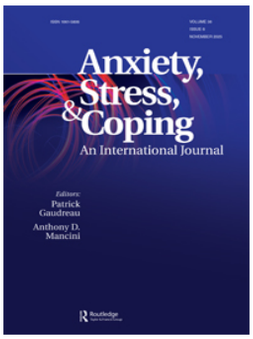

Routledge
Taylor & Francis Group

Anxiety, Stress, & Coping
An International Journal

ISSN: 1061-5806 (Print) 1477-2205 (Online) Journal homepage: www.tandfonline.com/journals/gasc20

Cross-sectional and longitudinal influences of stress mindset on adolescent depressive symptoms and cannabis use

Kendra L. Wilson, Bethany L. Boettner, Ping Bai, Dylan D. Wagner, Jodi L. Ford, Christopher R. Browning & Baldwin M. Way

To cite this article: Kendra L. Wilson, Bethany L. Boettner, Ping Bai, Dylan D. Wagner, Jodi L. Ford, Christopher R. Browning & Baldwin M. Way (2025) Cross-sectional and longitudinal influences of stress mindset on adolescent depressive symptoms and cannabis use, Anxiety, Stress, & Coping, 38:6, 607-621, DOI: 10.1080/10615806.2025.2507094

To link to this article: https://doi.org/10.1080/10615806.2025.2507094

ANXIETY, STRESS, & COPING
2025, VOL. 38, NO. 6, 607–621
https://doi.org/10.1080/10615806.2025.2507094

Routledge
Taylor & Francis Group

Cross-sectional and longitudinal influences of stress mindset on adolescent depressive symptoms and cannabis use

Kendra L. Wilson[a], Bethany L. Boettner[b], Ping Bai[a], Dylan D. Wagner[a], Jodi L. Ford[b,d], Christopher R. Browning[b,c] and Baldwin M. Way[a,e]

[a]Department of Psychology, Ohio State University, Columbus, OH, USA; [b]Institute for Population Research, Ohio State University, Columbus, OH, USA; [c]Department of Sociology, Ohio State University, Columbus, OH, USA; [d]College of Nursing, Ohio State University, Columbus, OH, USA; [e]Institute for Behavioral Medicine Research, Ohio State University, Columbus, OH, USA

ABSTRACT

Background and Objective: A stress-is-enhancing mindset refers to viewing the nature of stress as enhancing rather than debilitating and has been linked to better mental health in response to stressors. We examined the cross-sectional and longitudinal link between stress mindset and two mental health outcomes, depressive symptoms and cannabis use, over the COVID-19 pandemic in a diverse sample of adolescents.

Design and Methods: A community sample of adolescents completed measures assessing depressive symptoms, cannabis use, and intentions to use cannabis at three time points (T1: 2018-2020, N = 299, T2: 2020, N = 219, T3: 2021, N = 173). Participants completed the stress mindset measure at T2.

Results: Cross-sectionally, a more stress-is-enhancing mindset was associated with fewer depressive symptoms and reduced intentions to use cannabis, which in turn were associated with less cannabis use. Longitudinally, a more stress-is-enhancing mindset was associated with fewer depressive symptoms and indirectly associated with less future cannabis use through behavioral intentions to use cannabis.

Conclusion: This study establishes a stress-is-enhancing mindset as a protective factor against cannabis use and contributes to a growing literature that stress mindset is protective against depression, indicating that stress mindset may be an important protective factor even in the face of naturalistic, chronic stressors.

ARTICLE HISTORY
Received 7 June 2024
Revised 30 April 2025
Accepted 12 May 2025

KEYWORDS
Stress; Stress mindset; Depression; Substance use; Mental health; COVID-19 pandemic

Introduction

The global coronavirus (COVID-19) outbreak was a pandemic that profoundly impacted daily life, particularly for children and adolescents who experienced this stressor during a crucial period of development and social learning. Adolescents missed out on many formative social experiences such as graduation ceremonies and proms, while also facing serious challenges like economic insecurity and deaths of loved ones. Such negative experiences presumably contributed to the adverse mental health effects of the COVID-19 pandemic, as adolescents were more likely to experience depression after the pandemic than before (Meherali et al., 2021). The US surgeon general released

CONTACT Kendra L. Wilson wilson.2494@osu.edu Department of Psychology, Ohio State University, Columbus, OH, USA
Supplemental data for this article can be accessed online at https://doi.org/10.1080/10615806.2025.2507094.
This article has been corrected with minor changes. These changes do not impact the academic content of the article.

an advisory at the end of the pandemic calling youth mental health a "crisis," driven in part by the pandemic and subsequent lockdowns (Office of the Surgeon General (OSG), 2021)

Stressful life events like those experienced during the COVID-19 pandemic are known drivers of poor mental health, but individual differences can significantly influence whether stressful events lead to poor mental health (Hammen, 2005). Mindsets are a set of beliefs that form a "lens" through which individuals make sense of their experiences, and can subsequently influence cognition, affect, and behavior in response to those experiences (Burnette et al., 2013; Crum et al., 2013). Stress mindset refers to whether an individual believes that the broader nature of stress is enhancing or debilitating (Crum et al., 2013). Stress mindset can influence the way stressful life events are experienced by orienting an individual to focus on either the positive or negative effects of stress in a manner congruent with their mindset toward stress (Crum et al., 2017). In studies involving lab-based stressors, stress mindset has been linked to endocrine responses (Crum et al., 2013) and positive affect in response to stress (Crum et al., 2017). A more stress-is-enhancing mindset predicts more adaptive responses to stress and a more stress-is-debilitating mindset predicts more negative reactivity to stress.

Stress mindset and depression

Recent work has begun to examine the ability of a stress-is-enhancing mindset to buffer against negative mental health effects of naturalistic stressors as well. In cross-sectional studies, holding more positive beliefs about the nature of stress has been linked to fewer depressive symptoms in response to stressful life experiences and chronic pain (Chen & Qu, 2021; Grünenwald et al., 2023). A stress-is-enhancing mindset also attenuated the effect of perceived stress on depression (Huebschmann & Sheets, 2020; Jenkins et al., 2021; Jiang et al., 2019; Taouk et al., 2022). This work provides promising indications that stress mindset may influence downstream mental health consequences of stress like depressive symptoms. Although there have been several studies suggesting that stress mindset can moderate the effects of stressors on depressive symptoms over one or several months (Crum et al., 2023; Huebschmann & Sheets, 2020; Taouk et al., 2022), there is less of an evidence base as to whether or not stress mindset can influence the effects of chronic stressors on changes in mental health over time, particularly for time periods longer than a few months.

While prior work has investigated the relationship between stress mindset and depression amongst college students (Huebschmann & Sheets, 2020; Jenkins et al., 2021) only one study to our knowledge has examined this link in a non-college adolescent sample (Jiang et al., 2019). Thus, more work is needed investigating these effects in a wider variety of adolescent samples. Therefore, our first research question was to determine if the cross-sectional relationship between stress mindset and depressive symptoms replicated in a community-based adolescent sample and if this relationship held over time in response to a chronic stressor (the COVID-19 pandemic and its lifestyle disruptions).

