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Neurodivergent Mental Health in the Wake of the COVID-19 Pandemic: Exploring Impacts in Autistic, ADHD, and Co-occurring Populations

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Abstract

This study aimed to further clarify how the COVID-19 pandemic and its related consequences impacted mental health symptomatology across three neurodivergent diagnostic groups. Participants included 418 adolescents and young adults (70.3% male; M_{age} = 16.9 years old) previously diagnosed with autism (n = 208), attention-deficit/hyperactivity disorder (ADHD; n = 100), or both autism and ADHD (n = 110) who presented for programming at the UCLA PEERS® Clinic before (n = 185) or during (n = 233) COVID-19. Significant interactions between the diagnostic group and COVID-19 condition emerged for social anxiety (p = .028), adolescent depression (p = .049), and young adult loneliness (p = .006), such that only those with ADHD presented with significantly higher mental health symptoms during the pandemic (p's < .05). Results imply that the mental health of non-autistic young people with ADHD was uniquely impacted by changes brought about by the pandemic and its societal consequences.

Keywords

ADHD, autism, COVID-19, mental health, adolescents, adults, neurodivergent, depression, loneliness, social anxiety

Introduction

Neurodivergent populations, such as those diagnosed with autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD), are characterized by neurobiological development that often deviates from neurotypical societal norms, which frequently contributes to unique strengths and challenges in multiple facets of life. Autistic people, diagnosed through differences in social communication and the presence of restricted, repetitive behaviors (American Psychiatric Association [APA], 2022), often experience difficulties understanding neurotypical nonverbal social cues, discomfort with novelty and change in routines, and sensory sensitivity issues. In contrast, the attentional and organizational challenges, impulsivity, and hyperactivity present in ADHD frequently result in academic underachievement, risky behaviors, proneness to boredom, and consistent disruptions within social interactions (APA, 2022; Chou et al., 2018; Grygiel et al., 2014).

Despite unique diagnostic profiles, young people on the autism spectrum and/or with ADHD both commonly experience socioemotional challenges (Antshel & Russo, 2019). Further, autism and ADHD frequently co-occur, with a previous review indicating a range of comorbidity from 37% to 85% (Leitner, 2014). Evidence suggests that those with both diagnoses are at even greater risk for less favorable socioemotional functioning than those with either diagnosis alone (Katzman et al., 2017; Pehlivanidis et al., 2020; Zablotsky et al., 2020). Compared to neurotypical counterparts, autistic youth and youth with ADHD generally develop fewer friendships, experience poorer friendship quality, and are subject to higher rates of peer victimization (Antshel & Russo, 2019; McClemont et al., 2021). This social marginalization may partially explain why those on the spectrum and/

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or with ADHD are at higher risk for co-occurring internalizing symptoms such as depression and anxiety (Lugo-Marín et al., 2019; Pehlivanidis et al., 2020). Past literature has also demonstrated loneliness in autism (Mazurek, 2014; Schiltz et al., 2021) and ADHD populations (Jong et al., 2024) to be linked to mental health concerns.

The COVID-19 Pandemic

The connection between loneliness and mental health is especially crucial to consider in the context of social distancing measures taken during the COVID-19 pandemic. In times of crisis, such as the COVID-19 pandemic, marginalized populations are likely to be disproportionately negatively affected, with pre-existing disparities widening (Kantamneni, 2020; Mann et al., 2021). On a global level, the pandemic led to widespread increases in mental health symptomatology, such as anxiety, depression, suicidal ideation, and substance abuse in the general population (Salari et al., 2020; Wheaton et al., 2021). However, data collected through systematic reviews (Behrmann et al., 2021), mixed-methods surveys (Oomen et al., 2021), quantitative surveys (Chafouleas & Iovino, 2021), and cross-sectional studies (Laslo-Roth et al., 2022) suggest that neurodivergent people were impacted more significantly than the general population.

Lack of access to psychological and healthcare services, public health restrictions, and social isolation posed significant challenges for autistic individuals and those with ADHD (Adams et al., 2021; Behrmann et al., 2021; Oomen et al., 2021). Specifically, autistic populations reported sensitivity to disruptions to routine and changes in social contact, leading to increases in anxiety, depression, negative affect, and emotional dysregulation (Adams et al., 2021). Furthermore, autistic individuals reported that telecommunication and face coverings exacerbated their challenges in interpreting nonverbal social communication (Oomen et al., 2021). In ADHD populations, the onset of the pandemic and the transition to remote learning were related to worsening ADHD symptom severity, as well as increased boredom, social isolation, low mood, and loneliness (Behrmann et al., 2021; Laslo-Roth et al., 2022). The loss of environmental supports present in classrooms also likely exacerbated the impact of pre-existing symptoms of inattention and impulsivity, resulting in students with ADHD also reporting more challenges with distance learning than neurotypical students (Behrmann et al., 2021).

