

Full length article

## Adolescent recanting of alcohol use: A longitudinal investigation of time-varying intra-individual predictors



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## ARTICLE INFO

## Keywords:

Alcohol  
Recanting  
Sipping  
Longitudinal

## ABSTRACT

**Background:** Recanting – denying previous reports of lifetime substance use – occurs frequently in longitudinal investigations of adolescent substance use. While research has focused on how individual differences contribute to recanting, intra-individual factors associated with recanting over time remain understudied.

**Methods:** Adolescents ( $n = 1023$ ) were assessed six times between 2009 – 2015. The sample included participants who reported ever-sipping alcohol in at least one assessment who maintained or recanted ever-sipping at the subsequent assessment ( $n = 543$ , 53.1% of full sample; 54.5% female; 84.9% white; 89.5% non-Hispanic). The majority (58.6%) of the sample recanted ever-sipping. We fit linear mixed models to investigate whether prospective changes in perceived peer drinking, peer approval, alcohol expectancies, and fear of reprisal predicted recanting. To explore whether mechanisms of recanting differed for delayed (i.e., two assessments or later) recanting, we refit the models in a subset of data excluding immediate (i.e., subsequent assessment) recanters.

**Results:** Prospective increases in perceived peer drinking ( $OR = 0.65$ ), peer approval of drinking ( $OR = 0.82$ ), and positive and negative alcohol expectancies ( $OR = 0.96$ ;  $0.98$ , respectively) predicted lower odds of recanting. Similar effects were observed among only delayed recanters.

**Conclusion:** Time-varying, intra-individual factors uniquely predicted recanting over time. Although most recanting occurs immediately following the initial report of ever-sipping, the observed effects were consistent between delayed recanters and the sample as a whole. Considering the systematic patterns evident in recanting, researchers should consider using computer-assisted or other research methods that minimize or verify recanting when it occurs while also informing missing data models.

### 1. Introduction

Longitudinal research on adolescent substance use depends on validity and reliability in self-report assessments to establish onset and progression. Multiple psychometrically sound instruments have been developed that demonstrate high test-retest reliability (Johnson and Mott, 2001; Winters et al., 2002). While self-report assessments are ubiquitous, their use entails known challenges such as obtaining corroborative reporters or biochemical validation, particularly during experimentation, and the influence of social desirability motives on responding (Cohen et al., 1988; Van De Mortel, 2008; Williams and Nowatzki, 2005). Contextual and individual factors also affect the reliability of these assessments, including demand characteristics, peer influences, and erroneous or biased recall (Wellman and O'Loughlin, 2015). One challenge to reliability is 'recanting': denial of previous

reports of lifetime substance use when reassessed at a subsequent time (Fendrich, 2005; Fendrich and Rosenbaum, 2003). Rates of recanting vary between 7%–85% across studies of adolescents using alcohol, nicotine, cannabis, cocaine, opiates, and ecstasy (e.g., Fendrich and Rosenbaum, 2003; Percy et al., 2005). Due to the high priority of studying determinants of substance use initiation, researchers have applied different methodological approaches to handle recanting (e.g., first endorsement carried forward). Although these approaches entail various strengths and limitations, developing a more sophisticated understanding of the processes influencing misreporting may advance our methods for handling recanting.

Investigations into predictors of youth recanting predominantly focus on participant characteristics. Younger age at first-reported onset, female sex, being a racial or ethnic minority, lower educational status and academic expectations, receiving drug education, higher

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<https://doi.org/10.1016/j.drugalcdep.2018.08.035>

Received 1 May 2018; Received in revised form 28 August 2018; Accepted 29 August 2018

Available online 11 October 2018

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delinquency, and heaviness of use predict greater recanting (Fendrich and Rosenbaum, 2003; Fendrich and Vaughn, 1994; Fendrich and Yun Soo Kim, 2001; Kaestle, 2015; Mensch and Kandel, 1988; Percy et al., 2005; Shillington et al., 2011). Another line of research examines assessment characteristics that contribute to recanting. For example, face-to-face assessment and younger interviewer age predict lower rates of recanting (Fendrich and Vaughn, 1994; Fendrich and Yun Soo Kim, 2001), while familiarity with the interviewer predicted higher rates (Fendrich and Vaughn, 1994; Griesler et al., 2008; Mensch and Kandel, 1988). These findings suggest certain causes of recanting, such as fear of reprisal or self-presentation bias (e.g., seeking approval from or avoiding disappointing interviewers). Consistent with this, recanting is higher for socially stigmatized drugs, such as heroin (Fendrich and Rosenbaum, 2003; Fendrich and Vaughn, 1994; Percy et al., 2005).

Although research linking recanting to individual, assessment, and substance-related factors has elucidated conditions when recanting is more likely to occur, understanding the mechanisms underlying recanting is essential to anticipating such misreporting. Recanting is an intra-individual process: contexts influencing recanting evolve over time. An individual who accurately reports substance use at age 12 but recants at age 13 may be less likely to have recanted had they been assessed at age 14 when substance use may be perceived as more acceptable. These differences may be more attributable to context and developmental stage than broad subject-level disparities in reporting accuracy. Therefore, it is necessary to examine recanting across multiple sequential time points within individuals to understand the dynamics of recanting over time.

