Understanding COVID-19 Vaccine Technology and Vaccine Hesitancy Among Patients with Chronic Diseases

National Health Council Research Series
Issue 2 | July 2023

Lillian L.Q. Witting, MPH
Omar A. Escontrías, DrPH, MPH

PUTTING PATIENTS FIRST®
NATIONAL HEALTH COUNCIL

EXECUTIVE SUMMARY

Vaccination is considered one of the 10 greatest public health achievements of the 20th century, improving quality of life and decreasing severity of disease. The unprecedented COVID-19 pandemic precipitated international collaboration to produce vaccines on a global scale. However, challenges have arisen in ensuring lasting immunity for high-risk individuals, people with weakened immune systems and patients with chronic diseases. In addition, the disruption of the health care system widened existing health inequities and public health information was produced too quickly for communities to remain abreast of the research. The intent of this brief is to clarify the complexity of the vaccines and combat the spread of misinformation and vaccine hesitancy.

ABOUT THE AUTHORS:
Lillian L. Q. Witting, MPH, is the NHC Coordinator, Research, Education, and Programs.
Dr. Omar A. Escontrías is the NHC Senior Vice President, Equity, Research & Programs.

RESEARCH BRIEF DESIGN:
Breshay Moore is the NHC Manager, Digital Media.

FOR MORE INFORMATION:
Visit our website
www.nationalhealthcouncil.org/staff

1 BACKGROUND

The 2019 coronavirus (COVID-19) pandemic caused mass disruption in all aspects of life. From social distancing to mandatory quarantine, governments and public health officials across the globe had to rapidly implement policies and interventions utilizing real-time data. Research priorities shifted to testing new vaccine mechanisms, offering both physical and mental relief from lifestyle disturbance, yet revealing accessibility challenges for people at higher risk such as patients with chronic disease and compromised immune systems.

These challenges, compounded with health inequities among historically underrepresented racial and ethnic groups (HURE) and those of low socioeconomic status have led to increased vaccine hesitancy. The concerns surrounding the COVID-19 vaccines have shown a need for better public health messaging to curtail the spread of misinformation, and collaboration across governmental, non-profit, and private entities is essential to fight the rising distrust.

The National Health Council (NHC) has published this brief in partnership with Novavax. They are a biotechnology company aimed at the discovery, development, and delivery of vaccines against communicable diseases, emphasizing the need for disease prevention through vaccination efforts among patient groups and diverse patient stakeholders. The brief aims to examine the benefits of vaccines among patients with chronic disease and disability with an emphasis on the COVID-19 vaccine technology and underscore the importance of trusted public health messaging to curb vaccine hesitancy.

2 VACCINES CAN REDUCE THE SEVERITY OF COMMUNICABLE DISEASES

The function of the immune system is to identify and eliminate infectious pathogens. Vaccines can aid this process by imitating or stimulating an infection that facilitate the formation of antibodies and by preparing the immune system should it encounter an active infection and improving the immune response time.

Patients with weakened immune systems such as those with chronic disease are susceptible and have a higher risk for sickness and severe outcomes, which is why vaccinations are increasingly beneficial to prevent disease.

Vaccines have increased the quality of life and life expectancy in the United States, providing immunization to many public health threats such as vaccine preventable diseases (VPDs).[1] VPDs include a variety of bacterial and viral infections that may cause hospitalization or lead to more serious conditions. A 2022 systematic review found that vaccination decreased the rate of VDPs and provided additional benefits by reducing treatment costs and shorter hospital stays among patients.[2] Vaccinations among at-risk and immunocompromised populations (e.g., cancer patients, transplant patients, and those living with human immunodeficiency virus (HIV) are especially important in reducing burden and cost.[2] A 2019 U.S.-based study on the childhood vaccination program estimated that more than 24 million disease cases were averted over 10 years with decreased mortality from VPDs like influenza, measles, mumps, rubella, pertussis, polio, tetanus, and diphtheria.[3]

