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Parental Knowledge/Monitoring and Adolescent Substance Use: A Causal Relationship?

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Objective: Many studies have shown that parental knowledge/monitoring is correlated with adolescent substance use, but the association may be confounded by the many preexisting differences between families with low versus high monitoring. We attempted to produce more rigorous evidence for a causal relation using a longitudinal design that took advantage of within-family fluctuations in knowledge/monitoring during the COVID-19 pandemic. ***Method:*** Youth (N = 8,780, age range = 10.5–15.6 years) at 21 sites across the United States completed up to seven surveys over 12 months. Youth reported on their parents' knowledge/monitoring of their activities and their substance use in the past month. Regressions were fit to within-family changes in youth-perceived knowledge/monitoring and substance use between survey waves. By analyzing within-family changes over time, we controlled for all stable, a priori differences that exist between families with low versus high levels of youth-perceived knowledge/monitoring. ***Results:*** Youth initially denying substance use were significantly more likely to start reporting use when

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Florence J. Breslin is now at the Center for Health Sciences, Oklahoma State University.

We have no known conflicts of interest to disclose. The study was not preregistered. Data used in the preparation of this article were obtained from the Adolescent Brain Cognitive Development℠ (ABCD) Study (https://abcdstudy.org), held in the National Institute of Mental Health (NIMH) Data Archive (NDA). This is a multisite, longitudinal study designed to recruit more than 10,000 children age 9–10 and follow them over 10 years into early adulthood. The ABCD Study is supported by the National Institutes of Health and additional federal partners under Awards U01DA041048, U01DA050989, U01DA051016, U01DA041022, U01DA051018, U01DA051037, U01DA050987, U01DA041174, U01DA041106, U01DA041117, U01DA041028, U01DA041134, U01DA050988, U01DA051039, U01DA041156, U01DA041025, U01DA041120, U01DA051038, U01DA041148, U01DA041093, U01DA041089, U24DA041123, and U24DA041147. A full list of supporters is available at https://abcdstudy.org/federal-partners.html. Additional support for this work was made possible from supplements to U24DA041123 and U24DA041147, the National Science Foundation (NSF 2028680), and Children and Screens: Institute of Digital Media and Child Development Inc., the National Institute on Alcohol Abuse and Alcoholism (AA030197), and the National Institute on Drug Abuse (DA055935). A listing of participating sites and a complete listing of the study investigators can be found at https://abcdstudy.org/wp-content/uploads/2019/04/Consortium_Members.pdf. ABCD consortium investigators designed and implemented the study and/or provided data but did not necessarily participate in analysis or writing of this report. This article reflects the views of the authors and may not reflect the opinions or views of the NIH or ABCD consortium investigators. The ABCD data repository grows and changes over time. The ABCD data used in this report came from the ABCD 4.0 data release (DOI: 10.15154/1523041), the ABCD COVID-19 Survey First Data Release (DOI: 10.15154/1520584), and the ABCD COVID-19 Survey Second Data Release (DOI: 10.15154/1522601). DOIs can be found at https://nda.nih.gov/study.html?id=1299, https://nda.nih.gov/study.html?&id=1041, and https://nda.nih.gov/study.html?&id=1225. Code for analysis is available from William E. Pelham III upon request.

William E. Pelham III served as lead for conceptualization, formal analysis, writing the original draft, review, and editing. Susan F. Tapert, Marybel R. Gonzalez, Natasha E. Wade, Krista M. Lisdahl, Mathieu Guillaume, Andrew T. Marshall, Amandine Van Rinsveld, Anthony Steven Dick, Fiona C. Baker, Florence J. Breslin, Arielle Baskin-Sommers, Chandni S. Sheth, and Sandra A. Brown served in a supporting role for conceptualization, formal analysis, and writing, review, and editing.

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they experienced a decrease in the level of perceived knowledge/monitoring (relative risk [RR] = 1.18, $p < .001$). Youth initially endorsing substance use were significantly more likely to stop reporting use when they experienced an increase in the level of perceived knowledge/monitoring (RR = 1.06; $p < .001$). Associations were similar or larger when adjusting for several time-varying potential confounders. ***Conclusion:*** In a large, sociodemographically diverse sample, within-family changes in youth-perceived parental knowledge/monitoring over time were robustly associated with changes in youths' engagement in substance use. Findings lend support to the hypothesis that parent knowledge/monitoring is causally related to substance involvement in early adolescence.

Keywords: parental knowledge, parental monitoring, substance use, adolescence

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Substance use during early adolescence is associated with risk of negative health consequences in both the short- and long-term (e.g., Tapert et al., 2001). One factor that predicts less alcohol and drug use during adolescence is parental monitoring: The extent to which parents "structure the child's home, school, and community environments, and track the child's behavior in those environments" (Dishion & McMahon, 1998, p. 66). Dozens of studies have confirmed that low parental knowledge/monitoring is associated with increased use of alcohol, cannabis, and other drugs throughout adolescence (Lac & Crano, 2009; Ryan et al., 2015; Yap et al., 2017).

However, the evidence linking parental knowledge/monitoring to adolescents' substance use remains primarily correlational rather than causal (Crouter & Head, 2002; Racz & McMahon, 2011; Stattin et al., 2010). No study has experimentally isolated the causal effect of knowledge/monitoring on adolescent use by randomizing families to different levels of knowledge/monitoring. Instead, these studies have documented that low knowledge/monitoring and substance use tend to co-occur within cross-sectional samples (e.g., DiClemente et al., 2001) or that low parental knowledge/monitoring prospectively predicts substance use over time (e.g., Steinberg et al., 1994).

