Correspondence

COVID-19 pandemic and its effects on adolescents' neuropsychological development

La pandemia por COVID-19 y sus efectos en el desarrollo neuropsicológico de los adolescentes

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Dear Editor:

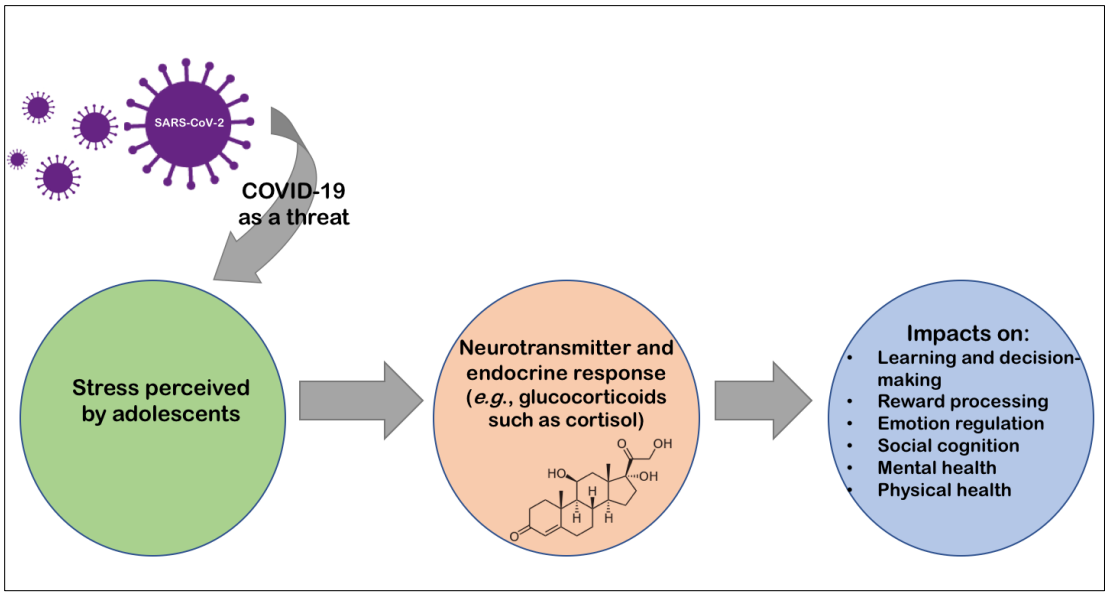
The interesting article by Mejía *et al.*[(1)] provides valuable information on how some media (social networks and television) have generated fear amongst the population during the coronavirus disease pandemic (COVID-19), whose aetiological agent is the SARS-CoV-2 virus. This fear adds up to the dangerous consequences of this disease, which, in most cases, can cause severe respiratory distress leading to multisystemic

failure and even death. In this context, adolescents are a group especially susceptible to fear and stress due to their particular neurobiological stage. Therefore, this Letter to the Editor aims at discussing the principal risks for adolescents' neuropsychological development during the COVID-19 pandemic.

The World Health Organisation declared COVID-19 as a pandemic more than a year ago (11 March 2020). Since then, hundreds of millions of families worldwide have had to face different levels of confinement, lockdowns or quarantines as a way to reduce contagion risks.[2] Many families have directly experienced infections, hospitalisations or, unfortunately, one of their members' death. This health crisis is associated with a social crisis characterised by the collapse of health systems and adverse effects on the economy and, therefore, on households' well-being. Restrictions on mobility have also impacted tremendously on educational systems at all levels, e.g. in the closure or partial operation of nursery, primary and secondary schools and higher education institutions. In particular, teachers have had to adapt their teaching strategies for online sessions (both synchronic and asynchronous), being forced to quickly adopting new educational tools and strategies to deliver their lessons as effectively as possible in this new setting. By contrast, students have had to adjust to a teaching methodology that favours the use of screen electronic devices and compulsory internet connections, even with numerous families in rural areas with limited or non-existent access to computers or an internet connection. This multidimensional emergency context is a significant stressor in the population, especially for adolescents, who are in a critical neurobiological stage.[2] They require contact with their peers, establish face-to-face social contact outside their household, participate in socialisation instances with their friends,[2] and reinforce their self-esteem and personal identity. All of this has been altered for more than a year by the COVID-19 pandemic. Thus, it is worth asking, what are the effects of such deprivation on the adolescent brain?

