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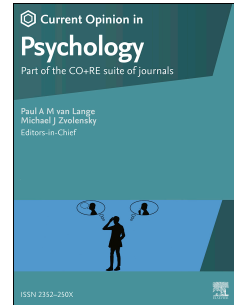
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Understanding Adolescent Stress during the COVID-19 Pandemic

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Abstract

Longitudinal studies across the globe documented significant increases in psychological stress and mental health problems among adolescents during the COVID-19 pandemic. Health concerns, school disruptions, and social disconnection were major sources of stress. High levels of perceived stress predicted worse mental health outcomes, with girls, older adolescents, and socio-economically marginalized youth experiencing more pronounced mental health deteriorations. However, social support from family and peers was a protective factor against increased stress and accompanying mental health problems. We urge policymakers and other key decision-makers to improve the availability and financing of mental health services and support programs for adolescents to address the wave of mental health challenges following the pandemic.

Key words: adolescence, COVID pandemic, stress, mental health

Highlights:

- Health concerns, school disruptions, and social disconnection were major sources of stress for adolescents across the globe during the COVID-19 pandemic.
- High levels of perceived stress predicted worse mental health outcomes, with girls, older adolescents, and socio-economically marginalized youth experiencing more pronounced mental health deteriorations.
- Social support from family and peers was a protective factor against increased stress and accompanying mental health problems, like anxiety and depression.

1. Introduction

Adolescence is a time of increased biological stress reactivity compared to childhood [1, 2, 3]. This vulnerability likely contributes to a steep rise in the prevalence of mood, anxiety, and behavioral disorders, which often have their first onset during this period [4, 5]. As a result, exposure to a multitude of stressors during the COVID-19 pandemic posed unique challenges for adolescents and may have long-lasting consequences for those who reached adolescence during this period. Yet, some adolescents also showed resilience if they had protective factors such as emotion regulation skills [42] and social support [39].

The dramatic disruptions to social routines, particularly during the lockdown phase of the pandemic, posed significant challenges for adolescents' well-being [6, 7]. A review of literature dating from pre-pandemic to May 2021 found that 23 of 33 international studies reported increases in adolescent perceived stress during the pandemic relative to pre-pandemic [8]. Among these studies, some longitudinal research pointed to decreases in perceived stress from early to later stages of the pandemic (e.g., a study in Switzerland showing decreases in perceived stress from 2020 to 2021 [9]), whereas others reported moderate levels of stress throughout the continuation of the pandemic (e.g., a study in the Netherlands [10]). These divergent patterns may be explained by variations in local infection rates, as indicated by a study in New York State, which reported that symptoms of adolescent anxiety and depression rose early in the pandemic and subsided by summer 2020, paralleling local infection rates [11]. Given that most studies reported increases in adolescent stress during the pandemic, this paper summarizes the literature on the major sources of stress for adolescents worldwide, the consequences of stress for their mental health and biological processes, and the protective factors that facilitated successful coping with pandemic-related stress.

2. Major Sources of Pandemic Stress for Adolescents

The pandemic both introduced novel sources of stress and exacerbated preexisting stressors in the lives of adolescents. The mandates to “lock-down” and “shelter-at-home” issued across the world created unprecedented disruptions to social ecosystems and instilled fear and worry. For instance, one study in India [12] reported that children and adolescents experiencing quarantine reported high rates of worry (68.59%), helplessness (66.11%), and fear (61.98%). Major pandemic-related stressors identified by adolescents fall into three main categories: health, school, and social life. Youth repeatedly expressed concerns about their own health and that of their family members [13, 14], with the magnitude of the fears directly relating to the degree of perceived health risk [15]. Youth also reported stress about accessing medical care, with one longitudinal study of adolescents in Switzerland finding that adolescent girls expressed increased stress around accessing healthcare one-year post-lockdown [9]. As many schools transitioned to virtual learning, youth reported increased concerns about falling behind in school and losing motivation [14]. However, school stress was not pervasive across all demographics. A study of United States (U.S.) youth found that school stress decreased during the pandemic for white youth with highly educated parents, while it increased for white youth from low and moderately educated households [13]. Ethnic-racial minority adolescents in the same study did not report

significant changes in school stress during the pandemic, but did report high levels of home and health-related stress. Shifting to online learning impacted academics and also stymied opportunities for social connection. Across many studies and cultural contexts, adolescents cited missing out on social events and disruptions to socializing with friends as major pandemic-time stressors [9, 16, 17].

