8-23-2024

Me, Myself, and High: Momentary Precipitants and Consequences of Solitary Cannabis Use Among Emerging Adults

Amelia Wedel
Syracuse University

Abstract

Objective: Social discomfort, including loneliness and adverse interpersonal experiences, is associated with greater solitary cannabis use, and in turn with worse cannabis consequences, among emerging adults. Temporality of this relationship, however, remains unknown due to largely cross-sectional findings. This 15-day experience sampling study tested the relationship of (a) social discomfort with proximal solitary cannabis use, (b) solitary cannabis use with next-day cannabis consequences, and (c) solitary cannabis use as a potential mediator for the relationship of social discomfort with cannabis consequences. **Methods:** Momentary assessment data were drawn from 59 emerging adult solitary cannabis users (M_{age}= 22.88 [SD=1.79]; 61% female; 66% Black). Multilevel structural equation models were used to test direct and indirect relationships of social discomfort, solitary cannabis use, and cannabis consequences within- and between-person over time. All analyses controlled for sex, age, Black race, and subjective high at time of survey completion. **Results:** Moment-to-moment, participants had greater odds of reporting solitary cannabis use in moments of greater loneliness (OR = 1.02 [1.01, 1.03], $p <$ .001), but not greater negative interpersonal exchanges (p = .21) relative to person-average. Day-to-day, greater solitary use (OR = 1.44, p = .03) and greater social use (OR = 1.56, p = .01) relative to person-average were associated with greater odds of next-day cannabis consequences. Solitary use did not mediate social discomfort-consequence relationships (all ps > .05). **Conclusions:** Findings provide novel evidence for proximal consequences of solitary cannabis use. Findings also highlight a proximal relationship of loneliness with solitary cannabis use, but this relationship does not extend temporally to the next moment or the next day, suggesting loneliness as a potential intervention cue to prevent solitary cannabis use and downstream consequences.

Me, Myself, and High: Momentary Precipitants and Consequences of Solitary Cannabis Use Among Emerging Adults

by

Amelia V. Wedel, M.S.

B.A., Oberlin College, 2016

M.S., Syracuse University, 2021

Dissertation

Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in

Clinical Psychology

Syracuse University

August 2024

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Cannabis is the most commonly used federally illicit drug among emerging adults; as of 2020, 23% reported past-month use, and between 8% and 13% of emerging adults reported daily or near-daily use (Schulenberg et al., 2021). Moreover, cannabis use rates among emerging adults have climbed steadily over the past twenty years due to the spread of recreational cannabis legalization (Hall & Lynskey, 2020), rising from 18% to 23% from 2002 to 2022 (Odani et al., 2019; Patrick et al., 2022). Continual decreases in young people's perceptions of cannabis-related risk and harm (Chen et al., 2016) and increases in perceived social norms (Romm et al., 2022) may in part explain increases in cannabis uptake and use frequency. Altogether, evidence suggests that cannabis use rates will continue to climb among emerging adults, necessitating greater understanding of underlying mechanisms which may be indicative of potential risk for development of cannabis use disorder.

One potential indicator for risk of cannabis use disorder is solitary cannabis use. While individuals are more likely to use cannabis in social situations (i.e., when others around them are also using), approximately 30% of college students (Wedel & Park, 2023) and adults more broadly (Spinella et al., 2019) report using alone in the past month, and up to 26% of individual cannabis use episodes occur in solitude (Phillips et al., 2018). Solitary use may be indicative of overall heavier cannabis use among adolescents and college students, as it has been associated with high-frequency use patterns such as weekly or daily use (Phillips et al., 2018; Wedel & Park, 2023), and greater cannabis consumption (Terry-McElrath et al., 2022). However, the bulk of this research has been conducted among college students, leaving unclear whether the same patterns may exist among emerging adults outside the college setting. Given evidence that non-college emerging adults' cannabis use patterns may differ from college students' (Schulenberg et

al., 2021), there is a pressing need to examine solitary cannabis use among a more diverse sample of emerging adults.