For seasonal infections such as influenza, severity can have detrimental impact for older adults and patients with pre-existing conditions. Although aging is a common risk factor for disease severity, studies have shown that patients older than 50 years with one or more comorbidities have a higher risk of hospitalization and intensive care unit admission from an influenza infection.[4,5] Additionally, patients with chronic heart failure are also at higher risk of influenza-related complications with infections linked to other cardiovascular issues such as ventricle dysfunction

and stroke.[6] A 2019 study found that influenza vaccination for patients with pre-existing chronic obstructive pulmonary disease (COPD) reduced the risk of exacerbation and hospitalization.[7] Furthermore, research indicates that the risk of severe COVID-19 is higher for chronic disease patients, therefore preventive methods through vaccination are paramount to mitigate new, novel coronavirus infections.[8,9]

3 INTERSECTIONAL RISK FACTORS FOR COVID-19 AMONG PATIENTS WITH CHRONIC DISEASE AND DISABILITY

A COVID-19 infection can be physically and mentally detrimental for patients with chronic disease and disability. Several 2021 studies found that patients with pre-existing chronic respiratory diseases, cancer, solid organ transplants, HIV, and primary immunodeficiency had a higher risk for severe COVID-19 outcomes and higher mortality rates.[8,10-12] Immunocompromised patients tended to have prolonged COVID-19 infections, leading to cardiovascular complications like thromboembolism.[13,14] Patients with intellectual and physical disability faced higher rates of hospitalizations and COVID-19 mortality in addition to the anxiety and stress from fear of infection that can severely impact mental health.[15-17]

The level of disruption that COVID-19 placed on the health care ecosystem created new public health challenges in chronic disease management.[18] Mandated quarantine, social distancing, and persistent COVID-19 infections impacted patients' interaction with care staff, increased delayed follow-up visits, impeded prescription refills, and interrupted ongoing therapies.[10,18,19] Other observed behaviors were medication stockpiling and avoidance of in-person medical visits, a troubling trend that could increase non-COVID-19 morbidity.[18,20] Issues also arose around access to care and financial constraints of long-term management, revealing differences among HURE groups and between income levels.

Disruptions over the course of the pandemic widened other health inequities, revealing disproportionate cases and mortality rates among HURE populations.[21,22] At the onset of the pandemic, Hispanic death rates were 2.3 times higher than non-Hispanic Whites.[22] As the pandemic progressed, Hispanics had increased infection rates up to 1.5 times higher than non-Hispanic Whites. (See Figure 1) These staggering rates were attributed to existing disparities due to the social drivers of health. For example, Hispanics are more likely to be uninsured and live in multigenerational households, which may consequentially lead to increased exposure to all ages.[22] Within Native Hawaiian or Pacific Islander (NHOPI) populations, high infection rates are attributed to lack of insurance and high rates of comorbidities.[23] (See Figure 2) The American Indian and Alaskan Native (AIAN) community had concerningly high COVID-19 death and infection rates 2.25 times and 1.5 times higher than non-Hispanic Whites, respectively.[24-26] Drivers such as underfunding of the Indian Health Service, discrimination, and marginalization have been cited as barriers to access of care in the AIAN community.[27] Throughout the following years of the pandemic, Black, Hispanic/Latino, AIAN individuals had high mortality rates and more severe clinical outcomes compared to non-Hispanic Whites.[25]

Among HURE populations, unequal reliance on low-wage jobs that were deemed essential during the pandemic positioned them at higher risk of exposure and negative COVID-19 outcomes.[28,29] A 2021 analysis across U.S. counties found that COVID-19 mortality increased rapidly for socio-economically disadvantaged areas as the pandemic progressed.[30] These economic inequalities also impacted the resources available for remote care, with limited access to the internet and transportation preventing telehealth or other health services, resulting in worse health outcomes.[18] Overall, the heavy COVID-19 burden among HURE populations and those with low socioeconomic status (SES) underscores the importance of understanding intersectional drivers of health and focusing on protecting high-risk populations.

