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The Role of ACEs and Discrimination on Mental Health: A Longitudinal Analysis Among College Students

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ABSTRACT

Both adverse childhood experiences (ACEs) and perceived discrimination have been found to impact mental health in adults, but less is understood about the ways they interact to affect anxiety and depression symptoms. In the spring and summer of 2020, there were large societal changes stemming from the COVID-19 pandemic and social and racial justice movements in the United States. The current study aimed to characterize the interactive associations of ACE history and perceived discrimination with mental health in a sample of college students assessed prior to the pandemic in the fall of 2019 and then again in the fall of 2020. Results showed that in 2019, greater discrimination and more ACEs were associated with greater anxiety/depression symptoms. In 2020, a negative interactive effect of ACE history and discrimination on mental health was found, such that for individuals with low ACEs, greater discrimination was associated with significantly greater anxiety/depression symptoms. We also found that increases in perceived discrimination from 2019 to 2020 were significantly positively associated with increases in anxiety/depression symptoms over that same time period. The findings highlight the significant impacts that both ACEs history and perceived discrimination have on mental health and suggest that experiences of discrimination should be thought of as a critical, dynamic factor impacting college students' mental health.

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Introduction

Adverse childhood experiences (ACEs) are a form of stressor that occur during childhood. Such experiences include psychological, physical, or sexual abuse, witnessing domestic violence, living with a family member with a substance use disorder or who is mentally ill, or having a parent or caregiver leave due to abandonment, incarceration, or death (Felitti et al., 1998). ACEs have been consistently linked to a range of negative outcomes, such as poorer health, poorer sleep, increase in substance use problems, a greater likelihood of

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experiencing mental health disorders such as depression and anxiety, and increased risk of attempted suicide (see Petruccelli et al., 2019 for review). Although ACEs occur before the age of 18, these experiences can have a negative impact on mental health during emerging adulthood, such as among college-aged students (see Counts & John-Henderson, 2023 for review).

From the perspective of a *diathesis-stress model* (McKeever & Huff, 2003), ACEs may serve as an ecological vulnerability factor that increases sensitivity to the impact of subsequent stressors on mental health. This framework is sometimes described as the *stress sensitization model*, a version of the diathesis-stress model that posits that individuals who experience early life stress subsequently have a lower threshold for developing mental health difficulties in the face of new stressors (Hammen et al., 2000). One stressor that can interact with such a sensitivity later in life is discrimination, which is defined as an unfair treatment based on a membership in a marginalized social group, such as ethnicity, race, socio-economic status, etc. (e.g., Williams et al., 2019). Although discrimination is a stressor that also may be experienced from a young age (Goff et al., 2014), it is also one that can evolve or be experienced chronically throughout one's life (Anderson et al., 2022). The impact of discrimination on physical and mental health has been studied extensively, operating through numerous mechanisms (Carter et al., 2017; Williams et al., 2019). First, discrimination at a structural level can lead to more difficulties in life, such as making it more difficult to find work or housing or to access needed resources (Williams et al., 2019). Furthermore, it can have a weathering effect on indicators of physiological functioning and health (Coimbra et al., 2020; Korous et al., 2017), and one's beliefs about one's self-worth (Fischer & Holz, 2007). Perceived discrimination or believing yourself to be the target of discrimination in day-to-day situations, can harm one's sense of self, as it communicates that the perpetrator believes you to be lesser than them in some respect, which may threaten an individual's self-concept (Schmitt et al., 2014). These effects of discrimination can have intergenerational reaches as well, where parental experiences of discrimination can lead to cumulative stress that threatens parent–child relationships and the family's access to resources (Bernard et al., 2021).

While discrimination has been widely studied as a psychosocial stressor, there is limited research on discrimination's interaction with ACEs in the development of psychological distress. Individuals who experience more forms of ACEs report greater experiences of both daily and lifetime discrimination (Campbell et al., 2020), possibly due to structural inequalities that co-exist in the United States. For instance, children who experience poverty, utilize public health insurance, or have special healthcare needs are at increased risk of ACE exposures (Crouch et al., 2019). Some researchers suggest that experiencing discrimination is itself an ACE, as more forms of

discrimination are being understood within a traumatic-stress framework (Bernard et al., 2021). However, ACEs have the distinction of occurring in childhood during developmentally sensitive periods, whereas discrimination can remain a chronic stressor across the lifespan.

