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Review

Continuing Education

A Comparison of Zika Virus and COVID-19: Clinical Overview and Public Health Messaging

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Prenatal exposure to the Zika virus (ZIKV) is associated with a significant risk of neurological impairment for infants. ZIKV serves as a cautionary model with significant parallels to the current coronavirus 2019 (COVID-19) pandemic. A limited literature search was performed to compare and contrast the clinical and psychosocial aspects of infection with ZIKV and COVID-19. There are significant parallels between ZIKV disease and COVID-19 in terms of limited diagnostic techniques, therapeutics, and prognostic uncertainties. Both infections are associated with a significant risk of adverse outcomes for either the pregnant individual or the fetus. Existing social and economic inequalities amplify the risk burden of ZIKV disease and COVID-19 in vulnerable communities. Although each pathogen has unique features, there are underlying common principles with regard to the recognition, communication, and mitigation of risk of infection. Misinformation spread by social media platforms has undermined public health efforts and patient adoption of recommended mitigation strategies. Health care providers can provide partnership, social support, and evidence-based information to enhance health-seeking behaviors, thereby minimizing the risks for pregnant and reproductive-aged persons.
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INTRODUCTION

Emergent viral pathogens with reproductive impacts are not a new phenomenon, but they have been brought to the forefront by the recent epidemic of Zika virus (ZIKV) disease in 2015 and 2016 and the current global pandemic of coronavirus disease 2019 (COVID-19).[1] The threat of infection with the ZIKV in 2015 and 2016 had significant psychological effects for pregnant people and those considering pregnancy. Infection with the virus has potential to cause neurological impairment in neonates infected in utero, ranging from microcephaly to cognitive and sensory deficits.[2] Although the threat of the ZIKV disease has disappeared from current news headlines, low level transmission persists, and because the virus is endemic, instances of infection will periodically reappear. Because the majority of infections are asymptomatic, there is some concern that transmission may be occurring in the absence of identified outbreaks, such as the silent and unreported outbreak that occurred in Cuba in 2017 and 2018.[3] Currently, there are no reported areas of active transmission globally according to the Centers for Disease Control and Prevention (CDC).[4] The World Health Organization (WHO) has listed ZIKV as a priority disease for further research and development and a ZIKV vaccine as a needed essential therapeutic.[5]

COVID-19 emerged as a global pandemic in 2020, and pregnant women were classified as a vulnerable population based on prior experience with other similar viral infections such as H1N1 influenza, severe acute respiratory syndrome (SARS) seen in Asia in 2003, and the Middle East respiratory syndrome (MERS) first identified in Saudi Arabia in 2012.[6] Although there continue to be many unknowns about the impact of COVID-19 during pregnancy, recent research suggests that the physiologic adaptations of pregnancy in the respiratory, immunologic, and coagulation systems increase risk of severe COVID-19 and subsequent mortality.[7] Vertical transmission of the virus from pregnant person to fetus and congenital infection are unlikely.[6] However, there are unanswered questions about causality and association with perinatal complications including preterm birth, preeclampsia, and increased incidence of thromboembolic events.[8] Current science is largely based on case series and cohort studies, and more definitive information will likely emerge as population-based results are published.[7]

Both viruses present threats to the well-being of pregnant persons and, as newly emergent pathogens, are characterized by diagnostic, prognostic and therapeutic uncertainty that pose challenges to both clinicians and patients. For this article, a limited thematic literature review was completed on PubMed, MEDLINE, and CINAHL to examine the most current state of the science on clinical implications of ZIKV, as well as similarities with and differences from the current COVID-19 pandemic. In addition, public health and social science literature examining risk perception, reproductive decision-making, social media messaging, and the spread of misinformation was reviewed as it applies to both viruses. Because of the rapidly developing science on COVID-19, some of the information in this article might be outdated by time of publication.

Background

Although ZIKV disease and COVID-19 share many similarities, the vectors, transmission, and epidemiology are distinct (Table 1). ZIKV is a single-stranded RNA virus from the flavivirus (or vector-borne pathogen) genus, primarily transmitted by the *Aedes aegypti* mosquito.[9] In addition, the virus can

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Quick Points

- There are significant similarities between the Zika virus epidemic and the current coronavirus disease 2019 (COVID-19) pandemic.
- Limited diagnostics, therapeutics, and prognostic uncertainty during the Zika epidemic and COVID-19 pandemic created information vacuums in which both childbearing people and clinicians lacked the context to make informed decisions about care.
- Contradictory public health messaging and the amplification of disinformation on social media platforms encourages conspiracy ideation, actively undermining the behavioral responses of vulnerable communities.
- By continuing to practice the values of patient- and family-centered care, embracing social support, providing science-based information, and countering social media misinformation, midwives can address the vulnerability of childbearing persons during the current COVID-19 pandemic.

be transmitted vertically from the pregnant person to fetus in all trimesters of pregnancy, through blood products, blood transfusion, organ donation, and laboratory exposures, and via sexual contact.[9] Sexual transmission can occur when partners are asymptomatic, and ZIKV RNA has been detected in semen up to 370 days after onset of illness, but shedding is most likely to result in infection in the first 30 days after exposure.[10] There is mixed research about transmission through human milk, although the WHO encourages breastfeeding regardless of ZIKV disease status.[5] Animal models demonstrate that the ZIKV crosses the placenta and preferentially infects neural tissue in the fetal brain,[11] but the human mechanism for vertical transmission is poorly understood.