Stress as a result of spending more time at home was of particular interest to researchers despite not being cited as a top concern for adolescents. Due to the shelter-at-home orders alongside school closures, adolescents also spent more time online, leading to increased smartphone and internet use [18]. Time spent online may have exacerbated stress for adolescents, as one Canadian study showed that adolescents who consumed more COVID-19-related news and used social media more reported higher COVID-19-related stress, and greater social media use was related to a stronger association between stress and depression [6].

3. Consequences of Stress for Adolescent Mental Health

Longitudinal studies document that the pandemic resulted in significant increases in psychological distress and mental health problems for adolescents compared to pre-pandemic [8, 18, 19, 20]. Adolescents reported various psychological symptoms during the COVID-19 pandemic, including anxiety [21], sadness [22], depression [16], and loneliness [6]. Meta-analytic findings cite a high prevalence of psychopathologies in children and adolescents during the pandemic, including depression (29%), anxiety (26%), post-traumatic stress (48%), and sleep disorders (44%) [23]. Adolescent perceptions and experiences of stress played a major role in adolescent mental health. For instance, perceived stress has been implicated in several studies as the mediator between pandemic conditions and maladaptive outcomes, including externalizing behavior [24] and anxiety and depression [25]. Overall, these studies suggest that stress management interventions would be a viable strategy for reducing youth mental health problems related to the pandemic.

4. Consequences for Adolescent Stress Biology

Most pandemic studies examining biological aspects of the adolescent stress response focused on cortisol, a product of the hypothalamic-pituitary-adrenal axis, or inflammation. Few studies examined changes in stress biology from pre- to post-pandemic. One study of typically developing adolescents ages 10-18 years old from the midwestern United States reported increases in adolescents' hair cortisol from pre-pandemic to the first few months of the pandemic lockdown [27, 29], whereas a study of 9-14-year-olds from Quebec, Canada did not find significant increases in HCC levels from pre- to early pandemic [28]. Regional infection rates and local governments' responses to the pandemic may explain these diverging findings.

In addition, stress biomarkers showed alterations among youth who experienced more negative affect or loneliness during the pandemic, suggesting the potential value of biomarkers for identifying more vulnerable youth. For instance, one study showed that youth with a history of non-suicidal self-injury (NSSI) and higher pre-pandemic cortisol reactivity were more likely to persist (as opposed to desist) in their NSSI behaviors during the pandemic, a finding that remained significant after controlling for pandemic-related stressors [26]. Loneliness was

associated with higher levels of cortisol at wake-up and a blunted cortisol awakening response during the pandemic among 13-14-year-olds in British Columbia, Canada [49]. For youth who already had high levels of HCC pre-pandemic, the pandemic took a heavy psychological toll. Higher pre-pandemic HCC was predictive of greater increases in negative affect from pre- to post-pandemic, particularly in older youth [29]. Taken together, these findings highlight the individual differences in response to stress exposure.

Other physiological markers have also been linked to psychosocial stress during the pandemic. In one study of 11-17-year-old Italian adolescents diagnosed with depression, higher levels of inflammatory markers (C-reactive protein and Interleukin-6) were associated with more severe depressive symptomatology, controlling for body mass index [30]. These findings are important, as inflammation has been linked to risk for depression in previous studies. Thus, these pandemic findings may inform future interventions.