These designs comprise weak evidence of a causal relationship because there are many other ways in which families with low vs. high knowledge/monitoring differ. These other factors, rather than knowledge/monitoring, could explain the discrepancy in youth substance use. Indeed, reviews indicate considerable overlap in the antecedents of parental knowledge/monitoring (Crouter & Head, 2002; Racz & McMahon, 2011) and adolescent substance use (Donovan, 2004). For example, both constructs are prospectively predicted by youth biological sex at birth, early temperament, defiance, and conduct problems; parental education, employment, marital status, and alcohol use; parent–child relationship quality; parental warmth; and peer antisociality. Because these variables precede both parental knowledge/monitoring and youth substance use during adolescence, they may serve as confounding variables, introducing a noncausal association.

The absence of strong causal evidence is troubling because many etiological models (Donovan, 2019; Racz & McMahon, 2011) and family-based intervention programs (Kuntsche & Kuntsche, 2016; Van Ryzin et al., 2016) rely on the assumption that an increase in parental knowledge/monitoring will cause a decrease in offspring substance use. If parental knowledge/monitoring merely predicts substance use, but does not cause it, then a clinical focus on increasing parental knowledge/monitoring to prevent or reduce substance use is misplaced and wastes intervention resources. If parental knowledge/monitoring merely predicts substance use, but does not cause it, then our etiological theories are misattributing the impact of other important factors to parental knowledge/monitoring.

Analysis of Within-Family Changes as Strategy to Improve Causal Inference

Randomizing families to low vs. high levels of parental knowledge/monitoring would produce the strongest causal evidence, but this design faces both practical and ethical obstacles (West et al., 2008). The current study pursued an alternative approach to establishing more rigorous evidence of a causal relation by analyzing within-family changes in youth-perceived parental knowledge/monitoring over time in a sample of 8,780 families assessed seven times over 12 months. When we compare knowledge/monitoring between families, the association between parental knowledge/monitoring and substance use can be confounded by the many preexisting differences between families with low vs. high knowledge/monitoring. However, when we compare knowledge/monitoring within a given family over time, preexisting, stable differences between families with low vs. high knowledge/monitoring (e.g., youth biological sex at birth, parental education, youth temperament) can no longer explain why knowledge/monitoring and substance use covary. Thus, analyzing within-family changes in knowledge/monitoring over time (rather than between-family levels of monitoring) can help address the issue of confounding variables and support stronger causal inference (Keijsers, 2016).

Another way to strengthen causal inference is to measure changes in monitoring and substance use over a shorter interval. Prior longitudinal studies have typically measured knowledge/monitoring at waves 1+ years apart (Racz & McMahon, 2011), whereas our assessments were spaced approximately 5–11 weeks apart. The shorter the interval between measurements, the less likely that a within-family change in some other factor causing both monitoring and substance use will occur. For example, over the course of one year, a family may move neighborhoods, the parents may divorce, or the youth may substantially change their friend group, with each change potentially affecting both knowledge/monitoring and substance use and explaining their covariation over time in that family. Yet each of these within-family changes is less likely to occur between measurements taken 5 to 11 weeks apart.

We applied this within-family design under conditions likely to reflect greater within-person variability and exogenous sources of within-family change: the coronavirus disease 2019 (COVID-19) pandemic. The COVID-19 pandemic produced large and time-varying disruptions to families' daily lives, as many youth transitioned between in-person, hybrid, and remote schooling; many parents transitioned between in-person and remote work; stay-at-home orders were issued then rescinded; and youths' contact with family and friends waxed and waned. Thus, within-family variability in knowledge/monitoring may be greater during the COVID-19 pandemic than over similar periods in other years, improving statistical power for the within-family analyses that can better address confounding factors. In addition, there were many potential sources of within-family changes in knowledge/monitoring that were external to the family—for example, changes in local infection rates and public health precautions, employer work-from-home policies, school format. Thus, within-family changes in knowledge/monitoring during the COVID-19 pandemic may be less dependent on preexisting youth, parent, and family characteristics, improving their suitability for causal inference.

Potential Moderators of the Causal Effect

It is also important to understand how the causal effect of parental knowledge/monitoring may vary across adolescents. We focus on three potential moderating variables that have been explored in previous research (Racz & McMahon, 2011): youth biological sex at birth, age, and externalizing spectrum psychopathology. The association between knowledge/monitoring and alcohol/drug use was stronger among biological females at birth in both within-study (Rusby et al., 2018) and between-study (Lac & Crano, 2009) comparisons. Longitudinal, school-based samples have found that the association between knowledge/monitoring and substance use tends to weaken from early to middle and late adolescence (Mak et al., 2020; Van Ryzin et al., 2012). Finally, considering externalizing psychopathology, the association between knowledge/monitoring and substance use was stronger among teens with Attention-Deficit/Hyperactivity Disorder than among matched controls (Walther et al., 2012), though in another study the association did not vary as a function of disinhibitory temperament at age 6 years (Rioux et al., 2016). None of these previous studies addressed the issue of confounding.

Current Study

The goal of this study was to test a core assumption undergirding many etiological models and clinical interventions: that low parental knowledge/monitoring causes increased substance use among adolescents. We hypothesized that within-family, month-to-month changes in youth-perceived parental knowledge/monitoring would be associated with within-family, month-to-month changes in youth substance use, consistent with a causal relationship. We also hypothesized that the within-family association of changes in youth-perceived parental knowledge/monitoring and substance use would be stronger among youth who were biological females at birth, who were older in age, or who exhibited a preexisting externalizing spectrum disorder.

