

REVIEW ARTICLE

The Epidemiology of COVID-19: A Review

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Abstract

COVID-19 is a new lethal disease with limited information on its transmissibility, the severity of its sequelae, its clinical manifestations, and epidemiology. This commentary analyzed the global epidemiology of COVID-19 among the vulnerable population. The analysis revealed that most pediatric COVID-19 cases are not severe, but related severe illness still occurs in children. All ages of children are susceptible to COVID-19, and no significant gender difference exists. COVID-19 infection during pregnancy produced fatal outcomes for mothers, but less risky for the baby. The hot spot clusters for COVID-19 are the prisons/jails, nursing/group homes, and long-term facilities where most of the vulnerable populations reside. Ethnic minority groups in the USA and UK are disproportionately exposed to COVID-19 infection and death than Caucasians. The difference may be because ethnic minorities are exposed to higher risks at work and the long-standing structural economic and health disparities in the two countries. There are now changes in guidelines on who is qualified to receive ventilators in dire situations in many countries around the world if the healthcare system is overwhelmed. (*Afr J Reprod Health 2020 (Special Edition); 24[2]: 117-124*).

Keywords: COVID-19, Epidemiology

Résumé

Le COVID-19 est une nouvelle maladie mortelle avec des informations limitées sur sa transmissibilité, la gravité de ses séquelles, ses manifestations cliniques et l'épidémiologie. Ce commentaire a analysé l'épidémiologie mondiale du COVID-19 parmi la population vulnérable. L'analyse a révélé que la plupart des cas pédiatriques de COVID-19 ne sont pas graves, mais que des maladies graves associées surviennent toujours chez les enfants. Tous les âges des enfants sont sensibles au COVID-19 et aucune différence significative entre les sexes n'existe. L'infection au COVID-19 pendant la grossesse a eu des conséquences fatales pour les mères, mais moins risquées pour le bébé. Les groupes de points chauds pour le COVID-19 sont les prisons / prisons, les maisons de soins infirmiers / de groupe et les établissements à long terme où résident la plupart des populations vulnérables. Les groupes ethniques minoritaires aux États-Unis et au Royaume-Uni sont exposés de manière disproportionnée à l'infection au COVID-19 et à la mort que les Caucasiens. La différence peut être due au fait que les minorités ethniques sont exposées à des risques plus élevés au travail et aux disparités structurelles économiques et sanitaires de longue date dans les deux pays. Il y a maintenant des changements dans les lignes directrices sur les personnes qualifiées pour recevoir des ventilateurs dans des situations difficiles dans de nombreux pays du monde si le système de santé est débordé. (*Afr J Reprod Health 2020 (Special Edition); 24[2]:117-124*).

Mots-clés: COVID-19, épidémiologie

Introduction

Among the nations of the world, the USA and the UK are still the epicenters of the COVID-19 pandemic. As of May 10, 2020, globally, there are now 4,118,782 reported cases and 282,947 deaths. In the USA, there were 1,329,799 cases with 78,528 fatalities¹. Over 32,000 fatalities were reported in the UK, marking the first time in the crisis that it has led Europe in the number of

deaths and surpassed Italy in COVID-19 deaths¹. The virus is spreading at an alarming rate in Russia, with 198,676 cases and 1,827 deaths². The infection and fatalities in China, Spain, and Italy have reached a plateau and on the decline. COVID-19 is a new global health nemesis with very little knowledge about its transmissibility, the severity of its sequelae, its clinical manifestations, and epidemiology. The vulnerable population composes a significant

proportion of the world population, but their issues are often neglected. Hence, the need for this commentary. But first, it is essential to clarify the term “vulnerable populations” in this article – they are the children, pregnant women, people living with disability (PLWD), prison/jail inmates, the elderly living in nursing/group homes, and long-term facilities and ethnic minority groups³.

Overall, there is limited available information in the literature on the epidemiology of COVID-19. The preponderance of the existing studies emanates from China and the USA. This observation is not surprising given that the crisis started in China in December of 2019, and the USA currently has the most significant number of infected and death worldwide. The purpose of this commentary is to analyze the global epidemiology of COVID-19 among the vulnerable population. The analysis of the epidemiological studies is desperately needed to educate the general public on the control and environmental factors that may impact the virus and uncover the necessary evidence-based training for workers in healthcare facilities, individuals, and businesses.

