



# Externalized anger as a mediator of harsh parenting and substance use among Appalachian adolescents

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## ABSTRACT

Adolescent substance use (SU) is a prevalent public health issue in the United States. Understanding how known risk factors such as harsh parenting and externalized anger may impact youth SU is crucial for structuring primary prevention efforts and interventions. This study examines the relationship between harsh parenting and both current SU and SU severity. We assess whether, and to what extent, externalized anger mediates the relationship between harsh parenting and the two SU outcomes. Two waves of a biannual prospective cohort study administered to adolescents between 10–16 years of age were used to test mediation models for SU outcomes. The sample was 44.5% female, 87.2% White, and 95.7% non-Hispanic. Significant direct effects ( $p < 0.05$ ) were observed between harsh parenting and externalized anger (Stand.  $\beta = 0.27$ ); harsh parenting and current SU (Stand.  $\beta = 0.11$ ); and externalized anger and current SU (Stand.  $\beta = 0.33$ ). Significant indirect effects were also observed between harsh parenting and current SU (Stand.  $\beta = 0.09$ ) and between harsh parenting and SU severity (Stand.  $\beta = 0.06$ ). Results indicate a total effect between harsh parenting and adolescent SU of Stand.  $\beta = 0.198$ ; about 44% of which is attributed to mediation via externalized anger. While no significant direct effect between harsh parenting and SU severity was found, significant mediation effects (Stand.  $\beta = 0.06$ ) were found for the role of externalized anger. While harsh parenting is known to affect adolescent SU directly, we found that this relationship is emphasized by the presence of externalized anger. Implications for prevention and interventions are discussed.

## 1. Background

Adolescent substance use (SU) is a prevalent public health problem in the United States (U.S.). SU in youth is associated with neurocognitive delays, mental health challenges, and substance use disorders later in life (DuPont et al., 2018; Steinfeld & Torregrossa, 2023). Past-year SU among adolescents in America is estimated to be as high as 10.9 percent (NIDA, 2023). Common substances used by adolescents are cigarettes, e-cigarettes, cannabis, and alcohol (Halladay et al., 2020; NIDA, 2023; WHO, 2024). SU among rural adolescents is particularly problematic and understudied as rural adolescents are more likely to engage in hazardous alcohol use and to consume higher amounts of alcohol and tobacco products than their urban counterparts (Friesen et al., 2022; Rural Health Information Hub, 2024; Saalfeld & Haag, 2024).

Parenting has been found to impact adolescent behavioral health,

including SU (Ramsewak et al., 2022; Trucco, 2020; Vermeulen-Smit et al., 2015). In particular, harsh parenting style, which overlaps with authoritarian parenting (Crouch et al., 2017; Wang, 2019), has been associated with both adolescent SU and physical aggression (Kingsbury et al., 2020; Trucco, 2020). Also, the use of alcohol, tobacco, and illegal drugs has been found to be higher among adolescents from homes in which authoritarian parenting styles are used, as compared to authoritative or permissive styles (Calafat et al., 2014). Harsh or authoritarian parenting has also been associated with higher anger, aggression, and externalized anger among adolescents (Brody et al., 2014; Kerr & Schneider, 2008; Wang, 2019). There is also evidence that parenting styles in rural parts of the U.S. differ significantly across the urban/rural divide, with adolescents and emerging adults from rural regions perceiving the experience of authoritarian parenting more frequently than their urban counterparts (Mckinney & Brown, 2017). Parenting

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differences across four U.S. regions have also been observed (Stearns et al., 2023), but more recent research on perceived parenting style differences between rural and urban American adolescents is needed.

Externalized anger is also associated with adolescent SU (Eftekhari et al., 2004; Serafini et al., 2016). Among rural adolescents specifically, higher anger – which is highly correlated with externalized anger (Ortiz & Gándara, 2006; Scaini et al., 2024) – is significantly associated with more frequent drug use (Puskar et al., 2008). Among adolescents in treatment for substance use disorder, externalized anger was correlated with addiction severity (Cedee, 2017); and higher anger scores were associated with a greater likelihood of relapse post treatment (Serafini et al., 2016). A study among incarcerated adolescents found that externalized anger was associated with increased alcohol and cannabis dependence (Eftekhari et al., 2004).

