

# Prevalence of Autism in Toddlers Born to Coronavirus Disease 2019-positive Mothers

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## ABSTRACT

Autism is a neurobehavioral disorder seen in toddler characterized by speech delay, lack of social interaction, and repetitive stereotyped behaviors. There were reports of increase in risk of neurodevelopmental disorders in children born to coronavirus disease 2019 (COVID-19)-positive mothers. This study was being done to find out any relation between COVID-19 infection in mothers and autism in children. It was a retrospective cross-sectional study of 250 children of age 1–3 years born to COVID-19-positive mothers attending outpatient department (OPD) of a tertiary care hospital of West Delhi. This study showed a significant rise in risk of autism in children born to mothers in COVID-19-positive mothers.

**Keywords:** Autistic spectrum disorder, Coronavirus disease 2019, Modified checklist for autism in toddlers score.

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## INTRODUCTION

As per the WHO, autism is disorder of developing brain characterized by lack of social interaction, speech delay, and fixed repetitive stereotyped movements. About one in 100 children has autism.<sup>1</sup> According to the Autism and Developmental Disabilities Monitoring (ADDM) networks in 2020, there has been an increase in the number of autism spectrum disorder (ASD) cases in the last few years. Presently, one in 36 children aged 8 years were identified with ASD in the year 2020.<sup>2</sup> This surge was being attributed to improvements in evaluation and ASD detection. However, discontinuation of this practice during the coronavirus disease 2019 (COVID-19) pandemic led to fall in ASD cases at a higher age-group. Early diagnosis of autism can pave the way for early intervention. This will improve the child's quality of life as they get older.<sup>3,4</sup> Late diagnosis is associated with increased parental stress and delayed early intervention, which is critical to positive outcome over time.<sup>5-7</sup> It has been proved that interventions done before 4 years of age are associated with significant gains in cognition, language, and adaptive behavior.<sup>8,9</sup>

For diagnosis of ASD, a screening method called modified checklist for autism in toddlers (M-CHAT) is used before age of 2 years,<sup>10</sup> but sometimes, these early symptoms can be misinterpreted as shyness.<sup>11</sup>

Due to COVID-19, there was a major effect on social and communicative life of people. So, it affected both physical and mental health of the individuals.<sup>12</sup> It was reported in a study in Spain that during lockdown, physical activity of pregnant women decreased significantly.<sup>13</sup>

## MATERIALS AND METHODS

It was a retrospective cross-sectional study done from March to September 2023. A total of 250 consecutive children born in the years 2020–2022, whose mothers were COVID-19-positive in pregnancy, were enrolled for the study. Parents were given M-CHAT screening questionnaire. Score of more than two was taken as risk for autism.<sup>14</sup> History of COVID-19 infection in pregnancy was being asked. Positive polymerase chain reaction (PCR) report was taken as positive.

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**Conflict of interest:** None

**Patient consent statement:** The author(s) have obtained written informed consent from the patient's parents/legal guardians for publication of the case report details and related images.

## Inclusion Criteria

All children of age 1–3 years born to COVID-19-positive mothers in the years 2020–2022 coming to the outpatient department (OPD) of the Tertiary Care Hospital of West Delhi were included in the present study.

## Exclusion Criteria

- Parents who refused to enroll for study.
- Children with other neurodisabilities like cerebral palsy.
- Children with congenital syndromes like Down syndrome, Williams syndrome, etc.

## Statistical Analysis

Taking the current prevalence of autism in the community as 2% and keeping 10% level of significance and absolute allowable error as 5%, the sample size came out to be 250.

The results have been taken using Statistical Package for the Social Sciences (SPSS) Software version 23.