Method

Sample and Design

Data were drawn from the Adolescent Brain and Cognitive Development (ABCD) Study, a prospective, longitudinal cohort. Entry criteria were minimal and the cohort was intended to reflect normal variability in adolescent development (Volkow et al., 2018). Youth (N = 11,880) were recruited at 21 study sites across the United States in the years 2016 to 2018; primarily using school-based ascertainment—see Garavan et al. (2018) for details. Youth were 9 or 10 years old at study entry. 48% of youth were biological females at birth. Fifty two percent of youth were White, 15% were Black, 20% were Hispanic, 2% were Asian, and 11% were of another racial/ethnic identification. Sixty-eight percent of parents/guardians were married. Maximum parent educational attainment within families was as follows: high school degree of less (15%), some college or Associate Degree (26%), bachelor's degree (25%), Master's degree (23%), professional degree (10%). Fifty-seven percent of families reported total annual household income above $75,000.

All procedures were approved by the UCSD Human Research Protection Program. Beginning in May 2020, ABCD Study families were sent links to complete a series of web-based surveys measuring the impacts of the COVID-19 pandemic. Youth were 10.5 to 14.6 years old (M = 12.4, SD = .9) at the beginning of these surveys, which spanned one year. Survey waves were spaced 5 to 11 weeks apart: Wave 1 (May 16, 2020), Wave 2 (June 23, 2020), Wave 3 (August 4, 2020), Wave 4 (October 8, 2020), Wave 5 (December 13, 2020), Wave 6 (March 2, 2021), and Wave 7 (May 17, 2021). There were separate links for youth and parent; youth were asked to complete the survey in private. A total of 8,780 youth completed a total of 34,747 surveys (94% to 97% of parents completed the corresponding parent survey). Table S1 in the online supplemental material compares those completing each survey wave to each other and to the full ABCD Study sample. There were no meaningful differences between completers of Waves 1 through 7. However, youth who were Black or whose parents had low education, low income, or were unmarried were underrepresented in Waves 1 through 7 relative to the full ABCD Study sample (see Table S1 in the online supplemental material). These differences were addressed through weighting, as described in the following text.

Measurement of Youth Substance Use

At each survey wave, youth completed several items measuring substance use, modeled on previous ABCD Study assessments (Lisdahl et al., 2018) and the Monitoring the Future study 2020 interview (Miech et al., 2020). Youth reported the number of days in the past 30 days on which they (a) had a drink containing alcohol; (b) used a nicotine product (cigarette; electronic nicotine delivery system; cigar, hookah, pipe; smokeless tobacco, chew/snus); (c) smoked, vaped, or ate a cannabis product (flower, concentrate, edible); (d) misused any prescription drug; (e) sniffed liquids, sprays, or gases to get high; or (f) used any other drugs. As expected given the age of participants, most reported use (72%) occurred on just 1 to 2 days in the last month. Previous literature suggests the impact of parental knowledge/monitoring is

similar across alcohol/drug classes (Lac & Crano, 2009; Mak et al., 2020; Yap et al., 2017) and preliminary analyses indicated the same was true in these data. Thus, following Pelham et al. (2021), we collapsed responses to items (a) through (f) into a dichotomous indicator of any substance use in the past 30 days. The proportion of youth endorsing use of any substance ranged from 3.2% to 3.7% across Waves 1 through 7 (n = 821 youth ever reported substance use). Among endorsements of use, 39% were of alcohol, 32% were of a nicotine product, 8% were of a cannabis product, 9% were of a prescription drug (i.e., misuse), and the remaining 10% were of inhalants or other drugs.

Measurement of Youth-Perceived Parental Knowledge/Monitoring

Parental knowledge/monitoring was measured via youth perceptions. At each survey wave, youth rated the following four items on a five-point Likert scale ranging from 1 (*never*) to 5 (*almost*), thinking of the last week: "How often do your parents/guardians know where you are?"; "If you are at home when your parents or guardians are not, how often do you know how to get in touch with them?"; "How often do you talk to your mom/dad or guardian about your plans for the coming day, such as your plans about what will happen at school (or school-at-home) or what you are going to do?"; and "How many times do you and your parents/guardians eat dinner together?" (Karoly et al., 2016). This scale reflects the broad conceptualization of monitoring taken in the vast majority of published literature (Handschuh et al., 2020; Racz & McMahon, 2011), tapping parents' knowledge of and communication about youths daily activities as well as involvement in their daily lives. Factor analyses supported a unidimensional conceptualization and scoring (omega reliability = .49–.55 across Waves 1 through 7). To improve measurement properties (McNeish & Wolf, 2020), we fit an item response theory model (Samejima, 1969) to item responses at survey wave 1 and used this model to estimate a latent variable score (i.e., theta) for all participants, at all survey waves. All subsequent analyses use the estimated value on the latent parental knowledge/monitoring variable (i.e., theta). The distribution of theta remained similar across Waves 1 through 7 (see Table S2 in the online supplemental material), with correlations over time ranging r = .53–.66. See online supplemental material for psychometric analyses and sensitivity analyses that examined findings for each scale item separately, replicating the pattern of findings in our primary results.