Research suggests that ZIKV disease has been endemic in areas of Asia and Africa since the 1950s and that a viral mutation spurred the 2015-to-2016 spike in cases in Brazil, Central and South America, and the Caribbean.[12] ZIKV transmission in the mainland United States was rare because of lack of *Aedes* mosquito habitat. The leading theory for the precipitous decline in ZIKV disease cases by 2017 is the development of herd immunity.[13] Crucial questions about the safety of pregnant women remain, and public health authorities anticipate that the virus will become endemic to the Americas, requiring vector control, ongoing disease surveillance, and widespread vaccination to eliminate reproductive risk.[12] The timeline for re-emergence is controversial and will depend on several factors: climate variability, the establishment of a viral reservoir in nonhuman hosts, and ZIKV disease immune interaction with other flaviviruses, all of which are poorly understood. Modeling of other similar diseases suggests that re-emergence could be in the near term or could take several decades.[13]

In contrast to the disappearance of ZIKV disease, COVID-19 cases are accelerating worldwide, and the WHO reported 106,125,682 confirmed cases of COVID-19, including 2,320,497 deaths, as of February 9, 2021.[14] COVID-19, which is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first identified in Wuhan, China, in December of 2019 and was declared a global pandemic on March 12, 2020, by the WHO. Like other coronaviruses, SARS-CoV-2 is transmitted by respiratory droplets and is likely aerosolized with airborne transmission.[15] This mode of transmission has necessitated the adoption of nationwide lockdowns, recommendations for masking, and social distancing precautions. The emergence of more infectious variant viral strains 501.V2 (first identified in South Africa) and B.1.1.7 (discovered in the United Kingdom) introduces further urgency to stop the transmission of this virus.[16] There is no clear scientific evidence documenting vertical transmission from an infected pregnant person to the fetus before birth[6] or transmission through ingestion of human milk.[17] Although the prevalence, transmission, and epidemiology of these viruses differ, there are many parallels in terms of diagnostic and prognostic uncertainty, lack of effective therapeutics, maternal and neonatal complications, and social impacts, which will be covered in the following sections (Table 2).

ZIKV DISEASE IN PREGNANCY

The primary concern for persons who contract ZIKV disease during pregnancy is fetal effects. The CDC notes that birth defects potentially associated with ZIKV disease include brain abnormalities with and without microcephaly, neural tube defects, ocular abnormalities and blindness, sensorineural hearing loss, and congenital contractures.[18] Although microcephaly is the most publicized result, observational studies of ZIKV-exposed infants revealed a constellation of abnormalities termed *congenital Zika syndrome* that includes irritability, feeding difficulties, damage to the macula and retina, facial dysmorphism, spasticity, seizures, and congenital contractures such as clubfoot.[19] Research suggests that even neonates born with normal head size may have sustained significant brain injury, some cases of which are evident postnatally following serial cranial ultrasound studies.[20] Longitudinal case studies in Brazil suggest that many infants exposed to ZIKV in utero, while not manifesting clear morphologic defects, exhibit delayed development and learning disabilities.[21]

Very preliminary research examining birth outcomes from the US Zika Pregnancy and Infant Registry suggested that among women with laboratory evidence of ZIKV disease, 6% had newborns with ZIKV-associated birth defects, and this percentage increased to 11% in women with first trimester exposure.[10] More recent work suggests that up to 14% of women whose pregnancies were complicated by vertical transmission of ZIKV resulted in fetal loss, with 21% of exposed fetuses suffering severe complications consistent with the congenital syndrome.[11] Reports of national surveillance systems as well as case control and cohort and modeling

Table 1. Comparison Between Zika Virus Disease and COVID-19

	Zika Virus Disease	COVID-19
Vector	Flavivirus: vector *Aedes aegypti* and *Aedes albopictus* mosquitos[3]	Coronavirus: droplets, fomites[74]
Transmission	Sexual transmission[10] Transmitted by blood transfusion, laboratory exposure[9]	Transmitted by respiratory droplets[74] Likely airborne transmission[75]
Vertical transmission during pregnancy	Vertical transmission from pregnant person to fetus occurs, and congenital infection is likely[9]	Vertical transmission/congenital infection is unlikely[76]
Symptoms	Often asymptomatic; mild flu-like symptoms such as fever, arthralgia, rash, and conjunctivitis[3]	Asymptomatic; also mimics normal rhinorrhea and physiologic dyspnea of pregnancy[65]
Diagnostic testing	RT-PCR, NAAT, PRNT, IgM serologies[32] High rate of false negatives and positives[26] Cross-reaction of immunoglobulin serologies with other endemic flaviviruses, such as dengue fever virus[26] Perinatal diagnosis limited by sensitivity and specificity of ultrasound for detection of viral injury[20]	RT-PCR, NAAT, IgM serologies[42] Sensitivity varies according to time from exposure, sampling technique, specimen source[76] Rapid antigen tests (COVID-19 Ag Respi-Strip) available, but there are concerns about their validity, accuracy, and performance[76] Continued lack of testing capacity and laboratory reagents[42]
Therapeutics	Supportive care Congenital Zika syndrome requires specialized care, physical therapy, pharmaco-therapeutics for seizure disorders, correction/prosthetics for auditory and optical deficits[23]	Supportive care Remdesivir appears safe in pregnancy Other therapies (ribavirin, baricitinib) are teratogenic, embryotoxic[39]

Abbreviations: COVID-19, coronavirus disease 2019; IgM, immunoglobulin class M; NAAT, nucleic acid amplification test; PRNT, plaque reduction neutralization test; RT-PCR, reverse transcription polymerase chain reaction test.

studies support that earlier exposure in pregnancy is associated with more severe impacts,[19,22] although confirmed congenital defects have been reported after exposure in all 3 trimesters.[23] It is hypothesized that transplacental transmission including damage to the placenta caused by the immune response may contribute to intrauterine growth restriction or play a role in other fetal anomalies.[24]

Long-term prognosis for infants exposed in utero to ZIKV infection are unknown, and wide ranges quoted in the literature are partly a result of unknown prevalence. Although the majority of exposed infants do not demonstrate microcephaly, infants who tested positive at birth may exhibit behavior, learning, and memory effects that are delayed. Studies of the US Zika Pregnancy and Infant Registry suggest that 9% of exposed infants born to ZIKV-positive women who had no identified defects at birth manifested neurodevelopmental abnormalities in the first 2 years of life.[10] Other studies estimate that as many as half of exposed infants will demonstrate impacts either at birth or during the first year of life.[23] Pediatricians in Brazil who are following infants with congenital Zika syndrome note dysphagia, reflux, pneumonia and other respiratory problems, persistence of primitive reflexes, abnormal posturing, epilepsy, hydrocephalus, hip dysplasia, subluxation of large joints, and abnormal posturing of extremities.[23] In animal models, ZIKV damages the testes, suggesting that congenital infection may have downstream reproductive and hormonal effects that have not been detected in humans to date.[11] Longitudinal epidemiological studies are necessary to more completely define the long-term consequences of in utero ZIKV infection and are currently underway.