## RESULTS

In the present study, 16 children, that is, around 7%, had M-CHAT score of more than two (Table 1). This suggested that the prevalence of autism in COVID-19-positive mothers was approximately one in 16 children, which was higher than the result of the studies done in the pre-COVID era. Study done in Chandigarh in the year 2019 suggested that the prevalence of ASD was found to be 2.25 per 1,000 children.<sup>15</sup>

The incidence of autism in males in the present study was 69%, while that of females was 31% only. This could be attributed to upregulation of placental interferon signaling leading to reduced maternal antisevere acute respiratory syndrome coronavirus 2 (SARS-CoV-2) antibodies in male offspring. So, the prevalence of neurodevelopmental and neuropsychiatric disorders like autism in the offspring differs as per the sex of the child (Table 2).<sup>16-19</sup>

Out of the 250 children, only eight were born preterm and had stormy neonatal course. However, none of them had autism. All 16 autistic children were born at term, and postnatal period was uneventful. A cohort study done in more than six hospitals in the United States showed that COVID-19 infection in mother was associated with risk for neurodevelopmental disorders in the first 12 months after birth (Table 3).<sup>20</sup>

## DISCUSSION

In this study, the prevalence of autism came out to be 7% in children of COVID-19-positive mothers. It was more than that of the prevalence in general population.<sup>2</sup>

Perlis found that babies born to COVID-19-positive mothers had increased risk of developmental disorder in infancy. The rationale for this was that development of fetal brain might be affected by mother's immune response to inflammation that gets transferred to the baby *via* the placenta. However, as COVID-19 infection may

also lead to preterm delivery, babies may have problems related to prematurity.<sup>21</sup>

It was also noted that COVID-19 infection in pregnancy had higher risk of neurodevelopment disorder in babies' brain if the infection occurred in the third trimester. However, we could not find any such association in our study.

Perlis found in their study that even after accounting for preterm delivery, there is still the risk of neurodevelopmental disorders more in babies of affected mothers.<sup>21</sup>

In a study done by Edlow et al., they found that male offsprings of mothers affected with COVID-19 during pregnancy have 94% more chances of having any neurodevelopmental diagnosis at age of 12 months.<sup>8</sup>

In a Swedish study, they found a 30% increase in risk for ASD among offspring of women infected with an intrapartum infection.<sup>22</sup>

Another study in Sweden found that the risk of ASD in offspring was 79% higher in mothers having any infection during pregnancy.<sup>21</sup>

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has persistent effect in brain development.<sup>23-29</sup>

Studies showing maternal and placental immune response for SARS-CoV-2 suggest that anti-SARS-CoV-2 antibodies in mothers were less in case of male babies compared to female babies.<sup>16</sup>

A large number of studies show that incidence of autism increases as gestational age decreases.<sup>30</sup> So, the odds of autism were 3.3 times more in preterm children than in the general population.<sup>31</sup>

## CONCLUSION

Children born to mothers who had COVID-19 during pregnancy had a higher risk of autism-like features. So, early screening and

**Table 1:** Prevalence of autism-like features having M-CHAT score of >2

		M-CHAT score			
		Frequency	Percent	Valid percent	Cumulative percent
Valid	2	235	93.6	93.6	93.6
	4	16	6.4	6.4	100.0
Total		251	100.0	100.0	

**Table 2:** Relation of autistic babies with sex of the baby

		Relation with sex			
		Frequency	Percent	Valid percent	Cumulative percent
Valid	F	5	31.3	31.3	31.3
	M	11	68.8	68.8	100.0
Total		16	100.0	100.0	

**Table 3:** Relation of autistic babies with the period of gestation they were born

		Relation with gestation			
		Frequency	Percent	Valid percent	Cumulative percent
Valid	Preterm (<37 weeks)	0	0	0	0
	Term (>37 weeks)	16	100	100	100.0
Total		16	100.0	100.0	

regular follow-ups are required for their better neurodevelopmental outcome.

### Limitations

As we were able to show only the association between maternal COVID-19 infection and autism in children, so further studies are needed to show a causal connection between the two.

Since we have studied only the toddler population, they have to be followed up further for their neurodevelopmental assessment.