Figure 1: Cumulative COVID-19 Age-Adjusted Infection Rates per 100,000 by Race/Ethnicity, 2020-2022

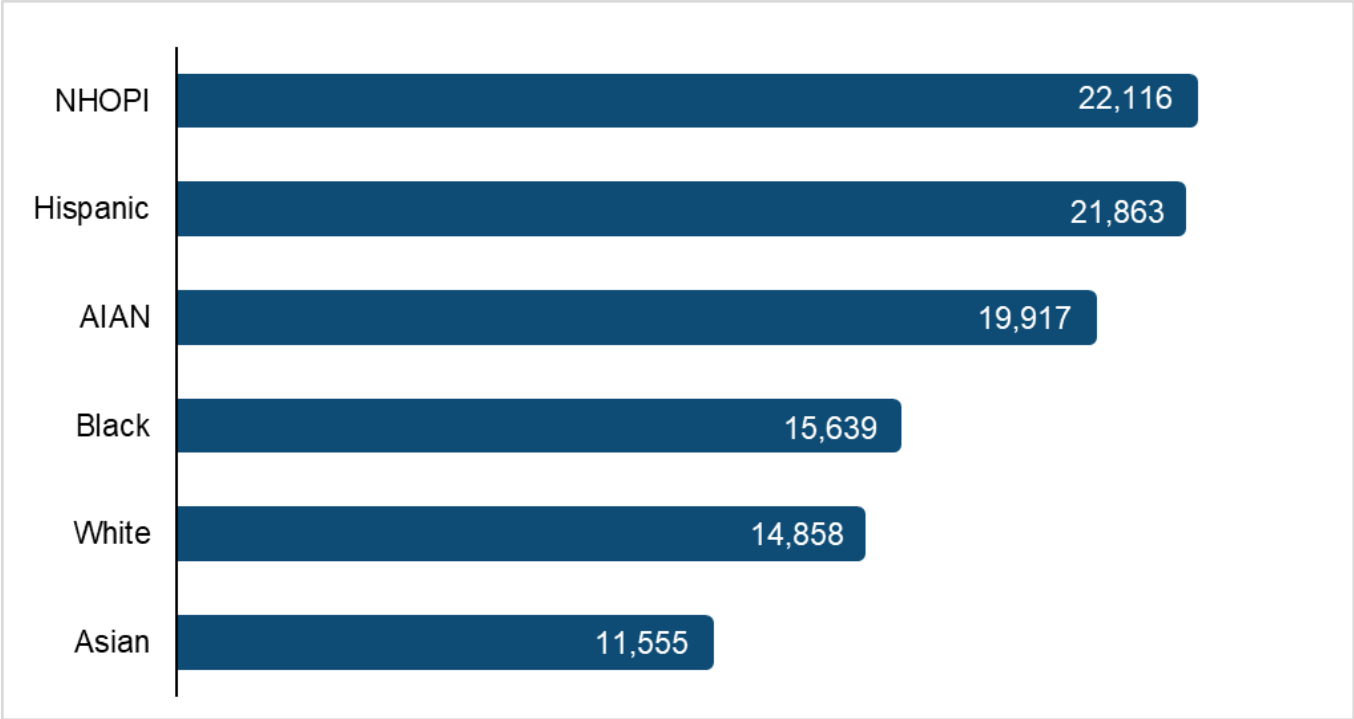
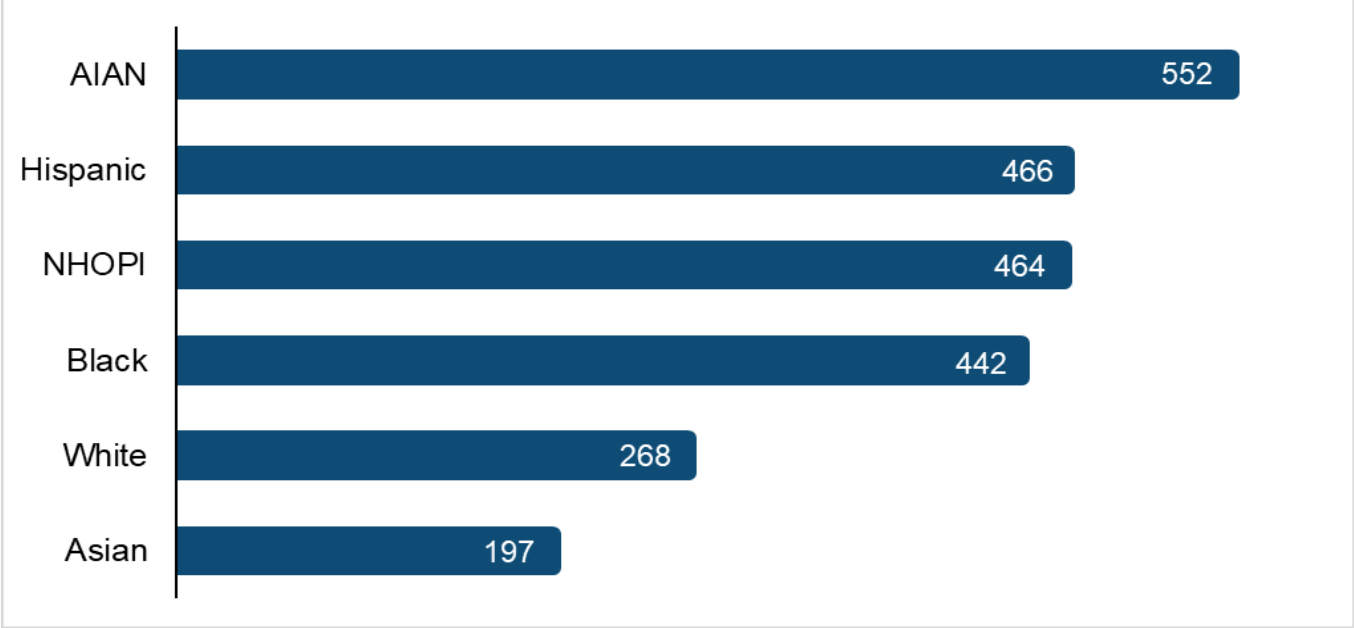


