

Temporal Discounting-based Cognitive Impulsivity in Adolescents Pre versus Post Substance Use Initiation

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BACKGROUND

- **Alcohol** and **cannabis** remain the **most frequently consumed** illegal substances in the U.S. by **adolescents** and **young adults**.⁽¹⁾
- While heavy alcohol use has declined since 1990, the prevalence of **cannabis use has increased** in recent years, particularly among adolescents⁽¹⁾ and young adults⁽²⁾.
- **Frequent alcohol and cannabis use** during this time is **associated with deficits** in memory, inhibitory control, and executive functioning, as well as a preference for smaller immediate rewards over larger delayed rewards. This behavior is called delay discounting.⁽³⁾
- It has also been suggested that **greater substance use** in adolescence results in heightened impulsivity.⁽⁴⁾ However, most of the supporting evidence in developmental samples is cross-sectional.
- The **goals of the present work** were to longitudinally examine whether:
 - 1) Greater discounting prior to substance use initiation predicts future use.
 - 2) Frequent use is associated with greater cognitive impulsivity.

Hypothesis: If adolescent substance use contributes to heightened cognitive impulsivity, impulsivity will be higher among more versus less frequent substance users *after* substance initiation but not necessarily before.

PARTICIPANTS AND METHODS

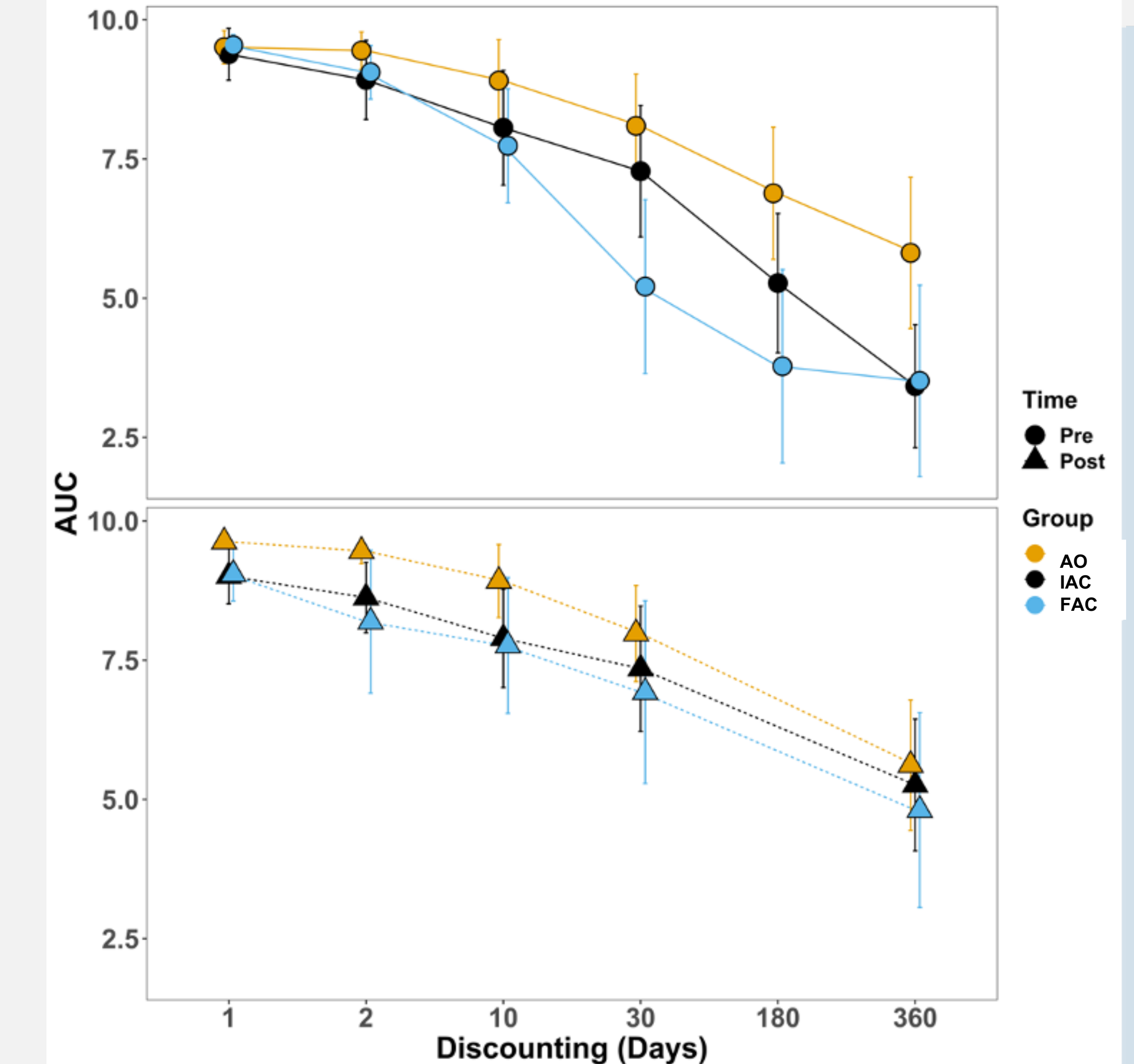
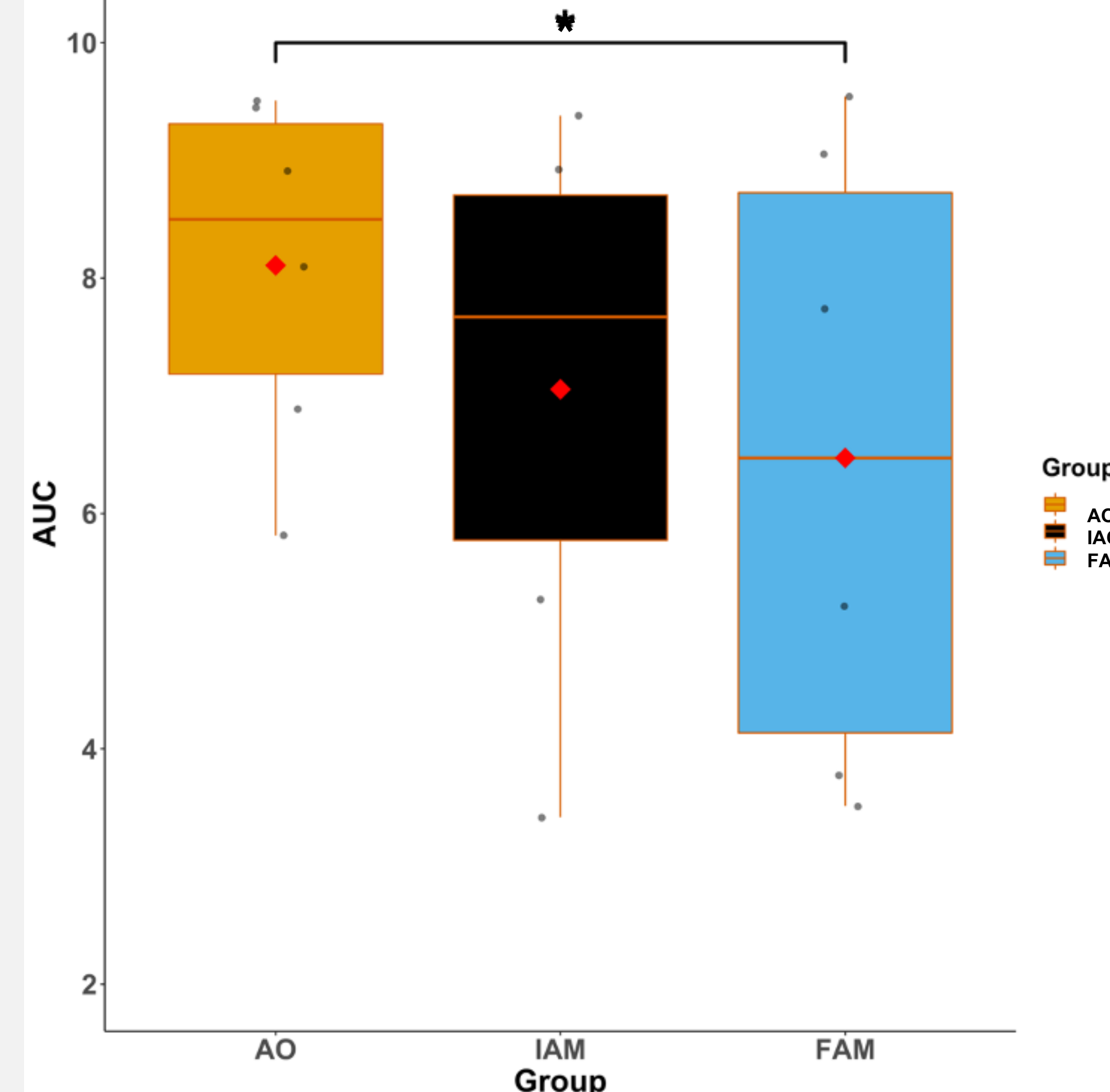
- 74 participants, aged 9-23, completed a delay discounting task and cognitive battery at baseline and every two years thereafter, yielding **five waves across 10 years**. Alcohol and cannabis use frequencies were assessed using the **Personal Experience Inventory (PEI)**.⁽⁵⁾
- This analysis focused on individuals who initiated substance use over time.
- Participants were placed into one of three groups: **alcohol-only (AO)**, **infrequent alcohol and cannabis (IAC)** if they used cannabis less than 5 times during the last year, or **frequent alcohol and cannabis (FAC)** if they used more than 5 times.