Prior research highlights the importance of response consistency and psychological processes as time-varying predictors. Two studies of adolescent alcohol and cigarette users in the National Longitudinal Study of Youth (NLSY) found rates of recanting decreased over time (Shillington et al., 2010b, 2010a). Although it is unclear whether findings stem from participant's ages, habituation to participation, or inherent tendencies to respond consistently, they suggest that *stability* of responses over time is an important consideration. Another study investigating recanting in young adult smokers found that depression ratings during adolescence but not young adulthood predicted recanting in young adulthood (Stanton et al., 2007). Although it is unclear where in Stanton et al.'s (2007) adolescent and young adult assessments recanting occurred, these findings suggest that the processes underlying recanting may vary across time. It is also possible that some processes will exert differential influence on recanting over time (e.g., depression may predict *immediate* recanting at the assessment following reported substance use onset but not *delayed* recanting at more distal assessments); however, no empirical investigations have tested this hypothesis. Understanding the breadth of the recanting phenomenon necessitates an exploration of time-varying intra-individual factors that contribute to erroneous reporting. We seek to elucidate intra-individual variability in recanting by examining the influence of psychological processes shown to be associated with alcohol use.

Assuming no a priori knowledge of the validity of a given response, a report of ever-using alcohol depends on factors associated with *actual* use of a substance as well as erroneous responding. In other words, two generative processes underlie responding – one relating to alcohol use onset and one relating to validity. Importantly, these factors may not be distinct: the factors contributing to actual substance use may be the same factors that influence recanting. For instance, an adolescent who perceives her peers drinking heavily may be more likely to actually drink but may also recant drinking at a later time if drinking is no longer normative. This decision, deliberate or implicit, to provide inconsistent data is a form of response editing, or modification of responses due to social desirability at the time (Fendrich and Mackesy-Amity, 2000; Fendrich and Rosenbaum, 2003; Sudman et al., 1996).

Two more factors that could be systematically related to recanting are alcohol expectancies and fear of parental reprisal. Etiological models of alcohol use onset converge on the growing influence of peers

and expectancies as adolescents age (Windle et al., 2008; Zucker et al., 2008). Older adolescents spend more time with peers and are more susceptible to peer influence on substance use behavior (Windle et al., 2008). Concurrently, adolescents' positive alcohol expectancies increase with age, and their negative expectancies decrease (Dunn and Goldman, 1998; Janssen et al., 2018; Miller et al., 1990). Research has further demonstrated a developmental critical period of susceptibility in adolescents to alcohol expectancies— they account for far more variability in alcohol use among adolescents than older samples (Leigh and Stacy, 2004). The influence of alcohol expectancies may extend beyond actual alcohol use among adolescents, contributing to reporting or recanting of past use. Additionally, parental behaviors including monitoring and attitudes regarding alcohol permissiveness predict alcohol use and also moderate relationships among peer influences and youth drinking (Barnes et al., 2006; Wood et al., 2004). Reports of adolescent alcohol use might conflict with parent expectations when parental alcohol permissiveness is low. Those who believe their parents would respond punitively to adolescent drinking may experience fears of reprisal when reporting drinking and recant past use. As these factors are linked with alcohol use onset among adolescents and may evoke socially desirable behaviors, they likely also contribute to recanting.

This study examines recanting of alcohol use among adolescents participating in an ongoing longitudinal study. We investigate the extent to which time-varying intra-individual factors predict recanting across six time points, focusing on sipping, an early milestone of alcohol involvement. Adolescents who report sipping prior to sixth grade are more likely to consume a full drink, get drunk, and drink more than three drinks per occasion by ninth grade relative to non-sippers (Jackson et al., 2015a). Early adolescent initiation of alcohol use is also associated with increased risk for drinking initiation (i.e., not just sipping or tasting; Donovan and Molina, 2011) and binge drinking (Aiken et al., 2018). Since these findings suggest that early sipping is a salient indicator of alcohol-related risks, characterizing the mechanisms that influence the reliability of such reports is essential to elucidate the risk posed by alcohol sipping. In this study, we examined whether increased perception of peer drinking, more positive and fewer negative alcohol expectancies, and decreased participant beliefs about their parent's punitive responses to drinking between two adjacent assessments predicted decreased odds of recanting versus consistent reporting at the latter assessment. We examined these effects beyond the influence of known between-subjects predictors of recanting (baseline age, sex, and race/ethnicity) and stability in response patterns. Additionally, to evaluate whether recanting was uniquely associated with focal predictors or merely indicated an individual's general likelihood to provide inconsistent responses, we controlled for an overall index of inconsistency in items unrelated to drinking. Furthermore, adolescents may vary in their willingness to identify as a 'drinker' or approach alcohol. As these differences may affect self-reports of drinking, we controlled for participants' willingness-to-drink at each time point (Gerrard et al., 2008; Jackson et al., 2014). This is the first study to investigate time-varying intra-individual predictors of recanting in a longitudinal analytic framework.