In addition to prognostic uncertainty, ZIKV disease poses troubling diagnostic challenges for the practicing clinician. Eighty percent of infections are asymptomatic,[25] which limits indications for testing. When symptoms do appear, they can be mistaken for those of mild flu (fever, rash, myalgia, and conjunctivitis). There are multiple testing modalities for the ZIKV, each with drawbacks, limiting actionability.[10] Nucleic acid amplification testing (NAAT) for ZIKV RNA is highly specific but has a short window for detection leading to high rates of false negative results. Detection of immunoglobulin class M (IgM) for ZIKV can be obtained from serum samples 2 to 12 weeks after exposure but can cross-react with other flaviviruses such as dengue fever virus, so this detection method has limited specificity and interpretability.[26] Positive IgM results require further testing with the plaque reduction neutralization test, which can only be performed in highly specialized reference laboratories.[10] Finally, ZIKV disease causes persistent viremia for weeks to months after exposure, which

Table 2. Comparison Between Zika Virus Disease and COVID-19 in Pregnancy

	Zika Virus Disease	COVID-19
Maternal effects	Often asymptomatic Mild flu-like symptoms such as fever, rash, myalgia, and conjunctivitis[3]	Mild disease: often asymptomatic,[39] less likely to have fever or myalgia[34] Moderate to severe disease: increased risk of death[36]
Effect on pregnancy outcome		Increased rate of preterm labor Increased rate of preeclampsia Increased cesarean birth[34]
Fetal effects	Congenital Zika syndrome includes a range of brain abnormalities with and without microcephaly, neural tube defects, numerous eye abnormalities, and congenital contractures and sensorineural hearing loss[8] Postnatal growth deficits, developmental delays, as well as neurological impairment whether or not associated with microcephaly at birth[22]	Intrauterine growth restriction, stillbirth, preterm birth[39]
Placental pathology	Nonspecific changes including edema, hypervascularity, and calcification[24] Placentas not distinguishable from other stillbirth or late term placentas[24]	Increased prevalence of maternal vascular malperfusion due to thrombi[77] Hypoxic-ischemic placental injury reflecting abnormalities in oxygenation[77]
Breastfeeding/chestfeeding	"The benefits of breastfeeding for the infant and mother outweigh any potential risk of Zika virus transmission through breast milk"[5]	Possible COVID-19 antibodies in breastmilk as protective factors[78] Breastfeeding/chestfeeding with face covering, hand washing[79]

Abbreviation: COVID-19, coronavirus disease 2019.

limits understanding of gestational age at onset of infection,[26] so predicting fetal prognosis is difficult. A complex algorithm for diagnostic testing has been developed by the WHO and CDC, which recommends serial ultrasound monitoring both during and after pregnancy and magnetic resonance imaging for fetuses with possible ZIKV exposure.[27] However, prenatal ultrasounds are limited in both sensitivity and specificity for the detection of viral injury in the fetus, rendering them diagnostically problematic.[20]

As maternal infection with ZIKV causes only mild symptoms, current treatment is supportive care. In the case of perinatal infection, there are no current medical therapies to prevent, mitigate, or manage active ZIKV infection.[10] Infants with congenital effects have similar neuropathology as infants exposed congenitally to toxoplasmosis and cytomegalovirus, although impacts are thought to be more severe. There continues to be a knowledge gap about long-term neurodevelopmental outcomes, but current data suggest that these infants have normal life spans similar to other populations with microcephaly, epilepsy, and other disabilities.[23]

The severity of perinatal outcomes paired with the difficulty of prenatal diagnosis underscores the urgency of developing preventive vaccines. Although there are 45 ZIKV vaccines in development, none are currently approved for human use. Vaccine approaches include inactivated vaccine, subunit vaccines (proteins expressed from DNA, RNA, or viral vectors), and live attenuated vaccines, all of which show promising results in animal models.[28] Of the options, the inactivated and subunit approaches are safe but require multiple doses and periodic boosting. The live vaccines show high single dose efficacy and are the standard for population dosing, but they carry safety concerns of infectivity (potential Guillain-Barre) and cross-reactivity with other flaviviruses, such as dengue fever virus, which could increase viral virulence in vaccinated individuals and could be teratogenic in pregnancy.[29] Several candidates have entered phase I/II clinical trials,[30] and there is concern about the ability to conduct large-scale efficacy trials given decreased ZIKV prevalence, as well as ethical concerns about exposing pregnant women.[31]

The American College of Obstetricians and Gynecologists recommends testing for pregnant people with possible exposure to the ZIKV following current CDC guidelines.[32] Consultation with infectious disease specialists or maternal-fetal medicine specialists may be useful in developing a plan for fetal surveillance. Perhaps most critical is the development of systems for follow-up of infants born to persons with possible ZIKV exposure to ensure that they are offered appropriate interventions and services if needed.[33]

COVID-19 IN PREGNANCY

Although ZIKV infection primarily targets the fetus and infant, COVID-19 more directly affects maternal health and pregnancy outcomes. Individuals infected with SARS-CoV-2

Table 3. Different Types of Coronavirus Tests[40]

	Molecular Test	Antigen Test	Antibody Test
Description	Diagnostic test, viral test, molecular test, NAAT, RT-PCR test, LAMP test	Diagnostic test	Serology, IgG, IgM
Sample	Nasopharyngeal, nasal or throat swab (most tests) Saliva (a few tests)	Nasal or nasal-pharyngeal swab (most tests)	Finger stick, blood draw
Time for results	Same day or up to 7 d depending on location	15-30 min in some locations	Same day, 1-3 d depending on location
Indication for further testing	This test is typically highly accurate and usually does not need to be repeated	Positive results are usually highly accurate, but false positives can happen, especially in areas where very few people have the virus Negative results may need to be confirmed with a molecular test	Sometimes a second test is needed for accurate results
What do results mean?	Diagnoses active coronavirus infection	Diagnoses active coronavirus infection	Demonstrates infection with the coronavirus in the past
Testing limitations	Show if you ever had COVID-19 or were infected with the virus that causes COVID-19 in the past	Antigen tests are more likely to miss an active COVID-19 infection compared with molecular tests Your health care provider may order a molecular test if your antigen test shows a negative result but you have symptoms of COVID-19	Diagnose COVID-19 at the time of the test or show that you do not have COVID-19