Demographics by group

	AO Alcohol-only Users <i>N</i> = 32	IAC Infrequent Alcohol & Cannabis Users <i>N</i> = 25	FAC Frequent Alcohol & Cannabis Users <i>N</i> = 17
	Mean (SD)	Mean (SD)	Mean (SD)
Age Before Initiation	16.62 (2.5)	16.70 (2.2)	16.00 (2.3)
Age After Initiation	19.28 (2.2)	19.30 (2.1)	19.27 (2.5)
Number of Visits	3.88 (.87)	4.08 (.86)	4.06 (.90)
Verbal IQ	113.25 (10.3)	114.04 (10.3)	113.35 (11.5)
Family Income	\$118,600 (\$101,852)	\$92,272 (\$38,536)	\$93,125 (\$52,181)
% Male	43.8	60.0	52.9

- The discounting task was an adaptive computerized program that **adjusted the amount of money and time delay** depending on the participant's prior responses. Participants chose between \$10 available after a delay (1 to 360 days later) or a lesser amount immediately.
- Groups were analyzed across two time points using **repeated measures ANCOVAs**. ANCOVAs were run on both pre- and post-timepoints as well.
- **Covariates used throughout models:** age, verbal IQ, number of visits before substance use initiation

RESULTS



- A univariate ANCOVA with continuous covariates yielded a significant effect of group on mean AUC scores: **($F=4.835$, $p=.002$, $\eta_p^2=.122$)**
- Follow-up post-hoc tests revealed FAC had reduced AUC scores relative to AO users (**Šidák corrected $p=0.018$**), but not IAC users (**Šidák corrected $p=0.082$**), indicating that frequent, but not infrequent cannabis users have greater cognitive impulsivity than those who only drink alcohol.
- A repeated measures ANOVA examining group differences in indifference points across six delays pre- and post-use indicated no main effect of group: **($F=2.093$, $p=.132$, $\eta_p^2=.062$)**. There was also not an interaction effect between group and delay interval: **($p=.356$, $\eta_p^2=.032$)** or between group and time: **($p=.252$, $\eta_p^2=.008$)**.