Figure 2: Cumulative COVID-19 Age-Adjusted Mortality Rates per 100,000 by Race/Ethnicity, 2020-2022

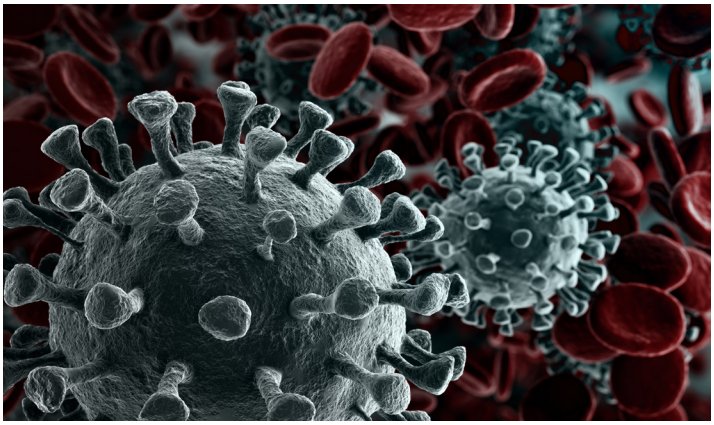


Source: Adapted data from L. Hill, Artiga S. COVID-19 Cases and Deaths by Race/Ethnicity: Current Data and Changes Over Time. *Keiser Family Foundation*. March, 2022

4 UNPACKING THE COMPLEXITY OF COVID-19 VACCINE TECHNOLOGY

The widespread use of vaccines to protect against a variety of infectious diseases has supported the foundation for recent breakthroughs in vaccines against COVID-19. Other mechanisms use weakened or inactivated pathogens to generate an immune response without causing disease.[31] This technology is used in vaccines against measles, chickenpox, yellow fever, polio, and influenza.[31] Another vaccine technological method facilitates antibody formation to protect against toxins that are produced by a pathogen for diseases like diphtheria and tetanus.[31] Studying how the immune system reacts to pieces of a pathogen promoted advancement in understanding how pieces of the COVID-19 virus could be utilized in a vaccine.

COVID-19 is not the first coronavirus to be studied. Past coronavirus outbreaks such as the acute respiratory syndrome coronavirus (SARS-CoV) in 2002 and the Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012 (NIH) provided empirical information about the COVID-19 virus' unique protein structure and composition. This better understanding of the surface proteins helped scientists determine mechanisms that would be most efficient to simulate an infection and create COVID-19 antibodies without using live viruses.[32]



The COVID-19 vaccines utilize various mechanisms to build immunity. Current COVID-19 vaccines are created based on several platforms including messenger ribonucleic acid (mRNA), viral vectors, inactivated/attenuated vaccine and protein subunit. mRNA is used to instruct cells on how to imitate the COVID-19 surface proteins, creating an immune response and causing the body to produce antibodies. Viral vectors work in a similar manner by containing genetic code that are packaged using modified microorganisms. While information is given to cells, neither of these vaccines hinder or damage normal genetic function.[32,33] As mentioned above, inactivated or weakened pathogens can be used to generate an immune response without causing disease. Comparatively, the protein subunit vaccines utilize pieces of proteins or synthetic proteins that are similar to those found on the COVID-19 surface to illicit an immune response.[34]