Stress mindset and cannabis use

Beyond influencing risk for depression, exposure to chronic stressors like the COVID-19 pandemic can impact other mental health outcomes such as cannabis use (Cavalli & Cservenka, 2021). Adolescents are a particularly important group in which to study this process. Past work has found that adolescent-onset cannabis use has harmful longitudinal effects on cognitive development (Meier et al., 2012), the likelihood of using other substances (Coffey & Patton, 2016), and the development of mental health disorders (Degenhardt et al., 2013; Godin & Shehata, 2022). One pathway by which chronic stressors can lead to increased cannabis use is through avoidant coping strategies, where individuals attempt to shift their focus away from the stressor instead of confronting it directly (Folkman & Lazarus, 1988). Avoidance coping has been linked to higher lifetime cannabis use (Lee-Winn et al., 2018) and adolescents are increasingly using cannabis as a method of coping with stressors (Patrick et al., 2024). In contrast, a stress-is-enhancing mindset, where stress is

viewed as something that should be approached rather than avoided, has been linked to more engagement and less avoidance coping strategies in response to stressors (Crum et al., 2013). Holding a stress-is-enhancing mindset led to less use of avoidant coping strategies, which in turn was associated with fewer depressive symptoms in a sample of migrant children and adolescents vulnerable to heightened stress (Chen & Qu, 2021). Furthermore, an intervention that led to increases in a stress-is-enhancing mindset was associated with decreased substance use as an avoidant coping strategy (Nguyen et al., 2023). Studies examining the associations between stress mindset, chronic stressors, and avoidance coping provide preliminary evidence that a more stress-is-enhancing mindset may reduce substance use in response to stress. Rather than focus on avoidance coping as in prior work, the present work extended these findings by examining the direct link between stress mindset and cannabis use during a chronic stressor (COVID-19). Therefore, our goal was to assess the association between stress mindset and cannabis use more directly. Our second research question asked whether stress mindset was associated with cannabis both cross-sectionally and over the stressful period of the COVID-19 pandemic.

Pathways to cannabis use

One driver of adolescent cannabis use can be situated within the Theory of Planned Behavior, which highlights behavioral intentions as an antecedent to future behaviors (Ajzen, 1991). Intentions to engage in substance use have reliably predicted future substance use in adolescents (Huba et al., 1981). Furthermore, behavioral intentions to engage in future substance use can be influenced by stressful life events and an individual's response to them (Booker et al., 2008). Crucially, when an individual is more motivated to disengage from a stressor and utilize avoidant coping strategies, behavioral intentions to engage in risky self-soothing behaviors like cannabis use in response to the stressor may increase (McConnell et al., 2014). The present work examined whether there was a direct link between stress mindset and behavioral intentions. Therefore, our third research question was to determine if a more stress-is-enhancing mindset reduced intentions to use cannabis in the face of the chronic stress elicited by the COVID-19 pandemic.

Major depression is also a risk factor for cannabis use (Abraham & Fava, 1999; Crane et al., 2021; Markou et al., 1998; Wilkinson et al., 2016). This appears to have been true during the COVID-19 pandemic as well (Dumas et al., 2020; Romano et al., 2021) when adolescents did not have access to healthier coping mechanisms such as face-to-face gatherings, extracurriculars, and sports. Our final research question was to determine if depressive symptoms were a risk factor for heightened cannabis use in response to stress experienced during the pandemic and whether stress mindset influenced cannabis use through its known association with decreased depressive symptoms in response to stressors.

The current study

We addressed these questions by examining two chronic stress outcomes with known deleterious effects on mental health, depression and cannabis use, in a diverse community sample of adolescents during the COVID-19 pandemic. In addition, we investigated the association between stress mindset and cannabis use through two pathways: depressive symptoms and intentions to use cannabis in the future. We hypothesized that a stress-is-enhancing mindset would buffer against longitudinal increases in depression, which in turn would be associated with less cannabis use. We also hypothesized that those with a stress-is-enhancing mindset would be less likely to report intentions to use cannabis, which would predict less future cannabis use.

Method

Participants

Participants were drawn from three time points of the Adolescent Health and Development in Context (AHDC) longitudinal study of environmental and social factors on the development of

adolescents ages 12–22 in the greater Columbus, OH area. Ethics approval was obtained by the Social and Behavioral Sciences and the Biomedical Sciences Institutional Review Boards at Ohio State University. For detailed information on the AHDC sampling design, study area, and procedures, see (Boettner et al., 2019). In brief, the AHDC study was designed to improve understanding of how the contexts of adolescent development – including schools, residential areas, activity spaces, and social network ties – contribute to risk behavior and mental health. Recruitment information was mailed to households within the Columbus, OH Interstate 270 beltway that were likely to have an adolescent based on vendor provided lists as well as data from public school districts. This yielded 1405 adolescents in the first wave of the study, which was conducted between the spring of 2014 and the summer of 2016. The sample matched the income and racial demographics of the city of Columbus with the exception of a slightly higher proportion of Black youth in the original wave of the sample (Boettner et al., 2019). Wave 2 was fielded between January and December 2016. The sample was restricted to respondents who were under age 18 and due to funding constraints was limited to those for whom Wave 1 participation had occurred at least 9 months prior. Wave 3 commenced in July of 2018 and ended with the COVID-related research shutdown in March of 2020. In addition to participants recruited from the original sample, 117 youth in Wave 3 were newly recruited using the same methods from low-income census tracts as well as tabling at schools in these tracts. Due to the COVID-related research shutdown, recruitment was prematurely ended, and initial sample size goals were not able to be achieved. However, post-hoc power analyses confirm that all analyses were powered above 80% to detect small-to-medium effect sizes. Participants were included in longitudinal analyses if they had provided data for all three waves. Participants were included in cross-sectional analyses if they had provided data during Wave 4 when the stress mindset measure was first collected. Wave 3 (July 2018 to March 2020, referred to henceforth as T1) included 299 participants aged 12–20 (52% Black, 29% White, 10% Multiracial, 6% any Hispanic, 1% Asian, .3% Native American, 55% female, $M_{age} = 15.5$). Wave 4 (July 2020-November 2020; referred to henceforth as T2) included 219 participants aged 12–21 (54% Black, 31% White, 8% Multiracial, 6% any Hispanic, 1% Asian, 58% female, $M_{age} = 16.6$). Wave 5 (February 2021-July 2021; referred to henceforth as T3) included 173 participants aged 13–22 (50% Black, 34% White, 9% Multiracial, 6% any Hispanic, 1% Asian, 60% female, M_{age} 17.2).

Materials

Stress Mindset (T2). Participants responded to the youth version of the stress mindset measure (Crum et al., 2013) ($\alpha = .52$, see supplementary material). This eight-item measure assesses the degree to which participants find the broader nature of stress to be enhancing or debilitating. Participants responded to items using a five-point scale (0 = *Strongly Disagree*, 5 = *Strongly Agree*) including statements such as "The effects of stress are bad and I should avoid them" and "Stress helps me work hard and reach my goals."

Depressive Symptoms (T1, T2, and T3). Participants responded to the Center of Epidemiologic Studies Depression Scale, 10-item version (CES-D-10) developed by Andresen et al., 1994. (T1 $\alpha = .73$, T2 $\alpha = .72$, T3 $\alpha = .59$). This ten-item measure assesses the frequency of depressive symptoms over the past week. Participants responded to items using a 4-point scale (0 = *Rarely or none of the time, less than 1 d*, 4 = *Most, All of the time, 5–7 days*) including statements such as "I was bothered by things that don't usually bother me" and "I felt hopeful about the future" and depressive symptoms scores were calculated by taking the mean of these items.

