ISSUE BRIEF

From Health Disparities to Hotspots to Public Health Strategies: The Impact of the COVID-19 Pandemic in North Carolina

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The coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute coronavirus type 2 (SARS-CoV-2), has significantly affected the lives of many people across North Carolina and the United States. Similar to the rest of the country, the epidemiology of SARS-CoV-2 in the state indicates health disparities among Black and Hispanic/Latino individuals, the presence of hotspots, or counties with high numbers of infected persons, and clusters of transmission among congregate living facilities. There have been many advances in diagnostic methods for SARS-CoV-2 and therapies for hospitalized patients nationwide. Public health strategies have included widespread testing for SARS-CoV-2, optimal management of cases, contact tracing efforts, and a phased reopening of sectors/activities in North Carolina with masks and physical distancing to minimize spread of the virus. In this issue, several authors, researchers, and public health leaders discuss the challenges that North Carolinians have experienced with respect to COVID-19 and several factors that are likely contributing to the health disparities among racial/ethnic minorities who have had the highest number of cases and deaths from SARS-CoV-2. Additional strategies also reported in this issue include the use of strike teams and mobile units to reach populations at high risk for infection and severe illness. Promoting individual and population-level strategies for minimizing transmission of SARS-CoV-2, especially among the most vulnerable, and consistent public health messaging based on science are critical as we face the new year and continued uncertainties around the COVID-19 pandemic.

Introduction

The pandemic caused by severe acute coronavirus type 2 (SARS-CoV-2) has been the most significant pandemic since the 1918 "Spanish Influenza" pandemic. Coronavirus disease 2019 (COVID-19), the illness caused by SARS-CoV-2, has challenged all of us, from the ability of our scientific and medical community to develop and implement widescale diagnostic, therapeutic, and preventive strategies to our public health infrastructure's efforts to mitigate the impact locally and nationally. The first laboratory-confirmed case was reported in the United States on January 22, 2020. Only nine months later, as of October 21, the country had over 8 million reported cases of SARS-CoV-2 infection and over 200,000 deaths [1]. At that time, North Carolina had over 250,000 reported cases and over 4,000 deaths from COVID-19 [2].

Epidemiology and Health Disparities

Early data from the Centers for Disease Control and Prevention (CDC) identified the most vulnerable groups for COVID-19 as persons with underlying medical conditions (i.e., cardiovascular disease, diabetes, chronic lung disease), and older adults, with a startling death rate of 902/100,000 among persons aged ≥ 80 years [3]. In comparison, the overall US death rate from SARS-CoV-2 infection was 64/100,000 as of October 10, 2020 [1]. The reported death rate in North Carolina was lower than the national rate at 35/100,000; however, 81% of deaths have been among people aged ≥ 65 [2]. Nationwide, persons aged 20–29 years accounted for > 20% of all SARS-CoV-2 infections during June–August 2020 [4]. In North Carolina, persons aged 18-24 represent 16% of all cases, with individuals aged 25-49 representing 40% of cases and 4% of deaths [2].

National surveillance data revealed the health disparities in COVID-19 associated with race/ethnicity of persons affected and area of residence. Compared to non-Hispanic whites, non-Hispanic Blacks had 2.6 times the risk for SARS-CoV-2 infection and 4.7 times the risk of being hospitalized [5]; Hispanic/Latino persons had 2.8 times higher risk for infection and 4.6 times higher risk for hospitalization from COVID-19 [5]. Using cumulative county-level data collected during February–June 2020, the CDC identified US counties that were "hotspots," based on algorithmic thresholds related to the number of new cases and the changes in incidence [6]. Among all 18 hotspot counties identified in North Carolina, health disparities in COVID-19-associated mortal-

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ity were notable among Hispanics in each area [6].

The impact of health disparities on COVID-19 incidence is summarized by Dr. Corbie-Smith and colleagues in this issue [7]. They note that Black and Latino individuals are overrepresented in COVID-19 deaths in North Carolina, and that this is likely a result of inequities in housing, transportation, food access, and educational opportunity. Importantly, the authors provide several opportunities for reducing these disparities. In this issue, George Hendrix further discusses the impact of COVID-19 on the Hispanic and Latino community in the state, and notes that their barriers to health care include language and the fact that some are migrant workers [8]. He notes that a grassroots approach is critical to addressing health disparities in these groups.