Solitary cannabis use has been cross-sectionally associated with greater cannabis-related problems. Compared with social use, solitary cannabis use has been concurrently associated with greater cannabis problems, including memory loss and cannabis consequences such as diminished cognitive performance and amotivation (Okey et al., 2022; Spinella et al., 2019; Wedel & Park, 2023). Solitary cannabis use also appears to exacerbate associations of social cannabis use with negative cannabis consequences, such that individuals who engage in frequent social cannabis use (but no solitary use) evidence a lower number of negative cannabis consequences, while individuals who report frequent solitary use evidence high consequences regardless of social use frequency (Wedel & Park, 2023). Additionally, solitary use has been concurrently associated with poorer mental health, including elevated risk for psychosis (Spinella et al., 2019) and social anxiety (Buckner et al., 2016). Though not yet evaluated in relation to solitary use, recent research has demonstrated within-person associations of social anxiety motives for cannabis use with specific interpersonal consequences, namely social withdrawal and/or avoidance of others (Walukevich-Dienst et al., 2023). These potential associations of solitary cannabis use with interpersonal problems are of particular concern, as interpersonal difficulties are increasingly prevalent among young people (Buecker et al., 2021), are common reasons for treatment-seeking behavior (Knowles et al., 2015) and generate a high burden on healthcare costs (Meisters et al., 2021). However, it is impossible to determine from the current body of research whether poor psychosocial health precipitates solitary cannabis use, or whether solitary cannabis use precipitates poor psychosocial health.

Social Discomfort and Solitary Cannabis Use

Given the association of solitary cannabis use with poorer psychosocial functioning, particularly that characterized by negative affectivity, more attention is warranted toward underlying emotional and interpersonal risk factors for solitary cannabis use. Prior research with solitary alcohol use has consistently demonstrated greater solitary drinking among youth who drink to cope with negative affect (for a review, see Skrzynski & Creswell, 2020). Furthermore, drinking to cope has been shown to be exacerbated among those who experience greater social discomfort (i.e., loneliness, social anxiety, or adverse social experiences; Skrzynski et al., 2018). For solitary cannabis use, however, prior research has been equivocal: while earlier studies demonstrated cross-sectional psychosocial trait differences in depression (OR = 2.29; Spinella et al., 2019) and social anxiety (β = 0.17, Buckner et al., 2016) for solitary cannabis users, more recent research found null associations with both depression and social anxiety symptoms, but significant associations with interpersonal sensitivity and COVID-19-related stress (Wedel & Park, 2023). Though close temporal precipitants of solitary use remain unexplored in the literature, meta-analytic evidence that took into consideration repeated assessment data found little evidence for temporal relations of affect with cannabis use independent of social context, and issued a call to action that future researchers consider discrete emotional states over more globalized affective traits (Dora et al., 2023). It is possible that attending to underlying social affective factors, rather than symptoms of specific disorders, may more directly capture individual vulnerability and sensitivity to interpersonal and cannabis-related problems.

Two such social affective factors are interpersonal sensitivity and loneliness. These separate but related forms of social discomfort are common among emerging adults, with 25-32% of adults between 18-25 reporting moderate to severe loneliness (Lasgaard et al., 2016). Moreover, they have been associated with a number of short- and long-term psychosocial outcomes, including but not limited to substance use. Specifically, high interpersonal sensitivity,

a trait sense of fragility in the presence of others due to constant expectations of criticism or rejection (Masillo et al., 2018), has been associated with greater drinking quantity (Armeli et al., 2007, 2021), greater solitary cannabis use (Wedel & Park, 2023), and greater risk for physical and mental health conditions (Marin & Miller, 2013; van Eeden et al., 2019), including loneliness (Knowles et al., 2015; Watson & Nesdale, 2012). Loneliness, a subjective experience of disparity between desired and received social contact, has likewise been associated in the long term with adverse physical and mental health outcomes (J. T. Cacioppo et al., 2011; J. T. Cacioppo & Hawkley, 2009; S. Cacioppo et al., 2015; van Eeden et al., 2019), and in the short-term with greater cannabis use (Gulliver & Fowler, 2021; Rhew et al., 2021) and cannabis use consequences (Perez et al., 2022).