The development of these different vaccine types has expanded research analyzing the benefits as well as some challenges. All three of these technologies have been studied extensively with the use of these platforms for different diseases changing over the past years. mRNA vaccines are championed as a high-cost therapeutic application to diseases like cancer.[35,36] However its immune response to infectious diseases such as COVID-19 has revealed low but measurable risk of heart complications like myocarditis.[37] Viral vectors have been used in Ebola vaccines and researched for zika, flu, and HIV, but may trigger the immune system to react to the modified microorganism delivery system before the code can be delivered to the cell.[33,38] The protein subunit vaccine platform has been approved for use for other infectious disease vaccines such as the hepatitis B, human papillomavirus, pneumococcal disease, shingles, and herpes zoster.[31,39] However the vaccine type has not been shown to result in lifetime immunity, meaning it requires booster doses to ensure long-term immunity.[38] Despite this, research has shown that protein subunit vaccines overall have low rates of side effects, making them preferable for older adults, immunocompromised patients, and pregnant people compared to other vaccine mechanisms.[38, 40]

5 FINDING TRUSTED SOURCES FOR VACCINE INFORMATION

Even with robust research on vaccine safety and efficacy, concerns over the safety and usefulness of vaccines have increased in the past decade. The spread and evolution of COVID-19 was so rapid that public health messaging could not keep up with the demand for informed decision making and real-time data.[41] This unfortunately led to the spread of COVID-19 vaccine misinformation fueling vaccine hesitancy.[41] A 2022 global survey of patients with chronic diseases and caregivers showed that the leading reason for vaccine hesitancy was apprehension regarding the newness of the vaccine, followed by concerns for safety, and distrust in the development process.[42] This further supports the importance of targeted messaging to ensure that patients are equipped with evidence-based, accurate, and sound COVID-19 vaccine education.

While health information can often be overwhelming and opaque in delivery, communication from practitioners, researchers, and academics need to meet patients where they are. Patients must navigate these challenges to find trustworthy and science-based information that uses appropriate health and medical language to support their medical decisions. Academic institutions such as Johns Hopkins University and Harvard Medical School have worked to break down general vaccine information, but as more data become available, patients must also evaluate the health information they find online. Organizations such as the Coalition for Trust in Health & Science have resources to help patients with topics including health literacy, limiting misinformation, and identifying reliable health information. The NHC is spearheading a series of videos focused on evaluating important risk factors for those at-risk for severe COVID-19 including the aging, those with cardiometabolic diseases, the immunocompromised, and women.

Patient-focused organizations have worked arduously to provide information for patients with particular chronic conditions. For example, the Autoimmune Association has created a comprehensive COVID-19 guide with a variety of blogs, videos, and papers answering questions about the vaccine's benefit for patients with weakened immune systems. It also includes additional resources from other autoimmune patient groups. Other patient advocacy organizations such as the National Multiple Sclerosis Society have provided detailed, evidence-based information on COVID-19 vaccine safety for multiple sclerosis patients. Regarding other concerns over accessibility, insurance, and finances, Mental Health America has created a directory to assist patients in finding information and resources for issues that are just as important as physical ones. Patient-focused organizations and groups must work to aggressively address misinformation on vaccines, ensuring that the information is available, evidence-based, and easy to understand. The NHC is committed to transparency and ensuring that the information promotes health and digital literacy through the NHC website where patient organizations can find more resources.

ROLE OF THE NATIONAL HEALTH COUNCIL

COVID-19 has had an impactful effect on patient experience and outcomes, challenging and disrupting the health care system and disrupting quality of life. The NHC, in partnership with NHC members and external partners, is providing evidence-based information through a patient-centered perspective that brings awareness to the different vaccine technologies available. The NHC values transparency and collaboration to forge consensus on important issues such as the importance of receiving a COVID-19 vaccine and dispelling the spread of misinformation.