During a six-week period from June to mid-July 2020, the North Carolina Department of Health and Human Services (NCDHHS) reported a 183% increase in the incidence of COVID-19, from 7 to 19 per 100,000 persons per day [9]. However, differences between counties throughout the state are evident based on the COVID-19 Pandemic Vulnerability Index (PVI), which is calculated from key indicators including infection rates, baseline population concentration, current interventions, and health and environmental vulnerabilities (e.g., age distribution, health disparities, and hospital beds) [10 {preprint}]. Several North Carolina counties are in the top 100 counties with the highest PVI scores nationwide. One rural county located in Eastern North Carolina had a reported death rate of nearly 140/100,000 [11].

In a commentary that appears in this issue, Dr. Pettigrew identifies potential contributors to the vulnerability of some of our counties facing COVID-19 challenges, including racism, lack of universal health care access and workers' protections, and defunded public health infrastructure [12]. Dr. Gerald also notes the specific impact of this pandemic on rural communities and provides recommendations for reducing health disparities [13].

Viral Transmission

North Carolina has some of the top scientists in the world conducting research on SARS-CoV-2. The virus has ribonucleic acid (RNA) as its genetic material, and is covered by a large number of "spike" (S) proteins on its surface that bind to specific receptors (angiotensin-converting enzyme 2 receptors), allowing the virus to enter cells in the lungs and other organs; these S proteins serve as targets for some diagnostic assays and future vaccines [14]. The virus is zoonotic, probably originating from bats with spread to humans, although the range of other mammals that can become infected remains unknown. SARS-CoV-2 has been demonstrated to spread from humans to other animals. NCDHHS reported the first dog in the state with laboratory-confirmed SARS-CoV-2 infection in August, but transmission from pets or livestock to humans appears rare [15].

SARS-CoV-2 is primarily transmitted through droplet transmission between persons within a short range (e.g., less than six feet), similar to other respiratory viruses (Table 1). The period of infectivity among most otherwise healthy people without immunosuppression is up to 10 days [16]; among immunocompromised or hospitalized patients, the period of infectivity may be up to 20 days. In addition, an infected person may be infectious starting from 48 hours (or two days) before symptoms or testing positive for COVID-19 [16]. Furthermore, a significant proportion of persons with COVID-19 (estimated 40%-45%) may have subclinical or no symptoms and still transmit the virus [17].

The CDC has acknowledged the potential for airborne transmission of SARS-CoV-2, based on a few well-documented examples that occurred under special circumstances [18]. These circumstances involved enclosed spaces, prolonged exposure to respiratory particles that were generated with expiratory exertion (e.g., shouting, singing, exercising), and inadequate ventilation or air handling. The virus has been shown to remain viable in closed conditions for up to three hours and on certain surfaces for up to 72 hours [19] (Table 1), underscoring the need for frequent disinfection of potentially contaminated surfaces or shared objects with an EPA-approved disinfectant. Like similar enveloped viruses, SARS-CoV-2 is inactivated by 60%-90% alcohol-containing hand antiseptics within 15 seconds [20].

Transmission of SARS-CoV-2 infections is highest among close contacts (defined as individuals who have been within six feet of an infected person for a cumulative total of 15 minutes or more over a 24-hour period) [16]. Among households with a laboratory-confirmed COVID-19 case, the overall secondary attack rate (defined as the probability that an infected individual will transmit the disease to uninfected persons) is estimated to be 18.8% [21 {preprint}], emphasizing the importance of education about home isolation for persons with mild SARS-CoV-2 infections. Persons with COVID-19 can generally discontinue isolation 10 days after symptom onset and after 24 hours with no fever, without the use of fever-reducing medications, and with improvement of other symptoms [22].

Testing and Surveillance

Over 3 million tests for SARS-CoV-2 have been conducted in North Carolina to date, based on patient-level and aggregate data submitted electronically through the NC COVID-19 Surveillance System (NC COVID) and COVID-19 Aggregate Test Reporting (eCATR) [2]. The overall positivity rate was 6.3% as of October 15, 2020 [2].