Abbreviations: COVID-19, coronavirus disease 2019; IgG, immunoglobulin class G; IgM, immunoglobulin class M; LAMP, loop mediated amplification technology (Lucira); NAAT, nucleic acid amplification test; RT-PCR, reverse transcription polymerase chain reaction test.
Source: Adapted from the US Food and Drug Administration's web page on Coronavirus Disease 2019 Testing Basics.[40]

during pregnancy have an increased risk of intensive care unit admission, invasive ventilation,[34] and death[8] compared with nonpregnant individuals who contract COVID-19. This risk is highest for patients with increased body mass index, advanced maternal age, and comorbidities including hypertension and diabetes.[34] Recent research in Washington state demonstrated that hospitalization for COVID-19 complications was 3.5 times higher among pregnant patients compared with nonpregnant control patients, with a mortality rate 13.6 times higher in pregnant individuals, suggesting that pregnancy is an independent risk factor for severe disease.[35] Overall racial and ethnic disparities in COVID-19–related mortality are stark, with cases among American Indian/Alaskan Native, Black, and Hispanic populations 2.4, 1.9, and 2.3 times higher, respectively, than those among white populations.[36,37] Research on pandemic pregnancy outcomes suggests that COVID-19 further amplifies racial disproportionality in mortality largely because of the multiple effects of structural racism.[38]

In addition to maternal disease, COVID-19 can have deleterious impacts on pregnancy and is associated with adverse birth outcomes. Preliminary studies demonstrate an increased risk of preterm birth and neonatal intensive care unit admission[34] and higher rates of preeclampsia, perinatal death, and cesarean birth likely related to maternal illness.[8] Fetal complications include heightened rates of miscarriage and intrauterine growth restriction,[39] although these rates must be interpreted with caution as they are based on small case numbers. Pyrexia, the prevailing symptom of COVID-19, is associated with childhood attention disorders in cohort studies of patients with other infections.[39]

Similar to the ZIKV disease, people with COVID-19 are often asymptomatic, and mild cases of the disease can mimic normal rhinorrhea and physiologic dyspnea of pregnancy.[39] In fact, pregnant women are less likely to have fever or myalgia than the general population, complicating diagnosis.[34] There are 3 types of COVID-19 testing available: molecular diagnostic tests (reverse transcription polymerase chain reaction [RT-PCR] and NAAT), antigen tests, and antibody tests[40] (Table 3). The current gold standard for detecting SARS-CoV-2 from nasopharyngeal samples in patients with suspected COVID-19 is the real-time RT-PCR test. Performed in a health care setting, this is a quantitative test and can determine viral load. However, most commercially available assays are qualitative, which can result in false negative results because of low viral load.[39] The RT-PCR test is now available as an at-home test kit, but there are concerns about poor sensitivity because of low viral load and sampling variability.[41] Rapid antigen tests have high specificity in symptomatic individuals, but false negative results can be as high as 50% in asymptomatic people, so the current recommendation is to have a confirmation RT-PCR test. Finally, antibody tests detect an immune response to a previous infection and are not effective at detecting active COVID-19 infection or risk of transmission.[40] Perhaps more concerning than the limitations of the testing itself is continued supply shortages affecting availability of testing kits and

reaagents.[42] Lack of testing capacity undermines public health understanding of prevalence, limiting on-the-ground public health measures such as workplace protections and school closures.

With regard to therapeutics, the US Food and Drug Administration has issued an Emergency Use Authorization for 3 vaccines approved for use in the United States: the Pfizer-BioNTech vaccine, the Moderna mRNA-1273 vaccine, and the Johnson and Johnson vaccine. Globally, there are 212 vaccines in development, 4 of which are in phase III trials, the most promising of which are the, Russian Sputnik V, and the Oxford-AstraZeneca candidates, which are expected to gain approval shortly.[43] Pregnant and lactating people have been excluded from all vaccine trials, but expert consensus and the American College of Obstetricians and Gynecologists recommend that pregnant women should be vaccinated.[44] Although some vaccines are approved, there are critical shortages, supply chain issues, logistical challenges, and concerns about equitable distribution.[45] Although vaccination against COVID-19 is a promising avenue to stem the pandemic, vaccination hesitancy because of safety concerns remains a significant challenge.[46]

DISCUSSION

Emergent infections uniquely challenge practicing clinicians and public health professionals to rapidly develop clinical protocols, patient guidance, and public health messaging in a context with very little evidence-based information. The ZIKV experience provides interesting parallels to the current COVID-19 pandemic in that both viruses are associated with community transmission, limited diagnostics, significant perinatal risks, prognostic uncertainty, and lack of effective therapeutics, leading to a relative information vacuum. The crucial difference is that although ZIKV disease was conceptualized largely as a remote threat by the majority of the US population, the COVID-19 virus is a clear and present risk. Because COVID-19 is an active pandemic in the United States, the effects on the population of public messaging, disproportionate disease burden, and psychological effects are more striking.