Rates of concurrent cannabis use and interpersonal problems are high among emerging adults seeking treatment for mental health concerns (Bonar et al., 2022; Ingram et al., 2018; Rhew et al., 2021; Stasio et al., 2020). However, whether social discomfort (i.e., interpersonal sensitivity and loneliness) prompts subsequent solitary cannabis use remains critically unexplored; all known associations of social discomfort with cannabis use come from cross-sectional data (e.g., Gulliver & Fowler, 2021; Wedel & Park, 2023). Solitary cannabis use may occur in response to social discomfort as a form of simultaneous coping and social withdrawal, and may subsequently exacerbate cannabis-related consequences related to interpersonal functioning (potentially explaining unique proximal cannabis consequence findings reported by Walukevich-Dienst et al., 2023). Thus, understanding the temporal relationship between cannabis use and social discomfort is becoming increasingly critical for public health knowledge (J. T. Cacioppo & Cacioppo, 2018; Hall & Lynskey, 2020) and the development of targeted prevention and intervention strategies.

Theoretical models, including the Socio-Cognitive Model of Loneliness and Health (J. T. Cacioppo & Hawkley, 2009) and the Stressor-Vulnerability Model of Substance Use (Armeli et al., 2007; Hyman & Sinha, 2009), outline a cyclical relationship between interpersonal stress exposure, feelings of social discomfort, and risky health behaviors (for a conceptual model, see Figure 1). Broadly, loneliness and interpersonal sensitivity have been associated with greater social withdrawal (Achterbergh et al., 2020; Watson & Nesdale, 2012). These findings implicate feelings of social discomfort in solitary behaviors such as solitary cannabis use, which in turn leads to greater consequences, including interpersonal consequences (Buckner et al., 2016). Solitary cannabis use may therefore represent a maladaptive form of coping or social withdrawal, thus exacerbating both interpersonal and cannabis-related difficulties and associated social discomfort (i.e., loneliness) over time. Altogether, theory and empirical evidence suggest a feed-forward process in which interpersonal precipitants (i.e., negative social interactions and feelings of loneliness) prompt simultaneous social withdrawal and substance use (i.e., solitary cannabis use), which then leads to interpersonal and cannabis use problems.

Momentary Research on Solitary Cannabis Use

Despite considerable prevalence of solitary cannabis use among emerging adults (Buckner et al., 2016; Okey et al., 2022; Wedel & Park, 2023), research assessing and describing this phenomenon remains sorely lacking. Understanding of within-person patterns of solitary cannabis use is extremely limited, as most existing research on social contexts of cannabis use has focused on characterizing patterns of social use among emerging adults (Phillips et al., 2018). Many cannabis users across age groups indicate using cannabis multiple times daily (Buckner et al., 2013), yet it remains unknown how within-day cannabis use episodes may vary by social context. Although my prior research provided an estimate of solitary cannabis use frequency (Wedel & Park, 2023), the cross-sectional and retrospective nature of that study

precluded knowledge of situational variation in emerging adults' day-to-day solitary cannabis use. To date, there have been no studies which have examined within-person variation in frequency of solitary (versus social) cannabis use episodes among emerging adults.

