

LONGITUDINAL EFFECTS OF THE COVID-19 PANDEMIC ON INFANT AND TODDLER DEVELOPMENT

A Retrospective Cohort Study

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Introduction

The COVID-19 pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was a novel public health event with an unprecedented accumulation of potential stressors for families with young children. The pandemic environment introduced several risk factors for adverse early child development, including: risks related to infection, social disruption, economic hardship, food insecurity, reduced access to healthcare and supportive services, disrupted routines, and parental anxiety and depression. In addition to structural and social-environment concerns, prenatal viral infections are widely recognized as an important cause of developmental disabilities. Furthermore, the societal response to the pandemic disrupted the psychosocial, economic, and educational environments in which young children live, learn, and grow. These disruptions may have lasting developmental consequences.

Objective

To determine if developmental outcomes differed at 24 months between U.S. children born before and during the pandemic.

Methodology

Study Design: Restrospective chort study comparing three cohorts: 1) children born and turning two prior to the pandemic, 2) children born before and turning two during the pandemic, and 3) children born and turning two after the start of the pandemic.

Study Participants: Children who were term infants and who completed a 24-month well-child visit during the study period (March 2019 - December 2022).

Outcome Measures: Child development milestones were assessed in the domains of communication, gross motor, fine motor, problem-solving and personal-social using the ASQ-3.

Statistical Analysis: Participant characteristics between cohorts were compared using analysis of variance (ANOVA). The primary outcome was the 24-month ASQ-3 Communication score. Multivariable logistic or linear regression compared differences between cohorts and were adjusted for child age at questionnaire completion, sex, and insurance type.

Results

Of 604 children, most were Hispanic/Latino (37%) or Black (26%) and on government-sponsored insurance (77%). Compared to prepandemic, pandemic children scored lower for Total ASQ-3 (250 vs 262, p=.03), Communication (45 vs 49, p=.02), and Personal-Social (49 vs 52, p=.03) and had higher odds of atypical scores for Fine Motor (2.2, 95% CI 1.2-4.2; p=.01), with males more likely to have atypical scores for Communication (2.2, 95% CI 1.2-4.0; p=.03) and Fine Motor (2.3, 95% CI 1.0-5.0; p=.04). For the transitional cohort, pandemic exposure was negatively associated with Total ASQ-3 (p=.048), Communication (p=.02), and Personal-Social (p=.03).

Discussion

Children born during the COVID-19 pandemic showed worse developmental screening outcomes at age 2 compared to pre-pandemic children, particularly in communication and socioemotional development. Several potential explanations have been proposed: elevated maternal stress, increased screen time, mask-wearing limiting exposure to speech sounds, and the general disruption of early social environments. While the effects may be modest at the individual level, the pandemic’s universal reach means the population-level impact could be substantial, particularly given how critical the first few years of life are for brain development. There are however a number of limitations. Results rely on a parental screening tool (ASQ-3) rather than formal diagnostic assessment and data drew from a single clinical setting, which limits how broadly the findings can be generalized. The complexity and regional variability of the pandemic itself also makes it difficult to capture its full effects. There is need for future research to examine differences in developmental outcomes, assess the impact on high-risk groups like premature infants, and consider how social determinants of health may have shaped developmental trajectories among the most vulnerable families.

Conclusion

Our findings suggest a negative association of the COVID-19 pandemic with early child development, especially for emerging language and social-emotional skills, with males likely affected more than females. These findings have important implications for the educational system. Additional developmental resources and early intervention support may be needed for pandemic-born children as they near school-age.

