

VIEWPOINT

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Pediatrics and COVID-19

Years from now, today's children will tell the next generation about their experiences during the coronavirus disease 2019 (COVID-19) pandemic. What they recount will depend on how old they are currently and the circumstances in which they currently live. If an effective vaccine is developed soon, today's infants will have no recollection of the direct effects of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection on their lives. Toddlers may have some vague nondescript recollections, but older children will vividly recollect missed milestones that can never be restored. An entire birth cohort of children will have missed seminal events such as middle school, high school or college graduations, senior proms, and sports seasons, that will be indelibly lacking from their memories, their yearbooks, and their Instagram feeds. These lacunae in their childhood experiences will assuredly be conveyed to their children, especially as their offspring approach the events they missed.

What most children will not recount is having been ill with COVID-19 disease. Less than 6% of COVID cases have occurred in children, and most of those cases have involved minor symptoms.¹ While the biological

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explanation for this remains elusive, it may be because there is an age-dependent expression of angiotensin-converting enzyme 2 in nasal epithelium, the initial point of entry for the virus.² The greatest direct medical risk to children remains multisystem inflammatory syndrome in children (MISC), a likely rare, poorly understood postinfection inflammatory condition that can cause severe complications but rarely results in death.³

In addition to these direct medical risks, measuring the effects of COVID-19 on children, beyond missing memories and milestones, involves understanding that they are experiencing other adverse effects from the virus and recognizing that those effects will have lasting and yet to be appreciated consequences. The indirect nature of these effects means children will not, in many cases, attribute them to the pandemic as adults.

Perhaps the most profound of these effects involves their psychological and educational well-being. Some newborn children are being separated briefly from their mothers at birth because of concern for vertical transmission, and this separation can adversely affect at-

tachment and breastfeeding.⁴ Many children are likely to spend crucial formative years raised by parents who are more financially and psychologically stressed because of the pandemic, and parental stress has been shown to be associated with changes in cortisol regulation as well as brain structure and function in children and young adults.⁵ Tens of thousands of children will have lost parents or grandparents at an age when they cannot appreciate (or later recall) the loss, but those loved ones' absences will influence their lives in innumerable and immeasurable ways.

School-age children will recollect their months of distance learning, but they will not appreciate that those months online potentially significantly altered the educational trajectory of their lives. In particular, given the notable deficits in teaching young children via video chat, it is likely that many more children today are not acquiring basic educational building blocks such as reading and early numeracy as they otherwise would have. Research has shown that the single best predictor of high school graduation is third grade reading. By 1 account, 23% of children not reading at grade level by the end of third grade will fail to graduate from high school compared with 9% of those who are. The risks are even greater for Black or Hispanic students from low-income households—33% of those not reading at grade level will fail to finish high school.⁶

How many adults of the future will appreciate the role that the COVID-19 pandemic during their youth had in their not graduating from high school as they endure the attendant financial and health consequences of not doing so? What of the social and emotional effects of COVID-19 on children of all ages? School-age children in Wuhan, China showed increases in depression and anxiety during the lockdown.⁷ How long will those effects last, and what will their sequelae be over time, especially as it appears likely that restrictions on in-person gatherings will be extended further? Prior to COVID-19, digital addiction in children was already an emerging concern.⁸ How will the requirement that children use online access to get the vast majority of their schooling and social interactions affect this issue?

Most of the public discourse and much of the published literature and media coverage assessing the effects of COVID-19 focus on the health and economic implications for adults in the present, but the full measure of the effects of COVID-19 on children will not be recognized so much today as it will 15 to 20 years from now. Notably and sadly, all of those effects will be felt more substantively by socially disadvantaged children and children of color, as their families have been disproportionately affected by the health and

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economic effects of COVID-19 further compounding existing and persisting inequities.⁹

JAMA Pediatrics has tried to do its part to advance current scientific understanding of COVID-19, and as of August 31, the journal has published 43 articles related to various aspects of the pandemic. With enormous amounts of scientific effort and perhaps some

biological luck in finding an effective vaccine quickly, the immediate effects of COVID-19 may soon be in the past, but the virus will leave a long trail.

The mantra of my lab is "If you change the beginning you change the whole story." The COVID-19 pandemic has assuredly changed the beginning for millions of children.

ARTICLE INFORMATION

Conflict of Interest Disclosures: None reported.

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