RECOMMENDATIONS

Prioritizing vaccination and enhancing health literacy can improve health outcomes for patient groups, highlighting the importance of science-based communication to counter vaccine misinformation. With an overwhelming amount of health information, patient advocacy groups, researchers, and other stakeholders play a vital role in providing resources to help educate and engage high-risk populations on vaccines. Thus, the NHC provides the following recommendations:

- Individuals with a number of chronic conditions can reduce their risk of severe outcomes by getting vaccinated for COVID-19.
- Advocacy organizations can combat misinformation and increase patient understanding of medical conditions by providing tailored information regarding a specific disease or disability and how the COVID-19 vaccine may interact with their system.
- To maintain and improve health literacy, patient-focused organizations, academic institutions, and research groups should provide equitable access to science-based information that is comprehensible and health literate to patients.
- Patients can maintain or increase their independence and improve their health literacy through combating misinformation by evaluating health information to ensure it is reliable using resources provided by evidence-based sources such as the National Health Council, Coalition for Trust in Health & Science, and other patient-focused and advocacy organizations.

ACKNOWLEDGEMENTS

This research was funded by Novavax. The NHC is grateful to its membership and to staff for their contributions to this research brief.

REFERENCES

1. Public Health Initiatives and Life Expectancy: Immunizations. Regis College Online. Published March 9, 2018. Accessed March 28, 2023. https://online.regiscollege.edu/blog/public-health-initiatives-life-expectancy-immunizations/

2. Kolobova I, Nyaku MK, Karakusevic A, Bridge D, Fotheringham I, O'Brien M. Burden of vaccine-preventable diseases among at-risk adult populations in the US. *Hum Vaccines Immunother*. 2022;18(5):2054602. doi:10.1080/21645515.2022.2054602

3. Talbird SE, Carrico J, La EM, et al. Impact of Routine Childhood Immunization in Reducing Vaccine-Preventable Diseases in the United States. *Pediatrics*. 2022;150(3):e2021056013. doi:10.1542/peds.2021-056013

4. Derqui N, Nealon J, Mira-Iglesias A, Díez-Domingo J, Mahé C, Chaves SS. Predictors of influenza severity among hospitalized adults with laboratory confirmed influenza: Analysis of nine influenza seasons from the Valencia region, Spain. *Influenza Other Respir Viruses*. 2022;16(5):862-872. doi:10.1111/irv.12985

5. Acosta L, Soldevila N, Torner N, et al. Influenza Vaccine Effectiveness in Preventing Severe Outcomes in Patients Hospitalized with Laboratory-Confirmed Influenza during the 2017–2018 Season. A Retrospective Cohort Study in Catalonia (Spain). *Viruses*. 2021;13(8):1465. doi:10.3390/v13081465

6. Gutiérrez-Spillari L, Palma M. G, Aceituno-Melgar J. Obesity, Cardiovascular Disease, and Influenza: How Are They Connected? *Curr Trop Med Rep*. 2020;7(3):92-97. doi:10.1007/s40475-020-00207-0

7. Agrawal R, Moghtader S, Ayyala U, Bandi V, Sharafkhaneh A. Update on management of stable chronic obstructive pulmonary disease. *J Thorac Dis*. 2019;11(Suppl 14):S1800-S1809. doi:10.21037/jtd.2019.06.12

8. Rabbani G, Shariful Islam SM, Rahman MA, et al. Pre-existing COPD is associated with an increased risk of mortality and severity in COVID-19: a rapid systematic review and meta-analysis. *Expert Rev Respir Med*. 2021;15(5):705-716. doi:10.1080/17476348.2021.1866547

9. Yang J, Zheng Y, Gou X, et al. Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: a systematic review and meta-analysis. *Int J Infect Dis*. 2020;94:91-95. doi:10.1016/j.ijid.2020.03.017

10. Haidar G, Mellors JW. Improving the Outcomes of Immunocompromised Patients With Coronavirus Disease 2019. *Clin Infect Dis*. 2021;73(6):e1397-e1401. doi:10.1093/cid/ciab397

11. Beltramo G, Cottenet J, Mariet AS, et al. Chronic respiratory diseases are predictors of severe outcome in COVID-19 hospitalised patients: a nationwide study. *Eur Respir J*. 2021;58(6). doi:10.1183/13993003.04474-2020

12. Fung M, Babik JM. COVID-19 in Immunocompromised Hosts: What We Know So Far. *Clin Infect Dis Off Publ Infect Dis Soc Am*. Published online June 27, 2020:ciaa863. doi:10.1093/cid/ciaa863