Although the relationship between parenting styles and adolescent SU has been well-documented, externalized anger has yet to be examined as a potential mediator of this relationship, and no studies of this relationship exist among Appalachian adolescents, a heavily understudied population. In this study, we examine the relationship between harsh parenting and four types of adolescent SU – cigarettes, e-cigarettes, alcohol, and cannabis – with self-reported externalized anger as a potential mediator. We hypothesize that externalized anger will significantly mediate the relationship between harsh parenting and SU as shown in Fig. 1.

## 2. Methods

### 2.1. Participants

This study utilized data from the Young Mountaineer Health Study (YMHS), a single prospective cohort of students from 20 public middle schools in grades six through eight (ages 10–16) across five West Virginia counties that were surveyed twice yearly for three years (Kristjansson et al., 2022). The first (baseline) assessment occurred in the fall of 2020 and the final survey wave took place in the spring of 2023; thus, each wave was separated by approximately six months (Kristjansson et al., 2022). Students self-reported responses during each wave. Response rates ranged from 74.2 percent to 87.0 percent across all six waves of survey data, totaling 2,861 unique participants. Not all students participated in each wave of the survey due to aging out of the study, moving, or for other reasons.

### 2.2. Procedure

A detailed description of the study protocol has been published elsewhere (Kristjansson et al., 2022). For each survey wave, students responded to a confidential, computer-based survey using Qualtrics software (Kristjansson et al., 2023; Kristjansson et al., 2022). Data collection was confidential, and protocols ensured anonymity of participants. No identifying information was collected. Students were permitted to skip any questions. The West Virginia University