Cannabis Use (T1, T2, and T3). To assess participants' cannabis use, they were asked a question derived from National Survey for Drug Use and Health and the Project for Human Development in Chicago Neighborhoods (PHDCN): "How often did you use marijuana (weed, pot) or hashish (hash, hash oil) in the last 30 days? This includes edibles, vaping, and smoking." Responses were on an ordinal scale with the following 6 items: "Never in the last month," "Once or a few times in the last month," "1-2 times a week," "3-4 times a week," "5-6 times a week," "Almost every day."

Behavioral Intentions to use Cannabis (T1, T2, and T3). To assess participants' intentions to use cannabis, participants responded to the item "do you intend to use marijuana in the next year?". Participants responded to this item using a 7-point scale (1 = *Definitely no,* 7 = *Definitely yes*).

Behavioral willingness is a distinct measure from behavioral intentions that predicts future risky behaviors in adolescents (Gibbons et al., 1998). Our analyses focused on behavioral willingness mirrored those of behavioral intentions. Given the near identical results using behavioral intentions and behavioral willingness, our results using behavioral willingness as a predictor variable and mediator variable are reported in the online supplementary material.

Procedure

During T1 (July 2018 to March 2020), an interviewer visited the participant's home and the adolescent participants as well as their primary caregivers responded to a battery of interview and self-report measures. Approximately one week later, participants came for an in-person research session at The Ohio State University and completed additional behavioral measures and self-report questionnaires. All participants gave informed consent or assent; a guardian provided permission for participants under 18 in accordance with the guidelines set by the Office of Responsible Research Practices at The Ohio State University. T2 (July 2020-November 2020) and T3 (February 2021-July 2021) were conducted entirely online due to the COVID-19 pandemic. T2 & T3 participants had also participated in T1 of the AHDC study and were recruited via phone by employees of CHRR (Center for Human Resource Research).

Analytic approach

To test our prediction that a more stress-is-enhancing mindset was *cross-sectionally* associated (i.e., at T2) with fewer depressive symptoms, cannabis use, and behavioral intentions to use marijuana, we conducted 3 independent multiple linear regressions with T2 stress mindset as the independent variable and sex (male = 1, female = 0), race (represented with two dummy variables with participants identifying as black or white as the included groups and participants identifying as other races as the excluded group), age, and household income as covariates. To test our hypothesis that a more stress-is-enhancing mindset was *prospectively* associated with fewer T3 depressive symptoms, cannabis use, and behavioral intentions to use cannabis, we conducted 3 independent multiple linear regressions with T2 stress mindset as the independent variable and sex, race, age, and household income as covariates. To test our hypothesis that a more stress-is-enhancing mindset was *longitudinally* associated with fewer depressive symptoms, cannabis use, and behavioral intentions to use cannabis, we conducted 3 independent multiple linear regressions identical to the prospective models, but with an additional predictor that measured our dependent variables (depressive symptoms, cannabis use, and behavioral intentions to use cannabis) at the first time point, which allowed us to model change over time in these measures as the dependent variable. For analyses with cannabis use as the outcome measure, we additionally conducted binary logistic regression models to examine the association between stress mindset and cannabis use measured dichotomously given the high degree of non-users. In our main pathway models, we similarly modeled cannabis use as a dichotomous measure due to the fact that most adolescents were non-users, in line with past work examining cannabis use in demographically similar samples (D'Amico et al., 2016; Patrick et al., 2024). To test our hypotheses that depressive symptoms and behavioral intentions to use cannabis mediated the effect of a more stress-is-enhancing mindset on current and future cannabis use, we conducted 5000-sample bootstrap mediation analyses using Model 4 of the PROCESS program (Hayes, 2017).

Results

See Table 1 for descriptive statistics and zero order correlations between study variables. Stress mindset, which was assessed only in T2, had a significant relationship with concurrent (T2) and

Table 1. Descriptive statistics and bivariate correlations.

Variable	*Mean*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1. T2 Stress Mindset	3.06	.52							
2. T1 Depressive Symptoms	1.90	.51	−.056						
3. T2 Depressive Symptoms	1.81	.48	−.263***	.453***					
4. T3 Depressive Symptoms	2.02	.42	−.229**	.267***	.455***				
5. T2 Cannabis Intentions	2.09	2.09	−.210**	.191**	.155*	.154*			
6. T2 Cannabis Use	.19	.39	−.147*	.155*	.188**	.055	.728***		
7. T3 Cannabis Intentions	2.51	2.62	−.162*	.180*	.151*	.210**	.748***	.672***	
8. T3 Cannabis Use	.28	.45	−.044	.073	.042	.142	.618***	.643***	.773***

* = $p < .05$, ** = $p < .01$, *** $p < .001$.

future measures of depressive symptoms (T3), but not retrospective measures of depressive symptoms (T1). Similarly, stress mindset was associated with concurrent cannabis use and cannabis use intentions as well as future cannabis use intentions. The relationship with future use did not reach statistical significance. Not surprisingly, there were robust associations between cannabis intentions and use at each wave and across waves.

Figure 1 Legend: Stress mindset is scored such that higher values represent a more stress-is-enhancing mindset. Similarly, for all other scales higher values represent more of the respective measure. T2 and T3 Marijuana use are dichotomized such that 1 = any use and 0 = no use.

Stress mindset and depression

Stress mindset and depressive symptoms measured cross-sectionally

As denoted in Table 1, there was a zero-order relationship between a stress-is-enhancing mindset measured at T2 and depressive symptoms measured at T2. To determine if the relationship between depressive symptoms and stress mindset was robust to the inclusion of covariates, we regressed depressive symptoms at T2 on stress mindset at T2. The overall model was significant ($R^2 = .10$, $F(6,197) = 4.81$, $p < .001$). Stress mindset was significantly associated with depressive symptoms ($\beta = -.27$, $t = -3.94$, 95%CI [−.38, −.13], $p < .001$) after adjusting for covariates (see Table 2, Model 1). For every one unit increase in stress mindset, depressive symptoms were expected to decrease by −.27 standardized units. T2 stress mindset was also a significant predictor of T2 depressive symptoms without demographic covariates included in the model ($\beta = -.26$, $t = -4.01$, 95%CI [−.36, −.12], $p < .001$).

Stress mindset and depressive symptoms measured longitudinally

We conducted regression analyses to predict future depressive symptoms and change in symptoms over time as a function of stress mindset. The zero-order relationship between T2 stress mindset and T3 depressive symptoms (Table 1), was robust to the inclusion of covariates ($\beta = -.20$, $t = -2.44$, 95% CI [−.29, −.03] $p = .016$). T2 stress mindset was also a significant predictor of T3 depressive symptoms without demographic covariates included in the model ($\beta = -.22$, $t = -3.07$, 95%CI [−.31, −.07], $p = .003$).