Local health departments have conducted most of the case investigations in the state after notification of cases in the North Carolina Electronic Disease Surveillance System (NC EDSS), which involves collection of information including symptom onset, source of illness, activities during the case's infectious period, and list of potentially exposed contacts. Surveillance data are updated weekly on the COVID-19 Dashboard [2], which also houses data regarding number of hospitalizations and cases diagnosed at North Carolina hos-

pitals. In this issue, Dr. Sickbert-Bennett and Lauren DiBiase describe in detail all the sources of COVID-19 surveillance in North Carolina and provide recommendations for improvements to our current surveillance system [23].

Under the national declaration of a public health emergency due to COVID-19, the United States Food and Drug Administration (FDA) has approved more than 200 diagnostic and antibody tests for SARS-CoV-2 detection under an Emergency Use Authorization (EUA) [24]. Several tests using polymerase chain reaction (PCR) assays that can detect the virus's genetic material from respiratory specimens collected by either health care professionals or through self-collection in clinics or at home have been authorized for diagnosis of SARS-CoV-2; newer PCR-based tests using saliva as a specimen have also been authorized [24]. Furthermore, SARS-CoV-2 rapid antigen tests that have received EUAs can quickly detect fragments of proteins found on or within the virus by testing swabs collected from the nasal cavity, although antigen tests have substantially lower sensitivity.

Diagnostic testing for SARS-CoV-2 is recommended for persons with symptoms of COVID-19 and for close contacts irrespective of symptoms. Some experts recommend that close contacts wait at least 5 days after last known exposure before testing; however, it is important to note that a negative test following an exposure to a person with COVID-19 does not exclude infection if the contact is still within the 14-day incubation period. Testing is also recommended for individuals with higher risk of exposure or a higher risk of severe disease if they become infected, regardless of symptoms (e.g., health care personnel, first responders, and people in long-term care facilities, homeless shelters, and correctional facilities) [25].

Other tests using blood samples have received EUAs for the qualitative detection of antibodies to SARS-CoV-2. Antibodies are generally detectable 1-3 weeks after symptom onset, indicating the development of an adaptive immune response [26]. It is still unknown whether and to what degree an antibody response indicates immunity to future infection, and reinfection with SARS-CoV-2 has been reported in a small number of persons [27]. A study conducted in North Carolina that enrolled outpatients and inpatients across a health system representing 267 different zip codes identified a low prevalence of 0.8% for SARS-CoV-2 based on antibody testing during late April through June [28]. A nationwide study reported that fewer than 10% of the adult population developed antibodies against SARS-CoV-2 during the first wave of the pandemic [29].

TABLE 1.
Characteristics of SARS-CoV-2, Therapeutic Options, and Infection Prevention

Pathogen	Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
Characteristics[a]	
Incubation period	2-14 days (median 4-5 days)
Period of infectivity	2 days before symptom onset (or testing positive) to day 10 (immunocompetent); Up to 20 days (hospitalized and/or immunocompromised)
Transmission	Respiratory droplets; direct contact and fomite; possibly airborne in special circumstances;[b] rare vertical transmission[c]
Duration in environment	Up to 3 hours from aerosols; up to 72 hours on various surfaces[d]
Reproductive number (R0)[e]	~2-3 secondary cases (1.66 among high-density counties)[f]
Household secondary attack rate	~18.8%[g]
Therapeutic options	
Pre-exposure prophylaxis	None
Post-exposure prophylaxis	None
Treatment for hospitalized patients[h]	Remdesivir, dexamethasone, prone ventilation
Infection prevention[a]	
Preventive measures	Masks, physical distancing, hand-washing or alcohol-based hand sanitizers, disinfection of potentially contaminated surfaces and shared objects outside the home
Isolation period (ambulatory persons)	10 days from symptom onset and resolution of fever for at least 24 hours, without the use of fever-reducing medications, and with improvement of other symptoms
Quarantine period	14 days since last exposure
Disinfection	List N products approved by the EPA;[i] bleach solution containing 5.25%–8.25% sodium hypochlorite