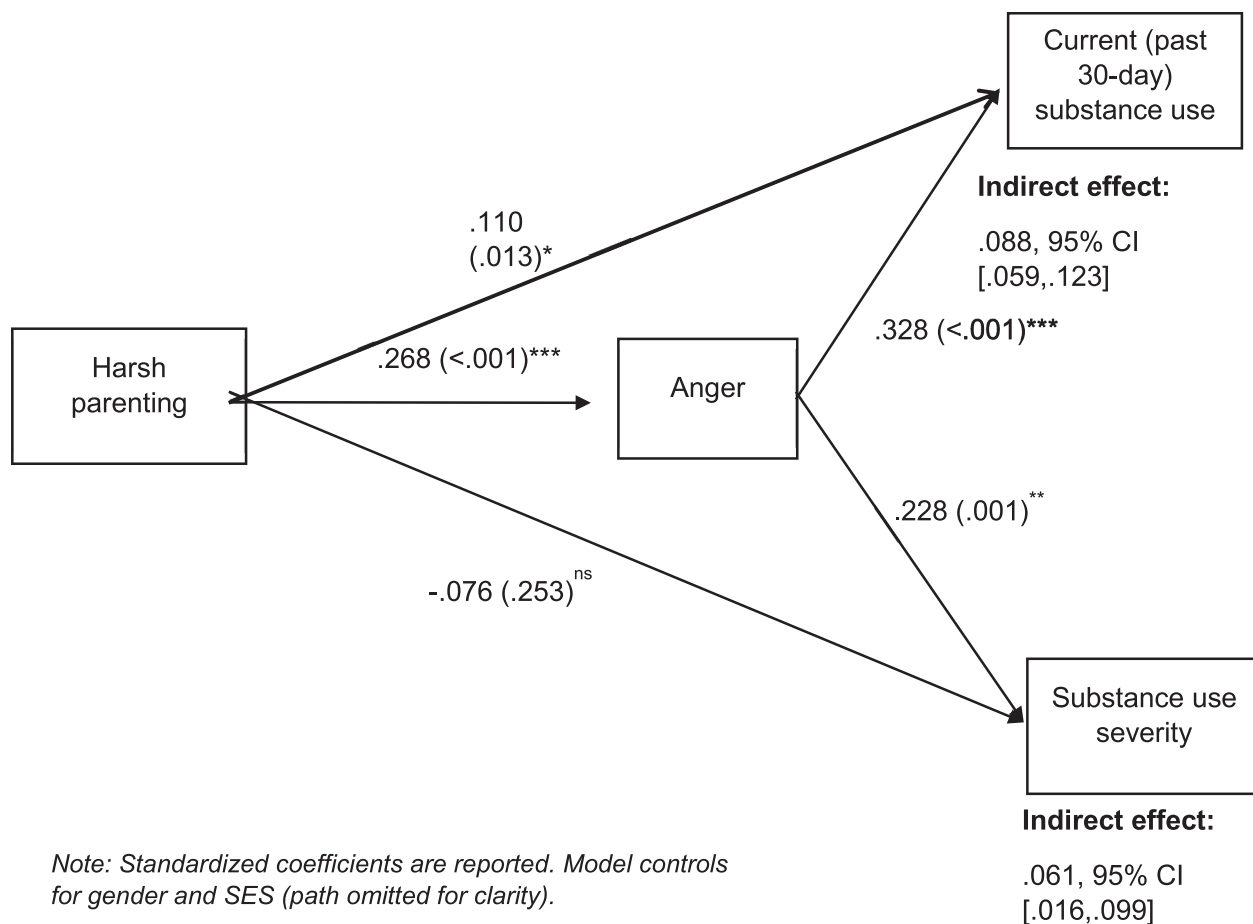


**Fig. 1.** Externalized anger as a mediator between (1) harsh parenting and past 30-day substance use; and (2) harsh parenting and substance use severity. Gender and SES assessed as covariates (not pictured).

Institutional Review Board (IRB) approved all study protocols (#1903499093A001).

### 2.3. Measures

**Harsh parenting.** A five-item Harsh Parenting scale was used to measure harsh parenting experienced by adolescents (Arnold et al., 1993). The stem of the question was, “When you do something wrong do any of your parents/caregivers do the following things?” and the items included: “Tell you to get out or lock you out of the house?”; “Insult or say mean things to you?”; “Raise their voice or yell?”; “Hit you with a hand such as slapping or spanking?”; “Hit you with a belt, a paddle, or something else?”. Participants ranked their responses on a scale from 1 = “Never” to 4 = “Always”. Responses were summed and produced a scale ranging from 5 (no harsh parenting) to 20 (high harsh parenting) ( $\alpha = 0.77$ , indicating good reliability). Harsh parenting at Wave 4 (Spring of 7th grade) was the predictor used for substance use at Wave 6 (Spring of 8th grade) to examine substance use among early adolescents.

**Substance use.** SU outcome assessments were taken at Wave 6 (Spring of 2023, when participants were completing 8th grade) in order to establish temporality with harsh parenting. Cigarette use was assessed with the question “In the past 30 days, how often have you smoked cigarettes? (smoked a whole cigarette not just taken a puff)?”. E-cigarette and vaping device use was measured with the question “In the past 30 days, how often have you used e-cigarettes or vaping devices?”. Alcohol use was assessed with the question “In the past 30 days, how often have you had a drink of alcohol of any kind, even just a few sips (e. g. beer, wine, spirits, shots)?”. Cannabis use was assessed with the question “In the past 30 days, how many times have you used marijuana (weed, pot, etc.)?”. For each type of substance assessed, response options included: (0) 0 times; (1) 1–2 times; (2) 3–5 times; (3) 6–9 times; (4) 10–19 times; (5) 20–39 times; (6) 40 or more times. Combined each of these measures (ranging from 0 to 6) into a single SU measure ranging from 0 to 24. To measure *current* SU as a binary outcome, we transformed this variable into 0 = no current use and  $>0$  = current use. For SU *severity*, we utilized cases that responded  $>0$  for ‘past 30-day SU’ on any of the four SU questions as a continuous variable.