Brain circuits are configured by experience during critical periods of development, periods with heightened neural plasticity. This setting allows us to adapt our behaviours to the environment that surrounds us. A critical stage in which we are more sensitive to this configuration begins at puberty and extends during adolescence.[3] Adolescence (the stage between 10 to 24 yr)[2] is an adaptive period between childhood and adulthood. It comprises changes in psychological, social and physiological development, including the capacity to acquire affective and sexual behaviours, typically feminine or masculine. This period involves modulating the limbic-cortical circuits associated with adult cognition acquisition and establishing neural information pathways required to promote emotional and social development.[2-4] Hence, in parallel with the biological changes associated with puberty, adolescence is a deep psychological and social transformation period.[2] During this stage, both the social world and peer interactions become increasingly relevant. Teenagers are at a unique period in their lives when the social environment is essential for crucial functions in brain development, self-concept construction, and mental health.[2] Thus, adolescence is a stage in which experiences are essential for neuropsychophysiological development. The adolescent brain is susceptible to stress,[4,5] a concept that, from the perspective of psychoneuroendocrinology, comprises the response to stimuli that disturb biochemical,

immune, physiological and psychological homeostasis, in this case, of youngsters.[4] The environment can occasionally affect this homeostasis quite strongly. Stressful stimuli (stressors) can acquire alarm characteristics, placing the human organism in a state of functional response to emergencies.[4] These months of pandemic have resulted in chronic stress, which, in turn, can trigger permanent action of hormones and neurotransmitters related to the stress response (Fig. 1), producing changes at the genetic, neurochemical and neurophysiological levels in the adolescent brain.[4] The impact of stress on teenagers is solid, long-lasting and sex-specific; this, in part because sex steroid hormones and stress hormones –e.g., glucocorticoids such as cortisol (hydrocortisone) and corticosterone– interact to shape future endocrine responses.[4] Activation of the stress response, culminating in the secretion of stress hormones, would induce genetic alterations in multiple brain regions.[4]



Note: COVID-19: Coronavirus disease | SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2.

Fig. 1 - Proposed effects for COVID-19 as a stressor amongst adolescents.

Post-traumatic stress disorder involves long-lasting psychological disturbances attributed to the experience of a significant traumatic event.[4] The state of catastrophe due to the COVID-19 pandemic constitutes a significant stressor (Fig. 1) that can generate post-traumatic stress disorder, characterised by nightmares, insomnia, repetitive thoughts, memory problems, irritability, anxiety, panic attacks and depressive symptoms.[4] Youngsters who experience traumatic stress and develop post-traumatic symptoms secrete higher cortisol levels than those without trauma history.[4] Animal studies suggest that excessive corticosterone (17-deoxycortisol) secretion may cause neurotoxicity in areas of the brain rich in glucocorticoid receptors, e.g.,

hippocampus and prefrontal cortex.[5] These two areas are involved in memory processing and executive functions, both critical to learning.[5] The long-term effects of COVID-19 on children and adolescents cannot yet be assessed in their full extent but must be followed seriously by the scientific community.

The aforementioned evidence led us to conclude that the COVID-19 pandemic affects adolescents' psychological development. These effects could be transient; however, there could be some long-term consequences that are still unsuspected. It is necessary to highlight the essential preventive measures that will lessen the consequences of the pandemics on teenagers' neuropsychological development, namely: promoting awareness of both families and educational centres about the psychological impacts of the pandemic among adolescents, implementing strategies to promote resilience and healthy social media dynamics,[1] establishing work and study routines and schedules for adolescents, avoiding excessive use of screen electronic devices, and encouraging active breaks. These strategies should also include regular contact with family and close friends, ideally through video calls to establish face-to-face social interactions,[2] an adequate diet and healthy habits to avoid the consumption of alcohol and drugs,[3] physical activity at home, as well as meditation, and recreational activities within families. Amongst teenagers who have already suffered intense stress due to the pandemic, emotional support, counselling, and psycho-educational support and curricular flexibility are also necessary. More severe cases require referral to professionals specializing in managing post-traumatic stress disorder and its comorbidities.

References

1. Mejía CR, Rodríguez-Alarcón JF, Garay-Ríos L, Enríquez-Anco MG, Moreno A, Huaytán-Rojas K, *et al*. Percepción de miedo o exageración que transmiten los medios de comunicación en la población peruana durante la pandemia de la COVID-19. Rev Cubana Invest Bioméd. 2020 [acceso: 20/03/2021]; 39(2):e698. Disponible en: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-03002020000200001&lng=es

2. Orben A, Tomova L, Blakemore SJ. The effects of social deprivation on adolescent development and mental health. Lancet Child Adolesc Heal. 2020;4(8):634-40. DOI: 10.1016/S2352-4642(20)30186-3

3. Cortés ME, Veloso BC. Alteraciones conductuales en adolescentes que consumen Cannabis y motivos de su consumo. Rev Méd Chile. 2020 [acceso: 20/03/2021]; 148(11):1696-7. Disponible en: http://www.revistamedicadechile.cl/ojs/index.php/rmedica/article/view/8710/6481

4. Cortés ME. COVID-19 como amenaza a la salud mental de los adolescentes. Rev Peru Investig Salud. 2020;4(4):192-4. DOI: 10.35839/repis.4.4.757
5. Carrion VG, Wong SS. Can Traumatic Stress Alter the Brain? Understanding the Implications of Early Trauma on Brain Development and Learning. J Adolesc Heal. 2012;51(2): S23-8. DOI: 10.1016/j.jadohealth.2012.04.010

Conflict of interests

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