The overall model predicting change in depressive symptoms over time was also significant ($R^2 = .09$, $F(7,147) = 3.03$, $p = .005$). Stress mindset predicted change in depressive symptoms over time from T1, pre-pandemic, to T3, post-pandemic, after adjusting for covariates ($\beta = -.16$, $t = -1.94$, 95%CI [−.26, .002], $p = .054$) (see Table 2, Model 2). T2 stress mindset was also a significant predictor of change in depressive symptoms over time without demographic covariates included in the model ($\beta = -.21$, $t = -2.89$, 95%CI [−.29,−.06], $p = .004$).

Stress mindset, cannabis use, and intentions to use cannabis

Stress mindset and cannabis use measured cross-sectionally

Binary logistic regression models predicting T2 cannabis use from T2 stress mindset with cannabis use as a dichotomized variable provided mixed evidence as to the direct association between T2

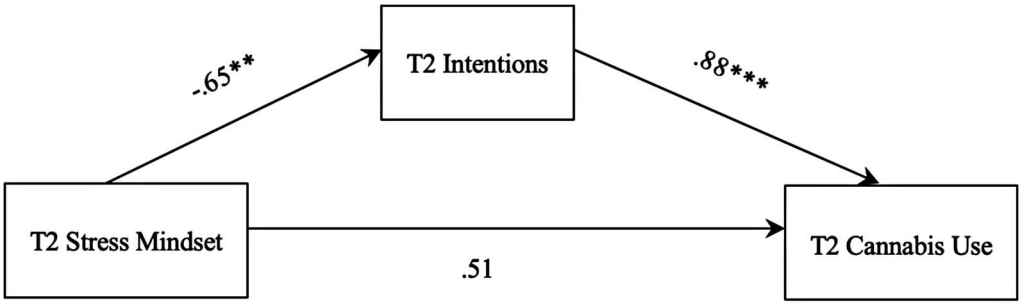

Figure 1. T2 Stress Mindset indirectly associated with less T2 Cannabis Use through T2 Behavioral Intentions to Use Cannabis. Higher values of T2 Stress Mindset indicate a more stress-is-enhancing mindset. Higher values of T2 Intentions indicate greater intentions to use cannabis, and higher values of T2 Cannabis Use indicate more cannabis use.

stress mindset and T2 cannabis use. As denoted in Table 1, there was a significant zero-order relationship between T2 stress mindset and T2 dichotomous cannabis use. Although the direct association between T2 stress mindset and dichotomous T2 cannabis was significant without covariates (B = −.87, p = .032, Exp(B) = .42), the association was marginally significant after adjusting for sex, race, and household income (B = −.78, p = .066, Exp(B) = .46). The direct cross-sectional effect of stress mindset on dichotomous cannabis use was no longer significant after adjusting for age (B = −.53, p = .233, Exp(B) = .59; Supplemental Table 2)

When cannabis use was measured continuously, there was a significant association between T2 stress mindset and T2 cannabis use that was robust to covariates. The overall linear regression model predicting T2 cannabis use from T2 stress mindset and demographic covariates was significant (R^2 = .09, F(6,196) = 4.33, p < .001) and the association between stress mindset and cannabis use measured continuously was significant after adjusting for covariates (β = −.16, t = −2.30, 95%CI [−.73, −.06], p = .022; Supplemental Table 3). T2 stress mindset was also a significant predictor of T2 cannabis use without covariates (β = −.21, t = −3.12, 95%CI [−.81,−.18], p = .002).

Stress mindset and cannabis use measured longitudinally

Binary logistic regression models assessing the association between stress mindset and dichotomous cannabis use at T2 and T3 were not significant. T2 stress mindset was not a significant predictor of prospective cannabis use at T3 (B = −.19, Exp(B) = .83, p = .572) nor was T2 stress mindset a

Table 2. Coefficients from linear regression models predicting T2 and T3 depressive symptoms.

		Model 1: Predicting T2 depressive symptoms cross-sectionally			Model 2: Predicting T3 depressive symptoms longitudinally	
Predictor	β	95% CI	p	β	95% CI	p
T2 Stress Mindset	−0.27	[−.383, − .127]	< .001	−0.157	[−.261, .002]	0.054
Age	−0.128	[−.057, .003]	0.072	−0.025	[−.037, .027]	0.769
Sex	−0.086	[−.213,, 046]	0.206	−0.148	[−.259, .006]	0.062
Household Income	0.13	[−.013, .149]	0.1	−0.01	[−.088, .079]	0.92
Dummy Race (white)	−0.14	[−.351, .061]	0.167	0.135	[−.095, .333]	0.274
Dummy Race (black)	−0.213	[−.388, − .023]	0.028	−0.013	[−.201, .179]	0.907
T1 Depression				0.203	[.040, .312]	0.011

significant predictor of change in cannabis use from T1 to T3 (B = −.01, Exp(B) = .99, $p = .977$; Supplemental Table 2).

Similarly, there was no significant association between stress mindset, prospective cannabis use at T3, or change in cannabis use over time from T1-T3 when cannabis use was measured continuously. Stress mindset was not significantly associated with prospective cannabis use after controlling for age, sex, race, and household income (β = −.05, t = −.56, 95%CI [−.66, .37], $p = .58$). Similarly, stress mindset did not predict change in cannabis use from T1 to T3 (β = −.01, t = −.098, 95%CI [−.51, .47] $p = .92$; Supplemental Table 3).

Stress mindset and intentions to use cannabis measured cross-sectionally

The overall model predicting T2 intentions to use cannabis from T2 stress mindset and demographic covariates was significant ($R^2 = .06$, $F(6,195) = 3.30$, $p = .004$) and stress mindset significantly predicted T2 intentions to use (β = −.16, t = −2.25, 95%CI [−1.22, −.08], $p = .025$) after controlling for demographic covariates (Supplemental Table 4). T2 stress mindset was also a significant predictor of T2 intentions to use cannabis without covariates (β = −.21, t = −3.14, 95%CI [−1.36, −.31], $p = .002$).

Stress mindset and intentions to use cannabis measured longitudinally

We conducted regression analyses to predict future intentions to use cannabis and change in intentions to use cannabis over time as a function of stress mindset. As denoted in Table 1, there was a zero-order relationship between T2 stress mindset and T3 intentions to use cannabis (Table 1), however this relationship was not robust to the inclusion of covariates (β = −.10, t = −1.24, 95%CI [−1.18, .27], $p = .216$). In addition, changes in intentions to use cannabis over time (from T1, pre-pandemic, to T3, post-pandemic) were not significantly predicted by stress mindset (β = −.09, t = −1.14, 95%CI [−1.14, .31], $p = .255$) after adjusting for covariates (Supplemental Table 4).

Pathways to cannabis use

Cross-Sectional mediation of T2 stress mindset on T2 cannabis use through T2 behavioral intentions to use cannabis

Given the shared variance between stress mindset, intentions to use cannabis, and cannabis use, we conducted mediation analyses to examine whether the association of stress mindset on cannabis use was best explained as a direct effect, or as an indirect effect through the mediating pathway of intentions to use cannabis.

Intentions to use cannabis fully mediated the effect of stress mindset on cannabis use (indirect effect = −.58, 95%CI [−1.33, −.20]) after adjusting for covariates (Figure 1). When intentions to use cannabis were entered as a mediator, the direct effect of stress mindset on cannabis use was no longer significant (β = .51, $p = .39$). The mediation model was also significant without covariates and indicated full mediation through T2 intentions (indirect effect = −.68, 95%CI [−1.24, −.32], direct effect = .11, $p = .83$).