**Externalized anger.** Externalized anger was assessed using three items from the Symptom Checklist 90 (SCL-90) scale (Derogatis et al., 1973; Derogatis et al., 1973; Schmitz et al., 2000), asking students to share the frequency of their externalized anger within the past week. Items included: “I experienced outbursts of anger that I could not control.”; “I had an argument with someone.”; and “I yelled at somebody or threw things.” Response options ranged from 1 = “Never” to 4 = “Often.” Scores were totaled to produce a scale ranging from 3 (lowest anger) to 12 (highest anger) ( $\alpha = 0.86$ , indicating excellent reliability). Anger at Wave 6 (Spring of 8th grade) was used to coincide with the measurement of substance use. Externalized anger was treated as continuous for the purpose of this analysis.

### 2.4. Covariates

Given the extant literature citing the relationship of gender and socioeconomic status (SES) to harsh parenting and SU (Fonseca et al., 2021; Kim et al., 2022; Mills et al., 2024; NIDA, 2020; Rahman et al., 2014), these were entered as covariates in the analysis. Gender was a categorical variable and scored with the following response options: 1=“Boy”, 2=“Girl”, or 3= “Other”, which included the options “Gender non-conforming” and “Other (specify)”. In case of different answers regarding gender across waves, we assigned the highest categorical value indicated by the participant.

Socioeconomic status (SES) was assessed with responses to the Family Affluence Scale (FAS) (Boyce et al., 2006; Corell et al., 2021; Hobza et al., 2017). This scale contains six items with the questions: “Does your family own a car or another motorized vehicle?”; “Do you have your own bedroom?”; “How many computers does your family

own?”; “How many bathrooms (room with a bath/shower or both) are there in your home?”; “Does your family own a dishwasher?”; and “How many times did you and your family travel out of West Virginia for holiday/vacation later year?”. Some response options were measured with 0= “No” and 1= “Yes”, while others ranged from 0 = “None/Never” to 3 = “Three/More than two”. Scores from each item were summed to create a scale ranging from 0 (low SES) to 13 (high SES). The FAS has been identified as a more precise alternative to parental earned income as an proxy for SES (Corell et al., 2021). In this analysis, the highest individual FAS score for each participant across all six waves was used as a measure of SES.

### 2.5. Analysis

Using Mplus 8.10, we combined outcomes of all four SU measures (cigarettes, e-cigarettes, alcohol, and cannabis) to create a singular outcome of “current SU”. Then, utilizing weighted least squares estimation, we conducted an analysis that simultaneously modeled two processes (a two-part model), both of which tested whether anger mediated the association between harsh parenting and SU. One part of the model involved a logistic regression predicting a binary measure of whether students engaged in any current SU. The second part involved a regression of the total frequency of use among those who reported SU (severity). This outcome used a log-transformed continuous measure of SU due to its right-skewed distribution. Both parts of the model control for gender and socioeconomic status. Predictors of the binary outcome were estimated using a probit link function, and indirect effects were computed for both the binary and the log-transformed continuous outcomes. We tested mediation effects using bootstrapped confidence intervals (1000 samples). Full Information Maximum Likelihood (FIML) was used to handle missing data. For each model, regression coefficients were reported with *p* values and 95% Confidence Intervals where applicable.

## 3. Results

Table 1 shows descriptive statistics for the full sample included in the analysis ( $N = 1109$ ). The sample self-identified as 44.5 percent female, with a mean FAS score of 10.89. The mean perceived harsh parenting score for Wave 4 (Spring 2022) was 7.34, and the mean externalized anger score for Wave 6 (Spring 2023) was 5.67. Past 30-day SU ranged from 3.4% to 9.5%. Given the racial and ethnic homogeneity of Appalachia, race/ethnicity was not included in this analysis due to lack of power; the vast majority of the sample was White (87.2%) and non-Hispanic (95.7%).