Because of the overlap in systemic risk factors that may lead to both experiencing ACEs and discrimination, understanding their combined effect on mental health is critical. To date, though, research on the relationship between ACEs and discrimination in their impact on mental health is limited. A recent study found that discrimination mediated the association between ACEs and psychological distress in adulthood (Gangamma et al., 2020). Another study of young adults showed that the combined effect of ACEs and discrimination on mental health was greater than if each effect were simply added together (Helminen et al., 2022). These findings indicate the need to study ACEs and discrimination in tandem, but more research is clearly needed.

In line with the diathesis-stress theory, periods of increased stressors offer unique research contexts, as they provide the opportunity for stress sensitization models to be tested via a natural experiment. In March 2020, the United States declared a national emergency related to the COVID-19 pandemic, with major travel bans put in place and stay-at-home orders enacted in a majority of states (A Timeline, 2021; Kushner, 2015; Mervosh et al., 2020). This led to an increase in daily stressors for many individuals, as routines changed and uncertainty about health, safety, and the future grew. The COVID-19 pandemic had many downstream effects related to discrimination, including an increase in hate crimes toward Asian Americans in 2020 (The United States Department of Justice, 2021) and differential treatment of the elderly, who were more vulnerable to the serious effects of the virus (Donizzetti & Lagacé, 2022). The pandemic also led to changes in socioeconomic changes and shifts in work practices, which disproportionately negatively impacted women (Fortier, 2020). Concurrently, the summer of 2020 saw a massive shift in how individuals in the USA and around the world understood and discussed racism and other forms of discrimination after the killing of George Floyd by police. In a report from the FBI, anti-Black hate crimes increased by 49% between 2019 and 2020 (The United States Department of Justice, 2022). While the largest rates of hate crime increases were attributed to race/ethnicity/ancestry, there were also increases in incidents related to gender and gender identity between 2019 and 2020 (The United States Department of Justice, 2022). Although these statistics only capture reported hate crimes, it is plausible that incidents of perceived day-to-day discrimination also increased in 2020.

The current study sought to characterize the interactive associations of ACE history and perceived discrimination with mental health, to examine whether these associations differed as a function of amplified national-level stressors

and to examine the changes over time. We tested these questions on a sample of college students assessed in both 2019 (prior to the COVID-19 pandemic) and 2020 (after the onset of the COVID-19 pandemic). Specifically, we evaluated depression and anxiety symptoms, as these symptoms are often linked to experiences of ACEs (see Counts & John-Henderson, 2023 for review) and discrimination (Livingston et al., 2020; Stein et al., 2019) and are the most prevalent disorders among a college sample (Eisenberg et al., 2013). We hypothesized that both perceived daily discrimination and levels of overall depression and anxiety symptoms would increase from 2019 to 2020. We then evaluated the associations between a history of ACEs and discrimination with depressive and anxiety symptoms using data from both time points. Based on previous literature, we hypothesized that (1) more types of ACEs experienced and greater lifetime discrimination would be associated with higher levels of depression and anxiety in both years; (2) ACEs and discrimination would interact in predicting overall symptoms in both years, such that associations of discrimination with symptoms would be stronger in the context of ACEs; (3) there would be a stronger synergistic association between ACEs and discrimination on symptoms in 2020 compared to 2019 due to increased national-level stressors; and (4) that ACEs would interact with the change in discrimination between 2019 and 2020 to significantly predict change in anxiety and depression from 2019 to 2020, and such greater increases in discrimination would be a stronger predictor of increases in symptoms among those with higher ACE scores.

Method

Procedure and participants

The current study is a secondary data analysis from a larger parent study. First-time freshman undergraduates at a large public Mid-Atlantic University enrolled in a longitudinal cohort study examining health, health behaviors, and mental health as predictors of college completion and the influence of individual factors on student mental health, physical health, and wellbeing (Cuellar et al., 2021). Participants were recruited through flyers outside of classrooms, brief presentations given in classes, and to select student organizations, online video, postcards distributed in class, and e-mail. Informed consent was obtained from all participants. Participants completed an online survey measuring physical and emotional health, nutrition, sleep, civic engagement, and academic success. They also completed an in-person visit to the university's public health clinic where they were asked about their medical history and underwent a physical exam. Participants were asked to participate in the study for 4 years, completing an online survey once per semester and the in-person visit the fall semester for their first and fourth year of participation.