Measurement of Time-Varying Covariates During Pandemic

As described above, the advantage of analyzing within-family changes in knowledge/monitoring and substance use is that any factor that remains stable from one survey wave to the next (e.g., youth biological sex at birth) cannot explain covariation between within-family changes in knowledge/monitoring and substance use. This strategy rules out a broad class of potential confounders. However, factors that change within a family from one survey wave to the next could still confound the association between changes in knowledge/monitoring and substance use. Thus, we measured and adjusted for several time-varying covariates that could cause within-family changes in parental knowledge/monitoring and youth substance use. We developed a list of such variables based on theory and review of the literature. We then reviewed the assessment battery to determine whether the identified variable was measured and therefore could be adjusted for. Selection of confounding variables is a difficult process requiring both substantive and methodological judgment (Miller & Chapman, 2001). We attempted to increase confidence in this process by (a) describing in detail our criteria and rationale for selecting each potential confounder (see Table S6 in the online supplemental material) and (b) comparing findings while adjusting for different sets of potential confounders, in case any selection was improper. We included 10 time-varying covariates, grouped into three sets for analyses—these are described next (see Table S2 in the online supplemental material for descriptive statistics and reliability/validity information).

Youth Factors

Youth completed a four-item measure of perceived stress in the past month (omega reliability = .65; Cohen et al., 1983) and rated the intensity of their worry about COVID-19 during the past week (*not at all* to *extremely*).

Parent Factors

Parents rated how much they were able to enjoy things (*never* to *most of the time*) and the intensity of their worry about COVID-19 (*not at all* to *extremely*) during the last week (NIH Intramural Research Program Mood Spectrum Collaboration, 2020).

Household Events

Youth indicated whether they were currently in school (online or in-person). Parents indicated whether the youth had tested positive for COVID-19, the family engaged in social distancing during the past week, anyone in the household was at increased risk for COVID-19 due to work, the household went without telephone service in the past month due to lack of payment, or the household suffered another indicator of material hardship.

Measurement of Other Variables

Parent Use of Alcohol, Cannabis, and Nicotine

At Survey 2, parents reported whether they had used alcohol, nicotine (cigarettes/electronic nicotine delivery system), or cannabis (flower/vaping) in the last 30 days.

Preexisting Youth Externalizing Spectrum Disorders

Prior to the pandemic, parents had completed a self-administered, computerized, modified Kiddie Structured Assessment for Affective Disorders and Schizophrenia (KSADS; Kobak et al., 2020) to evaluate whether youth met *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM–5)* criteria for psychiatric disorders (American Psychiatric Association, 2013). For each participant, we used data from the most recently completed KSADS, which occurred a median of 10.6 months before the first survey during the COVID-19 pandemic (interquartile range = 7.3–13.5). We created a binary indicator of whether youth met *DSM–5* criteria for any of the following externalizing spectrum diagnoses: attention-deficit/hyperactivity disorder (combined or predominantly hyperactive/impulsive presentation), oppositional defiant disorder, or conduct

disorder. 8% of youth met criteria for 1+ externalizing spectrum diagnosis.[1]

Analytic Plan

Analyses were conducted in R (Version 4.2.1; R Core Team, 2022). Observations were weighted during analysis to account for differences between the full ABCD Study sample and the subset of participants completing each survey wave (i.e., longitudinal attrition). We estimated inverse probability weights (Seaman & White, 2013), which can produce unbiased estimates assuming a Missing at Random mechanism and comprise a standard approach for addressing missing data in surveys. After applying these weights, completers of each survey wave were sociodemographically similar to the full ABCD Study sample at baseline, exhibiting the composition described earlier (see the online supplemental material for details).

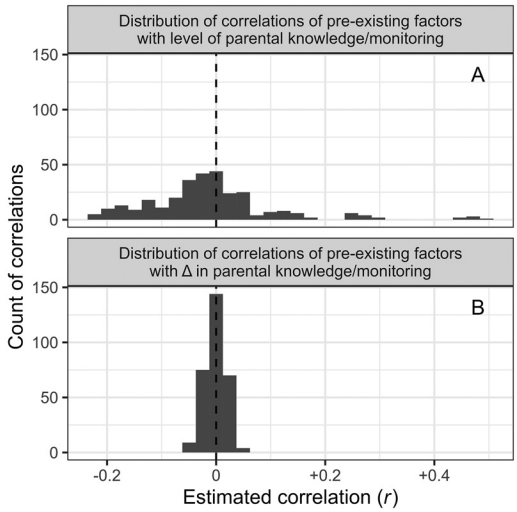
There are many models for longitudinal data, each of which addresses different research questions (Grimm et al., 2016; Selig & Little, 2012). Our goal was to control for all preexisting, stable differences between families with different levels of knowledge/monitoring, thereby yielding stronger evidence for a causal relation. Accordingly, we selected an approach called first differencing that is recommended for by methodologists for this purpose (Allison, 1990; Cameron & Trivedi, 2005; Cunningham, 2021; Wooldridge, 2010). First differencing is a special case of the latent change score model (Grimm et al., 2016). Longitudinal data are transformed to reflect a series of within-family changes between pairs of temporally adjacent measurements ($\Delta X_{i,t} = X_{i,t} - X_{i,t-1}$). Regressions are fit to the differenced data ($\Delta Y_{i,t} = \Delta X_{i,t} + \ldots + e_{i,t}$). Any confounding factor (C) that remains constant between two adjacent timepoints cannot possibly explain covariation between changes in knowledge/monitoring and substance use, because that factor has remained constant (i.e., $\Delta C_{i,t} = 0$). Thus, investigating the relation between knowledge/monitoring and substance use within a first differenced model rules out confounding by all factors invariant between surveys. As first differencing may be unfamiliar to psychologists, the online supplemental material provides a detailed description of the technique, its applicability, and its relation to other longitudinal models.