Fig. 1 shows the mediation model utilized in this analysis. Table 2 summarizes these model findings for direct effects, indirect (mediation)

**Table 1**

Descriptive characteristics of Appalachian students in the Young Mountaineer Health Study, West Virginia, 2020–2023, with complete data for both Wave 4 and Wave 6 for at least one substance ( $N = 1109$  unique cases).

| Categorical Variables: n (%)                |              |
|---------------------------------------------|--------------|
| Boys                                        | 459 (41.4%)  |
| Girls                                       | 493 (44.5%)  |
| Other                                       | 157 (14.2%)  |
| Family Affluence (Individual SES)           | 10.89 (1.85) |
| Past 30-day Cigarette Use (Wave 6)          | 31 (3.4%)    |
| Past 30-day E-cigarette Use (Wave 6)        | 71 (7.7%)    |
| Past 30-day Alcohol Use (Wave 6)            | 88 (9.5%)    |
| Past 30-day Cannabis Use (Wave 6)           | 42 (4.6%)    |
| Past 30-day Substance use (any substance/s) | 128 (11.5%)  |
| No 30-day Substance use                     | 981 (88.5%)  |
| Continuous Variables: mean (SD) or n (%)    |              |
| Harsh parenting (Wave 4)                    | 7.34 (2.61)  |
| Externalized anger Score (Wave 6)           | 5.67 (2.96)  |

**Table 2**

Table of standardized results from two mediation models: Current (past 30-day) substance use; and substance use severity.

| Substance Use Model Effects                                                  | Standardized Coefficient <i>b</i> | <i>p</i> | Lower 2.5% CI | Upper 2.5% CI |
|------------------------------------------------------------------------------|-----------------------------------|----------|---------------|---------------|
| <b>Outcome: Past 30-day substance use (N = 1109)</b>                         |                                   |          |               |               |
| <i>Direct Effects:</i>                                                       |                                   |          |               |               |
| Harsh Parenting on externalized anger                                        | 0.268                             | <0.001   | 0.201         | 0.333         |
| Gender (girl) on externalized anger                                          | 0.216                             | <0.001   | 0.153         | 0.278         |
| Gender (other) on externalized anger                                         | 0.224                             | <0.001   | 0.160         | 0.291         |
| SES on externalized anger                                                    | −0.138                            | <0.001   | −0.193        | −0.079        |
| Harsh Parenting on past 30-day substance use                                 | 0.110                             | 0.013    | 0.019         | 0.195         |
| Externalized anger on past 30-day substance use                              | 0.328                             | <0.001   | 0.237         | 0.411         |
| Gender (girl) on past 30-day substance use                                   | −0.029                            | 0.585    | −0.134        | 0.071         |
| Gender (other) on past 30-day substance use                                  | 0.047                             | 0.346    | −0.062        | 0.136         |
| SES on past 30-day substance use                                             | −0.025                            | 0.607    | −0.125        | 0.078         |
| <i>Indirect Effects:</i>                                                     |                                   |          |               |               |
| Harsh Parenting on past 30-day substance use, through externalized anger     | 0.088                             | <0.001   | 0.059         | 0.123         |
| <i>Total effects</i>                                                         |                                   |          |               |               |
| Direct + indirect effects between harsh parenting and current substance use  | 0.198                             | <0.001   | —             | —             |
| <b>Outcome: Substance use severity (N = 128)</b>                             |                                   |          |               |               |
| <i>Direct Effects:</i>                                                       |                                   |          |               |               |
| Harsh Parenting on externalized anger                                        | 0.268                             | <0.001   | 0.201         | 0.333         |
| Gender (girl) on externalized anger                                          | 0.216                             | <0.001   | 0.153         | 0.278         |
| Gender (other) on externalized anger                                         | 0.224                             | <0.001   | 0.160         | 0.291         |
| SES on externalized anger                                                    | −0.138                            | <0.001   | −0.193        | −0.079        |
| Harsh Parenting on substance use severity                                    | −0.076                            | 0.253    | −0.226        | 0.048         |
| Externalized anger on substance use severity                                 | 0.228                             | 0.001    | 0.094         | 0.368         |
| Gender (girl) on substance use severity                                      | −0.115                            | 0.254    | −0.316        | 0.077         |
| Gender (other) on substance use severity                                     | 0.128                             | 0.166    | −0.056        | 0.313         |
| SES on substance use severity                                                | 0.033                             | 0.660    | −0.117        | 0.166         |
| <i>Indirect Effects:</i>                                                     |                                   |          |               |               |
| Harsh Parenting on substance use severity, through externalized anger        | 0.061                             | 0.001    | 0.016         | 0.099         |
| <i>Total Effects:</i>                                                        |                                   |          |               |               |
| Direct + indirect effects between harsh parenting and substance use severity | −0.015                            | 0.817    | —             | —             |

\*Boys are the referent group for gender effects.

effects, and total effects.