Notably, prior literature also documents that the effect of the pandemic on neurodivergent young people was not solely negative. For example, reduced social stress and sensory load, the ability to spend more quality time with family, and improved youth mood have all been reported as positive outcomes of the pandemic for autistic people and their families (Dal Pai et al., 2022; Mumbardó-Adam et al., 2021; Oomen et al., 2021). Remote learning reduces the possibility of peer victimization, thus potentially reducing associated emotional dysregulation for autistic people too (Repo et al., 2023). Additionally, online academic and work environments may have provided autistic people with more control over their sensory environments and reduced pressure to mask social communication differences. For young people with ADHD, some studies have also reported benefits during COVID-19, such as increased family time, less stress, and/or more support related to schoolwork (e.g., parents available to help, more time to work at their own pace, and take breaks as needed), and reduced anxiety (Behrmann et al., 2021).

Still, given the distinct challenges that arose from the pandemic for autistic people and those with ADHD, it is plausible that the co-occurrence of both diagnoses may compound the risk of worsened mental health. However, only a few studies have previously examined COVID-19's impact on the co-occurring ASD+ADHD group (Hall et al., 2023; Houghton et al., 2022; Nonweiler et al., 2020; Pecor et al., 2021; Thorell et al., 2022), and have thus far been limited in their reliance on parent-report and lack of comparable pre-COVID-19 comparison. Moreover, those who have investigated the pandemic's impact on populations with co-occurring ASD+ADHD diagnoses present conflicting findings. Thorell et al. (2022) and Houghton et al. (2022) both discovered relatively nonsignificant differences in social and emotional functioning before and during the pandemic for those diagnosed with both autism and ADHD. However, Hall et al. (2023) revealed that emotional symptoms, conduct problems, and hyperactivity/inattention were slightly reduced for those with both autism and ADHD diagnoses during the pandemic. On the contrary, Nonweiler et al. (2020) and Pecor et al. (2021) both reported notably worse socioemotional outcomes for those on the autism spectrum and with ADHD (e.g., worse emotional symptoms, hyperactivity, and prosocial behaviors) and their caregivers (e.g., a greater decrease in quality of life). With these conflicting findings, it is vital to further investigate the role of the pandemic in predicting the mental health of those who have both autism and ADHD diagnoses, especially in comparison to those with either diagnosis alone.

The Present Study

Given the mixed findings on the impact of the COVID-19 pandemic on neurodivergent mental health, it is crucial to further understand the effects of the pandemic and its related societal consequences on these populations. It is especially critical to include samples beyond the acute onset of COVID-19 in early 2020 to better capture the lasting impact as the pandemic lingered and continued to impact daily life. Further, very few studies in the current literature include a

participant sample that spans developmental stages or considers the unique response and needs of those with co-occurring autism and ADHD, which enables comparison across age and diagnostic groups.

It is worth noting that even though the COVID-19 pandemic presented unique sociocultural changes, and its immediate impacts on neurodivergent populations' socioemotional well-being might differ from longer-term impacts, it is still essential to examine the potential mental health differences in neurodivergent populations before and after the onset of this pandemic. It is imperative to explore how socioemotional well-being might have shifted for neurodivergent populations since the start of the pandemic up until the immediate years following its onset, as general societal attitudes toward social communication have shifted and behaviors previously characterized as "disordered" (e.g., decreased frequency of social contact, increased physical distance during social interactions, heightened alertness in personal hygiene, less focus on facial expressions from wearing masks and face coverings) might not be viewed as such under the context of the pandemic and its related protective guidelines (Behrmann et al., 2021; Nash, 2021). Wearing masks, social distancing, and remote learning, all of which are practices that have existed before the pandemic and will continue to be in place in specific contexts, may also be associated with and lead to different levels of well-being for neurodivergent populations. It is important to consider how changes in broader societal expectations might challenge our understanding of "disorder" and, in turn, lead to differences in the socioemotional well-being of neurodivergent populations.

Thus, the current study examined mental health symptoms—specifically social anxiety, depression, and loneliness—in adolescents and young adults on the autism spectrum, with ADHD, and with co-occurring autism and ADHD diagnoses who presented for social skills programming before the pandemic and in the 2 years following the initial COVID-19 lockdown in the United States. By exploring these relationships, this study sought to clarify whether the presence of the COVID-19 pandemic yielded significant associations with social anxiety, depression, and loneliness within neurodivergent young people. More specifically, did participants exhibit significant differences in mental health symptomatology before and after the onset of the COVID-19 pandemic? Did participants' diagnostic categories (i.e., ASD, ADHD, ASD+ADHD) account for these potential differences in mental health symptomatology between pandemic presence conditions? Finally, did participants' age groups (i.e., adolescents or young adults) explain these potential differences between pandemic presence conditions?