## 2. Methods

### 2.1. Participants and procedure

Data came from a longitudinal investigation of adolescent progression through drinking milestones (Jackson et al., 2015b). Adolescents ( $N = 1023$ ) in grades 6–8 from six urban, suburban, and rural Rhode Island schools were enrolled between 2009 to 2011 in five sequential cohorts. Students expressing study interest in response to information provided by mail or teachers (initial 38% response), for whom written parental consent was obtained, were invited to participate (65% of those returning consent forms). Response rates were consistent with other studies of youth substance use requiring active parental consent

(Liu et al., 2017; Pokorny et al., 2001). Of these youth, 88% attended a 2-hour group orientation session prior to providing assent and being enrolled. Following orientation, participants were provided with access to a computer, instructed on using the online survey platform (Illume; DATSTAT, 1997), and completed T1 data collection. Computer access during data collection minimized exposure to other participants and research staff and maximized privacy in responding. Participants used the same online survey platform to complete follow-up assessments. To minimize the potential impact of social desirability, parents and youth received information on the importance of privacy and confidentiality (including explaining the Certificate of Confidentiality) during the consent, orientation, and assent processes. Confidentiality was reiterated throughout the study, and participants were explicitly told that parents and teachers would not see their responses.

Participants were assessed at baseline (T1), four follow-up assessments at six-month intervals (T2–T5), and one follow-up assessment 12 months after T5 (i.e., 3-year follow-up; T6). Retention rates were 92% (T2), 88% (T3), 85% (T4), and 83% (T5–T6). The analytical sample consisted of participants who reported ever-sipping alcohol at T1–T5 and then maintained or recanted sipping at the subsequent assessment ( $n = 543$ , 53.1% of full sample; 54.5% female; 84.9% white; 89.5% non-Hispanic; see Table 1). Participants included in analyses did not differ from those excluded on gender ( $t(1021) = 1.58$ ;  $p = .12$ ), race (white vs. non-white;  $t(1021) = 1.73$ ;  $p = .08$ ), or ethnicity (Hispanic vs. non-Hispanic;  $t(1021) = 1.68$ ;  $p = .09$ ). Those excluded were significantly younger ( $M = 12.3$ ,  $SD = .95$ ) than those included ( $M = 12.6$ ,  $SD = .93$ ;  $t(1021) = 5.65$ ;  $p < .001$ ).

2.2. Measures

2.2.1. Subject-level covariates

2.2.1.1. Demographic information. Participants reported their gender, age, race, and ethnicity at enrollment. We dichotomized race and ethnicity as White/non-White and Hispanic/non-Hispanic.

2.2.1.2. Overall index of inconsistency. Participants' tendency toward inconsistent responding was indexed using the procedures outlined in Wardell et al. (2014). Briefly, we identified seven item pairs that assessed redundant information and therefore should have yielded

consistent responses (e.g., “skipped school” vs. “skip school all or part of the day”; “go to church” vs. “attend religious services”). Items were intentionally unrelated to drinking in order to obtain a general tendency for inconsistency which could relate to low effort or inattention independent of alcohol use recanting. To adjust for the distributional properties of different items (i.e., variability in the range of possible responses), we transformed item scores into z-scores, computed differences between paired items, and calculated a mean difference score. This standardization procedure ensured that items on larger response scales did not disproportionately bias the inconsistency index. The mean difference score (based on standardized items), reflecting the tendency to provide inconsistent reports across item pairs, served as each participants' overall index of inconsistency.

2.2.2. Time-varying covariates

2.2.2.1. Sipping stability. We defined sipping stability as the time-varying number of consecutive assessments a participant endorsed ever-sipping (“Have you ever had a sip of alcohol?”; responses: Yes / Yes but as part of a religious service only / No). We calculated stability as:  $[current\ time\ point] - [time\ point\ of\ first\ sip] - [1\ if\ recanting\ occurred]$  (see Fig. 1). Covarying for stability controls for the possibility that providing consistent responses over time decreases the odds of recanting for an individual at a given assessment.

2.2.2.2. Willingness to drink. Willingness to drink was assessed with one item (“If your best friend offered you an alcohol beverage would you drink it?”; Jackson et al., 2014). Participants responded on a Likert scale ranging from 0 (definitely not) to 3 (definitely yes).