Table 1. Sample demographic characteristics ($n = 316$).

	n (%)
Gender identity	
Male	102 (32.3%)
Female	212 (67.1%)
Gender Non-conforming	2 (0.6%)
Sexual Identity	
Heterosexual	246 (78.3)
Gay or Lesbian	12 (3.8)
Bisexual	41 (13.1)
Unsure	13 (4.1)
Other	2 (0.6)
Race/Ethnicity	
White/Non-Hispanic or Latinx	112 (35.6)
Hispanic or Latinx	41 (13.0)
African American or Black	38 (12.1)
Asian/Pacific Islander	83 (26.3)
2 or more races	28 (8.9)
Other	13 (4.1)
Subjective appraisal of income	
Not enough [money] to get by	10 (3.2)
Just enough to get by	88 (28.3)
Only have to worry about money for fun and extras	164 (52.7)
Never have to worry about money	49 (15.8)

The study procedures were approved by the university's Institutional Review Board.

Participants in the current study were those who completed surveys during the Fall of 2019 and Fall of 2020. The initial sample consisted of 349 first-year undergraduate students who completed the study survey in Fall 2019. Full sample characteristics are shown in Table 1. The majority of the 2019 sample identified as female (67.1%), and 2 participants identified as a gender other than male or female. The sample included 35.4% non-Hispanic White, 26.3% Asian/Pacific Islander, 12.0% Black or African American, and 13.0% Hispanic, with 13.0% of the sample identifying as of another race/ethnicity or as having two or more races. The participants ranged in age from 18 to 24 years ($M = 18.57$, $SD = 0.56$). The 2020 study sample is a subset of the original sample consisting of 128 students who completed the study surveys at both timepoints. Despite the attrition in the sample, participants who provided data at both timepoints did not differ significantly from participants who only completed time 1 on demographic variables (χ^2 scores ranged from 0.07 to 6.05, ps $> .05$). There were also no differences between groups on total ACEs ($t = 0.34$, $p > .05$), total perceived discrimination ($t = 0.81$, $p > .05$) or total anxiety/depression symptoms ($t = 0.57$, $p > .05$).

Measures

Demographics questionnaire

Study participants completed a demographics questionnaire collecting information related to their gender, sexual identity, race, ethnicity, and income, among other information.

Adverse Childhood Experiences (ACEs)

Adverse childhood experiences were assessed using a measure adapted from the CDC-Kaiser Permanente ACE Study (Felitti et al., 1998) that assessed maltreatment and other adverse experiences before the age of 18. This measure was administered during the baseline (Fall, 2019) survey only. The adapted measure consists of 10 items assessed using a frequency-based Likert scale. To remain consistent with the typical ACEs measure, we converted responses on each item to dichotomous scores of 0 (*No, has not happened to me*) or 1 (*Yes, has happened to me*). One item was administered incorrectly and had to be removed, leaving nine items representing experiences of various adverse childhood experiences. In our sample, total scores ranged from 0 to 8, with higher total scores indicating a greater number of types of ACEs experienced. Prior research has shown that the effects of ACEs tend to become most significant at the level of four ACEs or more, although many researchers also treat ACEs scores continuously (Petruccelli et al., 2019).

Everyday Discrimination Scale (EDS)

The Everyday Discrimination Scale (Sternthal et al., 2011) was administered in 2019 and 2020. The EDS measures lifetime experiences of perceived discrimination in a number of domains and perceived reasons for experiences of discrimination. The scale consists of five items that ask participants to indicate the frequency with which unfair treatment in interpersonal experiences occurs (e.g., "You receive poorer service than other people at restaurants or stores"; "You are treated with less courtesy than other people are"). Responses are rated on a 6-point scale from 0 (*Never*) to 5 (*Almost every day*). Participants are then prompted to attribute the main reason for these experiences and are allowed to select as many options as apply (i.e., gender, race, age, religion, education or income level, height, weight, ancestry or national origins, some other aspect of physical appearance, or other). As we were interested in a broad range of discrimination experiences, we used a total perceived discrimination frequency score, created by summing across the five items, without accounting for perceived reason for discrimination. The measure had an acceptable internal consistency in 2019 ($\alpha = .75$) and 2020 ($\alpha = .78$).