Children

At the onset of the COVID-19 crisis, it was a generally held view that children are “immune” to the virus. This posit is now debunked as pediatric cases of infection were reported all over the world. A study from China by Dong and associates⁴ investigated the epidemiological characteristics and transmission patterns of 2,143 children diagnosed with COVID-19 from January 16 to February 8, 2020. Of the 2,143 cases, 731 (34.1%) were confirmed by laboratory analysis, and 1,412 (65.9%) were not. The median age of the sample was seven years old, and the boys were 56.6% of the cases. Over 90% of the sample were asymptomatic, mild, or moderate in the symptomatologic presentation. The median time from the onset of the illness to diagnosis was two days (range: 0 to 42 days). The disease increased rapidly at the early stage, followed by a gradual and steady decrease. The clinical manifestations of the disease in children were generally less severe compared to adults and infants who are vulnerable to infection. The study findings suggest strong

evidence for human-to-human transmission of the COVID-19 virus⁴.

Another retrospective study⁵ from Zhejiang, China reviewed the electronic medical records of 36 children ranging in age from birth to 16 years (mean age 8.3; SD = 3.5 years) with confirmed COVID-19 from three hospitals between January 17 and March 1, 2020. The 36 children had severe acute respiratory syndrome, and the reported route of transmission was by close contact with family members (89%) or exposure to the epidemic area (33%), and both exposures (22%). Half (53%) of the children were classified as “moderate” clinical type with pneumonia, and 47% was a “mild” clinical type. Neither of the two clinical presentation types was asymptomatic (28%) or had acute upper respiratory symptoms (9%). On admission, 36% of the children had a fever, and 19% had a dry cough. Of the children with elevated temperature, 11% had a body temperature of 38.5°C or higher, and 25% had body temperature between 37.5-38.5°C. About 31% of the children had elevated creatine kinase MB levels, another 31% had decreased lymphocytes, 19% presents with leucopenia, and 17% had elevated procalcitonin levels. The severity of COVID-19 was significantly associated with decreased lymphocytes, elevated body temperature, and high levels of procalcitonin, D-dimer, and creatine kinase MB. All the children were treated with interferon alpha by aerosolization twice a day, 39% of them received lopinavir-ritonavir syrup twice a day, and only 17% needed oxygen therapy. The mean hospital stay was 14 (SD=3) days, and all the children were discharged home⁵.

About 22% of the USA population are infants, children, and adolescents less than 18 years. In the state of Michigan, as of April 21, 2020, about 1% of the 32,967 reported COVID-19 cases were patients younger than 20 years old. The average age of COVID-19 cases who die in Michigan was 74 years⁶. A retrospective review of 149,760 laboratory-confirmed COVID-19 cases seen between February 12 to April 2, 2020, appeared in the *Morbidity and Mortality Weekly Report* published by the US Centers for Disease Control and Prevention⁷. The findings revealed that only 1.7% (2,572) of the cases were children