2.2.3. Time-varying predictors

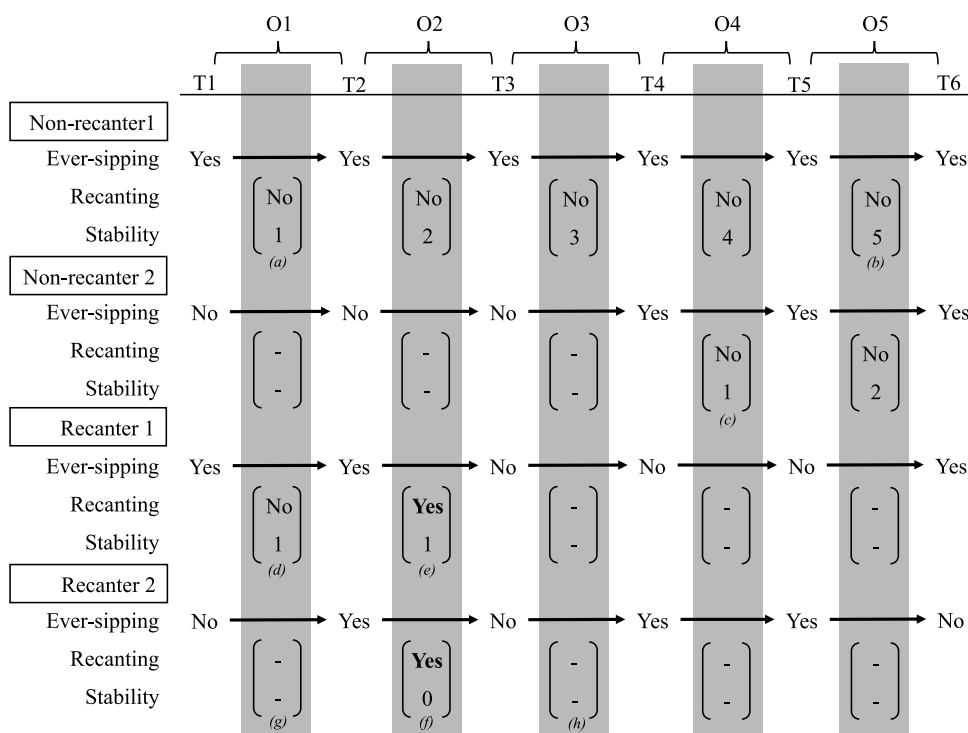
To evaluate whether intra-individual change in time-varying predictors contributed to recanting, we computed difference scores from the prior observation for all predictors below:

2.2.3.1. Perceptions of peer drinking. Participants' perceptions of peer drinking and peer approval of drinking were assessed with two items on 5-point Likert scales modified from Wood et al. (2004) to be appropriate for younger participants: (1) “When your close friends drink, how much on average does each person drink at a sitting?” from

**Table 1**  
Assessment of first sip onset and subsequent recanting.

	First Sip Onset; N (%)				
	T1 (0 mos.)	T2 (6 mos.)	T3 (12 mos.)	T4 (18 mos.)	T5 (24 mos.)
Onset	389 (71.6)	41 (7.6)	47 (8.7)	28 (5.2%)	38 (7.0%)
Recant at T2	124 (31.9)	-	-	-	-
Recant at T3	37 (9.5)	14 (34.1)	-	-	-
Recant at T4	33 (8.5)	5 (12.2)	21 (44.7)	-	-
Recant at T5	24 (6.2)	5 (12.2)	7 (14.9)	5 (17.9)	-
Recant at T6	23 (5.9)	1 (2.5)	3 (6.4)	4 (14.3)	12 (31.6)
Never recanted	148 (38.0)	16 (39.0)	16 (34.0)	19 (67.9)	26 (68.4)

Note: In columns, first sip onset proportion is reported as percent of total sample who first reported sipping at a given assessment (T1 – T5). In rows, recanting proportion at each assessment (T2 – T6) represents percent of those who originally reported first sipping at the assessment in the corresponding column. Recanting proportions above the stepped diagonal line are immediate recanters whereas those below stepped diagonal line are delayed recanters.



**Fig. 1.** Example calculation of time-varying measure of stability in participant responding. Note: T[1-6] = time point; O[1-5] = observation; incidents of recanting are bolded. Stability in participant responding is defined as the number of continuous assessments in which a participant reports ever-sipping following their first report. For instance, non-recanter 1 consistently reports ever-sipping at every assessment beginning with T1. Stability for non-recanter 1 thus begins at one in O1 (a) and increases by one at each assessment until the final observation is reached (b). Non-recanter 2 first reports ever-sipping at T3 and continues to report ever sipping through T6. Thus stability for non-recanter 2 is one at O4 (c) and increases by one at the final observation. Recanter 1 reports ever sipping at T1 and T2. Stability at O1 is thus one (d). However, this recanter 1 recants at T3 and thus we maintain a stability of one (e). Recanter 2 immediately recants at T3 after first reporting ever sipping at T2. Stability at O2 for recanter 1 is thus zero (f). We observe stability as occurring between a pair of observations following the first report of ever sipping. As participants cannot demonstrate stable responding at their first report of ever-sipping, we exclude prior observations (g). We also exclude observations following recanting (h). We calculated stability as: [current time point] – [time point of first sip] – [1 if recanting occurred]

observations following recanting (h). We calculated stability as: [current time point] – [time point of first sip] – [1 if recanting occurred]

0 (they don't drink) to 4 (more than 3 drinks), and (2) "How do most of your close friends feel about kids your age drinking alcohol?" ranging from 1 (strongly disapprove) to 5 (strongly approve).

**2.2.3.2. Alcohol expectancies.** Participants' positive and negative expectancies about the effects of alcohol use were assessed with 22 items querying affective, cognitive, and behavioral expectancies (Schell et al., 2005). Participants responded on a Likert scale ranging from 1 (very unlikely) to 4 (very likely). We computed positive ( $\alpha = .95$ ) and negative ( $\alpha = .87$ ) expectancy subscale factor scores based on recommendations from Schell et al. (2005).