Table 2. ASQ-3 Total and Developmental Domain Scores with Rates of Atypical Screening by Study Cohort at 24 Months						
	Total (n=604)	Prepandemic* (n=192)	Transitional† (n=239)	p-value	Pandemic* (n=173)	p-value
Total score,† mean (SD)	260.8 (40.4)	262.0 (38.8)	267.4 (35.4)	0.407	250.3 (46.4)	0.025
Communication score,† mean (SD)	48.6 (15.8)	49.4 (15.8)	50.8 (13.6)	0.740	44.8 (18.0)	0.024
Atypical (<1 SD below mean), n (%)	115 (19.0)	36 (18.8)	32 (13.4)		47 (27.2)	
Unadjusted OR (95% CI)		[Reference]	0.67 (0.40-1.13)	0.131	1.62 (0.99-2.65)	0.056
Adjusted† OR (95%CI)		[Reference]	0.72 (0.43-1.23)	0.234	1.61 (0.97-2.66)	0.066
Adjusted† OR (95%CI) in Males		[Reference]	0.75 (0.39-1.45)	0.392	2.17 (1.18-4.02)	0.026
Adjusted† OR (95%CI) in Females		[Reference]	0.68 (0.28-1.63)	0.389	0.77 (0.30-2.01)	0.600
Gross Motor score,† mean (SD)	56.4 (7.2)	56.8 (6.1)	57.0 (7.0)	0.857	55.3 (8.3)	0.190
Atypical (<1 SD below mean), n (%)	49 (8.1)	13 (6.8)	16 (6.7)		20 (11.6)	
Unadjusted OR (95% CI)		[Reference]	0.99 (0.46-2.11)	0.975	1.80 (0.87-3.74)	0.115
Adjusted† OR (95%CI)		[Reference]	0.96 (0.45-2.07)	0.722	1.79 (0.86-3.72)	0.518
Adjusted† OR (95%CI) in Males		[Reference]	0.79 (0.28-2.22)	0.667	1.66 (0.65-4.26)	0.568
Adjusted† OR (95%CI) in Females		[Reference]	1.22 (0.38-3.89)	0.243	2.00 (0.62-6.40)	0.716
Fine Motor score,† mean (SD)	52.7 (8.2)	52.7 (8.0)	53.9 (7.8)	0.271	51.1 (8.5)	0.242
Atypical (<1 SD below mean), n (%)	67 (11.1)	17 (8.9)	19 (7.9)		31 (17.9)	
Unadjusted OR (95% CI)		[Reference]	0.89 (0.29-2.74)	0.833	2.13 (0.74-6.19)	0.162
Adjusted† OR (95%CI)		[Reference]	0.91 (0.45-1.81)	0.781	2.23 (1.18-4.20)	0.013
Adjusted† OR (95%CI) in Males		[Reference]	0.97 (0.41-2.32)	0.952	2.27 (1.03-5.01)	0.042
Adjusted† OR (95%CI) in Females		[Reference]	0.85 (0.27-2.63)	0.773	2.10 (0.76-6.10)	0.214
Problem Solving score,† mean (SD)	51.3 (10.2)	51.2 (10.3)	52.4 (8.8)	0.459	49.8 (11.7)	0.472
Atypical (<1 SD below mean), n (%)	62 (10.3)	22 (11.5)	19 (7.9)		21 (12.1)	
Unadjusted OR (95% CI)		[Reference]	0.67 (0.35-1.27)	0.219	1.07 (0.56-2.02)	0.840
Adjusted† OR (95%CI)		[Reference]	0.67 (0.35-1.28)	0.258	1.06 (0.56-2.01)	0.863
Adjusted† OR (95%CI) in Males		[Reference]	0.70 (0.30-1.65)	0.412	1.15 (0.51-2.59)	0.734
Adjusted† OR (95%CI) in Females		[Reference]	0.64 (0.24-1.74)	0.854	0.91 (0.32-2.57)	0.854
Personal-Social score,† mean (SD)	51.9 (10.0)	52.2 (9.5)	53.4 (8.8)	0.509	49.3 (11.6)	0.025
Atypical (<1 SD below mean), n (%)	92 (15.2)	30 (15.6)	25 (10.5)		37 (21.4)	
Unadjusted OR (95% CI)		[Reference]	0.63 (0.36-1.11)	0.112	1.47 (0.86-2.50)	0.157
Adjusted† OR (95%CI)		[Reference]	0.67 (0.38-1.20)	0.183	1.45 (0.84-2.49)	0.183
Adjusted† OR (95%CI) in Males		[Reference]	0.56 (0.28-1.14)	0.111	1.53 (0.81-2.88)	0.191
Adjusted† OR (95%CI) in Females		[Reference]	0.99 (0.35-2.79)	0.994	1.22 (0.41-3.65)	0.696

*Prepandemic cohort born before 3/1/2018. Transitional cohort born on or after 3/1/2018 and before 3/1/2020. Pandemic cohort born on or after 3/1/2020.
†Linear regression models were adjusted for child age at questionnaire completion, sex, and insurance.
‡Logistic regression models were adjusted for child age at questionnaire completion, sex, and insurance.
§Logistic regression models were adjusted for child age at questionnaire completion and insurance.

Table 1. Study Participant Characteristics				
	Total (n=604)	Prepandemic* (n=192)	Transitional† (n=239)	Pandemic* (n=173)
Child’s age (months) at 24-month visit, mean (SD)†	24.8 (0.7)	25.0 (0.7)	24.8 (0.7)	24.7 (0.6)
Gestational age (months) at birth, mean (SD)	39.2 (1.1)	39.3 (1.2)	39.2 (1.1)	39.2 (1.1)
Birthweight (grams), mean (SD)	3236 (467)	3233 (491)	3245 (444)	3226 (471)
Sex, n (%)				
Male	327 (54.1)	104 (54.2)	124 (51.9)	99 (57.2)
Female	277 (45.9)	88 (45.8)	115 (48.1)	74 (42.8)
Race and/or ethnicity, n (%)				
Hispanic/Latino	222 (36.8)	72 (37.5)	79 (33.1)	71 (41.0)
Non-Hispanic Black	155 (25.7)	55 (28.6)	59 (24.7)	41 (23.7)
Non-Hispanic White	86 (14.2)	18 (9.4)	43 (18.0)	25 (14.5)
Non-Hispanic Asian	52 (8.6)	23 (12.0)	19 (7.9)	10 (5.8)
Multiracial	23 (3.8)	10 (5.2)	10 (4.2)	3 (1.7)
Other/Unknown‡	66 (10.9)	14 (7.3)	29 (12.1)	23 (13.3)
Maternal age (years) at birth, mean (SD)	29.2 (5.8)	29.0 (5.9)	29.0 (6.0)	29.9 (5.6)
Preferred language, n (%)				
English	472 (78.1)	146 (76.0)	193 (80.8)	133 (76.9)
Spanish	61 (10.1)	22 (11.5)	17 (7.1)	22 (12.7)
Other	71 (11.8)	24 (12.5)	29 (12.1)	18 (10.4)
Child’s insurance, n (%)†				
Government-sponsored	467 (77.3)	156 (81.3)	172 (72.0)	139 (80.3)
Private	130 (21.5)	33 (17.2)	66 (27.6)	31 (17.9)
Unknown/Self-pay	7 (1.2)	3 (1.6)	1 (0.4)	3 (1.7)

*Prepandemic cohort with date of birth before 3/1/2018. Transitional cohort with date of birth on or after 3/1/2018 and before 3/1/2020. Pandemic cohort with date of birth on or after 3/1/2020.

†p<0.05

‡Other or unknown race and/or ethnicity includes: American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and declined to self-identify.

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