With their Cognitive Performance Adolescents' COVID-19 History is Associated

Researchers investigated the associations between coronavirus disease 2019 (COVID-19) infection history, symptom severity, and cognitive, motor, and psychomotor performance among adolescents, including potential gender differences.

Adolescents reporting more severe COVID-19 symptoms scored lower in logical reasoning and numerical ability, with lower verbal scores particularly evident among girls. Neither infection occurrence nor frequency was significantly linked to cognitive performance.

The research was conducted by scientists from the Faculty of Psychology at Karl Landsteiner University of Health Sciences, in collaboration with the WKNÖ Educational Information Centre in Austria.



Study

The researchers conducted a cross-sectional study involving 3,860 adolescents aged 12–16 (mean age: 13.5 years) living in Lower Austria, Austria. Data were collected from April to October 2024 through the Austrian Institute for Economic Development's vocational information center. Girls accounted for 47.4% of the sample. Participants and their parents provided written informed consent, and the assessments were conducted in German under standardized conditions.

Study participants self-reported their COVID-19 history, including whether they had been infected, how often, and the severity of their worst illness. Symptom severity was assessed using a 9-point scale, ranging from mild illness with minimal symptoms to severe illness requiring hospitalization.

Cognitive abilities were measured using the Inventory for Testing Cognitive Capabilities (INT), which assessed verbal ability, logical reasoning, numerical ability, visual-spatial ability, and long-term memory. The Motorische Leistungsserie (MLS) assessed fine motor ability by measuring tapping speed, gross and fine finger dexterity, and hand guidance errors.

A computerized choice-reaction test was used to evaluate the ability to process information during mentally demanding tasks, with the researchers focusing on errors. This custom assessment had not been independently validated.

The researchers used multivariate regression and gradient-boosting machine-learning models to examine associations, identify gender differences, and detect potential nonlinear patterns. The models accounted for age, gender, and school type, and the regression analysis incorporated corrections for multiple statistical comparisons.

Findings

Among the 3,860 participants, 83.9% reported having experienced at least one SARS-CoV-2 infection. On average, previously infected participants who provided infection counts reported around 1.6 infections. The average symptom severity score among those who rated their symptoms was 2.9 out of 9. The researchers found no significant gender differences in infection prevalence, infection frequency, or symptom severity.

The multivariate regression analysis showed that COVID-19 symptom severity was associated with lower performance in logical reasoning, numerical ability, and verbal ability among girls, who served as the reference group in the primary statistical model.

For logical reasoning, this relationship did not differ significantly between boys and girls.

Lower numerical ability was also associated with increasing symptom severity when both genders were analyzed together. The association appeared considerably weaker among boys, but the gender difference was not statistically significant.

Verbal ability demonstrated a gender-specific association. More severe COVID-19 symptoms were linked to lower verbal scores among girls, with a significantly weaker relationship among boys.

After cognitive scores were converted to a standardized scale (mean = 100, SD = 15), the estimated differences between the least and most severe symptom courses ranged from approximately 3 to 7 points. The gaps were 5.4 points for reasoning and 2.9 points for numerical ability across boys and girls combined, and 7.2 points for verbal ability among girls.

These estimates represent differences in specific cognitive domains rather than measured declines in overall IQ. The authors considered these differences potentially meaningful for adolescents' cognitive and educational development.

The machine-learning analysis largely supported the findings on reasoning and verbal ability. Using gradient boosting and SHapley Additive exPlanations (SHAP) values, the researchers identified reasoning, verbal ability, fine finger dexterity, and long-term memory as domains for which symptom severity contributed most to model predictions. Numerical ability followed closely.

The models suggested possible nonlinear relationships between symptom severity, fine finger dexterity, and long-term memory, but neither outcome showed statistically significant associations in the linear regression models. In particular, fine finger dexterity appeared to deteriorate at the upper end of the severity scale. These exploratory findings need confirmation.

After accounting for demographic and educational variables, COVID-19-related factors explained less than an additional 1% of the variation in each performance outcome. The primary regression

analysis found no significant links between symptom severity and motor or psychomotor abilities.

Additional sensitivity analyses identified logical reasoning as the ability most consistently linked to symptom severity. After excluding participants with the highest severity ratings (7 or above), the association with reasoning remained statistically significant. The association with numerical ability and the gender-specific verbal finding no longer met the threshold for statistical significance, but the estimates remained similar.

Infection frequency was not significantly associated with any of the ten performance outcomes. Infection occurrence was also unrelated to performance across the ten domains tested in the primary regression analysis.

Conclusion

The findings suggest that adolescents experiencing more severe COVID-19 symptoms may perform less well in certain cognitive domains, particularly reasoning and numerical skills, with lower verbal ability specifically associated with symptom severity among girls. Systemic inflammation and disruption of developing neural networks are possible explanations, but the study did not investigate these mechanisms directly.

The cross-sectional design, self-reported infection histories, and lack of pre-infection cognitive assessments prevent causal conclusions. Pre-existing differences in cognitive ability or related factors could also have contributed to more severe illness.

The researchers lacked precise infection dates, vaccination histories, and information on pre-existing health conditions, pubertal development, and detailed socioeconomic circumstances. School closures, social isolation, and mental health difficulties may also have influenced cognitive performance.

The researchers called for longitudinal studies and confirmation in independent international populations to establish whether these associations reflect lasting effects of infection.

Further investigations should also examine the underlying biological processes, factors that may make some adolescents more vulnerable, and effective interventions. Identifying cognitive difficulties following more severe infections may help adolescents receive appropriate educational and developmental support.

Source:

https://www.news-medical.net/news/20261118/COVID-19-and-the-teenage-brain-Why-the-severity-of-symptoms-may-matter.aspx