**2.2.3.3. Parental reaction to youth drinking.** Chassin et al.'s (1998) parental reaction to youth smoking measure was adapted to assess participant's beliefs about how their parents would respond if they caught participants drinking. Participants described the likelihood of eight parental reactions on a Likert scale ranging from 1 (not at all likely) to 5 (very likely). As alcohol-related parental punishment may vary substantially over time as participants progress in age and sipping alcohol becomes less deviant, we focus here on the punishment subscale ( $\alpha = .88$ ).

**2.2.4. Outcome- recanting of ever-sipping**

Ever-sipping was assessed with one item: "Have you ever had a sip of alcohol? (not including consumption as part of a religious service)" that was embedded within broader measures of lifetime alcohol and other drug involvement. Recanting occurred when participants denied ever-sipping following a prior report of ever-sipping.

**2.3. Data transformation and reduction**

We structured the data such that each observation included the binary recanting outcome and all subject-level and time-varying covariates and predictors. This approach produced 1536 observations across participants and time points. We excluded all data prior to participants' first report of ever-sipping and data following participants' recanting – if it occurred – from analyses. Missing ever-sipping

responses (139 observations; 9.0%) that were "bookended" (e.g., both immediately followed and preceded) by affirmative reports of ever-sipping were recoded to affirmative.

No missing data were observed for subject-level covariates. Data were missing for willingness-to-drink in 148 (9.6%) observations. Missing data ranged from 218 (14.2%) to 228 (14.8%) observations for focal predictors. We used multiple imputation using chained equations (Azur et al., 2011; Buuren and Groothuis-Oudshoorn, 2011) to impute ten datasets in five iterative cycles, including covariates and the outcome variable in the imputation model (White et al., 2011). We report on pooled parameter estimates (Rubin, 1987).

**2.4. Analysis strategy**

We examined potential differences on demographic variables, index of inconsistency, and baseline willingness-to-drink between: (1) consistent reporters of ever-sipping and recanters and (2) immediate recanters and delayed recanters with *t* and  $\chi^2$  tests. We fit a series of generalized linear mixed models (GLMM) (Hedeker, 2005; McCulloch and Neuhaus, 2006) testing whether changes in perceptions of peer drinking, drinking expectancies, and parent's punitive reactions predict recanting. Because ages varied within each of the five sequential cohorts, analyses controlled for age at baseline. Additionally, we controlled for subject-level and time-varying covariates. To explore whether mechanisms of recanting differed for delayed (i.e., two assessments or later) recanting, we refit the above models in a subset of data that excluded observations from immediate (i.e., subsequent assessment) recanters. We conducted all data analyses in R 3.4.1 (R Core Team, 2017) using lme4 (Bates et al., 2015) for estimation of GLMMs.

**3. Results**

**3.1. Descriptive statistics**

Assessment (T1-T5) of first report of ever sipping and subsequent recanting (T2-T6) is presented in Table 1. Most participants reported ever sipping at baseline (*n* = 389; 71.6%). Overall, 318 participants

**Table 2**

Demographic characteristics, data consistency, and willingness-to-drink for all participants, consistent reporters, and recanters including subsets of immediate and delayed recanters.

Variables	Total Sample (n = 543)	Consistent Reporters (n = 225)	Recanters (n = 318)	$\chi^2$ or t	p	Immediate Recanters (n = 176)	Delayed Recanters (n = 142)	$\chi^2$ or t	p
Age; M (SD)	12.6 (0.93)	12.6 (0.89)	12.6 (0.95)	t = 0.14	.89	12.6 (0.97)	12.7 (0.93)	t = 1.25	.21
Hispanic or Latino (%)	10.5	11.0	9.8	$\chi^2 = 0.10$	.75	12.6	9.2	$\chi^2 = 0.62$	.43
Non-White (%)	15.1	14.2	15.7	$\chi^2 = 0.13$	.72	15.3	16.2	$\chi^2 < 0.01$	.96
Female (%)	54.5	63.1	51.6	$\chi^2 = 10.87$	< .001	50.0	46.5	$\chi^2 = 0.26$	.61
Index of inconsistency; M (SD)	0.38 (0.20)	0.40 (0.19)	0.36 (0.20)	t = 2.03	.043	0.36 (0.21)	0.37 (0.20)	t = 0.66	.51
Willingness-to-drink (T1); M (SD)	0.47 (0.72)	0.51 (0.73)	0.43 (0.70)	t = 1.24	.214	0.30 (0.58)	0.59 (0.80)	t = 3.69	< .001

Note: Test statistics and p-values reflect comparisons of consistent reporters to recanters (center panel) and immediate recanters to delayed recanters (right panel). Index of inconsistency represents overall inconsistency of responding across seven pairs of items in each of the first three assessments (T1 – T3).

(58.6%) recanted ever-sipping, predominantly at the assessment immediately following the first report of ever sipping (n = 176; 55.3%). Rates of recanting over the course of the study ranged from 17.9% (T4–T5) to 44.7% (T3–T4). Descriptive statistics for the full sample and comparisons of consistent reporters versus recanters are presented in Table 2.