FREQUENCY OF USE ACROSS AGE

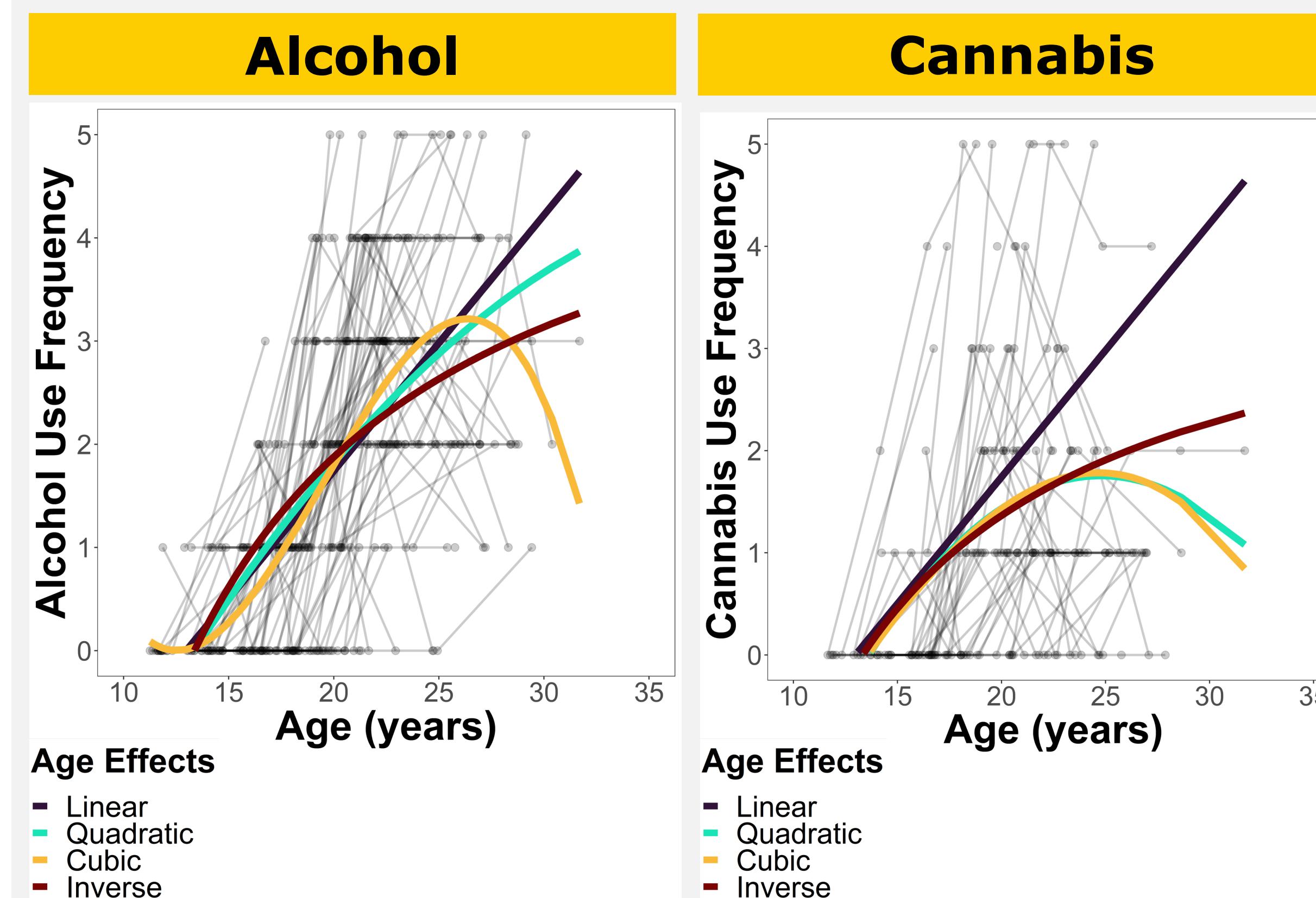


Figure 1. A comparison of linear mixed effects models (LMEs) with various polynomial age effects. The developmental trajectory of alcohol use frequency was **best approximated by the cubic effect of Age ($T = -5.82$, $p < .0001$)** in the current sample.

Figure 2. A comparison of linear mixed effects models (LMEs) with various polynomial age effects. The developmental trajectory of cannabis use frequency was **best approximated by the cubic effect of Age ($T = -6.12$, $p < .0001$)** in the current sample.

DISCUSSION

- Contrary to our hypothesis, **findings support a trait-based perspective** in which predispositions toward cognitive impulsivity precede substance use initiation in those who become more frequent cannabis users.
- It remains unclear as to why the differences observed before initiation do not persist once use has begun. **Consideration of additional post-initiation data points** could help identify potential long-term effects of substance use on discounting behaviors.
- **Premorbid vulnerabilities** to impulsive decision making should be the **focus of future research**, aimed at the early identification of those who might later transition to problematic substance use.

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