13. Dioverti V, Salto-Alejandre S, Haidar G. Immunocompromised Patients with Protracted COVID-19: a Review of "Long Persisters." *Curr Transplant Rep*. 2022;9(4):209-218. doi:10.1007/s40472-022-00385-y

14. Lopes LA, K Agrawal D. Thromboembolism in the Complications of Long COVID-19. *Cardiol Cardiovasc Med.* 2023;07(02). doi:10.26502/fccm.92920317

15. Brown HK, Saha S, Chan TCY, et al. Outcomes in patients with and without disability admitted to hospital with COVID-19: a retrospective cohort study. *CMAJ*. 2022;194(4):E112-E121. doi:10.1503/cmaj.211277

16. Shankar R, Perera B, Roy A, Courtenay K, Laugharne R, Sivan M. Post-COVID syndrome and adults with intellectual disability: another vulnerable population forgotten? *Br J Psychiatry*. 2023;222(1):1-3. doi:10.1192/bjp.2022.89

17. Williamson EJ, McDonald HI, Bhaskaran K, et al. Risks of covid-19 hospital admission and death for people with learning disability: population based cohort study using the OpenSAFELY platform. *BMJ*. 2021;374:n1592. doi:10.1136/bmj.n1592

18. Kendzerska T, Zhu DT, Gershon AS, et al. The Effects of the Health System Response to the COVID-19 Pandemic on Chronic Disease Management: A Narrative Review. *Risk Manag Healthc Policy*. 2021;14:575-584. doi:10.2147/RMHP.S293471

19. Olmastroni E, Galimberti F, Tragni E, Catapano AL, Casula M. Impact of COVID-19 Pandemic on Adherence to Chronic Therapies: A Systematic Review. *Int J Environ Res Public Health*. 2023;20(5):3825. doi:10.3390/ijerph20053825

20. Nguyen JL, Benigno M, Malhotra D, et al. Pandemic-related declines in hospitalization for non-COVID-19-related illness in the United States from January through July 2020. *PLOS ONE*. 2022;17(1):e0262347. doi:10.1371/journal.pone.0262347

21. Hacker KA, Briss PA, Richardson L, Wright J, Petersen R. COVID-19 and Chronic Disease: The Impact Now and in the Future. *Prev Chronic Dis*. 2021;18:E62. doi:10.5888/pcd18.210086

22. Luck AN, Preston SH, Elo IT, Stokes AC. The unequal burden of the Covid-19 pandemic: Capturing racial/ethnic disparities in US cause-specific mortality. *SSM - Popul Health*. 2022;17:101012. doi:10.1016/j.ssmph.2021.101012

23. Kaholokula JK, Samoa RA, Miyamoto RES, Palafox N, Daniels SA. COVID-19 Special Column: COVID-19 Hits Native Hawaiian and Pacific Islander Communities the Hardest. *Hawaii J Health Soc Welf*. 2020;79(5):144-146.

24. 2022. COVID-19 Cases and Deaths, Vaccinations, and Treatments by Race/Ethnicity as of Fall 2022. KFF. Published November 17, 2022. Accessed May 18, 2023. https://www.kff.org/racial-equity-and-health-policy/issue-brief/covid-19-cases-and-deaths-vaccinations-and-treatments-by-race-ethnicity-as-of-fall-2022/

25. Parolin Z, Lee EK. The Role of Poverty and Racial Discrimination in Exacerbating the Health Consequences of COVID-19. *Lancet Reg Health - Am*. 2022;7:100178. doi:10.1016/j.lana.2021.100178

26. Aschmann HE, Riley AR, Chen R, et al. Dynamics of racial disparities in all-cause mortality during the COVID-19 pandemic. *Proc Natl Acad Sci*. 2022;119(40):e2210941119. doi:10.1073/pnas.2210941119

27. Musshafen LA, El-Sadek L, Lirette ST, Summers RL, Compretta C, Dobbs TE III. In-Hospital Mortality Disparities Among American Indian and Alaska Native, Black, and White Patients With COVID-19. *JAMA Netw Open*. 2022;5(3):e224822. doi:10.1001/jamanetworkopen.2022.4822