3.2. Recanting in the full sample

Results from the GLMM excluding focal predictors are presented in Table 3, top panel. Odds of males recanting were approximately 40% higher than females. Neither baseline age nor race were associated with increased odds of recanting. Sipping stability (i.e., the time-varying number of consecutive assessments in which a participant reported ever sipping) was associated with reduced odds of recanting such that the odds decreased by approximately 65% with each consecutive report of ever sipping following the initial report. Greater willingness-to-drink was also associated with reduced odds of recanting after adjusting for other covariates. Participant index of inconsistency (i.e., inconsistency on other measures) was not associated with recanting.

We entered each focal predictor separately into a series of five GLMMs, controlling for all subject-level and time-varying predictors (Table 3; bottom panel). Positive difference scores from the previous assessment in both perceived peer drinking and approval predicted reduced odds of recanting. Specifically, a one-unit increase in perceived

peer drinking decreased the odds of recanting by approximately 35%, while a one-unit increase in perceived peer approval of drinking decreased the odds of recanting by 18%. We observed similarly valenced, but much smaller, effects for positive (4% reduced odds) and negative (2% reduced odds) expectancies. Parents' punitive reactions did not predict recanting.

3.3. Recanting in delayed recanters

In the GLMM including only subject-level and time-varying covariates (Table 4; top panel), odds of males showing delayed recanting were approximately 53% higher than females. Neither baseline age, race, nor ethnicity were associated with increased odds of delayed recanting. Sipping stability was associated with reduced odds of delayed recanting such that the odds of recanting decreased by approximately 18% with each consistent report of ever sipping following the initial report. Willingness-to-drink was also associated with reduced odds of delayed recanting. Participant's index of inconsistency was not associated with delayed recanting.

In the GLMMs with focal predictors (Table 4, bottom panel), positive difference scores from the previous assessment in perceived peer drinking predicted reduced odds of delayed recanting. Specifically, a one-unit increase in perceived peer drinking decreased the odds of delayed recanting by approximately 31%. For positive and negative expectancies, one-unit increases predicted 5% and 2% reduced odds of

**Table 3**

Parameter estimates of GLMMs predicting recanting in the full sample (n = 543).

Unadjusted Model						
Variable	Estimate	SE	p	OR and 95% CI		
				Low	OR	High
1: Intercept	-0.25	1.04	-	-	-	-
1: Sex (Ref: female)	<b>0.34</b>	<b>0.15</b>	<b>.02</b>	<b>1.05</b>	<b>1.40</b>	<b>1.87</b>
1: Race (Ref: white)	0.23	0.22	.30	0.82	1.25	1.92
1: Ethnicity (Ref: non-Hispanic)	0.03	0.25	.91	0.63	1.03	1.68
1: Age	0.06	0.08	.44	0.91	1.07	1.25
1: Stability	<b>-1.04</b>	<b>0.08</b>	<b>&lt; .001</b>	<b>0.30</b>	<b>0.35</b>	<b>0.41</b>
1: Inconsistency	-0.20	0.39	.61	0.38	0.82	1.78
1: Willingness-to-drink	<b>-0.57</b>	<b>0.11</b>	<b>&lt; .001</b>	<b>0.45</b>	<b>0.57</b>	<b>0.71</b>
Partially Adjusted Models						
Variable	Estimate	SE	p	Low	OR	High
1 <sup>a</sup> : Δ Perceived peer drinking	<b>-0.43</b>	<b>0.11</b>	<b>&lt; .001</b>	<b>0.52</b>	<b>0.65</b>	<b>0.81</b>
1 <sup>b</sup> : Δ Perceived peer approval	<b>-0.19</b>	<b>0.08</b>	<b>.01</b>	<b>0.71</b>	<b>0.82</b>	<b>0.96</b>
1 <sup>c</sup> : Δ Positive expectancies	<b>-0.04</b>	<b>0.01</b>	<b>&lt; .001</b>	<b>0.94</b>	<b>0.96</b>	<b>0.98</b>
1 <sup>d</sup> : Δ Negative expectancies	<b>-0.02</b>	<b>0.008</b>	<b>.02</b>	<b>0.97</b>	<b>0.98</b>	<b>1.00</b>
1 <sup>e</sup> : Δ Parent punishment	-0.08	0.06	.18	0.82	0.92	1.04

Note: Parameter estimates in the top panel come from GLMM (1) regressing any recanting onto all subject-level and time-varying covariates. Parameter estimates for focal predictors in bottom panel come from five separate GLMMs (1<sup>a</sup> – 1<sup>e</sup>) where we entered each focal predictor into the model along with all covariates from unadjusted model. Bolded estimates are significant at p < .05.