Patient-Reported Outcomes Measurement Information System (PROMIS)

The PROMIS scale assesses patient functioning across various domains of well-being. The PROMIS items reliably assesses sadness, anxiety, and anger with low participant burden (Pilkonis et al., 2011). Respondents report their feelings of these emotions over the past 7 days utilizing a 5-point Likert scale from 1 (*never*) to 5 (*always*). Given the high overlap in anxiety and depression symptoms, and the broad interest of our study in overall psychological symptoms, the 8-item anxiety subscale, and 8-item sadness subscale were combined to calculate a total score for anxiety/depressive symptoms, where a higher

score indicated more symptoms of anxiety and depression over the past week. The internal consistency was excellent for the combined scales in 2019 (α = .96) and 2020 (α = .97).

Data analysis

Thirty-three participants were excluded from the study sample due to incomplete data, resulting in a total sample size of 316 in 2019 and 128 in 2020. A subset of the sample was missing data for three items of the PROMIS anxiety and sadness scales. Linear interpolation was used to replace these data. After calculating descriptive statistics, bivariate correlations of ACEs, discrimination, and anxiety/depression symptoms were examined at each timepoint (ACEs was only collected in 2019). Paired sample *t*-tests were run to assess whether discrimination or mental health symptoms changed significantly between 2019 and 2020.

To test the main research questions, we ran three moderated linear regression models. Each regression was conducted using Model 1 from the SPSS PROCESS Macro, with 1000 bootstrap resamples (Hayes, 2017). The PROCESS Macro combines ordinary least-squares regression and bootstrapping methods, which increase statistical power and do not require normal distribution assumptions (Hayes, 2017). All main effect variables were mean-centered prior to running the regression to improve the interpretability of the interaction terms and reduce the risk of multicollinearity. The first two regression models tested the main effects of and interaction between ACEs and perceived discrimination in predicting total anxiety/depression symptoms to test hypotheses 1 through 3 above. One regression used variables from 2019, and the second used variables from 2020 (except ACEs, which were assessed in 2019 only). The final regression model was run to examine hypothesis 4 and tested the main effects of and interaction between ACEs (2019) and the residualized change score of discrimination from 2019 to 2020 as predictors of the residualized change score of total anxiety/depression symptoms from 2019 to 2020. The residualized change scores allowed us to examine whether ACEs and changes in discrimination between 2019 and 2020 were associated with changes in anxiety/depression symptoms over the same time period. When a significant interaction was detected, the Johnson-Neyman procedure was used to identify at which levels of the moderator (ACEs) the association between discrimination and symptoms became significant (Johnson & Neyman, 1936). To visualize the simple slopes for any significant interactions, the slopes were plotted at one standard deviation above and below the mean for ACEs. Of note, we ran all analyses first with the ACEs variable treated as continuous. Subsequently, we re-ran analyses with

a dichotomous version of the ACEs variable (less than 4 ACEs vs. 4 or more ACEs), to detect whether effects differed based on the operationalization of the variable. Because no differences in patterns of significance and associations were detected, we report the results with the continuous ACEs variables.

Results

Sample characteristics

In the full 2019 sample, 61.4% of the participants reported having experienced at least one ACE before age 18, and approximately 16% of the sample reported experiencing 4 or more ACEs ($M = 1.60$, $SD = 1.80$). The most commonly reported ACEs were emotional abuse and emotional neglect (see Table 2).

In the full 2019 sample, 82.6% of the participants reported experiencing instances of discrimination ($M = 4.64$, $SD = 3.94$). When asked what they thought was the main reason for experiences of discrimination, 72.8% reported more than one reason. The most frequently reported reasons for discrimination were gender, race, and age (see Table 2). In 2020, 80.8% of the sample reported experiences of discrimination ($M = 4.61$, $SD = 3.97$). See Table 3 for descriptives of all key variables.