Materials and Methods

Participants

Participants in the current study included adolescents (ages 10–18; M_{age} = 13.9, SD = 1.9), young adults (ages 17–45; M_{age} = 22.1, SD = 4.5), and their caregivers who enrolled in the PEERS® for Adolescents and PEERS® for Young Adults social skills interventions (Laugeson, 2017; Laugeson & Frankel, 2010), respectively, at the University of California, Los Angeles (UCLA) PEERS® Clinic, an outpatient clinical setting, between 2017 and 2022. To be eligible for enrollment in the PEERS® program, adolescents and young adults had to demonstrate: (a) a motivation and desire to participate in social skills programming (e.g., verbal assent [for adolescents] or written consent [for adults] to participate in programming, verbal indication of targeted social skills they would like to improve, setting personal goals for the program); (b) appropriateness for outpatient care (e.g., absence of more pressing intervention priorities requiring higher levels of care, such as active psychosis or significant suicidal ideation); (c) sufficient cognitive ability to understand and engage in a group-based intervention (e.g., clinician judgment during intake appointment on ability to comprehend and apply social skills curricula, current or previous participation in group-based classroom settings, adequate verbal communication skills for engaging in conversations, understanding instructions, and interacting with peers during sessions); (d) English fluency; and (e) for telehealth during COVID-19, access to an electronic device(s) and stable Wi-Fi connection. Adolescents were required to attend with at least one parent, while young adults were required to attend with a caregiver willing and able to provide social coaching (e.g., family member, peer, life coach). The use of participants' archival clinical outpatient data for the current study was approved by and conducted in accordance with the UCLA Institutional Review Board.

Archival clinical data for the current study were drawn from all 418 adolescents and young adults who completed baseline assessments as part of the PEERS® enrollment process and had historical diagnoses of autism without ADHD, ADHD without autism, or co-occurring autism and ADHD. The pre-COVID-19 group included 185 adolescents and young adults who completed measures between 2017 and 2019, while 233 enrolled after the COVID-19 pandemic began in March 2020 through March 2022. Across the entire sample, the average participant age was 16.9 years (SD = 5.1), with 70.3% (n = 294) identifying as male, 27.8% (n = 116) identifying as female, and 1.9% (n = 8) identifying as gender expansive. Participants were ethnoracially diverse, with 57.2% (n = 233) identifying as white, 12.5% (n = 51) identifying as Asian, 7.4% (n = 30) identifying as Latiné, 2.9% (n = 12)

Table 1. Adolescent Demographic Information by Distinct Diagnostic Groups.

	Adolescent program participants (Ages 10–18)			
Demographic	ASD ($n = 117$)	ADHD ($n = 69$)	ASD+ADHD ($n = 75$)	χ^2 or F
COVID-19 condition				3.3
Pre-COVID-19	40% ($n = 47$)	54% ($n = 37$)	43% ($n = 32$)	
During COVID-19	60% ($n = 70$)	46% ($n = 32$)	57% ($n = 43$)	
Gender				6.7
Male	65% ($n = 76$)	65% ($n = 45$)	80% ($n = 60$)	
Female	32% ($n = 38$)	33% ($n = 23$)	20% ($n = 15$)	
Gender expansive	3% ($n = 3$)	2% ($n = 1$)	0% ($n = 0$)	
Ethnoracial identity				12.9**
White	44% ($n = 50$)	66% ($n = 44$)	68% ($n = 50$)	
Latiné	12% ($n = 13$)	3% ($n = 2$)	4% ($n = 3$)	
Black/African American	2% ($n = 2$)	2% ($n = 1$)	4% ($n = 3$)	
Asian	14% ($n = 16$)	10% ($n = 7$)	7% ($n = 5$)	
Multiracial or other	28% ($n = 32$)	19% ($n = 13$)	18% ($n = 13$)	
Age (*SD*)	14.1 (2.0)	13.6 (1.8)	13.8 (1.9)	1.4

Note. In chi-square analysis, race/ethnicity was considered a binary variable, white and non-white, due to small cell sizes. ASD = autism spectrum disorder. ADHD = attention-deficit/hyperactivity disorder. All percentages are based on valid data.
**$p < .01$.

Table 2. Young Adult Demographic Information by Distinct Diagnostic Groups.

	Young adult program participants (ages 17–45)			
Demographic	ASD ($n = 91$)	ADHD ($n = 31$)	ASD+ADHD ($n = 35$)	χ^2 or F
COVID-19 condition				5.0
Pre-COVID-19	51% ($n = 46$)	42% ($n = 13$)	29% ($n = 10$)	
During COVID-19	49% ($n = 45$)	58% ($n = 18$)	71% ($n = 25$)	
Gender				6.6
Male	79% ($n = 72$)	61% ($n = 19$)	63% ($n = 22$)	
Female	20% ($n = 18$)	35% ($n = 11$)	31% ($n = 11$)	
Gender expansive	1% ($n = 1$)	3% ($n = 1$)	6% ($n = 2$)	
Ethnoracial identity				4.3
White	57% ($n = 52$)	45% ($n = 13$)	71% ($n = 24$)	
Latiné	7% ($n = 6$)	7% ($n = 2$)	12% ($n = 4$)	
Black/African American	2% ($n = 2$)	7% ($n = 2$)	6% ($n = 2$)	
Asian	15.% ($n = 14$)	28% ($n = 8$)	3% ($n = 1$)	
Multiracial or other	18% ($n = 16$)	14% ($n = 4$)	9% ($n = 3$)	
Age (*SD*)	22.4 (5.0)	21.7 (4.0)	21.5 (3.4)	0.6

Note. In chi-square analysis, race/ethnicity was considered as a binary variable, white and non-white, due to small cell sizes. ASD = autism spectrum disorder. ADHD = attention-deficit/hyperactivity disorder. All percentages are based on valid data.

identifying as Black or African American, and a large portion identifying as multiracial or other ethnoracial identities (19.9%; $n = 81$). However, as the adolescent and young adult participants enrolled in separate social skills programs and completed different measures due to their age, they were often analyzed separately in this study. As such, demographic information for adolescents and young adults is shown in Tables 1 and 2, respectively, with statistical differences in demographic characteristics assessed across diagnostic groups (ASD, ADHD, ASD+ADHD).