As we have taken the M-CHAT score as our screening questionnaire, all at-risk babies need further diagnostic tests and follow-ups to assess the neurodevelopmental risk.

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### REFERENCES

- Zeidan J, Fombonne E, Scora J, et al. Global prevalence of autism: a systematic review update. *Autism Res* 2022;15(5):778–790. DOI: 10.1002/aur.2696
- Higher Autism Prevalence and Covid 19 Disruption centres for Disease Control and Prevention (gov).
- Volkmar FR. Editorial: the importance of early intervention. *J Autism Dev Disord* 2014;44(12):2979–2980. DOI: 10.1007/s10803-014-2265-9
- Rotholz DA, Kinsman AM, Lary KK, et al. Improving early identification and intervention of children at risk for autism spectrum disorder. *Pediatrics* 2017;139(2):e20161061. DOI: 10.1542/peds.2016-1061
- Swanson AR, Warren ZE, Stone WL, et al. The diagnosis of autism in community pediatric settings: does advanced training facilitate practice change. *Autism* 2014;18(5):555–561. DOI: 10.1177/1362361313481507
- Elder JH. Integrated Health Care for people with Autism Spectrum Disorder Interdisciplinary Planning and Delivery of core. Springfield IL: Thomas Publishers Ltd; 2016. pp. 173–192.
- Zwaigenbaum L, Bauman ML, Stone WL, et al. Early identification of autism spectrum disorder: recommendations for practice and research. *Pediatrics* 2015;136(suppl 1):S10–S40. DOI: 10.1542/peds.2014-3667C
- Dawson G, Rogers S, Munson J, et al. Randomized controlled trial of an intervention for toddlers with autism: the early start denver model. *Pediatrics* 2015;125(1):e17–e23. DOI: 10.1542/peds.2009-0958
- Vivanti G, Dissanayake CVictorian ASELCC Team, . Outcome for children receiving the early start denver model before and after 48 months. *J Autism Dev Disord* 2016;46(7):2441–2449. DOI: 10.1007/s10803-016-2777-6
- Baron-Cohen S, Allen J, Gillberg C. Can autism be detected at 18 months: the needle, the haystack, and the CHAT. *Br J Psychiatry* 1992;161:839–843. DOI: 10.1192/bjp.161.6.839
- Elder JH, Breshner J, Alexander B. Identifying the barriers to early diagnosis and treatment in underserved individuals with autism spectrum disorders (ASD) and their families: a qualitative study. *Issues Ment Health Nurs* 2016;37(6):412–420. DOI: 10.3109/01612840.2016.1153174
- Mazza C, Ricci E, Biondi S, et al. Nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: immediate psychological responses and associated factors. *Int J Env Res Pub Health* 2020;17(9):1–14. DOI: 10.3390/ijerph17093165
- Biviá-Roig G, La Rosa VL, Gómez-Tébar M, et al. Analysis of the impact of the confinement resulting from COVID-19 on the lifestyle and psychological wellbeing of Spanish pregnant women: an internet-based cross-sectional survey. *Int J Env Res Pub Health* 2020;17(16):5933. DOI: 10.3390/ijerph17165933
- Robins DL. Scoring M-CHAT 2023 [cited 20.11.23]. Available from: [www.mchatscreen.com/mchat-rf/scoring/15](http://www.mchatscreen.com/mchat-rf/scoring/15)
- Arun P, Chavan BS. Survey of autism spectrum disorder in Chandigarh, India. *Ind J Med Res* 2021;154(3):476–482. DOI: 10.4103/ijmr.IJMR\_930\_19
- Bordt EA, Shook LL, Atyeo C, et al. Maternal SARS-CoV-2 infection elicits sexually dimorphic placental immune responses. *Sci Transl Med* 2021;13(617):eabi7428. DOI: 10.1126/scitranslmed.abi7428