EPA= Environmental Protection Agency
[a]Information from the Centers for Disease Control and Prevention for COVID-19, unless otherwise noted.
[b]Reference 18;
[c]Meyerowitz EA, Richterman A, Gandhi RT, Sax PE. Transmission of SARS-CoV-2: a review of viral, host, and environmental factors. Ann Intern Med. 2020; M20-5008. doi: 10.7326/M20-5008;
[d]Reference 19;
[e]The reproductive number means the average number of infected contacts per infected individual.
[f]Sy KTL, White LF, Nichols B. Population density and basic reproductive number of COVID-19 across United States counties. medRxiv. 2020. doi: 10.1101/2020.06.12.20130021 (pre-print);
[g]Reference 21 (pre-print);
[h]Reference 30
[i]https://www.epa.gov/pesticide-registration/list-n-disinfectants-coronavirus-covid-19

Clinical Management

The National Institutes of Health (NIH) created clinical criteria for defining the severity of illness from COVID-19, which have been useful in identifying appropriate therapies for individual patients (Table 2) [30]. Mild to moderate pulmonary disease occurs in the majority (81%) of persons with symptomatic COVID-19. However, persons with severe to critical illness from SARS-CoV-2 can develop cardiac, hepatic, renal, hematological, neurological, and other complications (e.g., thromboembolic events). In North Carolina, an estimated 51.1% of adults are at higher risk for severe COVID-19 illness based on age ≥ 65 years, having at least one underlying health condition, or both [2]. Multisystem inflammatory syndrome in children (MIS-C) and adults (MIS-A) can also result in multiorgan involvement [31]; as of October 10, 2020, there have been 43 cases of MIS-C reported in North Carolina [2]. In this issue, Dr. Rolfe and coauthors describe the frequency and numerous long-term sequalae of SARS-COV-2 infection observed among patients [32]. Importantly, persistent symptoms are common and may occur even among symptomatic patients who were never hospitalized.

The NIH has also issued COVID-19 treatment guidelines for patients depending on the severity of illness, based on scientific data and review from an expert panel that includes members from North Carolina academic institutions [28]. For mild to moderate illness from COVID-19, there are no specific therapies for persons managed at home that have been formally recommended at this time. For hospitalized patients, the FDA recently approved remdesivir, an intravenous antiviral agent with activity against SARS-CoV-2, for use in adult and pediatric patients aged 12 and older and weighing at least 40 kilograms (about 88 pounds); younger children may be provided remdesivir under an EUA [33]. The NIH COVID-19 treatment guidelines also recommend the use of dexamethasone as an anti-inflammatory agent for hospitalized patients requiring supplemental oxygen and those with severe or critical illness [30]. Other therapies for SARS-CoV-2 infections, including convalescent plasma and monoclonal antibodies (specific proteins that are made to decrease the virus's ability to make more copies), are being investigated through clinical trials in North Carolina and across the country. It should be noted that there is no recommended pre- or post-exposure therapy for SARS-CoV-2.

Contact Tracing

Contact tracing is an important public health strategy for COVID-19 in order to identify people who have recently been in close contact with someone who is infected, allow rapid notification for testing, and provide support for necessary resources if the contact becomes symptomatic [16]. The CDC has supported and led a nationwide, coordinated training effort to build a public health COVID-19 contact-tracing workforce, and has responded to requests for assistance from hotspot counties in the United States. In June 2020, the CDC and the US Public Health Service (USPHS) deployed multidisciplinary teams to North Carolina to assist with case investigation, contact tracing, and data management; the CDC Foundation also provided additional contact tracers to support local health departments in the state to manage these hotspots [34].

In addition to traditional contact tracing procedures, digital contact tracing tools like SlowCOVIDNC are now being utilized by public health to enhance efforts during this pandemic. SlowCOVIDNC uses Bluetooth technology to let users anonymously share a positive COVID-19 test result through an app, which can notify other users who may be close contacts [2]. NCDHHS is also using a COVID-19 Community Team Outreach (CCTO) Tool, which provides a platform to manage cases and contacts, perform digital outreach, and store data in a central repository. CCTO provides local health departments access to contact-tracing data collected by other organizations during outbreak or cluster investigations [2].