Public Messaging

Epidemiologic data, diagnostics, and therapeutics are often absent in the early phases of emerging viral threats. Public health strategies during this phase include enhanced surveillance, risk-based communication, and development of systems capacity. These preventive strategies are only effective if there are political support and public receptivity. Work on risk appraisal suggests that individuals base their understanding of risk on risk salience (or the acuity of the risk), self-efficacy, and an understanding of the consequences of the threat.[47] External factors such as social networks and informational sources can either amplify or undermine risk perception. A systematic review of risk perception among women with high-risk pregnancies compared perceived levels of risk using quantitative measures. The study found that women and health care providers consistently had different estimations of risk.[48] A metasynthesis of qualitative studies that evaluated risk perception revealed that pregnant women do not determine risk based on the label assigned by health care providers but rather have highly individual processes by which they ascertain risk and weigh whether or not to follow medical recommendations.[49] Pregnant women actively balance their understanding of fetal risks and benefits in their consideration of public health interventions.[50] This process is complicated when there is "dissonance between women's risk management and expert advice which was … often uncertain and contradictory."[51(p 499)]

Social media platforms and news outlets were influential in determining risk perception and protective behaviors during the ZIKV disease outbreak,[52] as well as during the COVID-19 pandemic.[53] Historically, such public messaging during emergent infectious disease outbreaks has been spearheaded by government and public health institutions. With the increasing prevalence of social media in the last decade, individual influencers without medical training have emerged as popular sources of information, often amplifying and disseminating disinformation and conspiracy theories, which then shape the public's perception of disease and behavioral responses.[54] This is particularly evident when the science is still evolving. Work examining susceptibility to conspiracy ideation suggests that those who mistrust authority, rely on intuition, feel that they lack control over their environment, and do not have reliable sources to know the truth are particularly vulnerable.[55]

In fact, adoption of conspiracy theories can be conceptualized as a parallel process to information seeking as a response to a perceived threat and as a mechanism to increase feelings of control or self-efficacy. In the context of scientific uncertainty, conspiracies can seem helpful in sense-making and emerge as a coping technique to reduce anxiety and uncertainty. However, as these theories often dismiss the threat, studies have found negative relationships between conspiracy beliefs and health-protective behaviors.[56] Heightened anxiety about possible infection lends itself to circulation of misinformation in lay venues such as social media, which can adversely affect adoption of public health recommendations. Pervasive disinformation about the origin, infectivity, and preventive measures for COVID-19 on such platforms as Twitter, Facebook, Reddit, WhatsApp, Instagram, and Gab has been documented.[57] Other work suggests that feelings of powerlessness paired with social media exposure predicted low intent to engage in social distancing and other practices to reduce the spread of COVID-19.[58]

Disproportionate Burden of Disease

Key in an analysis of the effect of the current pandemic is the disproportionate impact of COVID-19 on Black communities and other communities of color.[59] Structural racism, residential segregation, multigenerational families, and economic and political determinants of health place these communities at increased risk.[60] Additionally, both women and communities of color are overrepresented in the essential worker workforce, with the expectation that these individuals will continue to work and risk exposure, effectively preventing them from adopting safety practices such as social distancing. Structural and social determinants of health also contribute to

higher rates of comorbidities in African Americans, undocumented Latinx workers, and rural communities increasing rates of mortality because of COVID-19.[59] Thus, the lived realities of many socially and economically marginalized communities increase their risk of viral exposure.

Like prior novel viral threats including SARS, H1N1, MERS, and Ebola, racialized public narratives around these infections place blame and responsibility for disease on minority groups. During the SARS outbreak in Toronto, the illness was attributed to Asians; the ZIKV disease outbreak in Brazil was associated with poor Latinx women, and the Ebola outbreak in Liberia was blamed on the consumption of bush meat and aberrant funerary practices.[61] Disproportionate COVID-19 mortality continues to be marked by racial disparities, which are blamed on the supposedly poor health of urban minority communities, without adequate attention to explanatory context.[60] This othering serves the dominant group by minimizing perception of majority risk, but this public narrative also has a negative psychological impact on communities of color, creating concerns about stigma and safety.[62]

Psychological Effects

Finally, the psychological toll of reproductive threats cannot be underestimated. Increased rates of anxiety, depression, and stress were documented in women in Brazil during the Zika epidemic[63] and during the current COVID-19 pandemic.[64] Maternal ZIKV infection in the Americas was associated both with intimate partner violence and abandonment,[65] and studies show similar impacts in the United States during the COVID-19 pandemic lockdown.[66,67] These psychological impacts, exclusive of viral infection, are known to increase perinatal complications such as preeclampsia, depression, increased nausea and vomiting during pregnancy, preterm labor, low birth weight, and low Apgar scores.[68]

Implications for Midwifery Practice

In the initial months of the pandemic, workplace segregation, full personal protective equipment compliance, restriction of family members, and isolation of persons with possible COVID-19 infection in negative pressure rooms with powered air purifying respirators or N-95 respirators for birth changed the landscape of hospital-based maternity care. Prior to an understanding of the dynamics of perinatal transmission, recommendations to avoid delayed cord clamping and skin-to-skin contact, isolation of the newborn, and concerns around human milk infectivity challenged traditional midwifery practices supporting physiologic management and family-based care.[39]

The current COVID-19 pandemic has forced health care workers to adjust to a rapidly changing situation. Telemedicine for early pregnancy care, tele-triage, video technology in early labor,[69] and virtual group prenatal visits[70] are just some of the ways that perinatal care providers have adapted to the pandemic. Concern about viral spread and the safety of health care settings has decreased access to preventive health care screenings, reproductive health, and abortion services as patients have opted to defer care because of concerns about safety. Finally, the sharp increase in unemployment and subsequent loss of health insurance had made access to care problematic with disproportionate impacts on vulnerable populations.[59]

In situations of reproductive uncertainty, we know that women and families, regardless of racial or ethnic background, need the same thing: information, compassion, and involvement in decision-making.[71] Parents put great value on expressions of hope[72] and reassurance, which is often overlooked from the perinatal care provider's point of view.[73] Women usually have tolerance for prognostic uncertainty as long as they feel that the care team is being forthright and transparent about what is understood.[74]

By focusing patient education on the evidence-based measures that women can take to protect themselves—masks, social distancing, and hand hygiene[15]—and providing a counternarrative to misinformation propagated on social media platforms, midwives can be valuable allies to patients and public health advocates. Combining therapeutic and transparent communication, shared decision-making, and partnering with our patients to understand the lived realities of their lives will result in safe therapeutic alliances to promote risk reduction and the safety of pregnant people and their fetuses.

