ScienceDirect

Early Human Development

Volume 192, May 2024, 105991

# A retrospective cohort study analyzing the changes in early childhood development during the COVID-19 pandemic

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https://doi.org/10.1016/j.earlhumdev.2024.105991

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## Highlights

- Overall, the COVID-19 pandemic had no effect on children meeting developmental milestones.
- Some high-risk groups' developmental milestones were negatively affected by the pandemic.
- COVID-19 Pandemic may be exacerbating existing inequities in child development.

## Abstract

### Objective

To investigate early childhood development (ECD) outcomes in different subgroups before and during the COVID-19 pandemic.

## Study design

A retrospective cohort study of children 3–58 months of age whose caregivers completed a Survey of Well-being of Young Children (SWYC) as part of a well child visit (WCC). The data were divided into two phases: pre-pandemic (September 2018 – February 2020), and during pandemic (September 2020 – February 2022). The difference in the proportion of forms with Meets Expectations interpreted scores on the SWYC Developmental Milestones pre-pandemic versus during the pandemic timeframe overall and among subgroups were reported. Hypotheses were tested using logistic regression with repeated measures.

## Results

14,550 patients were included in the sample for analysis with 52,558 SWYC form observations. There was no difference in the odds of a Meets Expectations interpreted score before and after the pandemic for the entire sample, OR 0.99 (95% CI: 0.94–1.04). There was evidence of decreased odds of an interpreted score of Meets Expectations for the following subgroups: male, Hispanic/Latino ethnicity, ages of 24, 30 or 36 months at WCC, Medicaid insurance, 2nd HOUSES Quartile, requiring interpreter, single parent household, young maternal age, maternal substance abuse, and race identified as Native Hawaiian/Pacific Islander, American Indian/Native Alaskan or Other.

## Conclusion

Decreased odds of meeting developmental milestones during the pandemic were evident in certain high risk sub-groups revealing unequal distribution of suboptimal developmental outcomes within our population during the pandemic that may be exacerbating existing inequities impacting development in children.

## Introduction

The COVID-19 pandemic has caused a drastic change in the daily life of society. Social isolation, economic disruptions, and school closures have created a unique set of circumstances whose impacts on society are still being discovered. While a tremendous amount of knowledge has been gained about SARS-CoV-2 since the start of the pandemic, there remains a gap in knowledge regarding the impact of the pandemic on early childhood development (ECD).

There are multiple publications discussing the pandemic's and past epidemics' negative effects on mental health, stress, substance use, and economic hardship [[1], [2], [3], [4], [5], [6], [7], [8], [9]]. The most negatively affected populations have been marginalized groups in society, including women, Black, LatinX, Native Americans, Asian Americans, Indian/Alaska Native and the lowest 25% socioeconomic group [7,[10], [11], [12]].

Felitti et al. [13] in 1998 linked adverse childhood events (ACEs) to the leading causes of morbidity and mortality in adults, and since then, retrospective studies in adults have shown that ACEs

increase the risk of mental illness, poor socioeconomic outcomes, and morbidity later in life [14]. Evaluations on the effects of ACEs on the cognition and behavior of developing children reveal an increased risk of developmental delay with increasing number of ACEs [[15], [16], [17], [18]]. Research exploring the association between parental ACEs and second-generation developmental delay also found more parental ACEs were associated with higher likelihood of developmental delay in the affected parents' children [19,20]. There is even evidence that maternal ACEs have an effect on childhood development beginning in pregnancy, with increased maternal stress linked to poor ECD [1,6,21,22].

Based on the analyses showing the increase in children's exposure to ACEs during sociohistorical disruptions, several publications have discussed the theoretical negative impact of these events on the cognitive, mental, and physical health of children and adolescents [1,2,23]. The pandemic results in disruptions to life that are important for development such as family structure, education, financial security, and normal critical transition points, including entrance to daycare, interpersonal support networks, and social play [2,24,25]. The destabilization of fundamental building blocks for optimal childhood growth and brain development along with increased exposure to ACEs results in an increased exposure to toxic stress. Toxic stress has been shown to have negative effects on brain architecture in early childhood [1,13,[25], [26], [27]].