### 3.1. Externalized anger

Significant direct effects were observed between harsh parenting and externalized anger (Stand.  $\beta = 0.27$ ,  $p < 0.001$ ). Both covariates also had significant direct effects on externalized anger (Stand.  $\beta = 0.22$  for girl and other genders, Stand.  $\beta = -0.14$  for SES,  $p < 0.001$ ).

### 3.2. Past 30-day substance use

Current SU, as measured by past 30-day SU, had a total sample of  $N = 1109$ . Significant direct effects were observed between harsh parenting and current SU (Stand.  $\beta = 0.11$ ,  $p = 0.01$ ); and externalized anger and current SU (Stand.  $\beta = 0.33$ ,  $p < 0.001$ ). A mediation effect of harsh parenting on current SU, through externalized anger, was also statistically significant (Stand.  $\beta = 0.09$ , 95% CI = 0.06–0.12). This indicates a total effect of Stand.  $\beta = 0.198$ , with Stand.  $\beta = 0.09$  (44.4%) attributed to the indirect mediation effect of externalized anger on the relationship between harsh parenting and current SU. No covariates reflected significant direct effects with past 30-day SU.

### 3.3. Substance use severity

The mediation model for SU severity had a total sample of  $N = 128$ . Significant direct effect relationships were found between externalized anger and SU severity (Stand.  $\beta = 0.23$ ,  $p = 0.001$ ). Furthermore, a mediation effect on the relationship between harsh parenting and SU severity through externalized anger was statistically significant (Stand.  $\beta = 0.06$ , 95% CI = 0.02–0.10). No covariates reflected significant direct effects with SU severity.

## 4. Discussion

### 4.1. Direct effects

Statistically significant direct effects were found between each predictor/covariate and the mediator (externalized anger). Higher perceived harsh parenting and lower SES were associated with externalized anger in this sample of rural adolescents. This finding is consistent with existing literature indicating that harsh parenting may influence later adolescent SU (Kim-Spoon et al., 2014; Neppi et al., 2020); and that rural adolescents with lower perceived SES may report higher levels of anger (Mills et al., 2024). Gender was also a significant covariate in this analysis, as female and other genders significantly predicted higher externalized anger. This finding departs from previous studies of externalized anger in international and urban adolescents (Kim et al., 2022; Rahman et al., 2014), further highlighting the importance of research among rural adolescent populations, as predictors of their behavioral outcomes may depart from predictors of their urban counterparts.

Externalized anger was also positively associated with both current SU and SU severity. This finding supports previous research indicating that lower emotional regulation and higher anger externalization is associated with higher frequencies of adolescent nicotine, alcohol, and cannabis use (McKee et al., 2020). Externalizing behaviors such as aggression have also been associated with increased odds of early SU initiation for adolescents (Mathias et al., 2015). These findings signal the importance of examining adolescent externalized anger as a public health problem for adolescent health and well-being. This may be especially salient for primary prevention efforts in rural settings, given the higher prevalence of tobacco and alcohol use among rural adolescents in the U.S. compared to urban youth (Wiggins et al., 2020; Friesen et al., 2022; Rural Health Information Hub, 2024; Saalfeld & Haag, 2024). While this study does not demonstrate a causal relationship between externalized anger and SU or SU severity, its findings do reflect a

significant association between externalized anger and these variables.

Finally, the direct effect of harsh parenting on current SU was statistically significant and positive. Previous studies examining harsh parenting as a predictor of SU have found a similar effect across all substances that were measured (tobacco, alcohol, and cannabis) (Becona et al., 2012; Bosk et al., 2021; Calafat et al., 2014; Fleming et al., 2016; Stewart et al., 2023). This finding may be especially salient within rural racially-homogenous settings, as White youth reportedly experience higher rates of harsh parenting than their Black counterparts (Bosk et al., 2021).