Finally, ZIKV disease and the ongoing COVID-19 pandemic have underlined the necessity of clear public health messaging and a commitment to resourcing a robust global perinatal data collection system.[75] Midwives must provide institutional leadership in advocating for these efforts both at a local and national level, with an emphasis on the collection of disaggregated data by race, gender, and geographic location, providing the potential to contextualize difference in terms of material deprivation, political neglect, racial discrimination, and place-based risk.[60] This work is crucial if we are to be prepared for the next emergent disease with reproductive implications.

CONCLUSION

This review has examined the commonalities and differences between the 2016 ZIKV disease epidemic and the current COVID-19 pandemic. It reveals the challenge of confronting a viral threat with reproductive implications, our understanding of which is defined by diagnostic and prognostic uncertainty. The complexity of the maternal decision-making process and risk perception, the paradoxical role of social media and conspiracy ideation, priorities for improved clinical care, and the necessity of developing robust public health surveillance systems to rapidly collect data on a global scale are critical considerations. In addition, a clinical approach that embraces reproductive justice and racial equity as frameworks to guide care are urgent priorities. Finally, in a historic moment defined by uncertainty, the hallmark values of midwifery—listening to women, shared decision-making, advocacy, and family-based care—continue to be vital tools in our response to emerging viral pathogens.

CONFLICT OF INTEREST

The author has no conflicts of interest to disclose.

REFERENCES

1.Beigi RH. Emerging infectious diseases in pregnancy. *Obstet Gynecol.* 2017;129(5):896-906.

2.Ali S, Gugliemini O, Harber S, et al. Environmental and social change drive the explosive emergence of Zika virus in the Americas. *PLoS Negl Trop Dis*. 2017;11(2):e0005135.
3.Grubaugh ND, Saraf S, Gangavarapu K, et al. Travel surveillance and genomics uncover a hidden Zika outbreak during the waning epidemic. *Cell*. 2019;178(5):1057-1071.e11.
4.Centers for Disease Control and Prevention. Zika in the US. Centers for Disease Control and Prevention website. Updated November 7, 2019. Accessed October 20, 2020. https://www.cdc.gov/zika/geo/index.html
5.World Health Organization. Infant feeding in areas of Zika virus transmission. e-Library of Evidence for Nutrition Actions (eLENA), World Health Organization. Updated February 11, 2019. Accessed March 1, 2021. https://www.who.int/elena/titles/zika_breastfeeding/en/
6.Diriba K, Awulachew E, Getu E. The effect of coronavirus infection (SARS-CoV-2, MERS-CoV, and SARS-CoV) during pregnancy and the possibility of vertical maternal-fetal transmission: a systematic review and meta-analysis. *Eur J Med Res*. 2020;25(1):39.
7.Wastnedge EAN, Reynolds RM, van Boeckel SR, et al. Pregnancy and COVID-19. *Physiol Rev*. 2021;101(1):303-318.
8.Di Mascio D, Khalil A, Saccone G, et al. Outcome of coronavirus spectrum infections (SARS, MERS, COVID-19) during pregnancy: a systematic review and meta-analysis. *Am J Obstet Gynecol MFM*. 2020;2(2):100107.
9.Centers for Disease Control and Prevention. Zika transmission. Centers for Disease Control and Prevention website. Updated July 24, 2019. Accessed April 1, 2021. https://www.cdc.gov/zika/prevention/transmission-methods.html
10.Musso D, Ko AI, Baud D. Zika virus infection - after the pandemic. *N Engl J Med*. 2019;381(15):1444-1457.
11.Platt DJ, Miner JJ. Consequences of congenital Zika virus infection. *Curr Opin Viroly*. 2017;27:1-7.
12.Siedner MJ, Ryan ET, Bogoch II. Gone or forgotten? The rise and fall of Zika virus. *Lancet Public Health*. 2018;3(3):e109-e110.
13.Ribeiro GS, Hamer GL, Diallo M, Kitron U, Ko AI, Weaver SC. Influence of herd immunity in the cyclical nature of arboviruses. *Curr Opin Virol*. 2020;40:1-10.
14.World Health Organization. WHO Coronavirus (COVID-19) Dashboard. World Health Organization. Accessed February 12, 2021. https://covid19.who.int/
15.Centers for Disease Control and Prevention. Ways COVID-19 spreads. Updated October 28, 2020. Accessed April 1, 2021. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html
16.Arif TB. The 501.V2 and B.1.1.7 variants of coronavirus disease 2019 (COVID-19): a new time-bomb in the making? [published online January 11, 2021]. *Infect Control Hosp Epidemiol*. https://doi.org/10.1017/ice.2020.1434
17.Picaud JC, Buffin R, Rigourd V, et al. It's time to change the recommendations on COVID-19 and human milk donations [published online February 2, 2021]. *Acta Paediatr*. https://doi.org/10.1111/apa.15782
