontier counties. *Am Surg* 2020;86:76-8.
- [33] Diaz A, Pawlik TM. Rural surgery and status of the rural workplace: hospital survival and economics. *Surg Clin North Am* 2020;100:835-47.
- [34] Paul R, Arif AA, Adeyemi O, et al. Progression of COVID-19 from urban to rural areas in the United States: a spatiotemporal analysis of prevalence rates. *J Rural Health* 2020;36:591-601.
- [35] Callaghan T, Lueck JA, Trujillo KL, et al. Rural and urban differences in COVID-19 prevention behaviors. *J Rural Health* 2021;37:287-95.
- [36] Souch JM, Cossman JS. A commentary on rural-urban disparities in COVID-19 testing rates per 100,000 and risk factors. *J Rural Health* 2021;37:188-90.
- [37] Dandachi D, Reece R, Wang EW, et al. Treating COVID-19 in rural America. *J Rural Health* 2021;37:205-6.
- [38] Kirzinger A, Munana C, Brodie M. Vaccine hesitancy in rural America. KFF. Accessed XXX. Available at: <https://www.kff.org/coronavirus-covid-19/poll-finding/vaccine-hesitancy-in-rural-america/>.
- [39] Paul R, Arif A, Pokhrel K, et al. The association of social determinants of health with COVID-19 mortality in rural and urban counties. *J Rural Health* 2021;37:278-86.
- [40] Dyer O. Covid-19: Black people and other minorities are hardest hit in US. *BMJ* 2020;369:m1483.
- [41] Cheng KJG, Sun Y, Monnat SM. COVID-19 death rates are higher in rural counties with larger shares of Blacks and Hispanics. *J Rural Health* 2020;36:602-8.
- [42] Sood L, Sood V. Being African American and rural: a double jeopardy from COVID-19. *J Rural Health* 2021;37:217-21.
- [43] Telehealth insurance coverage. Medicare.gov. Accessed April 21, 2021. Available at: <https://www.medicare.gov/coverage/telehealth>.
- [44] Royce TJ, Sanoff HK, Rewari A. Telemedicine for cancer care in the time of COVID-19. *JAMA Oncol* 2020;6:1698-9.
- [45] Chao GF, Li KY, Zhu Z, et al. Use of telehealth by surgical specialties during the COVID-19 pandemic. *JAMA Surg* 2021;156:620-6.
- [46] Gonzales G, Przedworski J, Henning-Smith C. Comparison of health and health risk factors between lesbian, gay, and bisexual adults and heterosexual adults in the United States: Results from the National Health Interview Survey. *JAMA Intern Med* 2016;176:1344-51.
- [47] Gorczynski P, Fasoli F. LGBTQ+ focused mental health research strategy in response to COVID-19. *Lancet Psychiatry* 2020;7(8):e56.
- [48] Phillips G II, Felt D, Ruprecht MM, et al. Addressing the disproportionate impacts of the COVID-19 pandemic on sexual and gender minority populations in the United States: actions toward equity. *LGBT Health* 2020;7(6):279-82.
- [49] Sanchez TH, Zlotorzynska M, Rai M, et al. Characterizing the impact of COVID-19 on men who have sex with men across the United States in April, 2020. *AIDS Behav* 2020;24:2024-32.
- [50] Salerno JP, Williams ND, Gattamorta KA. LGBTQ populations: psychologically vulnerable communities in the COVID-19 pandemic. *Psychol Trauma* 2020;12(suppl 1):S239-42.
- [51] Krause KD. Implications of the COVID-19 pandemic on LGBTQ communities. *J Public Health Manag Pract* 2021;27(suppl 1):S69-71.
- [52] Russell ST, Fish JN. Mental health in lesbian, gay, bisexual, and transgender (LGBT) youth. *Annu Rev Clin Psychol* 2016;12:465-87.
- [53] Salerno JP, Devadas J, Pease M, et al. Sexual and gender minority stress amid the COVID-19 pandemic: implications for LGBTQ young persons' mental health and well-being. *Public Health Rep* 2020;135:721-7.
- [54] Gonzales G, Loret de Mola E, Gavulic KA, et al. Mental health needs among lesbian, gay, bisexual, and transgender college students during the COVID-19 pandemic. *J Adolesc Health* Nov 2020;67(5):645-8.
- [55] Pedrosa AL, Bitencourt L, Fróes ACF, et al. Emotional, behavioral, and psychological impact of the COVID-19 pandemic. *Front Psychol* 2020;11:566212.
- [56] Fish JN, McInroy LB, Pacey MS, et al. I'm kinda stuck at home with unsupportive parents right now": LGBTQ youths' experiences with COVID-19 and the Importance of online support. *J Adolesc Health* 2020;67:450-2.
- [57] Akiyama MJ, Spaulding AC, Rich JD. Flattening the curve for incarcerated populations- COVID-19 in jails and prisons. *N Engl J Med* 2020;382:2075-7. doi:10.1056/NEJMp2005687.
- [58] Strodel R, Dayton L, Garrison-Desany HM, et al. COVID-19 vaccine prioritization of incarcerated people relative to other vulnerable groups: an analysis of state plans. *PLoS One* 2021;16(6):e0253208. doi:10.1371/journal.pone.0253208.
- [59] Saloner B, Parish K, Ward JA, et al. COVID-19 cases and deaths in federal and state prisons. *JAMA* 2020;324:602-3. doi:10.1001/jama.2020.12528.
- [60] Rocha A. Incarcerated Texans enlisted to work in county morgue as COVID-19 deaths overwhelm El Paso. The Texas Tribune. Published November 15, 2020. Accessed XXXX. Available: <https://www.texastribune.org/2020/11/15/coronavirus-texas-el-paso-inmates-morgue-deaths/>.