Impact on our Communities

Since March 2020, numerous outbreaks or clusters of SARS-CoV-2 have been reported in North Carolina in congregate living facilities, such as long-term residential care and

TABLE 2.
National Institutes of Health Criteria for SARS-CoV-2 Infections Based on Severity of Illness[a]

Severity of Illness	Clinical Criteria
Asymptomatic or presymptomatic	Individuals positive for SARS-CoV-2 using a virologic test (i.e., a nucleic acid amplification test or antigen test), but without symptoms consistent with COVID-19
Mild	Individuals with any sign and symptom of COVID-19 (e.g., fever, cough, sore throat, malaise, headache, muscle pain, nausea, vomiting, diarrhea, loss of taste and smell) but without shortness of breath, dyspnea, or abnormal chest imaging
Moderate	Individuals with evidence of lower respiratory disease during clinical assessment or imaging and saturation of oxygen (SpO_2) ≥94% on room air at sea level
Severe	Individuals with SpO_2 <94% on room air at sea level, a ratio of arterial partial pressure of oxygen to fraction of inspired oxygen (PaO_2/FiO_2) <300 mmHg, respiratory frequency >30 breaths per minute, or lung infiltrates >50%
Critical	Individuals with respiratory failure, septic shock, and/or multiple organ dysfunction

[a]National Institutes of Health. COVID-19 Treatment Guidelines: What's New in the Guidelines. NIH website. https://www.covid19treatmentguidelines.nih.gov/whats-new. Updated October 9, 2020. Accessed October 16, 2020.

correctional facilities [2]. In this issue, Dr. Boucher notes the increased health complications and financial stressors for recipients of long-term care services and their caregivers, which contribute negatively to quality of care and often lead to social isolation [35]. He also provides recommendations for decreasing social isolation.

Child care programs have also been significantly affected by COVID-19 in the state, and Michelle Rivest reports 384 COVID-19 child care clusters in North Carolina in this issue [36]. School-related closures have been widespread, and in this issue Dr. Boutzoukas and coauthors also note the impact of the COVID-19 pandemic on children, including decreased academic achievement and heightened food insecurity as a result of K-12 school closures [37]. Lastly, several universities in North Carolina also experienced clusters of COVID-19 cases among undergraduate students despite extensive planning for reopening this fall [38], prompting a shift from in-person classes to online-only virtual learning at most institutions, which may affect the quality of higher education among young people in our state.

Public Health Strategies

In response to this pandemic, North Carolina's strategy has involved a phased reopening of sectors/activities to minimize spread of SARS-CoV-2, and requirement of masks or face coverings in public locations (indoors and outdoors) when physical distancing of six feet is not possible. On May 8, 2020, North Carolina began "phase 1" of easing COVID-19 restrictions to help revive the economy while protecting public health. Based on the number of positive tests and hospitalizations for SARS-CoV-2 statewide, the state entered "phase 3" on October 2, 2020, which expanded outdoor venues for bars, movie theaters, and other entertainment venues to 30% capacity. Public school districts and charter schools can choose to implement different operational plans for elementary schools (grades K-5), which involve use of masks and various approaches to physical distancing in classrooms and during other school activities [2].

Public health initiatives conducted at the local level will continue to be critical in the response to rapid increases in cases and clusters, and to improve access to testing and outreach among our communities. In this issue, Dr. Pease and coauthors describe the strategy used by one county health department in the state to curb the spread of COVID-19 in congregate living facilities, including the use of a strike team to rapidly assess and control outbreaks [39]. Dr. Fiscus and coauthors also report in this issue on how mobile testing units rapidly established by health systems across North Carolina can provide underserved residents critical access to diagnostics and care [40].

The COVID-19 pandemic continues to take a large toll in North Carolina and across the United States. As we face the uncertainties of a new year with COVID-19, our medical and public health community will need to remain steadfast in our messaging to the public, especially as vaccines become widely available for SARS-CoV-2. In this issue, Dr. Sturgill emphasizes the importance of consistent and accurate public health messaging and patient education, based on scientific and evidence-based resources [41]. NCM