Table 2. Endorsement of the ACEs and perceived discrimination ($n = 316$).

Total # of ACEs	n (%)	
0	122 (38.6)	
1	60 (19.0)	
2	51 (16.1)	
3	32 (10.1)	
4 or more	51 (16.0)	
ACEs type		
Emotional abuse	103 (34.4)	
Physical abuse	38 (12.8)	
Sexual abuse	18 (5.8)	
Emotional neglect	103 (33.0)	
Physical neglect	17 (5.4)	
Parental divorce/loss	65 (20.7)	
Family member substance use	52 (16.5)	
Family member mental illness	86 (27.3)	
Family member in prison	25 (7.9)	
Discrimination type	2019	2020
Ancestry or National Origins	47 (14.9)	23 (18.9)
Gender	143 (45.3)	69 (56.6)
Race	132 (41.8)	47 (38.5)
Age	111 (35.1)	52 (42.6)
Religion	39 (12.3)	18 (14.8)
Height	39 (12.3)	19 (15.6)
Weight	35 (11.1)	17 (13.9)
Physical Appearance	73 (23.1)	34 (27.9)
Education or income level	29 (9.2)	14 (11.5)
Other	33 (10.4)	8 (6.6)

Note: Percentage reported is the Valid Percent.

Table 3. Descriptive and bivariate correlations between key variables.

Variables	M(SD)	Total ACEs	Discrim 2019	Discrim 2020	Anx/Dep 2019	Anx/Dep 2020
Total ACEs	1.60(1.80)		.24**	.22*	.18**	.21**
Discrim 2019	4.64(3.94)			.54**	.15**	.08
Discrim 2020	4.61(3.97)				.06	.23**
Anx/Dep 2019	20.14(14.20)					.62**
Anx/Dep 2020	22.24(17.53)					

Note: Total ACEs = sum composite of ACEs endorsed, Discrim 2019 = total discrimination score from 2019 dataset, Discrim 2020 = total discrimination score from 2020 dataset, Anx/Dep 2019 = total anxiety and depressive symptoms from 2019 dataset, Anx/Dep 2020 = total anxiety and depressive symptoms from 2020 dataset.
*$p < .05$. **$p < .01$.

Bivariate correlations

Bivariate correlations among variables are reported in Table 3. Total discrimination in 2019 and 2020 was significantly positively correlated, as was total anxiety/depression in 2019 and 2020. Total discrimination in 2019 was significantly correlated with anxiety/depression in 2019, but not 2020. In the same way, 2020 total discrimination was correlated with 2020 anxiety/depression, but not 2019 scores. Total ACEs were significantly correlated with total discrimination and total anxiety/depression at both time points.

Paired T-Tests (change in discrimination and mental health between 2019 and 2020)

Total discrimination scores did not change significantly from 2019 to 2020 (paired $t = 0.80$, $p > .05$). Total anxiety/depressive symptoms varied greatly between individuals and ranged from 0 to 62 in 2019 and from 0 to 64 in 2020. Total anxiety/depression did not differ significantly within individuals between 2019 and 2020 (*paired* $t = 0.57$, $p > .05$).

Regressions

The overall regression model of 2019 symptoms onto ACEs (2019) and discrimination (2019) was significant ($F[3,312] = 5.61$, $p < .001$; $R^2 = .05$). Both the main effects of ACEs and discrimination on symptoms were positive and significant, but the interaction was not significant (see Table 4). The overall regression model of 2020 symptoms onto ACEs (2019) and discrimination (2020) was significant ($F[3,124] = 4.71$, $p < .01$; $R^2 = .10$). The main effect of 2020 discrimination experiences was significant, while ACEs were not, and the interaction between discrimination and ACEs was negative and significant, explaining 3.68% of the additional variances above and beyond the two main effects (see Table 4). For individuals with low or average ACEs, there was a significant positive relationship between discrimination and symptoms, whereas the association was nonsignificant for those with higher numbers of reported ACEs. As

Table 4. Summary of regression analysis predicting total depression and anxiety.