18.Centers for Disease Control and Prevention. Microcephaly & other birth defects. Centers for Disease Control and Prevention website. Updated May 14, 2019. Accessed February 13, 2021. https://www.cdc.gov/zika/healtheffects/birth_defects.html
19.Lima GP, Rozenbaum D, Pimentel C, et al. Factors associated with the development of congenital Zika syndrome: a case-control study. *BMC Infect Dis*. 2019;19(1):277.
20.Walker CL, Little MTE, Roby JA, et al. Zika virus and the nonmicrocephalic fetus: why we should still worry. *Am J Obstet Gynecol*. 2019;220(1):45-56.
21.Honein MA. Recognizing the global impact of Zika virus infection during pregnancy. *N Engl J Med*. 2018;378(11):1055-1056.
22.Shapiro-Mendoza CK, Rice ME, Galang RR, et al; Zika Pregnancy and Infant Registries Working Group. Pregnancy outcomes after maternal Zika virus infection during pregnancy - U.S. Territories, January 1, 2016-April 25, 20217. *MMWR Morb Mortal Wkly Rep*. 2017;66(23):615-621.
23.Wheeler AC. Development of infants with congenital Zika syndrome: what do we know and what can we expect? *Pediatrics*. 2018;141(suppl 2):S154-S160.
24.Adibi JJ, Marques ETA Jr, Cartus A, Beigi RH. Teratogenic effects of the Zika virus and the role of the placenta. *Lancet*. 2016;387(10027):1587-1590.
25.de Carvalho NS, de Carvalho BF, Dóris B, Silverio Biscaia E, Arias Fugaça C, de Noronha L. Zika virus and pregnancy: an overview. *Am J Reprod Immunol*. 2017;77(2):e12616.
26.Eppes C, Rac M, Dunn J, et al. Testing for Zika virus infection in pregnancy: key concepts to deal with an emerging epidemic. *Am J Obstet Gynecol*. 2017;216(3):209-225.
27.Adebanjo T, Godfred-Cato S, Viens L, et al. Update: Interim guidance for the diagnosis, evaluation, and management of infants with possible congenital Zika virus infection - United States, October 2017. *MMWR Morb Mortal Wkly Rep*. 2017;66(41):1089-1099.
28.Shan C, Xie X, Shi PY. Zika virus vaccine: progress and challenges. *Cell Host Microbe*. 2018;24(1):12-17.
29.Tebas P, Roberts CC, Muthumani K, et al. Safety and immunogenicity of an anti-Zika virus DNA vaccine - preliminary report [published online October 4, 2017]. *N Engl J Med*. https://doi.org/10.1056/NEJMoa1708120
30.Gaudinski MR, Houser KV, Morabito KM, et al. Safety, tolerability, and immunogenicity of two Zika virus DNA vaccine candidates in healthy adults: randomised, open-label, phase 1 clinical trials. *Lancet*. 2018;391(10120):552-562.
31.Durbin A, Wilder-Smith A. An update on Zika vaccine developments. *Exp Rev Vaccines*. 2017;16(8):781-787.
32.Centers for Disease Control and Prevention. Testing for Zika. Centers for Disease Control and Prevention website. Updated January 3, 2019. Accessed October 20, 2021. https://www.cdc.gov/zika/symptoms/diagnosis.html
33.Management of patients in the context of Zika virus: ACOG Committee Opinion Summary, number 784. *Obstet Gynecol*. 2019;134(3):655-657.
34.Allotey J, Stallings E, Bonet M, et al; PregCOV-19 Living Systematic Review Consortium. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. *BMJ*. 2020;370:m3320.
35.Michael E, Silverman NS. COVID-19 mortality rate elevated in pregnant women. *Healio News*, February 5, 2021. Accessed February 12, 2021. https://www.healio.com/news/primary-care/20210205/covid19-mortality-rate-elevated-in-pregnant-women
36.Centers for Disease Control and Prevention. COVID-19 racial and ethnic health disparities. Centers for Disease Control and Prevention website. Updated December 10, 2020. Accessed February 13, 2021. https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/racial-ethnic-disparities/
37.Delahoy MJ, Whitaker M, O'Halloran A, et al; COVID-NET Surveillance Team. Characteristics and maternal and birth outcomes of hospitalized pregnant women with laboratory-confirmed COVID-19 - COVID-NET, 13 states, March 1-August 22, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(38):1347-1354.
38.Onwuzurike C, Diouf K, Meadows AR, Nour NM. Racial and ethnic disparities in severity of COVID-19 disease in pregnancy in the United States. *Int J Gynaecol Obstet*. 2020;151(2):293-295.
39.Dashraath P, Wong JLJ, Lim MXK, et al. Coronavirus disease 2019 (COVID-19) pandemic and pregnancy. *Am J Obstet Gynecol*. 2020;222(6):521-531.
40.US Food and Drug Administration. Coronavirus disease 2019 testing basics. US Food and Drug Administration website. Updated November 6, 2020. Accessed February 12, 2021. https://www.fda.gov/consumers/consumer-updates/coronavirus-disease-2019-testing-basics
41.Tang YW, Schmitz JE, Persing DH, Stratton CW. Laboratory diagnosis of COVID-19: current issues and challenges. *J Clin Microbiol*. 2020;58(6):e00512-e00520.
42.American Society for Microbiology. Supply shortages impacting COVID-19 and non-COVID testing. American Society for