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References
1. Centers for Disease Control and Prevention. CDC COVID Data Tracker. CDC website. https://covid.cdc.gov/covid-data-tracker/#trends_dailytrendscases. Accessed October 16, 2020.
2. North Carolina Department of Health and Human Services. NCDHHS' COVID-19 Response. NC DHHS website. https://covid19.ncdhhs.gov. Accessed October 30, 2020.
3. Stokes EK, Zambrano LD, Anderson KN, et al. Coronavirus disease 2019 case surveillance – United States, January 22–May 30, 2020. MMWR Morb Mortal Wkly Rep. 2020;69(24);759-765. doi: 10.15585/mmwr.mm6924e2
4. Boehmer TK, DeVies J, Caruso E. et al. Changing age distribution of the COVID-19 pandemic – United States, May–August 2020. MMWR Morb Mortal Wkly Rep. 2020;69(39);1404-1409. doi: 10.15585/mmwr.mm6939e1
5. Centers for Disease Control and Prevention. COVID-19 Hospitalization and Death by Race/Ethnicity. CDC website. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html#footnote02. Updated August 18, 2020. Accessed October 16, 2020.
6. 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(33):1122-1126. doi: 10.15585/mmwr.mm6933e1
7. Corbie-Smith G, Wolfe MK, Hoover SM, Dave G, Richmond A. Centering equity and community in the recovery of the COVID-19 pandemic. N C Med J. 2021;82(1):62-67 (in this issue).
8. Hendrix GJ. Addressing North Carolina Hispanics and Latinos affected by COVID-19: A grassroots approach. N C Med J. 2021;82(1):64-65 (in this issue).
9. Lash RR, Donovan CV, Fleischauer AT. COVID-19 contact tracing in two counties — North Carolina, June–July 2020. MMWR Morb Mortal Wkly Rep. 2020;69(38);1360-1363. doi: 10.15585/mmwr.mm6938e3
10. Marvel SW, House JS, Wheeler M, et al. The COVID-19 Pandemic Vulnerability Index (PVI) Dashboard: Monitoring county-level vulnerability using visualization, statistical modeling, and machine learning. Preprint. medRxiv. 2020. doi: https://doi.org/10.1101/2020.08.10.20169649
11. National Institute of Environmental Health Sciences. COVID-19 Pandemic Vulnerability Index. COVID-19 PVI website. https://covid-19pvi.niehs.nih.gov. Accessed October 16, 2020.
12. Pettigrew E. COVID-19: A mirror to our flaws. N C Med J. 2021;82(1):43-45 (in this issue).
13. Gerald L. Invest in rural North Carolina to ensure a thriving state, pandemic or not. N C Med J. 2021;82(1):46-49 (in this issue).
14. Fierabracci A, Arena A, Rossi P. COVID-19: a review on diagnosis, treatment, and prophylaxis. Int J Mol Sci. 2020;21(14):5145. doi: 10.3390/ijms21145145
15. North Carolina Has First Reported SARS-CoV-2 Positive Case in Dog [press release]. Raleigh, NC: NC DHHS; August 11, 2020. https://www.ncdhhs.gov/news/press-releases/north-carolina-has-first-re