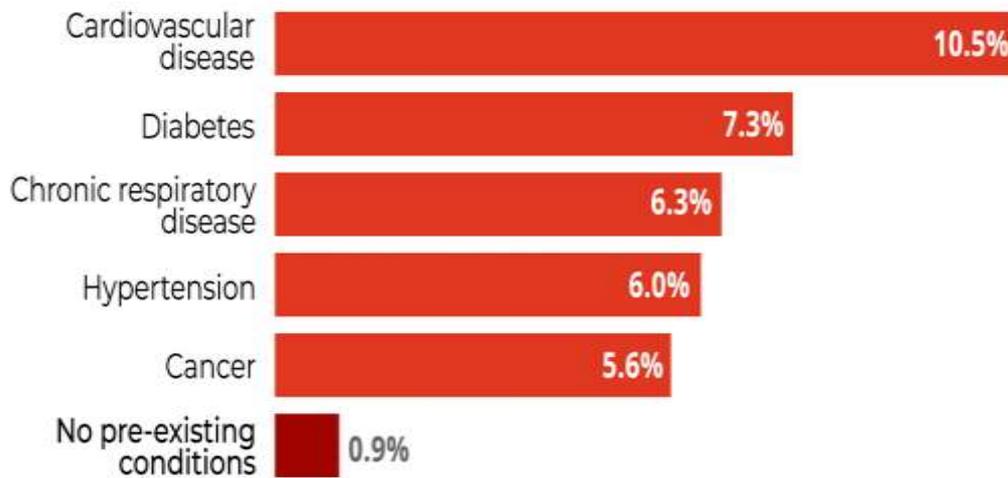


Figure 1: Pre-existing medical co-morbidities and COVID-19 fatalities¹²

under 18 years of age, and about 73% of the pediatric cases had symptoms of cough, fever, and shortness of breath compared to 93% of the adults (18–64 years). About 6% of the sample, or 20% of those for whom hospitalization status was known, were hospitalized. On the other hand, 10% were hospitalized among all adults aged 18–64 years, and 33% among those with a record of hospitalization. Three known pediatric deaths were reported. The outcomes of this investigation are consistent with previous studies that showed that children with COVID-19 might not have fever or cough as often as adults. The authors inferred that pediatric COVID-19 cases are less severe than in adults, and children experience different symptoms than adults.

A mysterious illness tagged "pediatric multi-system inflammatory syndrome" linked to COVID-19 has caused three fatalities in New York state. The government is investigating at least 85 reported cases of the disease. Children with the mysterious illness did not have respiratory problems but clinically presents as prolonged high fever, abdominal pain, nausea, vomiting, diarrhea, swollen limbs, change in the color of the skin, cracked lips, red eyes, swollen glands, or chest pain. It appears the immune system goes into overdrive, negatively impacting the body, causing the children to decompensate or deteriorate quickly. The clinical presentation bears a resemblance to that of the Kawasaki disease⁸.

Pregnant women

The month of April 2020 witnessed several well-publicized cases of pregnant women infected with COVID-19 around the world. A 30-year-old incarcerated pregnant woman with COVID-19 and underlying medical conditions serving a 26-month sentence for a drug, business died after giving birth while on a ventilator at the Federal Medical Center Carswell in Fort Worth, Texas, USA. Her death caused national outrage, particularly in the US congress, among criminal justice reform advocates and the families of inmates⁹. Another pregnant 28-year-old Ghanaian nurse in the UK with COVID-19 infection died after successfully delivering her baby¹⁰.

Mexico recorded its first two deaths of pregnant women with COVID-19, as the total fatalities in the country reached 194. The two women were clinically obese; one had diabetes, and the other had hypertension. One of the women gave birth to a son before she died. Postpartum, the baby boy, had respiratory problems but recovered. The incidence of COVID-19 in Mexico surged to 3,441 from 3,181 a day earlier, when the total number stood at 174 deaths. Mexico's neighboring Guatemala country reported 31 new COVID-19 cases, and three deaths¹¹.

A pregnant woman with COVID-19 from Switzerland delivered a stillborn infant at 19 weeks gestation. After delivery, swabs and

biopsies of the placenta tested negative for bacterial infection, but positive for SARS-CoV-2. The placenta remained positive 24 hours after birth, and no other causes of fetal demise were observed. Other previous studies had reported that in 40% of maternal infections with SARS and MERS coronaviruses, a placental infection produced miscarriage or fetal growth abnormalities¹².

A case series investigation from the Baylor College of Medicine in Houston, USA, found that pregnant mothers with COVID-19 are at risk¹¹. The study reported seven pregnant women with COVID-19 died of cardiopulmonary complications. And nine other women experienced a range of cardiopulmonary complications, including acute hypotension, persistent hypoxia, organ failure, acute respiratory distress syndrome, and cardiac arrest. Only one of the nine women recovered, one was critically ill and placed on ventilator support. This study was the first to report maternal deaths related to COVID-19¹³.