Microbiology website. Published January 19, 2021. Accessed April 1, 2021. https://asm.org/Articles/2020/September/Clinical-Microbiology-Supply-Shortage-Collecti-1
43.COVID-19 Real-Time Learning Network. Vaccines in development. COVID-19 Real-Time Learning Network website. Updated March 10, 2021. Accessed April 1, 2021. https://www.idsociety.org/covid-19-real-time-learning-network/vaccines/vaccines/
44.American College of Obstetricians and Gynecologists. Practice advisory: Vaccinating pregnant and lactating patients against COVID-19. American College of Obstetricians and Gynecologists website. Published December 2020. Accessed February 8, 2021. https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2020/12/vaccinating-pregnant-and-lactating-patients-against-covid-19
45.Shen AK, Hughes Iv R, DeWald E, Rosenbaum S, Pisani A, Orenstein W. Ensuring equitable access to COVID-19 vaccines in the US: current system challenges and opportunities. *Health Aff (Millwood)*. 2021;40(1):62-69.
46.Malik AA, McFadden SM, Elharake J, Omer SB. Determinants of COVID-19 vaccine acceptance in the US. *EClinicalMedicine*. 2020;26:100495.
47.Piltch-Loeb R, Abramson DM, Merdjanoff AA. Risk salience of a novel virus: US population risk perception, knowledge, and receptivity to public health interventions regarding the Zika virus prior to local transmission. *PloS One*. 2017;12(12):e0188666.
48.Lee S, Ayers S, Holden D. Risk perception of women during high risk pregnancy: a systematic review. *Health Risk Soc*. 2012;14(6):511-531.
49.Lee S, Ayers S, Holden D. A metasynthesis of risk perception in women with high risk pregnancies. *Midwifery*. 2014;30(4):403-411.
50.Lynch MM, Mitchell EW, Williams JL, et al. Pregnant and recently pregnant women's perceptions about influenza A pandemic (H1N1) 2009: implications for public health and provider communication. *Matern Child Health J*. 2012;16(8):1657-1664.
51.Lohm D, Flowers P, Stephenson N, Waller E, Davis MDM. Biography, pandemic time and risk: pregnant women reflecting on their experiences of the 2009 influenza pandemic. *Health (London)*. 2014;18(5):493-508.
52.Chan MPS Winneg K, Hawkins L, Farhadloo M, Jamieson KH, Albarracín D. Legacy and social media respectively influence risk perceptions and protective behaviors during emerging health threats: a multi-wave analysis of communications on Zika virus cases. *Soc Sci Med*. 2018;212:50-59.
53.Romer D, Jamieson KH. Conspiracy theories as barriers to controlling the spread of COVID-19 in the U.S. *Soc Sci Med*. 2020;263:113356.
54.Vijaykumar S, Nowak G, Himelboim I, Jin Y. Virtual Zika transmission after the first U.S. case: who said what and how it spread on Twitter. *Am J Infect Control*. 2018;46(5):549-557.
55.Lyons B, Merola V, Reifler J. Not just asking questions: effects of implicit and explicit conspiracy information about vaccines and genetic modification. *Health Commun*. 2019;34(14):1741-1750.
56.Allington D, Duffy B, Wessely S, Dhavan N, Rubin J. Health-protective behaviour, social media usage and conspiracy belief during the COVID-19 public health emergency [published online June 9, 2020]. *Psychol Med*. https://doi.org/10.1017/S003329172000224X
57.Ball P, Maxmen A. The epic battle against coronavirus misinformation and conspiracy theories. *Nature*. 2020;581(7809):371-374.
58.Biddlestone M, Green R, Douglas KM. Cultural orientation, power, belief in conspiracy theories, and intentions to reduce the spread of COVID-19. *Br J Soc Psych*. 2020;59(3):663-673.
59.Dorn AV, Cooney RE, Sabin ML. COVID-19 exacerbating inequalities in the US. *Lancet*. 2020;395(10232):1243-1244.
60.Chowkwanyun M, Reed AL Jr. Racial health disparities and COVID-19 - caution and context. *N Engl J Med*. 2020;383(3):201-203.
61.Kapiriri L, Ross A. The politics of disease epidemics: a comparative analysis of the SARS, Zika, and Ebola outbreaks. *Glob Soc Welf*. 2020;7(1):33-45.
62.Stop the coronavirus stigma now. *Nature*. 2020;580(7802):165.
63.Dos Santos Oliveira SJG, Dos Reis CL, Cipolotti R, Gurgel RQ, Santos VS, Martins-Filho PRS. Anxiety, depression, and quality of life in mothers of newborns with microcephaly and presumed congenital Zika virus infection: a follow-up study during the first year after birth. *Arch Womens Ment Health*. 2017;20(3):473-475.
64.Davenport MH, Meyer S, Meah VL, Strynadka MC, Khurana R. Moms are not OK: COVID-19 and maternal mental health [published online June 19, 2020]. *Front Glob Womens Health*. https://doi.org/10.3389/fgwh.2020.00001
65.Diniz D, Gumieri S, Bevilacqua BG, Cook RJ, Dickens BM. Zika virus infection in Brazil and human rights obligations. *Int J Gynaecol Obstet*. 2017;136(1):105-110.
66.Bradbury-Jones C, Isham L. The pandemic paradox: the consequences of COVID-19 on domestic violence. *J Clin Nurs*. 2020;29(13-14):2047-2049.
67.Roesch E, Amin A, Gupta J, García-Moreno C. Violence against women during COVID-19 pandemic restrictions. *BMJ*. 2020;369:m1712.
68.Qiao Y, Wang J, Li J, Wang J. Effects of depressive and anxiety symptoms during pregnancy on pregnant, obstetric and neonatal outcomes: a follow-up study. *J Obstet Gynaecol*. 2012;32(3):237-240.
69.Faucher MA, Kennedy HP. Women's perceptions on the use of video technology in early labor: being able to see. *J Midwifery Womens Health*. 2020;65(3):342-348.
70.Peahl AF, Smith RD, Moniz MH. Prenatal care redesign: creating flexible maternity care models through virtual care. *Am J Obstet Gynecol*. 2020;223(3):389.e1-389.e10.
71.Rosenthal SA, Nolan MT. A meta-ethnography and theory of parental ethical decision making in the neonatal intensive care unit. *J Obstet Gynecol Neonatal Nurs*. 2013;42(4):492-502.
72.Roscigno CI, Savage TA, Kavanaugh K, et al. Divergent views of hope influencing communications between parents and hospital providers. *Qual Health Res*. 2012;22(9):1232-1246.
73.Proctor S. What determines quality in maternity care? Comparing the perceptions of childbearing women and midwives. *Birth*. 1998;25(2):85-93.
74.Pozzo ML, Brusati V, Cetin I. Clinical relationship and psychological experience of hospitalization in "high-risk" pregnancy. *Eur J Obstet Gynecol Reprod Biol*. 2010;149(2):136-142.
75.Panchaud A, Favre G, Pomar L, Vouga M, Aebi-Popp K, Baud D. An international registry for emergent pathogens and pregnancy. *Lancet*. 2020;395(10235):1483-1484.
76.Wiersinga WJ, Rhodes A, Cheng AC, Peacock SJ, Prescott HC. Pathophysiology, transmission, diagnosis, and treatment of coronavirus disease 2019 (COVID-19): a review. *JAMA*. 2020;324(8):782-793.
77.Shanes ED, Mithal LB, Otero S, Azad HA, Miller ES, Goldstein JA. Placental pathology in COVID-19. *Am J Clin Pathol*. 2020;154(1):23-32.
78.Centers for Disease Control and Prevention. Considerations for inpatient obstetric healthcare settings. Centers for Disease Control and Prevention website. Updated May 20, 2020. Accessed February 12, 2021. https://www.cdc.gov/coronavirus/2019-ncov/hcp/inpatient-obstetric-healthcare-guidance.html
79.World Health Organization. Infant feeding in areas of Zika virus transmission. e-Library of Evidence for Nutrition Actions (eLENA), World Health Organization. Updated February 11, 2019. Accessed March 1, 2021. https://www.who.int/elena/titles/zika_breastfeeding/en/

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