ported-sars-cov-2-positive-case-dog. Accessed October 16, 2020.
16. Centers for Disease Control and Prevention. Contact Tracing. CDC website. https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/contact-tracing.html. Accessed October 15, 2020.
17. He X, Lau EHY, Wu P, et al. Author correction: Temporal dynamics in viral shedding and transmissibility of COVID -19. Nat Med. 2020;69(9):1491-1493. doi: 10.1038/s41591-020-1016-z
18. Centers for Disease Control and Prevention. Scientific Brief: SARS-CoV-2 and Potential Airborne Transmission. CDC website. https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html. Updated October 5, 2020. Accessed October 15, 2020.
19. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. New Eng J Med. 2020;382(16):1564-1567. doi: 10.1056/NEJMc2004973
20. Centers for Disease Control and Prevention. Hand Hygiene Recommendations. CDC website. https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene.html. Updated May 17, 2020. Accessed October 30, 2020.
21. Madewell ZJ, Yang Y, Longini IM, et al. Household transmission of SARS-CoV-2: a systematic review and meta-analysis of secondary attack rate. Preprint. medRxiv. 2020. doi: 10.1101/2020.07.29.20164590.
22. Centers for Disease Control and Prevention. Duration of Isolation and Precautions for Adults with COVID-19. CDC website. https://www.cdc.gov/coronavirus/2019-ncov/hcp/duration-isolation.html. Updated October 19, 2020. Accessed October 16, 2020.
23. Sickbert-Bennett E, DiBiase L. COVID-19 surveillance: Not everything that counts can be counted and not everything that can be counted counts. N C Med J. 2021;82(1):71-74 (in this issue).
24. U.S. Food and Drug Administration. Coronavirus Testing Basics. Silver Spring, MD: FDA; 2020. https://www.fda.gov/media/140161/download. Published July 2020. Accessed October 16, 2020.
25. Centers for Disease Control and Prevention. Overview of Testing for SARS-CoV-2 (COVID-19). CDC website. https://www.cdc.gov/coronavirus/2019-ncov/hcp/testing-overview.html. Updated October 21, 2020. Accessed October 16, 2020.
26. Centers for Disease Control and Prevention. Interim Guidelines for COVID-19 Antibody Testing. CDC website. https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antibody-tests-guidelines.html. Updated August 1, 2020. Accessed October 16, 2020.
27. To KK-W, Hung IF-N, Chan K-H, et al. Serum antibody profile of a patients with COVID-19 reinfection. Clin Infect Dis. 2020. doi: 10.1093/cid/ciaa1368
28. Barzin A, Schmitz JL, Rosin S, et al. SARS-CoV-2 seroprevalence among a southern U.S. population indicates limited asymptomatic spread under physical distancing measures. mBio. 2020;11(5):e02426-20. doi: 10.1128/mBio.02426-20
29. Shuchi A, Montez-Rath M, Han J, et al. Prevalence of SARS-CoV-2 antibodies in a large nationwide sample of patients on dialysis in the USA: a cross-sectional study. Lancet. 2020;396(10259):1335-44. doi: 10.1016/S0140-6736(20)32009-2
30. National Institutes of Health. COVID-19 Treatment Guidelines: What's New in the Guidelines. NIH website. https://www.covid19treatmentguidelines.nih.gov/whats-new. Updated October 9, 2020. Accessed October 16, 2020.
31. Morris SB, Schwartz NG, Patel P, et al. Case series of multisystem inflammatory syndrome in adults associated with SARS-CoV-2 Infection - United Kingdom and United States, March-August 2020. MMWR Morb Mortal Wkly Rep. 2020;69(40):1450-1456. doi: 10.15585/mmwr.mm6940e1
32. Rolfe RJ, Smith CM, Wolfe CR. The emerging chronic sequelae of COVID-19 and implications for North Carolina. N C Med J. 2021;82(1):75-78 (in this issue).
33. U.S. Food and Drug Administration. Letter from RADM Denise M. Hinton to Ashley Rhoades, Gilead Sciences, Inc. Silver Spring, MD: FDA; 2020. https://www.fda.gov/media/137564/download. Released October 22, 2020. Accessed October 29, 2020.
34. Oster AM, Kang GJ, Che AE, et al. Trends in number and distribution of COVID-19 hotspot counties – United States, March 8–July 15, 2020. MMWR Morb Mortal Wkly Rep. 2020;69(33):1127-1132. doi: 10.15585/mmwr.mm6933e2
35. Boucher N. No Hugs Allowed: Isolation and inequity in North Carolina long-term services and supports during COVID-19. N C Med J. 2021;82(1):57-61 (in this issue).
36. Rivest M. COVID-19 devastates North Carolina's child care system and threatens health and safety of children, families, and early educators. N C Med J. 2021;82(1):52-53 (in this issue).
37. Boutzoukas AE. Akinboyo IC, Wong CA, Benjamin DK, Zimmerman KO. Impact of COVID-19-related school closures on the drivers of child health. N C Med J. 2021;82(1):50-56 (in this issue).
38. Wilson E, Donovan CV, Campbell M, et al. Multiple COVID-19 clusters on a university campus – North Carolina, August 2020. MMWR Morb Mortal Wkly Rep. 2020;69(39):1416-1418. doi: 10.15585/mmwr.mm6939e3
39. Pease RC, Keen SK, Coleman GC, Pettigrew EM, Porterfield DS. Orange County, NC interdisciplinary "strike team" supports high-risk congregate living facilities in COVID-19 response. N C Med J. 2021;82(1):58-59 (in this issue).
40. Fiscus L, Towns R, Wood S, et al. Deploying mobile COVID-19 testing programs in North Carolina as an approach to improve health equity. N C Med J. 2021;82(1):80-82 (in this issue).
41. Sturgill A. Health care providers can help combat harmful misinformation about the pandemic. N C Med J. 2021;82(1):68-70 (in this issue).