People living with disability

People living with disability (PLWD) are often unemployed, poor, and more socially isolated than the general population. Hence, they are more vulnerable to poor health outcomes during a pandemic. Experience from previous crisis shows that health inequities worsen because PLWD have fewer financial and social resources, and they often encounter barriers accessing critical supplies, including social and healthcare services. Moreover, healthcare information for this population is often not presented in an easily understandable format, such as "Easy English" or graphic format used for children and adults with intellectual disabilities¹⁴.

Federal law in the USA prohibits discrimination based on disability in federally funded programs. Still, in several states, recommendation on the use of ventilators states clearly that some people with certain medical conditions, including intellectual and developmental disabilities, may not receive ventilator support during public health emergency¹⁵. In Italy, the professional organization that regulates the intensive care unit

(ICU) protocols and guidelines stated that priority in healthcare resources be provided to patients with the highest chance of "therapeutic success." PLWD and those with underlying health conditions and impairment that reduce the possibility of recovery have low priority for ICU treatment^{16,18}.

The Intensive Care Society in Australian and New Zealand recently revised its guidelines and recommended that when COVID-19 pandemic peaks, clinical decisions must be based on the probability of a good outcome, considering whether the patient has an underlying health condition and the relevant "burden of treatment" for the patient and their families. Although the guidelines did not mention specifically PLWD, it is easy to see how the "burden of treatment" could be easily interpreted to mean PLWD¹⁸.

Inmates

About 2.1 million adult Americans are incarcerated in 5,000 correctional and detention facilities, which are often crowded enclaves. Inmates share bathrooms and have limited medical resources, and their population continually change, which makes it challenging to prevent the spread of COVID-19. In mid-March 2020, the first case of COVID-19 in prison was reported in the USA at the Riker's Island main jail complex in New York City (NYC). Within two weeks, despite efforts to curb the spread, 200 more cases were reported¹⁷. Similarly, the Cook County jail in Chicago, reported in early April 2020, about 350 incarcerated persons and facility staff infected with COVID-19 and severe acute respiratory syndrome¹⁷.

Nationwide, prisons/jails reported outbreaks of COVID-19 and related deaths in the USA¹⁴. As of April 21, 2020, the number of inmates with COVID-19 soared to 4,893 in 420 prisons and jails across 32 states. About 491 (10%) inmates were hospitalized, and 88 died. Two thousand seven hundred seventy-eight staff members were reported infected with COVID-19 in the prisons/jails, 79 hospitalized, and 15 died¹⁵. The limited infrastructure at the prisons/jails makes it conducive to spreading the virus because handwashing with a disinfectant is not readily

available, and physical distancing is practically impossible.

The west wing of 1600 Pennsylvania Avenue NW, Washington, DC, is one of the most crowded real estate properties in the world. By not taking the wearing of the mask and physical distancing seriously, the White House is now rocked by COVID-19, with two White House staff currently infected and several staff have self-quarantined. This embarrassing development to the Trump administration that is desperate to reopen the economy shows that the deadly virus has no respect for national boundaries, race/ethnicities, the poor, the elite, and the powerful.

The elderly

The focus on the spread and death toll of COVID-19 among the elderly living in nursing and long-term facilities in the Northern nations have recently received global attention. As of May 5, 2020, over 4,813 residents have died at 351 of New York's 613 nursing facilities. In the states of New York and New Jersey, nursing home residents currently account for 25% and 50% of the fatalities, respectively. The number of COVID-19 related death is speculated to be higher because the exact amount of deaths at nursing facilities and hospitals are unknown¹⁶.

In the UK, the COVID-19 death toll sharply increased during the first week in May 2020 after officials of the National Health Service began monitoring the fatalities in nursing facilities alongside deaths in hospitals. The UK has 15,517 nursing facilities with 457,361 beds, and only 200 hospital trusts. As of April 19, 2020, there were 26,097 COVID-19 related fatalities in nursing facilities, which surged from the 3,096 cases reported a week earlier. Nursing home fatalities accounted for about 16% of all COVID-19 deaths that occurred in England and Wales - a high proportion, given that nursing home residents represent less than 1% of the country's population. By the 2011 census, 60% of the elderly living in the nursing facilities are 85 years or older; the number is today likely to be higher, because of the aging of the UK population¹⁷.