Cross-Sectional mediation of T2 stress mindset on T2 cannabis use through T2 depressive symptoms

Given the shared variance between stress mindset, depressive symptoms, and cannabis use, we conducted simple mediation analyses to examine whether the effect of stress mindset on cannabis use was best explained as a direct effect or as an indirect effect through the mediating pathway of depressive symptoms.

Depressive symptoms fully mediated the effect of stress mindset on cannabis use (indirect effect = −.22, 95%CI [−.57, −.004]) after adjusting for covariates (Figure 2). When depressive symptoms were entered as a mediator, the direct effect of stress mindset on cannabis use was no longer significant (β = −.19, $p = .67$). The mediation model was also significant without covariates and

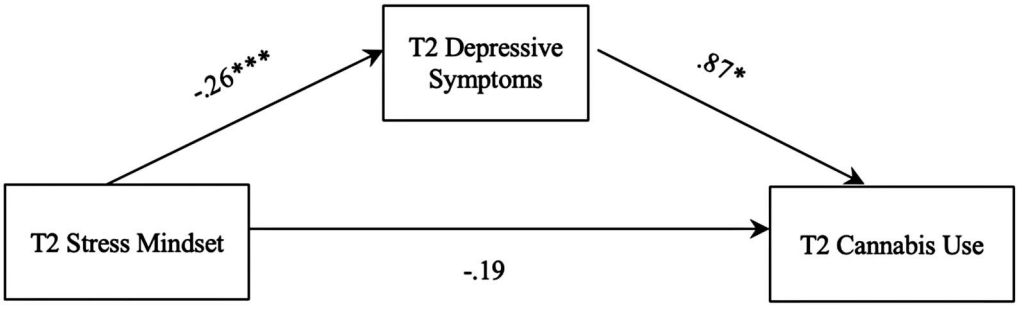

Figure 2. T2 Stress Mindset indirectly associated with T2 Cannabis Use through T2 Depressive Symptoms. Higher values of T2 Stress Mindset indicate a more stress-is-enhancing mindset. Higher values of T2 Depressive Symptoms indicate higher levels of depressive symptoms, and higher values of T2 Cannabis Use indicate more cannabis use.

indicated full mediation through T2 Depressive symptoms (indirect effect = −.19, 95%CI [−.42, −.007], direct effect = −.58, $p = .15$).

Analyses demonstrating that behavioral intentions to use cannabis and depressive symptoms are both distinct, parallel mediators of the indirect effect of stress mindset on cannabis use can be found in the supplementary analyses.

Longitudinal mediation of T2 stress mindset on T3 cannabis use through T2 intentions to use cannabis

Although there was no direct effect of stress mindset measured at T2 on future cannabis use at T3, we tested a pathway between stress mindset and future cannabis use through T2 intentions to use cannabis in the next year given that intentions to use cannabis fully mediated the cross-sectional link between stress mindset and cannabis use.

T2 stress mindset had a significant indirect effect on T3 cannabis use through T2 intentions to use cannabis (Figure 3). T2 intentions to use cannabis significantly mediated the effect of T2 stress mindset on T3 cannabis use (indirect effect = −.54, 95%CI [−1.21, −.13]) after adjusting for covariates. The mediation model was also significant without covariates (indirect effect = −.69, 95%CI [−1.28, −.29], direct effect = .66, $p = .09$). Those with a more stress-is-enhancing mindset at T2 tended to have less intentions to use cannabis at T2, which in turn predicted less cannabis use at T3.

Longitudinal mediation of T2 stress mindset on T3 cannabis use through T2 and T3 depressive symptoms

We tested an additional pathway between stress mindset and future cannabis use through T2 and T3 depressive symptoms given that depressive symptoms fully mediated the cross-sectional link between stress mindset and cannabis use.

T2 depressive symptoms were not a significant mediator (indirect effect = −.03, 95%CI [−.33, .29]) nor were T3 depressive symptoms (indirect effect = −.08, 95%CI [−.33, .11]) after adjusting for covariates.

Discussion

The aim of the current research was to elucidate the association between stress mindset and mental health in the face of a chronic stressor. The results fully supported our hypothesis that a stress-is-enhancing mindset would be associated with lower depressive symptoms and buffer against

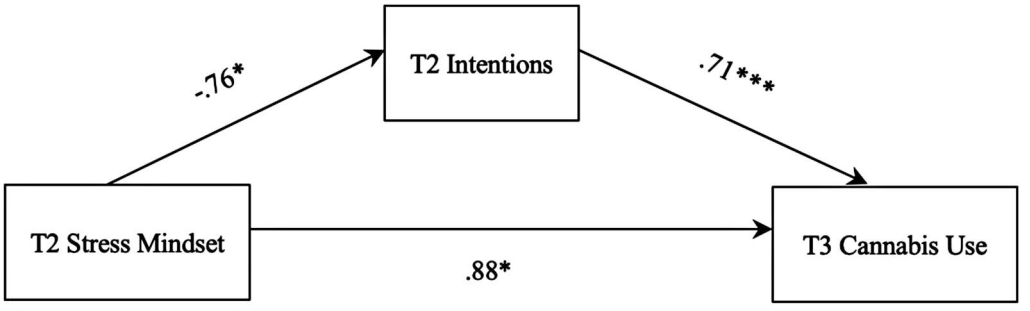

Figure 3. T2 Stress Mindset indirectly associated with less T3 Cannabis Use through T2 Behavioral Intentions to Use Cannabis. Higher values of T2 Stress Mindset indicate a more stress-is-enhancing mindset. Higher values of T2 Intentions indicate greater intentions to use cannabis, and higher values of T3 Cannabis Use indicate more cannabis use.

depressive symptom increase in response to the multifaceted stress brought about by the pandemic. Furthermore, this effect was robust to demographic covariates.

Mediation analyses suggested that the cross-sectional effect of stress mindset on cannabis use is explained through two indirect pathways: depressive symptoms and behavioral intentions to use cannabis. Stress mindset did not have a direct association with future cannabis use. However, it did have a significant indirect effect on future cannabis use through behavioral intentions. Contrary to expectations, depressive symptoms did not mediate the effect of stress mindset on future cannabis use. Interpreting this lack of mediation on future cannabis use is complicated by T2 depressive symptoms not predicting future cannabis use, which is contrary to prior work demonstrating a link between depressive symptoms and future cannabis use (Dierker et al., 2018; Womack et al., 2016). Thus, more conclusive determination of whether there is an additional psychological pathway predicting future substance use through depressive symptoms awaits future research. Overall, these results indicate that beliefs about the nature of stress influence mental health, and that these beliefs can act through multiple psychological pathways on both present and future mental health.

The pandemic was particularly stressful for adolescents and had a more severe impact on the mental health of adolescents already susceptible to higher stress levels, such as adolescents from lower-resourced families and adolescents experiencing discrimination (Jost et al., 2023). The present results were observed in a socioeconomically and racially diverse sample, suggesting that the ability of stress mindset to buffer against depressive symptoms and substance use in response to a multifaceted, potent, and chronic stressor is likely to be generalizable across stressors. While the pandemic was a unique and unprecedented stressor for those who experienced it, the results point to stress mindset being an important protective factor for mental health that should be considered in future work for a broad range of stressors.