- Glover V, Hill J. Sex differences in the programming effects of prenatal stress on psychopathology and stress responses: an evolutionary perspective. *Physiol Behav* 2012;106(5):736–740. DOI: 10.1016/j.physbeh.2012.02.011
- Werling DM, Geschwind DH. Sex differences in autism spectrum disorders. *Curr Opin Neurol* 2013;26(2):146–153. DOI: 10.1097/WCO.0b013e32835ee548
- Goldstein JM, Cohen JE, Mareckova K, et al. Impact of prenatal maternal cytokine exposure on sex differences in brain circuitry regulating stress in offspring 45 years later. *Proc Natl Acad Sci U S A* 2021;118(15):e2014464118. DOI: 10.1073/pnas.2014464118
- Edlow AG, Castro VM, Shook LL, et al. Neurodevelopmental outcomes at 1 year in infants of mothers who tested positive for SARS-CoV-2 during pregnancy. *JAMA Netw Open* 2022;5(6):e2215787. DOI: 10.1001/jamanetworkopen.2022.15787
- Roy H Perlis, Children of Mothers Infected by COVID in Pregnancy Had Increased Risk of a Developmental Disorder Diagnosis at 1 Year 2022 (cited 20.11.2023) Available from: <https://bbrfoundation.org/content/children-mothers-infected-covid-pregnancy-had-increased-risk-developmental-disorder>
- Lee BK, Magnusson C, Gardner RM, et al. Maternal hospitalization with infection during pregnancy and risk of autism spectrum disorders. *Brain Behav Immun* 2015;44:100–105. DOI: 10.1016/j.bbi.2014.09.001
- Al-Haddad BJS, Jacobsson B, Chabra S, et al. Long-term risk of neuropsychiatric disease after exposure to infection in utero. *JAMA Psychiatry* 2019;76(6):594–602. DOI: 10.1001/jamapsychiatry.2019.0029
- Douaud G, Lee S, Alfaro-Almagro F, et al. SARS-CoV-2 is associated with changes in brain structure in UK Biobank. *Nature* 2022;604(7907):697–707. DOI: 10.1038/s41586-022-04569-5
- Rogers JP, Watson CJ, Badenoch J, et al. Neurology and neuropsychiatry of COVID-19: a systematic review and meta-analysis of the early literature reveals frequent CNS manifestations and key emerging narratives. *J Neurol Neurosurg Psychiatry* 2021;92(9):932–941. DOI: 10.1136/jnnp-2021-326405
- Nalbandian A, Sehgal K, Gupta A, et al. Post-acute COVID-19 syndrome. *Nat Med* 2021;27(4):601–615. DOI: 10.1038/s41591-021-01283-z
- Castro VM, Rosand J, Giacino JT, et al. Case-control study of neuropsychiatric symptoms in electronic health records following COVID-19 hospitalization in 2 academic health systems. *Mol Psychiatry* 2022;27(9):3898–3903. DOI: 10.1038/s41380-022-01646-z
- Taquet M, Geddes JR, Husain M, et al. 6-Month neurological and psychiatric outcomes in 236 379 survivors of COVID-19: a retrospective cohort study using electronic health records. *Lancet Psychiatry* 2021;8(5):416–427. DOI: 10.1016/S2215-0366(21)00084-5
- Castro VM, Gunning FM, Perlis RH. Persistence of neuropsychiatric symptoms associated with SARS-CoV-2 positivity among a cohort of children and adolescents. *medRxiv* 2021. DOI: 10.1101/2021.09.28.21264259
- Crump C, Sundquist J, Sundquist K. Preterm or early term birth and risk of autism. *Pediatrics* 2021;148(3):e2020032300. DOI: 10.1542/peds.2020-032300
- Laverty C, Surtees A, O'Sullivan R, et al. The prevalence and profile of autism in individuals born preterm: a systematic review and meta-analysis. *J Neurodevelop Disord* 2021;13(1):41. DOI: 10.1186/s11689-021-09382-1