Procedures

Eligibility for enrollment in the clinical program was assessed by clinical staff through an initial phone screening with the participant (and with the parent for adolescent participants), and was confirmed during an intake conducted by a postdoctoral fellow or licensed clinical psychologist, with both the participant and their social coach present. Pre-COVID-19, all participants and caregivers completed standard hard copy assessment protocols during in-person intake procedures. From 2020 to 2022, during COVID-19, all participants and caregivers completed the same standard measures through UCLA Health Sciences Qualtrics, a secure online survey platform, before a virtual intake appointment. The standard assessment battery (see Laugeson, 2017; Laugeson & Frankel, 2010) includes measures that evaluate a range of constructs related to participants' socioemotional functioning—such as social skills knowledge, functioning, and cognition, and related constructs like social anxiety, depression, and loneliness—both before and following completion of the intervention. For the purposes of the current study's aims and analyses, only measures assessing mental health were included.

Measures

Social Anxiety Scale. The Social Anxiety Scale (SAS) is a 22-item self- and caregiver-report questionnaire that assesses social anxiety in peer social relationships and interactions (La Greca & Lopez, 1998). Total scores range between 18 and 90, with higher scores indicating higher levels of social anxiety and scores above 50 considered clinically significant. Though developed and psychometrically tested for adolescent populations (La Greca & Lopez, 1998; Nelemans et al., 2019), the SAS has also been used to measure social anxiety in young adults (Chabrol et al., 2017; Garcia-Lopez et al., 2006). Previous studies have shown modest support for convergent and divergent validity of the SAS within autistic samples, with some disparities in caregiver- and self-report (Schiltz et al., 2019).

Children's Depression Inventory–Second Edition. The Children's Depression Inventory–Second Edition (CDI-2) assesses cognitive, affective, and behavioral indicators of depression in youth aged 7 to 17 (Kovacs, 2011). The CDI-2 self-report consists of 28 items and has demonstrated high internal reliability with an alpha of .91 and a test-retest reliability coefficient of .89 (Kovacs, 2015). The CDI-2 yields a Total T-Score, with higher scores indicating more severe depressive symptoms.

Children's Loneliness and Social Dissatisfaction Scale. The Loneliness and Social Dissatisfaction Scale (L&SD) is a 24-item self-report measure of children's feelings of loneliness and social dissatisfaction (Asher et al., 1984). Items are rated on a 5-point Likert-type scale from 1 ("always true") to 5 ("not true at all"). Scores range from 16 to 80, with higher scores indicating higher levels of social satisfaction and less loneliness. The L&SD has demonstrated high internal consistency with alphas above .90 and a test-retest reliability coefficient over 1 year of .55 (Asher et al., 1990).

Major Depression Inventory. The Major Depression Inventory (MDI) is a 12-item self-report measure of depressive symptoms in young adults over the course of the previous 2 weeks (Bech et al., 2001). Items are rated on a 6-point Likert-type scale from 0 ("at no time") to 5 ("all the time"). The MDI produces a total score, with scores above 19 considered clinically significant. The MDI has demonstrated good reliability, sensitivity, and specificity (Cuijpers et al., 2007) and adequate internal and external validity (Olsen et al., 2003).

Social and Emotional Loneliness Scale for Adults. The Social and Emotional Loneliness Scale for Adults (SELSA) is a 37-item self-report measure that assesses social, familial, and romantic loneliness in adults (DiTommaso & Spinner, 1993). Items are rated on a 7-point Likert-type scale from 1 ("strongly disagree") to 7 ("strongly agree"). The SELSA produces a total score, with higher scores corresponding to greater loneliness. The SELSA has demonstrated very good internal consistency, with alphas ranging from .89 to .93 (DiTommaso & Spinner, 1993).

Data Analytics Plan

Analyses were conducted using SPSS (Version 23). A series of univariate analyses of variance (ANOVAs) were planned to test the interaction of COVID-19 conditions (i.e., pre-COVID-19 group, during COVID group) and diagnostic presentation (i.e., ASD group, ADHD group, ASD+ADHD group) in relation to mental health outcomes of social anxiety, depression, and loneliness. When the interaction was significant, such that its p-value was less than .05, simple effects of COVID-19 condition for each diagnostic group and pairwise comparisons were analyzed to specify the nature of the interaction. Given differences in the representation of ethnoracially minoritized identities across diagnostic presentations in the adolescent sample (see Table 1), all adolescent models were initially analyzed, controlling for ethnoracial background using a binary grouping (i.e., white, non-white). The binary grouping was determined as the optimal approach for both testing for differences and as a covariate, given small cell sizes. However, ethnoracial background was nonsignificant in every model and thus was removed in the final analyses for parsimony.