5. Which Adolescents Were Most Affected by Pandemic Stress?

A crucial insight from the literature on pandemic-related stress is that the effects of the pandemic were not uniform across all youth. Pandemic-related stress appeared to increase with age, as older adolescents frequently reported higher levels of stress compared to younger adolescents [31], and high school-aged youth reported higher stress than middle school and elementary-age youth [14]. Adolescent girls consistently reported higher stress levels during the pandemic across many studies from different countries [9, 10, 19, 31] and especially high stress due to social isolation [14]. However, one study from Kenya found that older adolescent boys reported higher levels of depressive symptoms resulting from pandemic stress [32]. The pandemic also exacerbated stress for many marginalized youths already experiencing chronic socioeconomic strain, discrimination, and childhood trauma [33, 34, 35], especially given that pre-pandemic stress significantly predicted levels of pandemic stress [15]. For example, a longitudinal study conducted in the U.S. found that low to moderate education levels of parents led to higher youth-reported perceived stress and more negative impacts on their well-being during the pandemic [13]. Another study showed that early-life stress significantly predicted perceived stress and depression symptoms during the pandemic, with the severity of depression symptoms being mediated by perceived stress [36]. Overall, these results suggest the need to target stress-reduction interventions based on age, gender, and prior exposure to adversity to address the alarming increases in adolescent mental illness.

6. Protective Factors Against Pandemic Stress

In spite of the aforementioned trends in adolescent pandemic stress, many youths exhibited resilience. Given the well-studied buffering effects of social support [37], it is unsurprising that adolescents reporting higher levels of social support from their family and peers experienced lower levels of pandemic-time stress [10, 18, 38, 39]. Some research suggests that positive parental relationships predicted better pandemic-time adjustment for adolescents [40], but parental stress and anxiety levels may have attenuated these effects [41]. Conversely, parental support effectively buffered adolescents' stress irrespective of the severity of the youth's stress [39]. Friendship quality and online communication with friends also buffered negative perceptions of pandemic-related changes [38]. Youth's appraisal of pandemic-induced changes

also served as a protective factor such that youth who perceived COVID-related changes to be less negative reported less stress, loneliness, and depression [38]. In the early part of the pandemic, implementing emotion regulation techniques—such as reflection—was found to be predictive of lower cortisol levels at awakening [42]. Another protective factor that decreased psychological distress and increased life satisfaction was benefit finding (i.e., perceiving benefits from home quarantine) [40]. Additionally, perceived familial closeness and increased family discussions due to the home quarantine orders appeared to have beneficial effects [18]. Finally, trait mindfulness was associated with lower levels of pandemic stress in Chinese adolescents [25]. In sum, social support, perceiving benefits, and trait mindfulness were highlighted as protective factors against stress for adolescents.

7. Conclusions and Recommendations for Practitioners and Caregivers

Although many studies point to transient increases in perceived stress during the pandemic, the effects of this stressful period may extend beyond the initial phase and continue to impact this generation of adolescents into the future. As illustrated in Figure 1, pandemic-related stressors in the health, school, and social domains were of primary concern to adolescents. High levels of perceived stress predicted worse mental health, but there were pervasive individual differences in youth outcomes. Various moderators explained some of the variability in youth-reported stress throughout the pandemic, including gender, family SES, context, the availability of social support, and the rigidity of pandemic restrictions. Thus, future research on stress in adolescence should carefully consider these factors and tailor interventions based on the identified risk factors.

To address the rising levels of perceived stress among adolescents, it is important for practitioners, teachers, and caregivers to recognize the signs of excess stress that adolescents may exhibit. These may include changes such as moodiness, irritability or hostility, not engaging in previously pleasurable activities, complaining or worrying about school or other activities more than usual, making frequent disparaging remarks about themselves, crying, changes in sleep or eating patterns, avoiding their parents or friends, or acting out [43, 44]. Stress may also have physical manifestations, such as abdominal pain or headaches [44]. Stress from the pressures and losses of the COVID-19 pandemic may have contributed to observed increases in youth anxiety and depression during the pandemic, although the prevalence of these conditions already showed rising trends across pre-pandemic years [45]. When left unmanaged, chronic stress can reduce immunity, increase blood pressure, and increase risk of future chronic conditions. However, safe, stable, and nurturing relationships can reduce stress for adolescents [46]. Furthermore, clinicians who provide care to children frequently develop long-standing trusting relationships with adolescents and their families and are well-positioned to provide trauma-informed care, screen for and identify stress, support families, and provide referrals to evidence-based interventions [47].