28. Rogers TN, Rogers CR, VanSant-Webb E, Gu LY, Yan B, Qeadan F. Racial Disparities in COVID-19 Mortality Among Essential Workers in the United States. *World Med Health Policy*. 2020;12(3):311-327. doi:10.1002/wmh3.358

29. Raine S, Liu A, Mintz J, Wahood W, Huntley K, Haffizulla F. Racial and Ethnic Disparities in COVID-19 Outcomes: Social Determination of Health. *Int J Environ Res Public Health*. 2020;17(21):8115. doi:10.3390/ijerph17218115

30. Dukhovnov D, Barbieri M. County-level socio-economic disparities in COVID-19 mortality in the USA. *Int J Epidemiol*. 2022;51(2):418-428. doi:10.1093/ije/dyab267

31. U.S. Department of Health and Human Services. Vaccine Basics. Published April 26, 2021. Accessed March 8, 2023. https://www.hhs.gov/immunization/basics/index.html

32. Tai W, Zhang X, Yang Y, Zhu J, Du L. Advances in mRNA and other vaccines against MERS-CoV. *Transl Res*. 2022;242:20-37. doi:10.1016/j.trsl.2021.11.007

33. Deng S, Liang H, Chen P, et al. Viral Vector Vaccine Development and Application during the COVID-19 Pandemic. *Microorganisms*. 2022;10(7):1450. doi:10.3390/microorganisms10071450

34. How do the vaccines work? - Mayo Clinic. Accessed March 1, 2023. https://www.mayoclinic.org/coronavirus-covid-19/how-the-vaccines-work

35. Dolgin E. The tangled history of mRNA vaccines. Accessed February 15, 2023. https://www.nature.com/articles/d41586-021-02483-w

36. Zhang C, Maruggi G, Shan H, Li J. Advances in mRNA Vaccines for Infectious Diseases. *Front Immunol*. 2019;10. Accessed March 9, 2023. https://www.frontiersin.org/articles/10.3389/fimmu.2019.00594

37. Li M, Wang H, Tian L, et al. COVID-19 vaccine development: milestones, lessons and prospects. *Signal Transduct Target Ther*. 2022;7(1):1-32. doi:10.1038/s41392-022-00996-y

38. Bayani F, Hashkavaei NS, Arjmand S, et al. An overview of the vaccine platforms to combat COVID-19 with a focus on the subunit vaccines. *Prog Biophys Mol Biol*. 2023;178:32-49. doi:10.1016/j.pbiomolbio.2023.02.004

39. Dooling KL, Guo A, Patel M, et al. Recommendations of the Advisory Committee on Immunization Practices for Use of Herpes Zoster Vaccines. *Morb Mortal Wkly Rep.* 2018;67(3):103-108. doi:10.15585/mmwr.mm6703a5

40. Anderson TC, Masters NB, Guo A, et al. Use of Recombinant Zoster Vaccine in Immunocompromised Adults Aged ≥19 Years: Recommendations of the Advisory Committee on Immunization Practices — United States, 2022. *Morb Mortal Wkly Rep.* 2022;71(3):80-84. doi:10.15585/mmwr.mm7103a2

41. Choi T, Chan B, Grech L, et al. Factors Influencing COVID-19 Vaccine Hesitancy among Patients with Serious Chronic Illnesses during the Initial Australian Vaccine Rollout: A Multi-Centre Qualitative Analysis Using the Health Belief Model. *Vaccines*. 2023;11(2):239. doi:10.3390/vaccines11020239

42. Tsai R, Hervey J, Hoffman K, et al. COVID-19 Vaccine Hesitancy and Acceptance Among Individuals With Cancer, Autoimmune Diseases, or Other Serious Comorbid Conditions: Cross-sectional, Internet-Based Survey. *JMIR Public Health Surveill.* 2022;8(1):e29872. doi:10.2196/29872

NATIONAL HEALTH COUNCIL

ABOUT THE NHC: Created by and for patient organizations more than 100 years ago, the National Health Council brings diverse organizations together to forge consensus and drive patient-centered health policy. We promote increased access to affordable, high-value, sustainable, equitable health care.

For more information, visit nationalhealthcouncil.org.
1730 M Street NW, Suite 650 ● Washington, DC 20036-4561 ● info@nhcouncil.org ● 202-785-3910