Preliminaries

We have claimed that within-family *changes* in knowledge/monitoring will be much less dependent on preexisting youth, parent, and family factors than are between-family *levels* of knowledge/monitoring, rendering within-family changes less vulnerable to confounding by these preexisting factors. We verified this claim empirically by examining the correlation of levels and changes in parental knowledge/monitoring during the COVID-19 pandemic with 51 preexisting, potential confounding factors measured at ABCD Study assessments in 2018/2019: demographic characteristics; prepandemic parental knowledge/monitoring, parental warmth, and family conflict; youth school involvement, school disengagement, and grade point average; parent alcohol and drug use; neighborhood safety; youth psychiatric problems and diagnoses; accessibility of substances in the community; parent rules about substance use; and youth impulsivity and fluid reasoning (see Table S7 in the online supplemental material for complete list). Figure 1 shows the distribution of correlations. As expected, many of the preexisting factors were correlated with the level of parental knowledge/monitoring at sizable magnitudes (maximum $|r| = .49$; see Figure 1, Panel A). In contrast, these same preexisting factors exhibited negligible to very weak correlations with within-family changes in parental knowledge/monitoring (maximum $|r| = .05$; see Figure 1, Panel B). Because these preexisting factors have minimal association with changes in parental knowledge/monitoring, they no longer comprise plausible confounders of the observed association between knowledge/monitoring and substance use.

Figure 1

Distribution of Correlations of Preexisting Potential Confounding Factors With Levels and Changes in Youth-Perceived Parental Knowledge/Monitoring During the COVID-19 Pandemic



Note. We examined how the levels of (Panel A) and changes in (Panel B) parental knowledge/monitoring at seven waves of surveys during the COVID-19 pandemic correlated with 54 pre-existing factors that were plausible causes of both knowledge/monitoring and youth substance use during the COVID-19 pandemic (i.e., confounders): demographics; prepandemic parental knowledge/monitoring, parental warmth, and family conflict; youth school involvement, school disengagement, and grade point average; parent alcohol and drug use; neighborhood safety; youth psychiatric problems and diagnoses; accessibility of substances in the community; parent rules about substance use; and youth impulsivity and fluid reasoning (see Table S7 for complete list). The upper panel (A) shows there were many sizeable correlations of pre-existing factors with levels of parental knowledge/monitoring; each of these factors comprises a potential confounding factor introducing non-causal association between knowledge/monitoring and substance use. The lower panel (B) shows the same pre-existing factors exhibit negligible correlation with within-family changes in parental knowledge/monitoring; thus, as desired, moving to the first differencing framework is successful in eliminating a large amount of potential confounding bias.

Regression Modeling

Analyses 1 through 3 report regression models fit with the following common structure. Observations were clustered on study site, family, and youth to account for nonindependence (repeated

[1] Criterion C for the *DSM–5* diagnosis of attention-deficit/hyperactivity disorder (i.e., symptoms present in multiple settings) was not required for diagnosis in the ABCD 4.0 data release. All other criteria were required.

measures) via Horvitz-Thompson-type standard errors (Lumley, 2003). In Analysis 1, we fit standard, between-family models to verify that the previously documented associations between knowledge/monitoring and substance use were present in this data. In Analysis 2, we fit the first differenced, within-family models that can provide more rigorous evidence of causal relations. In Analysis 3, we fit both standard and first-differenced models to examine moderation of the association between knowledge/monitoring and substance use.

In Analysis 1, we regressed a dichotomous indicator of youth substance use in the past 30 days (yes/no) on parental knowledge/monitoring. Next, we add fixed effects for youth age and survey wave, parent substance use, and family demographics to check the robustness of the association.

In Analysis 2, we fit regressions to the differenced data. Within each interval, substance use at Time 1 constrains the possible direction of within-family change: A change in youth substance must be positive (0→1) if the youth is initially denying substance use and a change must be negative (1→0) if the youth is initially endorsing substance use. Thus, we included fixed effects for the level of substance use at the first timepoint in the difference interval and the interaction of the differenced parental knowledge/monitoring variable with that level. This parameterization estimates the effect of within-family change in knowledge/monitoring on the probability of within-family change in substance use, conditional on whether the youth is initially denying or endorsing use. As in Analysis 1, we fit additional specifications to check the robustness of the association. We added fixed effects for the three groups of time-varying covariates that we identified as potential confounding variables (see appendix in online supplemental material): changes in youth perceived stress and worry about COVID-19, parent anhedonia and worry about COVID-19, and household events.

In Analysis 3, we tested whether the association between youth substance use and parental knowledge/monitoring varied by youth biological sex at birth, age, or presence of a *DSM–5* externalizing spectrum disorder. We fit regressions including the main effect of parental knowledge/monitoring, the main effect of the moderator, and the interaction thereof. Fixed effects for survey wave were included. First-differenced models were fit to the differenced versions of the knowledge/monitoring and substance use variables.

Results

Analysis 1: Standard (Between-Family) Models

Table 1 reports regressions relating youth-perceived parental knowledge/monitoring to youth substance use. In a univariate regression (model 1), youth-perceived parental knowledge/monitoring was negatively associated with youth substance use (coefficient = −1.30, standard error [*SE*] = .14, $p < .001$). Youth were 1.3 percentage points less likely to report substance use for each 1 *SD* increase in perceived parental knowledge/monitoring. The association remained statistically significant ($ps \leq .002$) and of similar magnitude when adjusting for youth age, survey wave, parent alcohol, nicotine, and cannabis use; and demographic variables (Models 2 through 4). Figure 2, Panel A shows the rates of youth substance use within deciles of perceived parental knowledge/monitoring. Youth in the bottom 10% of perceived parental knowledge/monitoring were 2.7 times more likely to report substance use than youth in the top 10% of perceived knowledge/monitoring (6.4% vs. 2.4%).