According to the World Health Organization, about 50% of the COVID-19 fatalities in Europe were residents of nursing and long-term care facilities. The residents of the nursing facilities are mostly the elderly, and persons with mental illness and physical illnesses who are at an elevated risk of being infected and suffering from complications related to COVID-19¹⁸. In Australia, the incidence of COVID-19 cases has plateaued, but deaths continued to increase at the nursing facilities in Western Sydney. The 13 nursing home residents with the virus account for 14% of the total 93 death toll nationally. It is anticipated that the number of COVID-19 cases will likely overtake the amount reported for the Ruby Princess cruise ship that was once the single most significant source of deaths in Australia¹⁸.

Ethnic minorities

The COVID-19 crisis is killing Black and Latino Americans at disproportionately higher rates than their population share¹⁹. For example, in NYC, the epicenter of the outbreak in the USA, Blacks fatalities are twice that of the Caucasians. Latinos are also dying at a much higher rate than Caucasians or Asians. The same trends are reported in infection rates and hospitalization¹⁹. Moreover, the same pattern of COVID-19 related non hospitalized and non-fatal hospitalized cases and fatalities by ethnic groups is happening across the USA (Figure 2).

Blacks in the state of Georgia in the USA represent less than 33% of the population, but they account for 80% of COVID-19 cases hospitalized as of March 2020¹⁹. Similarly, in Wisconsin, Blacks represent 6% of the population but account for about 40% of COVID-19 fatalities. Also, in Kansas, 6% of the population is Black, but they account for more than 30% of the COVID-19 deaths. The situation is even direr in Louisiana, where Blacks are 32% of the population, but 60% of the fatalities¹⁹.

The fatality proportions vary depending on the state, but the trends are consistent across the country. Compared to their share of the population, Blacks and Latinos die of COVID-19 in higher numbers than Caucasians. Nationally,

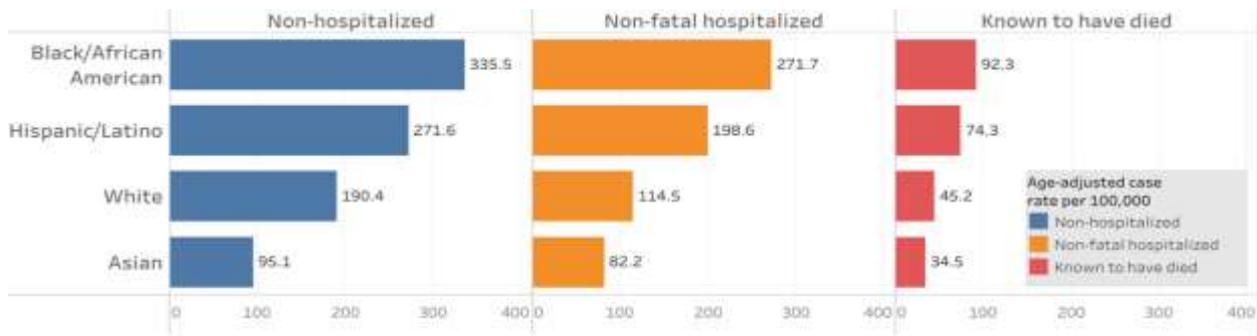


Figure 2: Age-adjusted rates of COVID-19 cases non hospitalized, estimated non-fatal hospitalized cases and patients reported to have died by ethnicity groups as of April 16, 2020 (per 100,000)¹⁷

Blacks represent 13.4% of the American people, but counties with more black people account for greater than 50% of all COVID-19 cases and almost 60% of deaths as of May 6, 2020¹⁹. The mortality rate difference is because ethnic minority groups are exposed to higher risks in their day-to-day lives and the long-standing economic and health disparities. Blacks and Latinos are more likely than Caucasians to be employed in the essential services exempted from the stay-at-home state orders. They work more in community-based healthcare settings and hospitals where the workforce makes up a disproportionate share of COVID-19 cases¹⁹⁻²¹.