**Table 4**  
Parameter estimates of GLMMs predicting recanting in *delayed recanters* (n = 367).

Unadjusted Model						
Variable	Estimate	SE	p	OR and 95% CI		
				Low	OR	High
2: Intercept	−3.22	1.33	–	–	–	–
2: Sex (Ref: female)	<b>0.43</b>	<b>0.18</b>	<b>.02</b>	<b>1.07</b>	<b>1.53</b>	<b>2.19</b>
2: Race (Ref: white)	0.38	0.26	.14	0.88	1.46	2.43
2: Ethnicity (Ref: non-Hispanic)	−0.12	0.32	.70	0.47	0.88	1.66
2: Age	0.14	0.10	.17	0.94	1.15	1.41
2: Stability	<b>−0.20</b>	<b>0.07</b>	<b>.006</b>	<b>0.71</b>	<b>0.82</b>	<b>0.94</b>
2: Inconsistency	−0.34	0.51	.51	0.26	0.71	1.93
2: Willingness-to-drink	<b>−0.56</b>	<b>0.14</b>	<b>&lt; .001</b>	<b>0.43</b>	<b>0.57</b>	<b>0.75</b>
Partially Adjusted Models						
Variable	Estimate	SE	p	Low	OR	High
2 <sup>a</sup> : Δ Perceived peer drinking	<b>−0.38</b>	<b>0.12</b>	<b>.002</b>	<b>0.54</b>	<b>0.69</b>	<b>0.87</b>
2 <sup>b</sup> : Δ Perceived peer approval	−0.16	0.09	.08	0.71	0.85	1.02
2 <sup>c</sup> : Δ Positive expectancies	<b>−0.05</b>	<b>0.01</b>	<b>&lt; .001</b>	<b>0.92</b>	<b>0.95</b>	<b>0.97</b>
2 <sup>d</sup> : Δ Negative expectancies	<b>−0.02</b>	<b>0.01</b>	<b>.03</b>	<b>0.96</b>	<b>0.98</b>	<b>1.00</b>
2 <sup>e</sup> : Δ Parent punishment	−0.12	0.07	.10	0.77	0.88	1.02

Note: Parameter estimates in the top panel come from GLMM (2) regressing delayed recanting onto all subject-level and time-varying covariates excluding observations from immediate recanters. Parameter estimates for focal predictors in bottom panel come from five separate GLMMs (2<sup>a</sup> – 2<sup>e</sup>) where we entered each focal predictor into the model along with all covariates from unadjusted model. Bolded estimates are significant at  $p < .05$ .

delayed recanting, respectively. Difference scores for perceived peer approval of drinking and parent's punitive reactions did not predict delayed recanting.

#### 4. Discussion

This study elucidates the dynamic intra-individual effects that proximally predict recanting. Our analyses found that time-varying intra-individual factors predicted recanting of ever-sipping alcohol among a sample of adolescents. Importantly, these effects were observed beyond the known influence of between-subjects predictors of recanting while also controlling for each individual's index of inconsistency, willingness-to-drink, and stability in response patterns. Adolescent responses were sensitive to their own positive and negative alcohol expectancies, their perceptions of peer drinking heaviness, and peer approval of drinking. However, beliefs about parents' punitive response to drinking did not influence recanting. These findings suggest that recanting is partially driven by response editing due to increasing beliefs about the positive and negative effects of alcohol and growing social desirability demands from peers, as could be expected with the changing influence of these factors across adolescent development (Windle et al., 2008; Zucker et al., 2008).

The processes that give rise to *immediate* versus *delayed* recanting were similar. Although delayed recanting occurred less frequently, the time-varying predictors of delayed recanting were generally consistent with predictors of recanting overall. Future research may consider exploring additional intra-individual factors that could exert a time-varying influence on recanting in adolescence or extend the window of analysis to include the transition from adolescent to young adulthood. While we compared effects across different time spans within adolescence, it is still possible that as the nature of perceived peer approval or peer drinking on substance use behavior itself shifts from adolescence to young adulthood (Brown et al., 2008) so too may the relationships between these factors and recanting. Given the heterogeneity in baseline age and ever-sipping onset in our sample, our data and analyses were not designed to test age-related differences in predictors of recanting.

Stability in adolescents' reports of ever-sipping over time predicted lower recanting. These findings corresponded with prior investigations

of alcohol use recanting among youth (Shillington et al., 2011, 2010a). Rates of recanting were highest at the assessment immediately following the first report of ever-sipping and declined over time. However, unlike prior findings that recanting is greatest among those reporting onset at the youngest ages (Shillington et al., 2011), we found that proportions of participants recanting after their initial reports were generally similar regardless of when sipping was first reported. Furthermore, despite stratifying recruitment of adolescents across grades 6–8 (Jackson et al., 2014), baseline age was non-significant in our models and did not differentiate consistent reporters from recanters or immediate recanters from delayed recanters. Although age-related maturation effects explain some of the variability in recanting due to stability, these findings suggest that this effect is at least partially due to within-person variability in a person's inherent tendencies towards consistent responding.