Analysis 2: First Differenced (Within-Family) Models

Table 2 reports regressions relating within-family changes in youth-perceived parental knowledge/monitoring and within-family changes in youth substance use. In a univariate regression (Model 1), within-family changes in youth-perceived parental knowledge/

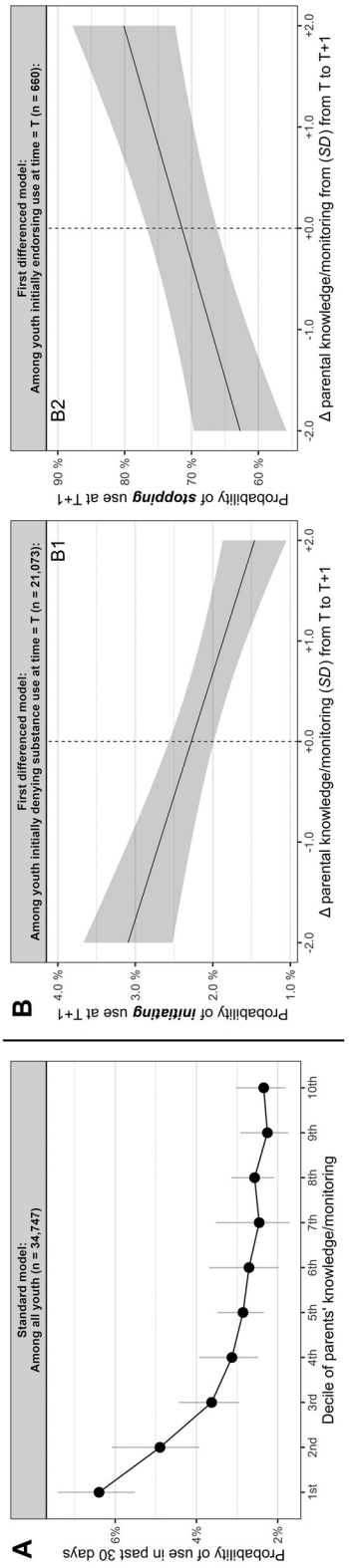
Table 1

Standard Regression Models for Association Between Youth-Perceived Parental Knowledge/Monitoring and Youth Use of Any Substance (Dependent Variable)

	Youth use of any substance in past 30 days (no/yes)							
Independent variable	Model 1 Coefficient (*SE*)	*p*	Model 2 Coefficient (*SE*)	*p*	Model 3 Coefficient (*SE*)	*p*	Model 4 Coefficient (*SE*)	*p*
Level of parental knowledge/monitoring	−1.30 (0.14)	<.001	−1.24 (0.15)	<.001	−1.30 (0.27)	.002	−1.26 (0.15)	<.001
Number of youths	8,780		8,780		6,804		8,482	
Number of observations	34,747		34,747		13,541		33,580	
				Covariates				
Covary youth age?	No		Yes		Yes		Yes	
Covary survey wave?	No		Yes		No		Yes	
Covary parent substance use: past-month use of alcohol, nicotine, cannabis?	No		No		Yes		No	
Covary demographics: youth biological sex at birth, youth race/ethnicity, parent education, parents married?	No		No		No		Yes	

Note. Four different models were fit, differing in which covariates were included. The bottom four rows of table indicate which covariates were included in each. All models clustered on site, family, and youth. Parental knowledge/monitoring is scaled by standard deviation of the estimated latent variable score at Survey 1. Coefficients and standard errors multiplied by 100 to be interpretable as percentage points. Demographics were measured at study entry: Youth was biological female at birth; youth is Black, Hispanic, Asian, or another non-White racial/ethnic category; maximum education among biological parents; and biological parents are married. Number of observations could vary across models due to missing data in the covariates that were included in each model. Number of observations is markedly lower for Model 3 because parent substance use covariates were measured only at Waves 2, 4, and 6. *SE* = standard error.

Figure 2
Associations Between Youth-Perceived Parental Knowledge/Monitoring and Youth Substance Use



Note. Panel A: Based on 34,747 observations of 8,780 youth. Dots indicate mean prevalence of substance use in past 30 days within each decile of parental knowledge/monitoring and vertical bars indicate 95% confidence intervals about the mean. Confidence intervals per logistic method. Panel B: Based on 21,733 differenced observations of 6,069 youth. Panel A (left) shows model-estimated probability of reporting substance use (y-axis) as a function of the within-family change in parental knowledge/monitoring (x-axis), among those not reporting any substance use at the previous survey wave. Panel B (right) shows model-estimated probability of denying substance use (y-axis) as a function of the within-family change in parental knowledge/monitoring (x-axis), among those not reporting any substance use at the previous survey wave. In other words, Panel A graphs how changes in parental knowledge/monitoring were related to transitions out of reporting substance use from one survey to the next and Panel B graphs how changes in parental knowledge/monitoring were related to transitions into reporting substance use from one survey to the next. "T" and "T + 1" refer to time = T and time = T + 1: two successive survey waves. Dashed vertical line indicates no change in parental knowledge/monitoring from one survey wave to the next. Gray ribbons indicate 95% confidence intervals about the estimated probabilities.

monitoring were negatively associated with within-family changes in substance use both for use initially denying use (coefficient = −.41, *SE* = .10, $p < .001$) and initially endorsing use (coefficient = −4.35, *SE* = 1.30, $p < .001$). The association remained of similar magnitude or grew larger when adjusting for changes in the 10 time-varying covariates (Models 2 through 6). Figure 2, Panel B graphs the estimated probability of change in substance use as a function of the within-family change in youth-perceived knowledge/monitoring (see Table 2, Model 1). Among youth initially denying substance use, relative to no change, a 1-standard-deviation *decrease* in perceived knowledge/monitoring was associated with being .4 percentage points more likely to *initiate* substance use (cf. base rate = 2.3%; relative risk [RR] = 1.18). Among youth initially endorsing use, relative to no change, a 1-standard-deviation *increase* in perceived knowledge/monitoring was associated with being 4.4 percentage points more likely to *stop* substance use (cf. base rate = 71%, RR = 1.06).