Stress mindset and depression

The present findings contribute to a growing cross-sectional (e.g., Jiang et al., 2019), longitudinal (Taouk et al., 2022), and experimental (Crum et al., 2023) literature demonstrating that a more stress-is-enhancing mindset predicts fewer depressive symptoms. To be consistent with this prior work, including work conducted during the pandemic (Crum et al., 2023), we modeled stress mindset as having a direct effect on depressive symptoms. An alternative conceptualization is that the effects reported here are due to stress mindset moderating the effects of pandemic and other related stressors on depression. This would be consistent with studies demonstrating that stress mindset moderates the effects of objective or perceived stress due to migration (Jiang et al., 2019), pregnancy (Taouk et al., 2022), and chronic pain (Grünenwald et al., 2023).

An important area for future research will be determining at which point or points in the stress process stress mindset is exerting influence. The present results could be consistent with an effect of stress mindset on stress appraisals (Wang et al., 2022) and effects on approach focused coping strategies (Grünenwald et al., 2023; Mansell & Turner, 2023), both of which have empirical support. Another potential pathway by which stress mindset could influence depressive symptoms is through positive affect. Reduced positive affect to momentary stressors is a risk factor for future depressive symptoms (Zhaoyang et al., 2020) and a stress-is-enhancing mindset has been linked to higher positive affect in response to a laboratory stressor (Crum et al., 2017). suggesting that a stress-is-enhancing mindset might have prevented declines in depressive symptoms in response to pandemic related stressors via preventing declines in positive affect to stressors.

Stress mindset and cannabis use

The connection between stress mindset and intentions to engage in risky behavior is a novel finding. Intentions to engage in a future risky behavior are known to predict actual later engagement in that behavior, and the data reported here support this pathway. Behavioral intentions are shaped by attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). There is no existing theory to our knowledge to suggest that stress mindset should influence attitudes or subjective norms, but there is theory to suggest that stress mindset might influence perceived behavioral control. Perceived behavioral control is comprised of two components: self-efficacy and controllability over the behavior (Ajzen, 2002). As a stress-is-enhancing mindset has been associated with greater general self-efficacy (Subhasree et al., 2023; but see Bates et al., 2021), it is possible that individuals with a stress-is-enhancing mindset are more open to facing stressors rather than avoiding them, which provides greater opportunities to develop self-efficacy in the face of stressors and control over risky behaviors like substance use. Similarly, a more stress-is-enhancing mindset has been linked with greater challenge as opposed to threat appraisal of stressors (Kilby & Sherman, 2016; Wang et al., 2022). Challenge/threat appraisals are theorized to be distinct but interrelated with efficacy and controllability (Karademas & Kalantzi-Azizi, 2004; Peacock & Wong, 1990), suggesting that stress mindset's association with greater challenge appraisals may be another mechanism through which stress mindset influences efficacy and controllability, which in turn influence behavioral intentions. Future work could more precisely examine the mechanism linking stress mindset and these constructs to intentions for substance use.

Limitations

Our study is not without limitations. First, our measure of cannabis use assessed cannabis use over the previous thirty days and we may have seen more robust results if we used a more sensitive measure, such as use over the previous year. Given the smaller thirty-day time window, our results are likely to capture heavier and more frequent users of cannabis compared to a measure of cannabis use over a longer period. Thus, the results may be interpreted as capturing the influence of stress mindset on heavier and more frequent use that is likely to be associated with use as a stress coping strategy rather than recreational use (Hyman & Sinha, 2009). Second, at each wave, our measure of depressive symptoms asked participants to report symptoms over the last week. Although the CES-D is a valid tool for predicting and screening for clinical depression amongst children and adolescents (Park & Kwon, 2023), the one-week time frame may limit our ability to capture more persisting depressive symptoms and whether participants were experiencing symptoms between each wave.

Future research directions

This growing body of evidence connecting stress mindset with depressive symptoms suggests that stress mindset should be considered along with other more traditional vulnerability and risk factors for depression such as neuroticism (Ka et al., 2021) and cognitive biases (Gotlib & Joormann, 2010).

Future work should both identify specific mechanisms linking stress mindset to depressive symptoms and investigate stress mindset as a potential clinical tool to lower depressive symptoms. Multiple stress mindset interventions have been developed that can be easily and inexpensively administered (Crum et al., 2013, 2023; Keech et al., 2021), thus future studies might examine the utility of stress mindset interventions amongst patients with clinical depression or at risk for developing clinical depression.

Stress mindset may also be a useful intervention strategy for preventing cannabis use in response to stress during adolescence. The effects of stress mindset on substance use have been less studied than on depressive symptomatology. Therefore, the field is likely to benefit from more basic research before testing interventions. In addition to replicating the effect seen here, it would be beneficial to study the effects of stress mindset on a sample with greater variability in cannabis use levels than was present in this sample.

Conclusion

This study establishes that stress mindset is a protective factor for two important mental health outcomes: depression and substance use. A more stress-is-enhancing mindset predicted fewer depressive symptoms cross-sectionally and longitudinally. These effects of stress mindset on depressive symptoms also appeared to influence risk for cannabis use. In addition, stress mindset influenced cannabis use by impacting intentions to use cannabis. Although the effects of stressors during adolescence on mental health are worrisome because they heighten risk for mental health problems in adulthood (Aalto-Setälä et al., 2002; Merline et al., 2004) stress mindset interventions have been shown to increase a stress-is-enhancing mindset (Crum et al., 2023) and may be one potential avenue of intervention to improve multiple aspects of the current adolescent mental health crisis and prevent future poor mental health outcomes.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The Adolescent Health and Development in Context study (AHDC) is funded by the National Institute on Drug Abuse (C.R.B., R01DA032371; B.M.W., R01DA042080); the Eunice Kennedy Shriver National Institute on Child Health and Human Development (the Ohio State University Institute for Population Research, P2CHD058484), the W.T. Grant Foundation, and the National Science Foundation (C.R.B., SES 2029043).

Data availability statement

The data will be made available upon reasonable request.