Results

Preliminary analyses examined whether mental health symptoms for any diagnostic group differed in the early or later stages of the COVID-19 pandemic, differentiated by the official reopening of the California state economy on June 15, 2021, which corresponded to increased return to in-person activities. No significant differences emerged on any outcome assessed for any of the three diagnostic groups (ASD, ADHD, ASD+ADHD), suggesting some level of continuity in mental health symptoms in these neurodivergent populations over the first 2 years of the pandemic and justifying utilization of binary division of COVID-19 variable (i.e., pre-COVID-19, during COVID-19).

Social Anxiety

In initial ANOVA models with age grouping (i.e., adolescent, young adult) included, no significant interactions emerged between age group and the two primary variables of interest, COVID-19 condition and diagnostic grouping. As such, the age group variable was removed from both models for parsimony and to enhance power. In the model using self-reported social anxiety as the outcome, the interaction between the COVID-19 condition and the diagnostic group was significant, $F(2,366) = 3.61$, $p = .028$, with a small effect size, $\eta_p^2 = .019$. In probing this interaction, a significant simple effect of COVID-19 emerged for the ADHD group only, $F(1,366) = 5.31$, $p = .022$, such that self-reported social anxiety was significantly higher during COVID-19 than pre-COVID-19. In contrast, no significant difference in social anxiety was observed for autistic individuals before and during COVID-19. For individuals with co-occurring diagnoses, the effect of COVID-19 did not reach statistical significance, $F(1, 366) = 3.02$, $p = .083$. However, the direction of the effect suggested marginally higher levels of social anxiety during the pandemic compared to pre-pandemic levels. While adolescents and young adults with ADHD presenting for social skills programming had significantly lower social anxiety than both autistic groups pre-COVID-19 (compared to ASD: $p = .020$; compared to ASD+ADHD: $p = .015$), these differences were no longer present following the significant increases in social anxiety during COVID-19 for non-autistic individuals with ADHD.

With respect to caregiver-reported social anxiety, the interaction between the COVID-19 condition and the diagnostic group was marginally significant, $F(2,394) = 2.45$, $p = .088$, with a small effect size, $\eta_p^2 = .012$. In this ANOVA model, the simple effect of COVID-19 on the ADHD group was similarly marginally significant, $F(1,394) = 3.59$, $p = .059$, while simple effects of COVID-19 were nonsignificant for both the autistic and dual diagnosis groups. Pairwise comparisons indicate that while there were no significant differences in caregiver-reported social anxiety across the diagnostic groups before the pandemic, young people with ADHD were reported to have significantly greater social anxiety during the pandemic as compared to autistic individuals, $p = .040$, and those with both autism and ADHD diagnoses, $p = .033$. See Figures 1 and 2 for visual representations of self-reported and caregiver-reported social anxiety pre-COVID-19 and during COVID-19, respectively.

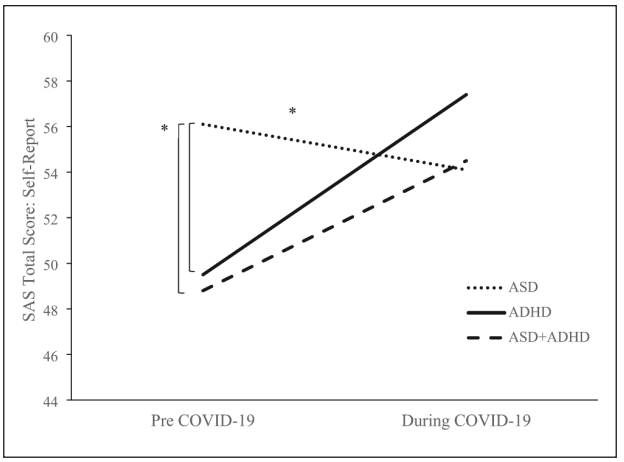


Figure 1. Social Anxiety Scale (SAS) self-report scores before and during the COVID-19 pandemic for neurodivergent diagnostic groups.
Note. ASD = autism spectrum disorder; ADHD = attention-deficit/hyperactivity disorder.
*$p < .05$.

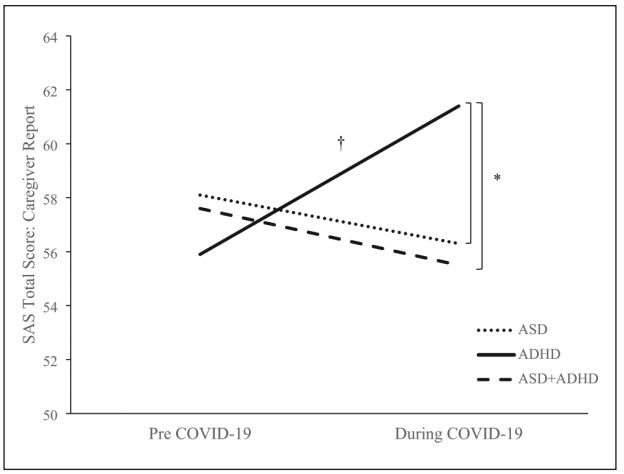


Figure 2. Social Anxiety Scale (SAS) caregiver-report scores before and during the COVID-19 pandemic for neurodivergent diagnostic groups.
Note. ASD = autism spectrum disorder; ADHD = attention-deficit/hyperactivity disorder.
†$p < .10$. *$p < .05$.