Analysis 3: Moderation Analyses

Table S3 reports regressions testing moderation of the association between youth-perceived parental knowledge/monitoring and youth's substance use. In the standard models, the interaction with youth-perceived knowledge/monitoring was statistically significant for child age ($p = .02$) but not for youth biological sex at birth ($p = .20$) or history of externalizing spectrum diagnosis ($p = .18$). The association between youth-perceived knowledge/monitoring and substance use was stronger among older youth (simple slopes: age 11: −.58, age 13: −1.53, age 15: −2.47). In the first differenced models, there were two statistically significant interactions. Among youth initially denying substance use, changes in perceived knowledge/monitoring were more strongly associated with changes in substance use among biological females at birth (Coef. = −.78) than biological males at birth (Coef. = −.15) ($p = .02$). Among youth initially endorsing substance use, changes in perceived knowledge/monitoring were more strongly associated with changes in substance use among youth with (Coef. = −17.9) versus without (Coef. = −2.6) history of externalizing spectrum diagnosis ($p = .02$). The remaining interactions were not statistically significant ($ps = .47–.99$).

Discussion

The assumption that parental knowledge/monitoring is causally related to adolescent substance use undergirds existing etiological models and clinical interventions. The present study provided more rigorous empirical support for that assumption. In a diverse, community-based, early-to-mid adolescent sample, we exploited within-family fluctuations in parent knowledge/monitoring during the COVID-19 pandemic to better support causal inferences about its association with adolescent substance use. We found that month-to-month, within-family changes in youth-perceived parental knowledge/monitoring were associated with month-to-month, within-family changes in youth substance use.

A Causal Relationship?

Previous literature linking parental knowledge/monitoring to adolescent substance use had the limitation that families with low

Table 2

Regression Models for Association Between First Differences in Youth-Perceived Parental Knowledge/Monitoring and Youth Use of Any Substance (Dependent Variable)

	Δ youth use of any substance in past 30 days (no/yes)											
Independent variable	Model 1 Coefficient (*SE*)	*p*	Model 2 Coefficient (*SE*)	*p*	Model 3 Coefficient (*SE*)	*p*	Model 4 Coefficient (*SE*)	*p*	Model 5 Coefficient (*SE*)	*p*	Model 6 Coefficient (*SE*)	*p*
Δ in parental knowledge/monitoring, when initially denying substance use	−0.41 (0.10)	<.001	−0.40 (0.10)	<.001	−0.39 (0.10)	<.001	−0.45 (0.10)	<.001	−0.62 (0.12)	<.001	−0.60 (0.12)	<.001
Δ in parental knowledge/monitoring, when initially endorsing substance use	−4.35 (1.30)	<.001	−4.34 (1.28)	<.001	−3.41 (1.38)	.01	−4.28 (1.35)	.001	−5.22 (1.40)	<.001	−4.63 (1.37)	<.001
Number of youths	6,069		6,069		6,069		5,727		5,414		5,414	
Number of observations	21,733		21,733		21,732		20,330		17,907		17,906	
						Covariates						
Covary survey wave?	No		Yes		Yes		Yes		Yes		Yes	
Covary Δ terms for youth factors: perceived stress, worry about COVID-19?	No		No		Yes		No		No		Yes	
Covary Δ terms for parent factors: ability to enjoy things, worry about COVID-19?	No		No		No		Yes		No		Yes	
Covary Δ terms for household events: Yuth tested positive for COVID-19, youth completing schooling, engagement in social distancing, household at increased risk for COVID-19 due to work or use of public transit, household without telephone service due to lack of payments, household suffered a material hardship?	No		No		No		No		Yes		Yes	

Note. Six models were fit, differing in which covariates were included: the bottom four rows of table indicate which covariates were included in each. All models clustered on site, family, and youth. Change in parental knowledge/monitoring is scaled by standard deviation of the estimated latent variable score at Survey 1. Coefficients and standard errors multiplied by 100 for reporting. See appendix in online supplemental materials for details of covariates included in Models 2 through 6. Number of observations could vary across models due to missing data in the covariates that were included in each model. *SE* = standard error.

vs. high knowledge/monitoring differ in many ways, and these other ways (rather than knowledge/monitoring) could explain differences in adolescent substance use. To improve rigor, we analyzed within-family changes in youth-perceived parental knowledge/monitoring that were (1) demonstrably unrelated to a broad swathe of antecedent factors (see Figure 1), (2) unrelated to all factors that remained constant between two surveys 5–11 weeks apart, and (3) statistically adjusted for several time-varying potential confounders. We continued to observe a robust association between knowledge/monitoring and substance use in this within-family analysis ruling out many potential confounders, lending support for the hypothesis of a causal relationship. Consistent with previous findings (Lac & Crano, 2009), the effect size was largest for the scale item directly measuring parent knowledge (Table S4).