References

Aalto-Setälä, T., Marttunen, M., Tuulio-Henriksson, A., Poikolainen, K., & Lönnqvist, J. (2002). Depressive symptoms in adolescence as predictors of early adulthood depressive disorders and maladjustment. *American Journal of Psychiatry*, *159*(7), 1235–1237. https://doi.org/10.1176/appi.ajp.159.7.1235

Abraham, H. D., & Fava, M. (1999). Order of onset of substance abuse and depression in a sample of depressed outpatients. *Comprehensive Psychiatry*, *40*(1), 44–50. https://doi.org/10.1016/s0010-440x(99)90076-7

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology*, *32*(4), 665–683. https://doi.org/10.1111/j.1559-1816.2002.tb00236.x

Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults: Evaluation of a short form of the CES-D. *American Journal of Preventive Medicine*, *10*(*2*), 77–84. http://dx.doi.org/10.1016/S0749-3797(18)30622-6

Bates, C. R., Nicholson, L. M., Rea, E. M., Hagy, H. A., & Bohnert, A. M. (2021). Life interrupted: Family routines buffer stress during the COVID-19 pandemic. *Journal of Child and Family Studies*, *30*(11), 2641–2651. https://doi.org/10.1007/s10826-021-02063-6

Boettner, B., Browning, C. R., & Calder, C. A. (2019). Feasibility and validity of geographically explicit ecological momentary assessment With recall-aided space-time budgets. *Journal of Research on Adolescence*, *29*(3), 627–645. https://doi.org/10.1111/jora.12474

Booker, C. L., Unger, J. B., Azen, S. P., Baezconde-Garbanati, L., Lickel, B., & Johnson, C. A. (2008). A longitudinal analysis of stressful life events, smoking behaviors, and gender differences in a multicultural sample of adolescents. *Substance Use & Misuse*, *43*(11), 1521–1543. https://doi.org/10.1080/10826080802238009

Burnette, J. L., O'Boyle, E. H., VanEpps, E. M., Pollack, J. M., & Finkel, E. J. (2013). Mind-sets matter: A meta-analytic review of implicit theories and self-regulation. *Psychological Bulletin*, *139*(3), 655–701. https://doi.org/10.1037/a0029531

Cavalli, J. M., & Cservenka, A. (2021). Emotion dysregulation moderates the association between stress and problematic cannabis use. *Frontiers in Psychiatry*, *11*, 597789. https://doi.org/10.3389/fpsyt.2020.597789

Chen, L., & Qu, L. (2021). From stressful experiences to depression in Chinese migrant children: The roles of stress mindset and coping. *Frontiers in Psychology*, *12*, 601732. https://www.frontiersin.org/articles/10.3389fpsyg.2021.601732

Coffey, C., & Patton, G. C. (2016). Cannabis use in adolescence and young adulthood: A review of findings from the victorian adolescent health cohort study. *The Canadian Journal of Psychiatry*, *61*(6), 318–327. https://doi.org/10.1177/0706743716645289

Crane, N. A., Langenecker, S. A., & Mermelstein, R. J. (2021). Risk factors for alcohol, marijuana, and cigarette polysubstance use during adolescence and young adulthood: A 7-year longitudinal study of youth at high risk for smoking escalation. *Addictive Behaviors*, *119*, 106944. https://doi.org/10.1016/j.addbeh.2021.106944

Crum, A. J., Akinola, M., Martin, A., & Fath, S. (2017). The role of stress mindset in shaping cognitive, emotional, and physiological responses to challenging and threatening stress. *Anxiety, Stress, & Coping*, *30*(4), 379–395. https://doi.org/10.1080/10615806.2016.1275585

Crum, A. J., Salovey, P., & Achor, S. (2013). Rethinking stress: The role of mindsets in determining the stress response. *Journal of Personality and Social Psychology*, *104*(4), 716–733. https://doi.org/10.1037/a0031201

Crum, A. J., Santoro, E., Handley-Miner, I., Smith, E. N., Evans, K., Moraveji, N., Achor, S., & Salovey, P. (2023). Evaluation of the "rethink stress" mindset intervention: A metacognitive approach to changing mindsets. *Journal of Experimental Psychology: General*, *152*(9), 2603–2622. https://doi.org/10.1037/xge0001396

D'Amico, E. J., Tucker, J. S., Miles, J. N. V., Ewing, B. A., Shih, R. A., & Pedersen, E. R. (2016). Alcohol and Marijuana use trajectories in a diverse longitudinal sample of adolescents: Examining use patterns from age 11 to 17. *Addiction (Abingdon, England)*, *111*(10), 1825–1835. https://doi.org/10.1111/add.13442

Degenhardt, L., Coffey, C., Romaniuk, H., Swift, W., Carlin, J. B., Hall, W. D., & Patton, G. C. (2013). The persistence of the association between adolescent cannabis use and common mental disorders into young adulthood. *Addiction*, *108*(1), 124–133. https://doi.org/10.1111/j.1360-0443.2012.04015.x

Dierker, L., Selya, A., Lanza, S., Li, R., & Rose, J. (2018). Depression and marijuana use disorder symptoms among current marijuana users. *Addictive Behaviors*, *76*, 161–168. https://doi.org/10.1016/j.addbeh.2017.08.013

Dumas, T. M., Ellis, W., & Litt, D. M. (2020). What does adolescent substance use look like during the COVID-19 pandemic? Examining changes in frequency, social contexts, and pandemic-related predictors. *Journal of Adolescent Health*, *67*(3), 354–361. https://doi.org/10.1016/j.jadohealth.2020.06.018

Folkman, S., & Lazarus, R. S. (1988). Coping as a mediator of emotion. *Journal of Personality and Social Psychology*, *54*(3), 466–475. https://doi.org/10.1037/0022-3514.54.3.466

Gibbons, F. X., Gerrard, M., Ouellette, J. A., & Burzette, R. (1998). Cognitive antecedents to adolescent health risk: Discriminating between behavioral intention and behavioral willingness. *Psychology & Health*, *13*(2), 319–339. https://doi.org/10.1080/08870449808406754

Godin, S.-L., & Shehata, S. (2022). Adolescent cannabis use and later development of schizophrenia: An updated systematic review of longitudinal studies. *Journal of Clinical Psychology*, *78*(7), 1331–1340. https://doi.org/10.1002/jclp.23312

Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology*, *6*(1), 285–312. https://doi.org/10.1146/annurev.clinpsy.121208.131305

Grünenwald, I., Kaluza, A. J., Schultze, M., & van Dick, R. (2023). Stress mindset and social identification in chronic pain patients and their relationship to coping. *Journal of Clinical Psychology in Medical Settings*, *30*(1), 153–168. https://doi.org/10.1007/s10880-022-09883-8

Hammen, C. (2005). Stress and depression. *Annual Review of Clinical Psychology*, *1*(1), 293–319. https://doi.org/10.1146/annurev.clinpsy.1.102803.143938

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis, second edition: A regression-based approach*. Guilford Publications.

Huba, G. J., Wingard, J. A., & Bentler, P. M. (1981). Intentions to use drugs among adolescents: A longitudinal analysis. *International Journal of the Addictions*, *16*(2), 331–339. https://doi.org/10.3109/10826088109038832

Huebschmann, N. A., & Sheets, E. S. (2020). The right mindset: Stress mindset moderates the association between perceived stress and depressive symptoms. *Anxiety, Stress & Coping: An International Journal*, *33*(3), 248–255. https://doi.org/10.1080/10615806.2020.1736900

Hyman, S. M., & Sinha, R. (2009). Stress-Related factors in cannabis use and misuse: Implications for prevention and treatment. *Journal of Substance Abuse Treatment*, *36*(4), 400–413. https://doi.org/10.1016/j.jsat.2008.08.005

Jenkins, A., Weeks, M. S., & Hard, B. M. (2021). General and specific stress mindsets: Links with college student health and academic performance. *PLoS One*, *16*(9), e0256351. https://doi.org/10.1371/journal.pone.0256351

Jiang, Y., Zhang, J., Ming, H., Huang, S., & Lin, D. (2019). Stressful life events and well-being among rural-to-urban migrant adolescents: The moderating role of the stress mindset and differences between genders. *Journal of Adolescence*, *74*(1), 24–32. https://doi.org/10.1016/j.adolescence.2019.05.005