The NYC Metropolitan Transportation Authority (MTA) exemplifies the acute reason posit. As of April 8, 2020, 6,000 MTA subway workers were infected and either self-quarantined because they had symptoms suggestive of an infection or diagnosed with COVID-19 and 41 dead. Blacks and Latinos account for more than 60% of the MTA's workforce. Blacks are particularly overrepresented in the MTA, representing 46% of the workforce, but only 24% of the NYC population. Conversely, Caucasians account for 30% of the MTA employees but 43% of the NYC population²⁰.

The pattern of COVID-19 related mortality among ethnic groups in the USA mirrors events in the UK. A study released in the week of May 1, 2020, from the UK compared the COVID-19 fatalities among Caucasians to five other ethnic groups - Indian, Pakistani, Bangladeshi, Black African and Black Caribbean²². The findings

revealed that ethnic minority groups had a higher death rate that is 3.5 times higher than Caucasian Britons after statistically adjusting for the differences in age, gender, and geography. The per capita deaths of Caribbean Blacks were 1.7 times higher than Caucasians and 2.7 times higher than for Pakistani descent.

Of the 135 healthcare workers who died from COVID-19 infection in the UK, 62% (84) of them were ethnic minorities - 21% (29) Blacks, 19% (26) South Asian, 17% (23) East Asian, 13% (17) Filipino; and 3% (4) Arabs. Ethnic minority groups in the UK are in crucial low-level frontline jobs that put them at higher risk. For example, over 20% of Black African women are employed in healthcare and social service jobs, and over 60% of Bangladeshi men over 60 years of age have a chronic health condition that puts them at risk of infection²³. The structural and long-standing health inequities in the USA and UK exacerbate the risks. Blacks and Latinos in the USA are historically more likely to be uninsured, and they are with higher rates of diabetes, heart disease, and high blood pressure than Caucasians – co-morbidities that are associated with severe COVID-19 and death.

Conclusion

Governments worldwide must address the high COVID-19 related morbidity and mortality rates, particularly in vulnerable populations. Testing must be made readily available and contact tracing and mitigation strategy scaled up within the

vulnerable communities. Making temporary accommodation available in hotels and dorms to quarantine symptomatic frontline healthcare and essential services workers and vulnerable people will go along to avoid spreading the virus to families and neighbors. Given the global sudden increased utilization of telemedicine and e-learning as a result of COVID-19, it is prudent to make available computers and Wi-Fi internet connectivity in prisons/jails, group homes and nursing/long-term facilities where most of the vulnerable populations reside. This once in a lifetime global moment creates the perfect unique opportunity to address the global structural long-standing inequities by making access to affordable housing and healthcare a fundamental human right issue.

A recently published cross-sectional study from France revealed that daily smokers had a much lower probability of developing symptomatic or severe SARS-CoV-2 infection compared to the general population²⁴. The findings call for further investigation on the potential of using nicotine patches as a therapy to recapitulate the protecting effect of smoking against SARS CoV2 infection. On a positive note, there was a global excitement on April 29, 2020, when scientists engaged in a multinational study released their preliminary findings²⁵. The outcomes revealed that Remdesivir, the antiviral drug made by Gilead Sciences, had "a clear-cut, significant positive effect on COVID-19," shortening hospital discharge time by four days among patients with COVID-19 who are severely sick. In the study, about 8% of the patients on Remdesivir died compared to 11.6% among the control group, but sadly the difference was not statistically significant. The US Federal Drug Administration has approved Remdesivir for emergency use on terminally ill patients with COVID-19²⁵.

While the race for a vaccine and effective treatment for COVID-19 is on, physical distancing and handwashing behavior modification strategies are the only effective strategies to curtail the spread of the virus and flatten the curve. Patients with less severe illness, and those without symptoms still play a crucial role in disease transmission. Maintaining six feet of physical

distancing behavior in urban centers, particularly in residential housing, where vulnerable populations reside, is challenging. In the COVID-19 era, there is an unintended escalation in drug and alcohol-related fatalities due to isolation and despair. Under this unfortunate circumstance, it will be wrong and immoral for any government anywhere in the world not to protect the vulnerable population by expanding economic assistance and healthcare services to the citizens

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