In moderation analyses, we found evidence suggesting the causal effect of youth-perceived knowledge/monitoring was stronger among biological females at birth and among youth with a history of externalizing spectrum disorder. Both findings replicate previous work (Lac & Crano, 2009; Rusby et al., 2018; Walther et al., 2012) using a more rigorous design that rules out many confounders as explanations for the differences by biological sex at birth or externalizing disorder. The mechanisms explaining each finding merit further study. Perhaps males are less responsive to parental influence during adolescence due to greater affiliation with deviant peer groups (Dishion et al., 2004). Perhaps knowledge/monitoring is especially important when youth are more prone to impulsive decision making, as are youth with externalizing diagnoses (Beauchaine et al., 2017).

Opposite Direction of Causation

Relative to the published literature (Stattin et al., 2010), our findings better rule out the possibility that the association between knowledge/monitoring and substance use is exclusively explained by youths' substance use causing parental knowledge/monitoring. Previous studies have typically measured knowledge/monitoring 1+ years apart (Racz & McMahon, 2011): over the course of years, it is plausible that youth repeatedly using substances despite rules to the contrary could cause parents to disengage and reduce their knowledge/monitoring (Kerr et al., 2008). In contrast, we measured youth-perceived knowledge/monitoring just 5–11 weeks apart: it is less plausible that parents would disengage and reduce their knowledge/monitoring in the weeks immediately following what for many youth in our sample was a single isolated instance of use.

Stronger Evidence for a Causal Relationship, but Still Not Experimental

Our design provided more rigorous evidence for a causal relationship, but it was not a randomized trial. In our within-family analyses, there may have remained important differences between the observations with low vs. high knowledge/monitoring that could independently explain the differences in youth substance use (i.e., residual confounding): for example, changes in parents' work arrangements. We did not measure all possible confounders, and a single study cannot "prove" causality. Thus, findings should not be regarded as definitive evidence of causality. Further strengthening the evidence for causality will require replication using other quasi-experimental designs (e.g., Lippold et al., 2014) that address confounding in different ways, with different measured confounders, as well as replication in different populations (e.g., treatment-seeking families) and conditions (e.g., outside the pandemic).

Generalizability of Findings

Findings were obtained in a large, nationwide, sociodemographically diverse sample. However, there are several constraints on generalizability. First, while data collection during the COVID-19 pandemic improved our ability to conduct analyses of within-family changes, it may also be viewed as a limitation. Parental knowledge/monitoring may have lesser or greater impact outside the context of an ongoing pandemic. Reassuringly, these pandemic data reflected the same robust association between knowledge/monitoring and substance use (Figure 2, Panel A) found in prior samples assessed before the pandemic (Lac & Crano, 2009; Ryan et al., 2015; Yap et al., 2017). In addition, because we analyzed *change* in knowledge/monitoring and substance use, the potential existence of pandemic-related alterations in the general *levels* of these constructs do not threaten the first differenced models. For example, in a given family, if parents began working from home during the pandemic, knowledge/monitoring may have been higher than outside the pandemic context, but this could not explain why changes in knowledge/monitoring *within* that family were related to changes in substance use.

Second, youth were 10.5–15.6 years old across observations and the overall prevalence of substance use was low (~12% of youth). Though youth were instructed to complete surveys in private to enhance disclosure, they may have underreported substance use. Moreover, the effect of parental knowledge/monitoring may differ in late adolescence, when youth are using substances more frequently (Miech et al., 2020) and are better equipped to circumvent parent attempts at supervision. Correlational studies suggest that the association between knowledge/monitoring and substance use attenuates across mid-to-late adolescence (Van Ryzin et al., 2012), so the causal effect may be smaller than was observed herein. Third, this was not a treatment-seeking sample. The dynamics around parental knowledge/monitoring may differ when the youth and parent have an extended history of conflict, the parent is especially distressed about the youth's behavior, or the youth is regularly abusing substances with friends.

Implications for Etiological Models and Clinical Interventions

Our findings support the hypothesis that parental knowledge/monitoring is a causal determinant of alcohol/drug use during early-to-mid adolescence. As such, they support the inclusion of parental knowledge/monitoring as not just as a predictive risk/resilience factor but as a causal mechanism underlying the etiology of adolescent substance use (Donovan, 2019). In addition, they support the continued focus of family-based interventions to reduce adolescent substance use on increasing parental knowledge/monitoring. Indeed, the one fourth of family-based prevention programs that do *not* currently include a focus on knowledge/monitoring may become more efficacious by adding that component (Van Ryzin et al., 2012). In addition, the timescale of our measurements should reassure parents: the protective effects of increased monitoring do not require years to manifest but rather were manifest over just a few weeks.

Limitations

Some limitations have already been discussed—the design was not experimental, data were collected in the context of a pandemic, and youth in late adolescence were not included. Two other limitations are important to note. First, we relied on youth report of knowledge/monitoring and substance use and could not validate these reports against more objective measures, such as parent and youth agreement on the occurrence of events or urine toxicology (Wade et al., 2022). Our findings pertain to youth-perceived parental knowledge/monitoring—we did not measure parenting behaviors directly. Second, we used a broadband measure of parental knowledge/monitoring that does not distinguish between parent- and youth-driven components (Guilamo-Ramos et al., 2010; Stattin & Kerr, 2000), so we were unable to parse separate facets of the knowledge/monitoring construct.

Conclusion

In a large, longitudinal study, within-family, month-to-month changes in the level of youth-perceived parental knowledge/monitoring were robustly associated with within-family, month-to-month changes in youth substance use. Findings place the existing role of knowledge/monitoring in etiological models and clinical interventions on stronger causal footing. The field would benefit from more studies estimating the relevant causal parameters in different populations (e.g., treatment-seeking youth), under different histories (e.g., older youth with established regular substance use), and using different quasi-experimental designs (e.g., discordant twin design).

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