While multiple studies describe the theoretical impact of the pandemic on ECD, we found only several studies that attempted to show a direct link between the pandemic and ECD. Examination of the effects of the pandemic on ECD during the prenatal period in over 300 infants in New York City showed that infants who were prenatally exposed to the pandemic for a longer period, scored lower on several subdomains of the Ages and Stages Questionnaire, 3rd Edition (ASQ-3) at 6 months of age [28]. Other studies have shown that infants whose mothers had SARS-COV-2 during pregnancy scored lower on several subdomains of the ASQ-3 compared to infants whose mothers did not have the virus [[29], [30], [31], [32]]. Examination of the impact of the pandemic on ASQ-3 scores in 1024 children 5–38 months of age in Southern Illinois revealed some difference in subdomain scores in certain age groups, but no statistically significant difference between the median ASQ-3 scores or the overall domain scores pre-pandemic and during the pandemic [33]. Evaluation of cognitive function, using the Mullen Scales of Early Learning, of 700 children ages 3 months to 3 years of age at Rhode Island Hospital/Brown University between 2011 and 2021, revealed an overall decline in cognitive performance in children born during the pandemic compared to children born pre-pandemic [34]. These results are consistent with other studies that have shown a decline in several developmental domains in children during the pandemic [32,[35], [36], [37], [38], [39], [40]]. The forementioned publications had several limitations including a small sample size (largest sample size of 7772 by Eldow et al.), a focus on limited age range, and completion early in the pandemic after only a short exposure of children to the unique pandemic circumstances.

This retrospective cohort study further investigates the impact of the COVID pandemic on ECD by exploring the effect of the pandemic after a prolonged exposure to societal disruptions, and on a

significantly larger sample size compared to previous studies. We hypothesize that there will be a smaller proportion of children who fall into the “Meets Expectation” category on developmental screening tools during the pandemic timeframe compared to the pre-pandemic timeframe. In addition, we investigated the role of multiple co-variates, and we hypothesize that children born to families from marginalized groups were more likely to have their development negatively affected by the pandemic.

Since the early childhood years are critical for development, and failure to address delays in these early years can lead to potentially irreversible negative outcomes later in life, results of our study are important in guiding decisions with future societal disruptions [2,[41], [42], [43]]. These decisions include school and daycare closures, missed well child visits, and implementation of preventative services during global times of stress.



## Section snippets

### Study design and data source

Data for this retrospective cohort study were obtained electronically from medical records of eligible participants. The data utilized for this project is routine data obtained for quality improvement for the *** Developmental Screening Program, as well as additional demographic factors from the electronic medical record. Additionally, socioeconomic status (SES) using the housing-asset-based measure of SES (HOUSES) Index was obtained on children living in all counties in Minnesota. The data was …

### Results

There were 14,550 patients with 52,558 SWYC form observations in the sample after inclusion/exclusion criteria were applied. Patients were predominantly male (51.1%), white (82.8%), and not of Hispanic or Latino ethnicity (88.8%), as seen in Table 1.

Overall, there was no difference in the odds of “Meets Expectations” interpreted score before and during the pandemic (OR, 0.99; 95% CI, 0.94–1.04). There was evidence of decreased odds of an interpreted score of “Meets Expectations” during the …

## Discussion

Although there was no evidence for a difference in odds of meeting developmental milestones before and during the pandemic overall, this study reveals unequal distribution of suboptimal developmental outcomes within our population during the pandemic that may be exacerbating existing inequities impacting development in children. Certain high-risk subgroups had a decreased odds of meeting developmental milestones during the pandemic, and their decrease in odds of an interpreted score of “Meets …

## Conclusion

Our study reveals that children with factors known to increase risk for health inequities were less likely to meet developmental expectations on routine developmental screening evaluations during the pandemic, as compared to their counterparts in sub-groups at lower risk of health inequities. It also reveals that these high-risk groups had a larger decrease in odds of an interpreted score of “Meets Expectations” on developmental screening pre vs during the pandemic compared to children from …

## Funding/Support

Department of Pediatric and Adolescent Medicine discretionary funding was used for statistical analysis. …

## CRediT authorship contribution statement

**Sahar Romem:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Maja Katusic:** Writing – review & editing, Writing – original draft, Supervision, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Chung-Il Wi:** Writing – review & editing, Methodology, Investigation, Data curation, Conceptualization. **Roland Hentz:** Writing – review & editing, Writing – original draft, …

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. …

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