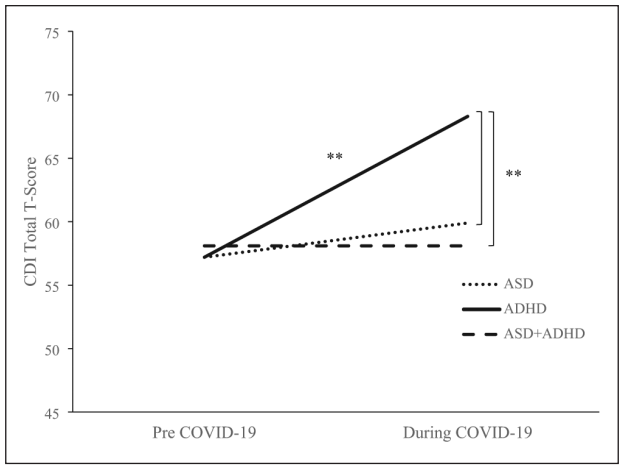


Figure 3. Children's Depression Inventory (CDI) scores before and during the COVID-19 pandemic for neurodivergent diagnostic groups.
Note. ASD = autism spectrum disorder; ADHD = attention-deficit/hyperactivity disorder.
$^{**}p < .01$.

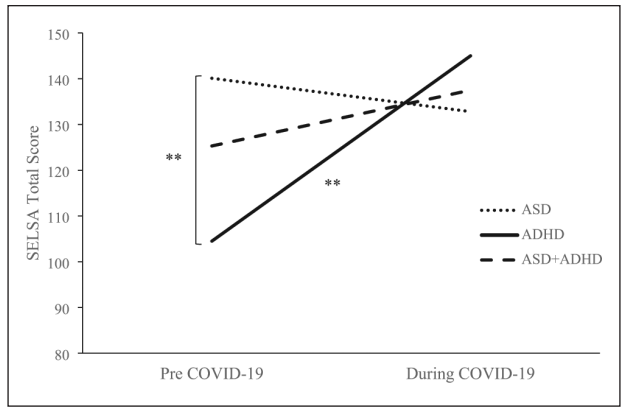


Figure 4. Social and Emotional Loneliness Scale for Adults (SELSA) scores before and during the COVID-19 pandemic for neurodivergent diagnostic groups.
Note. ASD = autism spectrum disorder; ADHD = attention-deficit/hyperactivity disorder.
$^{**}p < .01$.

Depression

For adolescents, utilizing CDI Total T-score as the outcome, there was a significant interaction between the COVID-19 condition and diagnostic group, $F(2,218) = 3.05$, $p = .049$, with a small effect size, $\eta_p^2 = .024$. Analysis of simple effects indicated that there was a significant effect of COVID-19 for the ADHD diagnostic group, $F(1,218) = 10.70$, $p = .001$. The direction of this effect showed that, on average, adolescents with ADHD who presented for social skills programming during the pandemic endorsed more depressive symptoms than those who enrolled pre-pandemic. For autistic teens and autistic teens with co-occurring ADHD, there was no significant effect of COVID-19 on depression (see Figure 3). Pairwise comparisons indicated that during COVID-19, non-autistic adolescents with ADHD reported significantly greater depression than autistic adolescents with ADHD, $p = .004$, and autistic adolescents without ADHD, $p = .008$. In contrast, depressive symptomatology across these groups did not differ pre-pandemic. For young adults, the model utilized MDI Total score as the outcome. No significant interaction or main effects emerged for young adults.

Loneliness

No significant interaction or main effects of COVID-19 condition or diagnostic group emerged with respect to adolescent-reported loneliness on the L&SD questionnaire. However, in the ANOVA model using young adult-reported loneliness on the SELSA, the interaction effect was significant, $F(2,139) = 5.33$, $p = .006$, with a medium effect size, $\eta_p^2 = .071$. The nature of this interaction indicated that only non-autistic young adults with ADHD during the pandemic reported greater levels of loneliness than this group before the pandemic, $F(1,139) = 9.93$, $p = .002$. There were no significant changes in the loneliness of autistic adults or those with both autism and ADHD after the pandemic. Although young adults with ADHD reported lower loneliness than autistic young adults without ADHD pre-pandemic, $p = .001$, these differences were nonsignificant during COVID-19, given increased loneliness in those with ADHD. This pattern of results is displayed in Figure 4.