	2019 Model		2020 Model	
Variable	*B*	*SE*	*B*	*SE*
Intercept	20.60***	0.80	22.75***	1.52
EDS	0.46*	0.20	0.90*	0.38
ACEs	1.29**	0.45	1.60	0.91
EDS * ACEs	−0.17	0.11	−0.55*	0.25

Note: EDS = Everyday Discrimination Scale total score; ACEs = Adverse Childhood Experiences Scale total score; EDS is measured in 2019 and 2020 respectively.
*$p < .05$. **$p < .01$. ***$p < .001$.

shown in Figure 1, those who experienced a higher number of ACEs reported greater symptoms, regardless of the level of discrimination experienced. The Johnson-Neyman procedure indicated that the association between discrimination and symptoms was significant below an ACE score of 1.88.

Finally, the regression of residualized change in symptoms onto ACEs (2019), residualized change in discrimination, and the interaction between ACEs and residualized change in discrimination was significant ($F[3, 119] = 3.03$, $p < .05$; $R^2 = .07$). Residualized change in discrimination in 2020 was a significantly positive predictor, whereas the main effect of ACEs and the interaction between ACEs and discrimination were nonsignificant (see Table 5).

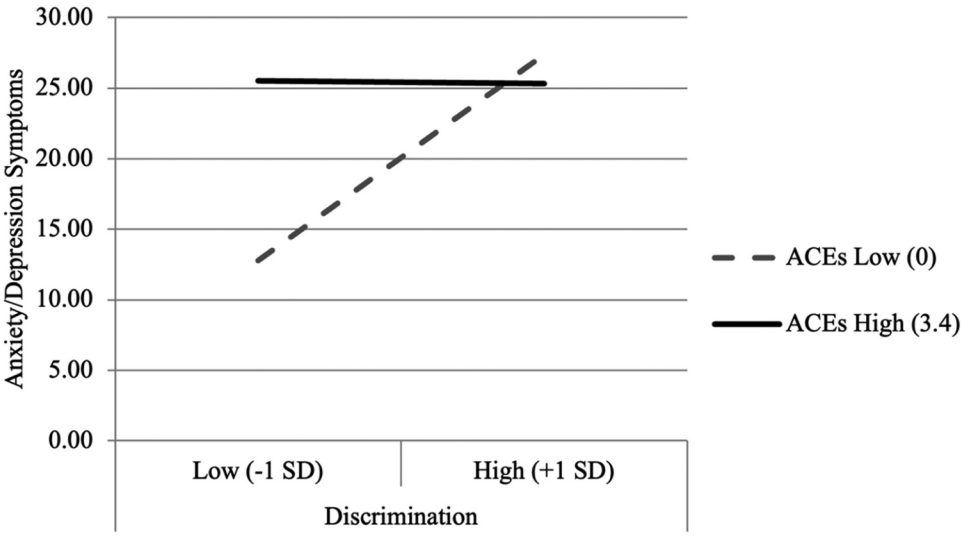

Figure 1. Interaction of discrimination and ACE history on anxiety/depression symptoms in 2020.
Note: The figure shows the association of discrimination with anxiety/depression symptoms at the minimum level of ACEs (0), which was slightly less than 1 SD below the mean due to skew, and a value of 3.4 ACEs, which was 1 SD above the mean number of ACEs.

Table 5. SuMmary of regression analysis predicting change in anxiety/depression between 2019 and 2020.

Variable	*B*	*SE*
Intercept	−0.01	0.01
Change in EDS	0.24**	0.09
ACEs	0.04	0.05
Change in EDS * ACEs	−0.05	0.05

Note: Change in EDS = residualized change in Everyday Discrimination Scale total score between 2019 and 2020; ACEs = Adverse Childhood Experiences Scale total score in 2019.
*$p < .05$. **$p < .01$. ***$p < .001$.

Discussion

The first goal of the present study was to characterize the concurrent influences of ACE history and discrimination on mental health in a sample of college students between 2019 and 2020. We also sought to determine whether changes in experiences of discrimination from 2019 to 2020 interacted with ACEs to explain changes in mental health over this same time period. Broadly, we found that, although mean levels of discrimination and mental health did not change between 2019 and 2020, the way that ACEs and discrimination interacted to impact mental health did. We also found that changes in discrimination across the year predicted changes in anxiety/depression symptoms during the same time frame.