The American Academy of Pediatrics' policy statement, "Unique Needs of the Adolescent," highlights the need for clinicians to recognize adolescence as a key period that influences health during adulthood [48]. Preventive care and counseling in the primary care

setting can help clinicians screen for stress, risky behavior, and mental health concerns. Creating a safe space in clinical settings where adolescents feel comfortable discussing stressors, ramping up current screening and counseling approaches, and advocating for improved access to mental health services are essential health system interventions to improve the quality of care delivered to adolescents. Finally, we urge policymakers and other key decision-makers to increase the availability and financing of mental health services and support programs for adolescents to reduce their risk for mental health problems. These steps are especially critical to proactively prepare for future large-scale emergencies that place adolescents at risk for stressors that can stem from school disruptions and social disconnection, similar to what was experienced during the COVID-19 pandemic. Finally, because the pandemic and disasters in general disproportionately impact socially and economically marginalized groups, policies that promote economic security and equity will likely also reduce mental health disparities [50].

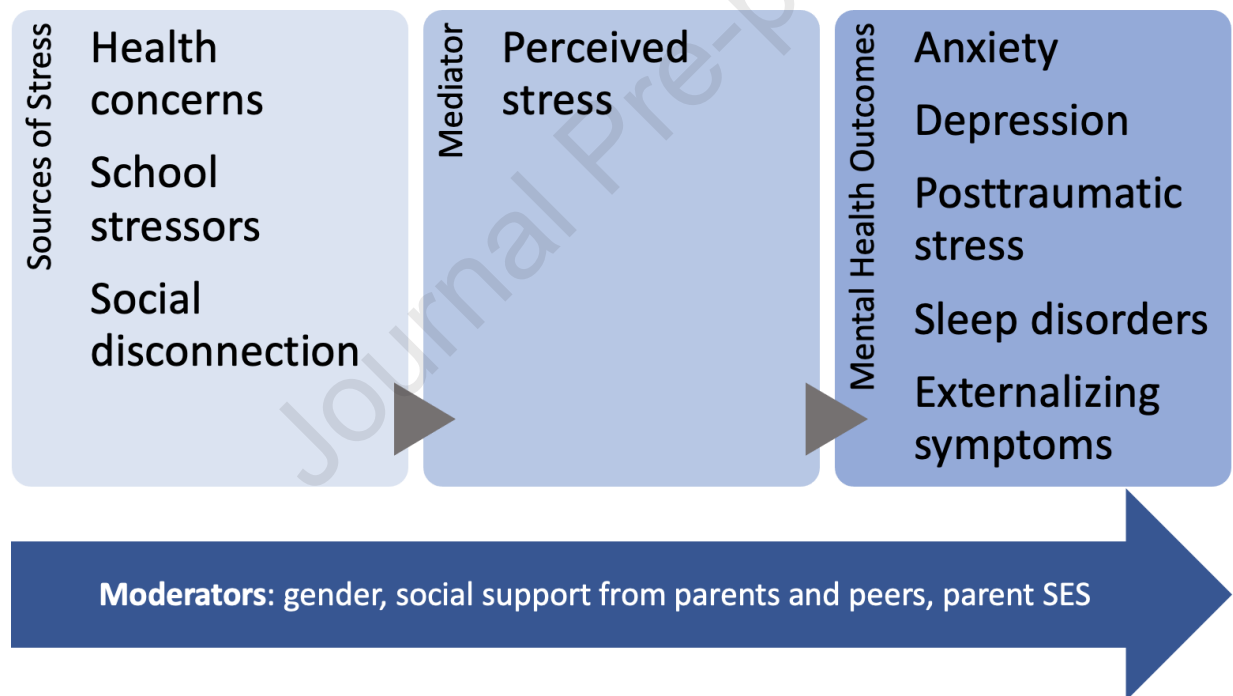


Figure 1. Primary sources of stress, consequences for mental health, mediators and key moderators of stress-mental health links among adolescents during COVID-19.

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