Jost, G. M., Hang, S., Shaikh, U., & Hostinar, C. E. (2023). Understanding adolescent stress during the COVID-19 pandemic. *Current Opinion in Psychology*, *52*, 101646. https://doi.org/10.1016/j.copsyc.2023.101646

Ka, L., Elliott, R., Ware, K., Juhasz, G., & Brown, L. J. E. (2021). Associations between facets and aspects of big five personality and affective disorders: A systematic review and best evidence synthesis. *Journal of Affective Disorders*, *288*, 175–188. https://doi.org/10.1016/j.jad.2021.03.061

Karademas, E. C., & Kalantzi-Azizi, A. (2004). The stress process, self-efficacy expectations, and psychological health. *Personality and Individual Differences*, *37*(5), 1033–1043. https://doi.org/10.1016/j.paid.2003.11.012

Keech, J. J., Hagger, M. S., & Hamilton, K. (2021). Changing stress mindsets with a novel imagery intervention: A randomized controlled trial. *Emotion (Washington, D.C.)*, *21*(1), 123–136. https://doi.org/10.1037/emo0000678

Kilby, C. J., & Sherman, K. A. (2016). Delineating the relationship between stress mindset and primary appraisals: Preliminary findings. *SpringerPlus*, *5*(1), 336. https://doi.org/10.1186/s40064-016-1937-7

Lee-Winn, A. E., Mendelson, T., & Johnson, R. M. (2018). Associations between coping and marijuana use in a nationally representative sample of adolescents in the United States. *Addictive Behaviors*, *80*, 130–134. https://doi.org/10.1016/j.addbeh.2018.01.025

Mansell, P. C., & Turner, M. J. (2023). The mediating role of proactive coping in the relationships between stress mindset, challenge appraisal tendencies, and psychological wellbeing. *Frontiers in Psychology*, *14*, 1140790. https://doi.org/10.3389/fpsyg.2023.1140790

Markou, A., Kosten, T. R., & Koob, G. F. (1998). Neurobiological similarities in depression and drug dependence: A self-medication hypothesis. *Neuropsychopharmacology*, *18*(3), 135–174. https://doi.org/10.1016/S0893-133X(97)00113-9

McConnell, M. M., Memetovic, J., & Richardson, C. G. (2014). Coping style and substance use intention and behavior patterns in a cohort of BC adolescents. *Addictive Behaviors*, *39*(10), 1394–1397. https://doi.org/10.1016/j.addbeh.2014.05.018

Meherali, S., Punjani, N., Louie-Poon, S., Abdul Rahim, K., Das, J. K., Salam, R. A., & Lassi, Z. S. (2021). Mental health of children and adolescents amidst COVID-19 and past pandemics: A rapid systematic review. *International Journal of Environmental Research and Public Health*, *18*(7), 3432. https://doi.org/10.3390/ijerph18073432

Meier, M. H., Caspi, A., Ambler, A., Harrington, H., Houts, R., Keefe, R. S. E., McDonald, K., Ward, A., Poulton, R., & Moffitt, T. E. (2012). Persistent cannabis users show neuropsychological decline from childhood to midlife. *Proceedings of the National Academy of Sciences*, *109*(40), E2657–E2664. https://doi.org/10.1073/pnas.1206820109

Merline, A. C., O'Malley, P. M., Schulenberg, J. E., Bachman, J. G., & Johnston, L. D. (2004). Substance use among adults 35 years of age: Prevalence, adulthood predictors, and impact of adolescent substance use. *American Journal of Public Health*, *94*(1), 96–102. https://doi.org/10.2105/AJPH.94.1.96

Nguyen, T., Pu, C., Waits, A., Tran, T. D., Ngo, T. H., Huynh, Q. T. V., & Huang, S.-L. (2023). Transforming stress program on medical students' stress mindset and coping strategies: A quasi-experimental study. *BMC Medical Education*, *23*(1), 587. https://doi.org/10.1186/s12909-023-04559-9

Office of the Surgeon General (OSG). (2021). *Protecting Youth Mental Health: The U.S. Surgeon General's Advisory*. US Department of Health and Human Services. http://www.ncbi.nlm.nih.gov/books/NBK575984/.

Park, S.-H., & Kwon, Y. M. (2023). Can the center for epidemiologic studies depression scale be used to screen for depression in children and adolescents? *An Updated Systematic Review. Child Psychiatry & Human Development*, 1–11. https://doi.org/10.1007/s10578-023-01553-6

Patrick, M. E., Peterson, S. J., Terry-McElrath, Y. M., Rogan, S. E. B., & Solberg, M. A. (2024). Trends in coping reasons for marijuana use among U.S. Adolescents from 2016 to 2022. *Addictive Behaviors*, *148*, 107845. https://doi.org/10.1016/j.addbeh.2023.107845

Peacock, E. J., & Wong, P. T. (1990). The stress appraisal measure (SAM): A multidimensional approach to cognitive appraisal. *Stress Medicine*, *6*(3), 227–236. https://doi.org/10.1002/smi.2460060308

Romano, I., Patte, K. A., de Groh, M., Jiang, Y., Wade, T. J., Bélanger, R. E., & Leatherdale, S. T. (2021). Substance-related coping behaviours among youth during the early months of the COVID-19 pandemic. *Addictive Behaviors Reports*, *14*, 100392. https://doi.org/10.1016/j.abrep.2021.100392

Subhasree, G., Jeyavel, S., Eapen, J. C., & Deepthi, D. P. (2023). Stress mindset as a mediator between self-efficacy and coping styles. *Cogent Psychology*, *10*(1), 2255048. https://doi.org/10.1080/23311908.2023.2255048

Taouk, L., Schulkin, J., & Gunthert, K. (2022). Brief report: The moderating effect of stress mindsets on associations between stress during pregnancy and symptoms of depression and anxiety. *Anxiety, Stress & Coping: An International Journal*, *35*(3), 313–322. https://doi.org/10.1080/10615806.2021.1967937

Wang, X., Zhang, J., Sun, X., & Zhang, L. (2022). Stress mindset and mental health status among Chinese high school students: The mediating role of exam stress appraisals. *PsyCh Journal*, *11*(6), 904–912. https://doi.org/10.1002/pchj.563

Wilkinson, A. L., Halpern, C. T., & Herring, A. H. (2016). Directions of the relationship between substance use and depressive symptoms from adolescence to young adulthood. *Addictive Behaviors*, *60*, 64–70. https://doi.org/10.1016/j.addbeh.2016.03.036

Womack, S. R., Shaw, D. S., Weaver, C. M., & Forbes, E. E. (2016). Bidirectional associations between cannabis use and depressive symptoms from adolescence through early adulthood Among At-risk young men. *Journal of Studies on Alcohol and Drugs*, *77*(2), 287–297. https://doi.org/10.15288/jsad.2016.77.287

Zhaoyang, R., Scott, S. B., Smyth, J. M., Kang, J.-E., & Sliwinski, M. J. (2020). Emotional responses to stressors in everyday life predict long-term trajectories of depressive symptoms. *Annals of Behavioral Medicine : A Publication of the Society of Behavioral Medicine*, *54*(6), 402–412. https://doi.org/10.1093/abm/kaz057