In both 2019 and 2020, discrimination experiences were associated with reported mental health difficulties, and those who reported more experiences of discrimination also reported greater anxiety/depression symptoms. ACEs also had a significant main effect on mental health symptoms in our 2019 sample. The main effect was not significant in the smaller 2020 sample, which may have been due to limited power to detect the effect. Overall, these findings are consistent with the literature, which has demonstrated that both ACEs and experiences of discrimination are associated with more mental health difficulties among college students (Carter et al., 2017; Karatekin, 2018; Lemon et al., 2021; Manyema et al., 2018; Williams et al., 2019).

We found that the way that discrimination and ACEs interacted in association with mental health differed between 2019 and 2020. Using data collected in 2019, we found an additive effect of discrimination and ACEs on mental health. Additive models of stressors and dispositional traits suggest that the combined effects of two stressors are equal to the sum of each of their separate effects (Kushner et al., 2015). This finding suggests that ACEs and discrimination similarly serve as stressors that can cumulatively impact mental health, rather than ACEs representing a dispositional vulnerability that makes an individual more susceptible to exacerbating the effects of subsequent discrimination-based stress on mental health.

Using data from the fall of 2020, we found that ACEs and discrimination had an antagonistic effect on mental health. Antagonistic effects occur when both predictors are associated with an outcome variable in the same direction, but their interaction is associated in the opposite direction (Cohen et al., 2013). This type of effect indicates that each construct is associated with an outcome in the same manner, but the combined effect of the two constructs is less than the sum of their individual effects. In our sample, the experience of ACEs and the experience of discrimination were both associated with greater levels of anxiety/depression symptoms. However, individuals who experienced a higher number of ACEs reported high levels of anxiety/depression symptoms, regardless of their reported discrimination. The reverse was also true. This finding differs from Helminen et al. (2022), who found a synergistic interaction effect between ACEs and experiences of discrimination.

These findings are less consistent with a diathesis-stress model, in which we expected the effect of stress (discrimination) to be stronger in the context of a maladaptive diathesis (ACEs). Instead, our results are more in line with a *social push model* (Raine, 2002), which suggests the effect of maladaptive predispositions or vulnerabilities (such as ACEs) are strongest in low-stress (low-discrimination) contexts. In our results, individuals who were low on ACEs only showed advantage over their high ACE counterparts when the frequency of discrimination experiences was low, representing a "low-stress context." In a higher stress context (e.g., greater frequency of perceived discrimination), individuals with low versus high ACEs reported equally high levels of mental health symptoms. This finding may also be understood through an *evolutionary-developmental framework*, which suggests that harsh, unpredictable environments may not exclusively impair functioning, but also allow individuals to become developmentally adapted for dealing with subsequent stressors (Ellis et al., 2017). It is possible that individuals with a history of ACEs developed adaptive functions to cope with the stressors that arose in 2020, so while they were generally more symptomatic on anxiety and depression, the subsequent stressor of discrimination did not have as large of an impact as it did on those without ACEs. It is also possible that based on the consistently high level of symptoms for those with high ACE scores that our results demonstrate a ceiling effect in anxiety/depression scores for our non-clinical sample.

Inconsistent with our hypotheses, average discrimination, and average mental health did not change significantly for the study sample from 2019 to 2020. However, we did find that a greater change in reported lifetime discrimination from 2019 to 2020 predicted worsening mental health in that same period. This result demonstrates that, even though there was not a significant change in individuals' experiences of overall discrimination across this year, the individual variability in that change was associated with individual variability in mental health. Our sample captured individuals both

during a vital life transition (i.e., starting college), but also during a period of dramatic changes in social context. Although our study did not directly measure these contextual factors, we collected data over a unique period that included increases in hate crimes, a shifting socioeconomic climate, significant political events, and increased social isolation due to COVID-19 precautions. It is possible that these contextual factors exacerbated mental health difficulties for those experiencing increased discrimination over the past year. Future research should measure social contextual factors to further support a life course perspective of discrimination.