Discussion

This study sought to explore the impact of the COVID-19 pandemic and its related societal consequences on the mental health of various neurodivergent populations. Participants with ADHD, particularly those without co-occurring autism, demonstrated statistically significant increases in depression, social anxiety, and loneliness during the pandemic. While those with ADHD emerged as a particularly vulnerable population to poor mental health during the pandemic, the autistic groups appeared to show more stable levels of mental health functioning from before the pandemic to during the pandemic. This pattern may suggest either a degree of psychological consistency across time or reflect pre-existing elevated levels of socioemotional distress that were less likely to show additional change during the pandemic period.

The fundamental distinctions in the symptom profiles of ADHD and autism could partially explain the differences in mental health outcomes across diagnostic groups. Challenges with inattention, boredom, impulsivity, and hyperactivity are prominent attributes that contribute to the ADHD symptom profile (APA, 2022), with the current literature suggesting

that the pandemic and its related societal consequences exacerbated these symptoms and worsened the severity of psychosocial distress in those with ADHD (Behrmann et al., 2021; Sibley et al., 2021). The reduced opportunities for physical and social activities caused by social distancing, quarantine guidelines, and economic closures likely were uniquely challenging for those with ADHD, given this symptom profile. Furthermore, the transition to virtual modalities of learning, work, and socialization resulted in reduced structure and increased distractions, an environment particularly problematic for young people with ADHD. These findings reinforce a social model of disability, which emphasizes the person-environment match, or mismatch, as resulting in disability (Haegele & Hodge, 2016). It is also plausible that transdiagnostic features may be more potent in understanding populations' responses to the pandemic, with one study finding that executive functioning deficits in working memory and inhibition held better explanatory power in predicting the negative effects of the pandemic on youth (Thorell et al., 2022). As deficits in these areas of executive functioning are more prevalent in ADHD (Margari et al., 2016) and may impact success in virtual/remote work and learning, this could be another possible factor to consider in explaining the current findings.

The stability of autistic individuals' mental health symptoms may uncover autism as a protective factor in the face of this pandemic. This is particularly evident in the analyses examining adolescent depression and caregiver-reported social anxiety for both adolescents and young adults. For these outcomes, no differences by diagnostic groups existed pre-pandemic, and only the ADHD group showed significant increases in reported symptoms during the pandemic. This deterioration was significant enough such that, on average, non-autistic adolescents with ADHD fell into the clinically elevated range of depression symptoms during the pandemic. It is possible that after the initial stress in the beginning phases of the pandemic (Oomen et al., 2021), autistic young people were better able to cope than expected, where reported benefits (Mumbardó-Adam et al., 2021), such as spending more quality time with family, reduced social pressure, and enhanced sensory control during the pandemic, effectively counterbalanced other stressors during the pandemic.

The results are more complex concerning self-reported social anxiety and young adult loneliness. Specifically, on these outcomes, autistic young people reported significantly higher levels of social anxiety and loneliness pre-pandemic than did non-autistic young people with ADHD. Although these symptoms did not further deteriorate during the pandemic for autistic participants, the worsening of symptoms for the ADHD group simply resulted in all neurodivergent groups presenting with similarly high levels of social anxiety and loneliness during the pandemic. To explain this pattern, we posit that those with ADHD without autism, who were doing relatively better pre-pandemic, experienced greater pandemic-related disruptions in the social, academic, and vocational environments that were working well for them. In contrast, autistic young people with poorer functioning pre-pandemic might have experienced such disruptions with more ambivalence, as they were already experiencing challenges in these pre-pandemic environments (e.g., peer rejection and barriers to employment). These findings mirror an effect previously seen in one study of youth with ADHD, where those with lower ADHD symptom severity showed the greatest deterioration during lockdown, while those with moderate and severe symptom severity demonstrated improvements during the COVID-19 lockdown (Melegari et al., 2021).

For young people with ADHD, there also appeared to be specificity in which areas of mental health were impacted based on developmental stage. Specifically, although both adolescents and young adults with ADHD showed increased social anxiety, only adolescents with ADHD reported greater depressive symptoms during the pandemic. In contrast, only young adults with ADHD endorsed greater loneliness. Whereas teens primarily still live with their families of origin, young adults with ADHD may have been particularly susceptible to increased loneliness as they are more likely to live independently than autistic young adults, given challenges with daily living common to autistic youth (Bolourian et al., 2018; Elias & White, 2018). As a recent study revealed that living with others was a significant protective factor against loneliness during the COVID-19 pandemic (Ray, 2021), the impact of living independently may have disproportionately affected the ADHD group.

Although loneliness often predicted depressive symptoms in both adults and adolescents in the general population, previous research indicates that adolescents reported significantly more severe depression than adults during the pandemic (Murata et al., 2021) and at levels more concerning than those endorsed by loneliness (Kayaoğlu & Başcıllar, 2022). This is consistent with current findings that only adolescents, not young adults, with ADHD reported significant worsening of depressive symptoms. Additionally, greater adolescent social media use during the pandemic has been linked to depression (Murata et al., 2021). While autistic adolescents' preferences for YouTube rather than more traditional interactive platforms, such as Snapchat or Instagram (Alhujaili et al., 2022), may have been protective for autistic populations, adolescents with ADHD are more likely to engage in problematic and intense social/digital media use, perhaps making them uniquely vulnerable to depression during COVID-19 (Dekkers & van Hoorn, 2022).