Sex and index of inconsistency were the only subject-level predictors of recanting. Consistent with some (Percy et al., 2005; Shillington et al., 2010a) but not all (Fendrich and Rosenbaum, 2003) prior studies, we found that males were more likely to recant than females. However, sex did not differentiate between immediate and delayed recanters. Although these findings contribute to the evidence of sex differences in recanting, generalizing findings on sex differences to other populations might be premature. A number of moderators could explain inconsistent findings: for example, the likelihood of females recanting may be moderated by age, location, or prevalence of the substance being investigated (i.e., different substance norms among females). Furthermore, it is unlikely that biological sex directly causes differential rates of recanting. Instead, sex differences in recanting may arise in response to other unexamined proximal factors such as peer group gender composition (Thrul et al., 2017) and gender-specific peer influence on drinking (Gaughan, 2006) that may drive observed sex differences. Investigating potential mechanisms for underlying sex differences is an important direction for future research. Although index of inconsistency differentiated consistent reporters from recanters, it did not distinguish delayed from immediate recanters or predict recanting in our models. In contrast to prior research (Fendrich and Rosenbaum, 2003; Fendrich and Vaughn, 1994; Fendrich and Yun Soo Kim, 2001; Shillington et al., 2011, 2010b, 2010a), race and ethnicity did not predict recanting in any study analyses. However, we found that

although a general willingness-to-drink did not differentiate recanters from consistent reporters, it did differentiate delayed from immediate recanters. Willingness-to-drink measured as a time-varying predictor also prospectively predicted lower odds of recanting. In the context of our findings on time-varying predictors of recanting, these results suggest that differences in recanting attributed to race and ethnicity in other studies may be generated by other more proximal and salient intra-individual processes; the same may be true for willingness to drink.

While this study suggests that proximal factors contribute to substance use recanting, questions remain about assessment and data analytic implications. Addressing the influence of recanting requires both a) changing assessments to reduce recanting and b) developing analytic strategies to address recanting. Changes to assessments could include using novel computerized surveys that integrate past responses into later surveys. Furthermore, to the extent that substance use recanting is associated with perceptions of peer drinking, surveys could provide participants with peer drinking norms following the assessment of these perceptions but prior to the assessment of substance use to help standardize the influence of these factors on reporting. Nevertheless, recanting will occur in future studies of adolescent substance use, and thus identifying recanting as it occurs and responding appropriately is essential to maintaining research integrity. Researchers could use peer or parental informants to inform participant's substance use. Additionally, recanting-sensitive survey methods could ask participants to provide a qualitative narrative regarding recanted behaviors. Such approaches would help clarify the management of recanted behaviors by providing convergent sources of information on a substance use behavior both across informants and within a participant.

This study has a number of strengths. We used data from six assessment points of a naturalistic longitudinal study of adolescent drinking that allowed joint modeling of within- and between-subjects predictors of recanting within a single analytic framework. Another strength is the high retention rate of participants across assessments that greatly reduces the likelihood of bias in the observed effects.

There are also several limitations. First, the cohort-sequential recruitment strategy of the parent longitudinal study prohibited investigating the full extent to which observed predictors of recanting varied systematically across age due to the variability in both ages and duration since ever-sipping onset within each measurement wave. Data are censored at both ends (enrollment of those who had already sipped yielded left censoring; enrollment of older adolescents in some cohorts yielded right censoring). Other studies (Percy et al., 2005; Shillington et al., 2010a) have examined age-specific predictors of recanting, but more research on the relationship between developmental factors and erroneous responding is needed. Second, while ideally all data collection would be in the same environment, this was not possible due to the need for in-person contact at baseline (T1) to fully orient the participant to web survey follow-ups. To note, ancillary analyses did not demonstrate meaningful differences in focal predictors of recanting between T1-T2 versus later assessment periods. Furthermore, the mode of data collection was consistent across all assessments and, as recanting responses could only occur in T2 onward, data collection was putatively comparable across these observations. Third, as the parent study was not designed to examine erroneous responding among adolescent alcohol users, we do not know whether reports of ever-sipping onset and recanting represent under-reporting or over-reporting. As noted above, future research would benefit from integrating novel assessment strategies sensitive to recanting. Such methodologies could require participants to clarify qualitatively whether recanting responses represent early over-reporting versus erroneous or deliberate later recanting of use.

## 5. Conclusion

This study highlights the influence of time-varying intra-individual factors on recanting of lifetime alcohol use among adolescents. Given

that recanting appears systematic, researchers should consider using methods that minimize or clarify instances of recanting while also integrating salient predictors of recanting into missing-data models. The current state of computer-assisted assessment methods should enable researchers to identify inconsistent responding as it occurs, which would both improve the integrity of longitudinal self-report data and provide novel opportunities to identify the mechanisms for recanting.

## Role of the funding source

This study was supported by grants R01 AA016838 (PI: Jackson), K02 AA13938 (PI: Jackson), T32 DA016184 (PI: Rohsenow), and T32 AA007459 (PI: Monti). The funding sources had no influence on the study design, data collection, analysis and interpretation of data, writing of the report, and the decision to submit the article for publication. Grants R01 AA016838 and K02 AA13938 (PI: Jackson) supported the parent project which was the source of data for the present study. Drs. Sokolovsky, Bernstein, and Janssen are postdoctoral research fellows at the training programs supported by grants T32 DA016184 and T32 AA007459.

## Contributors

All authors contributed to the collection, analysis, and interpretation of the data and to the writing of the present submission. All authors approve of the final manuscript included with this submission.

## Conflict of interest

The authors have no conflicts of interest to declare.

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