Clinical implications

Although ACEs are more commonly being screened for in medical settings (Loveday et al., 2022), our findings show the importance of screening for discrimination experiences as well, as discrimination was associated with worse mental health symptoms in both 2019 and 2020. Our significant interaction also indicates that individuals reporting high levels of discrimination, even without any ACE history, may be dealing with anxiety and depression at levels similar to those with higher ACE scores. Without screening for discrimination, individuals who may report having few to no ACEs on briefer measures might not receive the same level of consideration for referrals and treatment for mental health issues, despite a possibly increased risk. Incorporating discrimination into screening could be accomplished by utilizing an expanded ACEs measure that captures experiences of discrimination (Bernard et al., 2021) or by adding a question regarding individuals' recent experiences of discrimination to current screening methods.

Expanding on the evolutionary-developmental framework, there may be value in considering coping mechanisms that individuals may have adopted in the face of early life adversity. It is possible that these adaptive processes could better prepare them to respond to subsequent stressors, such as experiences of discrimination. These resiliency factors may be beneficial to target during interventions for individuals with preexisting vulnerabilities. Research on resilience process interventions is growing, with some support that they can improve mental health and adaptive strategies for individuals with histories of adversity or trauma (Masten et al., 2021).

Limitations and future directions

There are several limitations that should be considered when interpreting study findings. Because ACEs by definition occur before the age of 18, they were measured via retrospective self-report in our sample, which may be less reliable than contemporaneous measurements or objective reports. It is also possible that report of ACEs and discrimination were biased by concurrent

anxiety/depression symptoms, which would have also artificially increased the association of ACEs with symptoms measured in 2019 (at the same timepoint) versus 2020 (1 year later). Our measure of discrimination captured both frequency of discrimination and allowed for individuals to report events due to a large set of perceived reasons for discrimination (e.g., gender, race, ancestry, age, weight). Because 2020, in particular, led to numerous social changes that impacted many groups, this allowed us to capture multiple forms of discrimination that may have occurred for our sample. The discrimination measure was limited in that it focused on interpersonal acts of discrimination and did not capture the effects of witnessing and hearing about discriminatory acts by individuals, or experiencing discrimination by systems (educational, legal, government). The effect of those experiences may have been particularly relevant in 2020 when individuals were often socially distancing, and perhaps less likely to experience frequent interpersonal interactions but still engaging with the world through social media and the news, as well as interacting with their school, workplace, and the government's response to the pandemic. Future research may benefit from incorporating other ways that discrimination can affect individual mental health, such as media exposures, or through structural forms of discrimination.

Finally, because our discrimination measure asked about lifetime experiences, we could not fully distinguish the time frame in which experiences of discrimination occurred for individuals, meaning that discrimination as measured in our sample may have represented early life adverse experiences as well as current stressors. Moreover, the sensitivity of this measure to detect change from 2019 to 2020 was limited by the lifetime nature of this scale. Future studies may benefit from characterizing the timing of experiences of discrimination and how those differentially impact mental health. Although factors that explain heterogeneity in the relationship between discrimination and mental health symptoms are not well understood (Mak et al., 2007), our 2020 sample size limited us from further exploring individual factors that may have predicted increases in anxiety and depression. Future research should consider the way that varying types of discrimination or intersectional identities interact with perceived discrimination in predicting mental health symptom changes.

Despite these limitations, our study was able to capture a subsample's experiences of discrimination and anxiety/depression symptoms across 2019 and 2020, providing us with a unique look at how context may have shifted the relationships of ACEs and discrimination with mental health symptoms. The findings from this study have important implications for the way we understand the interaction between ACEs and discrimination, which are often comorbid. Experiences of ACEs can increase vulnerability for subsequent mental health difficulties but may not always interact with later stressors to worsen mental health in an

additive or synergistic way. There may be times when ongoing personal or cultural contextual factors are more impactful on mental health, outweighing the effects of ACE history. Changes in an individual's experience of discrimination over time may be critical in understanding changes in anxiety and depression symptomatology. Future research that continues to explore the relationships among ACEs, discrimination, and mental health, while accounting for possible protective or exacerbating factors, can improve our ability to identify and provide resources to those most vulnerable.

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No potential conflict of interest was reported by the authors.

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