#### 4.2. Externalized anger mediation

This study found modest but significant statistical evidence that anger mediates the relationship between harsh parenting and two SU measures among Appalachian adolescents. That is, externalized anger was found to mediate the relationship between harsh parenting and whether youth used *any* substances, as well as the relationship between harsh parenting and SU *severity*. In both cases, the indirect effect was positive, indicating that harsh parenting was associated with an increase in SU through externalized anger. Although the effects were relatively modest, we found a pattern of mediation across both measures of SU. The mediation effect of externalized anger on SU severity was small but nonetheless carries implications to support advocacy for developmentally appropriate harm reduction strategies, potentially paired with anger intervention strategies, that may help reduce SU severity and harms among adolescents (Jenkins et al., 2017; Winer et al., 2022; Zarshenas et al., 2017). While primary prevention is a common goal for this age group, reducing severity of SU through secondary prevention and interventions targeting coping skills and anger management (Haktanir et al., 2023) may be effective at reducing severity of SU as well; however, no such studies were found on this topic to date. Given the modest effects found in this study, more research is needed on this topic and outcome.

For current (past 30-day) SU, the mediation effect of externalized anger on the relationship between harsh parenting and current SU accounts for 44.4% of the total effect that was found. This suggests a potential pathway from harsh parenting to SU, through externalized anger. This observation has important implications for adolescent behavioral health more generally, as well as for rural adolescents. For example, if adolescents experience harsh parenting at elevated levels, this may trigger increased externalized anger (Brody et al., 2014; Kerr & Schneider, 2008; Wang, 2019), which may lead to increased odds of SU or early SU initiation (Eftekhar et al., 2004; Mathias et al., 2015; Serafini et al., 2016).

While this study does not prove a direct causal relationship between adolescent externalized anger and SU, future research should examine whether patterns of adolescent SU reflect ways of coping with anger. Future research should also identify evidence-based parenting interventions to reduce harsh parenting in favor of more positive or authoritative parenting approaches (Kingsbury et al., 2020; Wang, 2019) or whether various types of parental support can reduce harsh parenting (Chen & Raine, 2018).

#### 4.3. Limitations and strengths

This study has several limitations and strengths. Although the data is based on self-report, these assessments by adolescents have been found to compare favorably to objective measures (Casas, 2011; Quon & McGrath, 2014; Shek, 2014). Another strength of this study is its longitudinal assessment of early adolescents, in which a time-lag between measurement of harsh parenting (Wave 4) and later SU (Wave 6) allowed for examining a temporal relationship between harsh parenting and SU. Since externalized anger was assessed concurrently during the same wave as SU, we could observe its relationship as a mediator of harsh parenting assessed one year earlier. However, it should be noted

that the relationship between externalized anger and SU is a correlation mediation rather than a temporal mediation. Due to these variables being measured concurrently, there is no evidence for a causal relationship between externalized anger and SU.

A notable study limitation is that the sample of adolescents was relatively young, between 11–14 years old, which is early in the adolescent SU initiation trajectory. It is well documented that older adolescents are more likely to use substances than younger adolescents (Broman, 2016; National Institutes of Health, 2023). The transition from childhood into adolescence is often accompanied by increased risk taking and rule-breaking behavior as youth begin to form their identity as adolescents. Consistent with this existing knowledge, the frequency of use for all four substances assessed in this sample was low ( $n = 128$ ), with only 11.5% of adolescents in the sample reporting past 30-day SU. We hypothesized that externalized anger would be a serial predictor of any type of SU, as this serves as an indicator of early risk taking and rule breaking behavior that is highly correlated with later adolescent and young adult substance use. Combining the four substances into a single SU construct allowed us to examine this hypothesis directly with sufficient power.

Another consideration is the measurement of gender within this analysis. In the YMHS surveys, gender was measured at each wave. For the purpose of the current analysis, the highest categorical value for gender was captured. This indicates that if at any wave a student reported “3” (Other gender), this result was captured and utilized in analysis. Likewise, if at any point a student shifted from reporting “1” (boy) to “2” (girl), the student’s gender was coded as “2”. This may have inflated the number of data points coded as “girls” and “other” (thus removed) in the sample. Throughout the course of the study (6 waves),  $n = 122$  respondents changed their answer. Given the high proportion of changed answers across waves, we can infer this may be due at least in part to careless responding.

