

EDITORIAL



Trends in prenatal and pediatric viral infections, and the impact of climate change

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It has been nearly four years since the COVID-19 pandemic began unfolding, with myriad public health and societal implications worldwide. The SARS-CoV-2 virus shaped everyday life to such an extent that Oxford Languages listed dozens of terms for its 2020 Word of the Year,¹ among them “lockdown,” and “shelter-in-place,” and epidemiologic jargon like “R number.” Language in 2020 also had the imprint of social justice with “systemic racism,” and “Black Lives Matter,” entering the common lexicon, reflecting the global protest movement that was galvanized by the murder of George Floyd.¹ The intersection of equity and the COVID-19 pandemic was not just temporal; disparities in the rates of infection, vaccination, and access to care resulting from the social determinants of health were seen across the globe. Concurrent to the collective focus on COVID-19 and health equity in the years since, scholarship on other infectious diseases in the pediatric population has continued apace. The Winter 2024 *Pediatric Research* Annual Reviews Issue synthesizes a cross-sectional collection of articles on a number of prenatal and pediatric viral infections, including COVID-19, and highlights health disparities in pediatric infection as a pressing global health problem. Critically, this issue of the Journal also addresses the impact of climate change on emerging and re-emerging viral threats.

PRENATAL INFECTION COVID-19

Celik, Tanacan, and Canpolat² review the effects of COVID-19 on the placenta, fetus, and neonate, as well as fetal and neonatal outcomes after antenatal exposure to COVID-19. In a separate review by Celik and colleagues³ on the management of neonates with prenatal COVID-19, the authors discuss the manifold uncertainties clinicians contended with early in the pandemic due to insufficient knowledge. To reduce vertical and horizontal transmission, practices included immediate separation of mother-infant dyads, isolation of neonates, and avoiding of skin-to-skin contact, breast milk, and breastfeeding. As the pandemic progressed, and vaccines were implemented, data also emerged to inform changes in neonatal care practices. In both articles,^{2,3} the authors emphasize the importance of translating the lessons from the COVID-19 pandemic to the next pandemic, including iterative evaluation of care practices. This is echoed in a related Commentary by Mulkey⁴ that discusses how some early pandemic clinical protocols intended to reduce transmission inadvertently had a negative impact on maternal mental health.

Zika virus

The Zika virus epidemic of congenital infection began in Brazil in 2015 and quickly spread. In response, various systems were implemented regionally and nationally to monitor Zika virus in

pregnancy, and data from two national efforts are presented in this issue.^{5,6} The United States Zika Pregnancy and Infant Registry,⁵ reports pregnancy, infant, and neurodevelopmental outcomes up to age 36 months after Zika virus exposure during pregnancy. The authors argue that a mechanism for longitudinal follow-up of all infants with Zika virus exposure in utero is needed given the frequency of adverse outcomes. Alger et al. report on the Zika in Pregnancy Honduras cohort study⁶ that enrolled pregnant patients at the first prenatal visit. Comparing cognitive and language scores of normocephalic children with prenatal exposure to Zika and unexposed children, they found no statistical differences.

Cytomegalovirus

Cytomegalovirus (CMV) is the most common cause of congenital infectious disease. With the emergence of newborn congenital CMV screening programs, more infants are being diagnosed and require long term follow-up. Lawrence and colleagues⁷ discuss fetal transmission of CMV and clinical signs of congenital CMV infection. Currently available diagnostic methods and emerging platforms with improved sensitivity, specificity, limit of detection, viral quantification, detection of genomic antiviral resistance, and infection staging (primary, latency, reactivation, reinfection) are also discussed. A systematic scoping review from Pesch⁸ summarizes the literature on neurodevelopmental outcomes in children with congenital CMV with attention to study-specific definitions of disease severity (symptomatic vs. asymptomatic). While neurodevelopmental delays are common among children with congenital CMV, the review notes variation in definitions of asymptomatic and symptomatic congenital CMV, as well as the use of categorical outcomes of neurodevelopment (e.g., normal vs. abnormal), which limit the generalizability of the findings.

Other infections

A comprehensive review on lymphocytic choriomeningitis virus (LCMV) from Olivieri, Othman, and Gordon⁹ addresses transmission of LCMV from the natural reservoir to the pregnant individual, placenta, and fetus, and calls for increased patient and provider awareness, as well as global efforts to delineate LCMV seroprevalence and outcomes. An Insights piece from the same authors¹⁰ reflects on the health disparities revealed in a case of congenital LCMV transmitted through exposure to rodents in unsafe housing. The authors urge attention to the social determinants of health to decrease exposure to congenital pathogens and promote birth equity.

Examining maternal infection more broadly and its relationship with outcome in preterm newborns less than 29 weeks' gestation, Herrera et al.¹¹ retrospectively classified infection as extrauterine or intrauterine, and extracted placental pathology findings. Acute histologic chorioamnionitis was associated with neurodevelopmental impairment or death at 2 years in their cohort, whereas maternal extrauterine and intrauterine infection were not. Reviewing potentially asymptomatic viruses that are detectable using saliva and/or nasopharyngeal swabs at birth or under age

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one, Goh et al.¹² argue that research into the early detection of viruses that have delayed health outcomes may pave new ways to prevent non-communicable diseases in the future.

PEDIATRIC INFECTION

Mukhopadhyay and colleagues¹³ conduct a quantitative analysis of publications to identify trends in emerging pediatric vector-borne viral diseases over the last two decades. The review highlights various factors including deforestation, urbanization, global travel, and immunosuppression that contribute to disease emergence and resurgence. The clinical manifestations and long-term effects of the top 10 vector-borne viruses in children (Dengue, Zika, West Nile, Chikungunya, Yellow Fever, Japanese encephalitis, Tick-borne encephalitis, Rift Valley fever, Sindbis virus, and Venezuelan eastern encephalitis) are also reviewed. The vulnerability of the pediatric population to viral central nervous system invasion is discussed in a review of neurotropic viruses by Liu et al.¹⁴ New molecular assays and next-generation sequencing that have broadened diagnostic capabilities for identifying infectious meningitis/encephalitis are addressed, along with selection and interpretation of a suitable diagnostic test for emerging/re-emerging neurotropic viruses. A scoping review from Hoffman and Maldonado¹⁵ highlights the need for prevention, preparedness, and response efforts for emerging and re-emerging viral threats, particularly in resource-limited communities. The review also draws focus on the complex dynamics of globalization, socioeconomic interconnectedness, geopolitical tensions, vaccine hesitancy, misinformation, and disparities in access to healthcare resources, and how these dynamics may impact future epidemics.

CLIMATE CHANGE

Chitre and colleagues¹⁶ review the effects of climate change on viral threats to pediatric health, including zoonotic, vector-borne, water-borne, and respiratory viruses, as well as distal threats related to climate-induced migration and healthcare systems. An example of one such virus, Ebola, is reviewed in detail in this issue by Dobbs et al.¹⁷ As noted by Chitre et al.,¹⁶ children are particularly vulnerable to the adverse health effects of climate change because of their immunological immaturity, differences in physiology (e.g., size), dependence on caregivers, and behavioral traits. Moreover, the heaviest burden of viral disease resulting from climate change will disproportionately affect low and middle-income countries, underscoring the necessity for targeted programming and research to prevent and mitigate future viral outbreaks.

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COMPETING INTERESTS

The authors declare no competing interests.