Limitations and Future Directions

While interpreting the results of this study, a few limitations should be noted. The sample comprised individuals seeking social skills programming who were screened to meet specific eligibility criteria outlined in the methods. A social

skills-seeking group may be qualitatively different from neurodivergent populations in general in both awareness of and difficulties with mental health. Future research should explore results with a sample more representative of the broader population of neurodivergent adolescents and young adults, as well as explore alternative neurodivergent diagnostic groups, such as learning disability and intellectual disability.

The study is limited by the lack of longitudinal data. Specifically, the sample included distinct participants from pre-COVID-19 and during COVID-19, measured cross-sectionally at each timepoint. Longitudinal data would increase confidence in the pattern of results observed, where young people with ADHD were reported to have worsening mental health during the pandemic. Mixed-methods approaches could also be taken in future longitudinal studies to yield richer, more nuanced insights, particularly by including participant quotes that reflect the lived experiences of individuals across diagnostic groups.

The study also draws solely from standardized self-report measures, which inherently involve some degree of measurement error and response variability. Future research would benefit from incorporating multiple methods of data collection, including observational data, collateral reports, or qualitative interviews. Additionally, future research should investigate transdiagnostic features, such as executive functioning and social support, in the adaptive coping of youth during COVID-19 and other stressors.

Individual and family environmental circumstances were also highly variable during the pandemic, which may have had substantial effects on mental health outcomes. Differences in housing and financial stability, exposure to COVID-related stressors, and access to technology and healthcare were not assessed in the present study but could have moderated the observed differences in mental health. Future studies should incorporate these contextual and environmental factors to understand individual differences in pandemic responses within neurodivergent populations more comprehensively.

Finally, a key limitation of the present study is the absence of a neurotypical comparison group. In the absence of this comparison group, it is difficult to conclude whether the observed increases in depression, social anxiety, and loneliness among those with ADHD were uniquely attributed to this diagnostic group or whether this reflects broader pandemic-related disruptions that affected the general population. Future research should include neurotypical participants to better clarify whether mental health symptom changes observed in the present study were distinctive to those with ADHD.

Conclusions and Implications

This study suggests that various neurodivergent populations may respond differently to the maintenance of pandemic conditions. Autistic young people, regardless of co-occurring ADHD, demonstrated relatively stable levels of social anxiety, depression, and loneliness across COVID-19 pandemic presence conditions. However, non-autistic young people with ADHD likely struggled more during the COVID-19 pandemic. While non-autistic young people with ADHD across age groups demonstrated higher social anxiety than their pre-pandemic counterparts, non-autistic adolescents with ADHD specifically demonstrated higher levels of depression, and non-autistic young adults with ADHD specifically illustrated higher levels of loneliness during the COVID-19 pandemic.

The findings of this study provide meaningful insights and implications into the needs and challenges of neurodivergent populations. Many parts of society maintain virtual modalities of learning, social engagement, working, and entertainment even after the formal pandemic restrictions have subsided, so it is important to consider the benefits and negative consequences this may have on neurodivergent mental health. Since young people with ADHD were identified as a population uniquely sensitive to phenomena such as the COVID-19 pandemic and its related sociocultural consequences, additional support or accommodations may be considered for young people with ADHD in school, college, and the workplace, as well as preventative and proactive mental health services. As prior studies have identified remote learning and loss of environmental supports as potential disruptors to the socioemotional well-being of those with ADHD, relating to worsened boredom, loneliness, and low mood (Behrmann et al., 2021; Laslo-Roth et al., 2022), it is crucial for clinicians and practitioners to consider and recommend learning and working environments that will best support and accommodate the well-being of young people with ADHD.

Furthermore, young people with ADHD may have struggled more during the COVID-19 pandemic, as the quarantines and social distancing from this pandemic made it socially isolating in nature, suggesting social engagement and face-to-face contact as potential factors to be monitored and targeted through interventions and consultation to support the quality of life for young people with ADHD. Especially with clients who are undergoing major life events that are accompanied by significant disruptions in routine and support, akin to the COVID-19 pandemic, clinicians and practitioners must evaluate and facilitate the mental health of those with ADHD through validated and affirming practices (Danielsson et al., 2024; Swift et al., 2013).

Finally, although autistic young people did not demonstrate significant mental health symptomatology differences across pandemic presence conditions, this could have been a result of their profound levels of pre-pandemic social anxiety, depression, and loneliness (DeFilippis, 2018; Ee et al., 2019; Spain et al., 2018). These heightened levels of mental health symptoms could not have left much room for impact

by the pandemic and its related societal consequences. As such, it is still important to promote person-centered, neurodiversity-affirming awareness and understanding of autism to enhance care and socioemotional well-being for autistic individuals both within and outside of clinical settings (Graf-Kurtulus & Gelo, 2024; Linden et al., 2023).

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Ethical Considerations

The Institutional Review Board at the University of California, Los Angeles, approved the use of this data for secondary analysis for the purpose of this research.

Consent to Participate

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