This study offers temporality between harsh parenting, externalized anger and SU. For the purposes of the study, harsh parenting was considered to have a unidirectional effect on the other two variables. A potential limitation to consider is the ongoing discussion of bidirectionality between harsh parenting, externalized anger, and adolescent SU. In fact, there is evidence for bidirectionality across these variables (Laitano et al., 2022; Otterpohl et al., 2022). However, the design of the current study (harsh parenting was measured at an earlier date than anger and SU) presents a strength that a cross-sectional study would otherwise not offer.

Finally, consideration around the homogeneity of the current sample must be given, as it carries implications for the generalizability of this study’s findings. The current sample had a largely White (87.2%) and non-Hispanic (95.7%) population in a rural American setting. The current study findings are likely not applicable to the general population of US early adolescents with identities outside these demographics, as this is an understudied and underrepresented population.

## 5. Conclusion

This study shows that adolescent externalized anger is associated with current SU among rural adolescents, and suggests that harsh parenting may predict SU severity, through the mechanism of externalized anger. These findings underline the importance of adolescent anger as a possible risk factor for SU and points to the potential of preventive interventions to reduce use. While the etiology of adolescent SU is complex, this study provides evidence to support the possibility of addressing rural adolescent anger as a way to prevent rural adolescent SU. Finally, the mediation effect of externalized anger between harsh parenting and SU demonstrates the importance of examining both individual and interpersonal factors that influence SU. Although many anger and SU interventions are individually focused, these findings show the potential benefits of including parenting-focused interventions in preventing adolescent SU. Interventions that target more adaptive

approaches to externalized anger among rural adolescents, done in concert with targeting harsh parenting among this population, may help address rural adolescent SU overall. Interventions administered at the individual (adolescent) level of the socioecological model have been shown to help address behaviors such as externalized anger and SU (Byrne & Cullen, 2024; Te Brinke et al., 2021; Matson et al., 2022). Additionally, parenting interventions at the interpersonal level (Havighurst et al., 2015; Shorey & Ng, 2021), such as *Tuning into Teens*, have been shown to help reduce and/or prevent harsh parenting, and/or help address externalizing behavioral problems in adolescents. Parents of rural youths have expressed a need for preventive interventions and also parenting support, indicating they would be receptive to such interpersonal interventions if offered (Gunlicks-Stoessel et al., 2025). Real-world implications of these parenting interventions could include a shift from harsh parenting styles to more authoritative parenting styles, thus potentially helping to reduce externalized anger, SU, and/or SU severity among adolescents. In the future, crafting interventions at the institutional level (in schools or possibly churches, where rural communities tend to congregate for community and advice (Richards & Stambaugh, 2021)) would also be environments well-suited for helping address harsh parenting, externalized anger, and SU experienced by adolescents.

While conceptual models linking harsh parenting and SU are well established (Crano & Donaldson, 2018; Hinnant et al., 2015; Kapetanovic et al., 2023; Kim-Spoon et al., 2014), this study not only includes externalized anger as a mediator between these factors, but extends the conceptual model to this understudied rural population. Given that rural populations have a unique set of characteristics compared to their urban counterparts, including reduced access to resources like healthcare, transportation, internet, and higher rates of geographic isolation (Bettenhausen et al., 2021; Dow-Fleisner et al., 2022), anger and parenting interventions that consider these unique needs and characteristics are vital in reducing downstream adolescent SU.

#### CRedit authorship contribution statement

**Rosalina Mills:** Writing – review & editing, Writing – original draft, Formal analysis, Conceptualization. **Jacob K. Tebes:** Writing – review & editing, Writing – original draft, Conceptualization. **Michael J. Strambler:** Writing – review & editing, Software, Formal analysis. **Alfgeir L. Kristjansson:** Writing – review & editing, Writing – original draft, Supervision, Resources, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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#### Data availability

The data that has been used is confidential.

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