Temporal associations of social discomfort with solitary cannabis use and its consequences remain unexplored. Theory and similar temporal research with solitary alcohol use (Mohr et al., 2001) suggests that social discomfort may precipitate solitary cannabis use. Exposure to negative interpersonal experiences likely prompts concurrent feelings of social discomfort, which may be followed by solitary cannabis use. Likewise, associations of solitary use with proximal cannabis-related consequences have yet to be examined. Across social contexts, cannabis use has been associated with subsequent proximal cannabis consequences, including driving while high, nausea and/or vomiting, and feeling hungover (Stevens et al., 2021), as well as interpersonal consequences such as greater odds of conflict within the next two hours (Brown et al., 2018) and greater next-day hostility (Ansell et al., 2015). However, there is currently a paucity of research on temporal associations of solitary cannabis use specifically with subsequent general and interpersonal cannabis consequences, leaving unclear whether solitary cannabis may be more strongly associated with proximal problems that could benefit from momentary intervention. Lastly, research is needed to bridge these gaps and investigate a within-person risk mechanism by which social discomfort precipitates solitary cannabis use, which then leads to exacerbated cannabis problems.

Current Study

The aims of the present 15-day momentary assessment study were threefold. **Aim 1** examined temporal associations of social discomfort (as assessed by negative interpersonal experiences and feelings of loneliness) with solitary cannabis use, and it was hypothesized that solitary cannabis use would be temporally preceded by greater social discomfort. **Aim 2**

investigated temporal associations of solitary cannabis episodes with next-day general and interpersonal cannabis consequences, and it was hypothesized that days with greater solitary cannabis use episodes would be followed by days with greater general and interpersonal cannabis consequences. Lastly, **Aim 3** investigated a theoretically-indicated directional risk pathway wherein solitary cannabis use underlies lagged associations between social discomfort (Aim 1) and proximal cannabis-related consequences (Aim 2). It was hypothesized that solitary cannabis use would mediate within-person associations of social discomfort with next-day cannabis consequences.

Method

Participants

Emerging adult cannabis users (N = 60) were recruited from November 2022 through April 2023. One participant reported no solitary cannabis use during the momentary assessment period (despite reporting twice-weekly or more frequent solitary cannabis use at initial screening) and was therefore excluded from analyses, resulting in a final sample of 59 young adult cannabis users (M_{age} = 22.88 [SD = 1.79], 61% female). The sample was majority Black (66%), followed by White (25%), Multiracial (2%), Hispanic/Latinx/Spanish origin (2%), and Asian (2%), with 0% of the sample reporting monoracial Native American, Native Hawaiian, or Pacific Islander race. Twenty-eight percent of the sample was currently enrolled full-time or part-time in college.

Participants were recruited from: (a) virtual advertisements posted to Facebook and Instagram; (b) physical fliers posted around several university campuses in upstate New York; (c) peer-based snowball sampling. Participants were eligible to participate if they met the following inclusion criteria: (a) endorse use of combustible and/or vaporized THC-based cannabis (as opposed to non-psychoactive, cannabidiol-only cannabis, which may have separate

and distinct consequences [Boggs et al., 2018], or edible cannabis preparations, which evidence significant delays in onset of subjective effects [Barrus et al., 2016]) alone at least twice-weekly for the past 6 months (i.e., demonstrated pattern necessary to provide sufficient variability in data, as suggested by cross-sectional findings reported in Wedel & Park, 2023); (b) aged between 18-25, consistent with typical emerging adult age range (Arnett, 2000); (c) English-speaking and reading, with access to a device with ready internet access as necessary to complete momentary surveys; (d) current resident of New York state (as confirmed by zip code), where it is presently legal to use cannabis recreationally (*New York State Marihuana Regulation and Taxation Act*, 2021). As the target sample was non-clinical recreational cannabis users, participants were further expected to (e) endorse recreational cannabis use (as opposed to exclusive use of cannabis as management for a medical condition); (f) report no current treatment-seeking for cannabis use disorder, consistent with other momentary assessment surveys examining regular cannabis use (Joyce et al., 2021; Treloar Padovano & Miranda, 2018); (g) report use of substances other than cannabis, alcohol, or tobacco on no more than 100 instances in their lifetime, which may be indicative of more disordered substance use behavior (Karoly et al., 2019); and (h) screen negative for current psychosis given known associations of solitary cannabis use with risk for psychosis (Spinella et al., 2019), as indicated by scores ≤ 27 on the Revised Green Paranoid Thoughts Scale (Freeman et al., 2021).

Procedure

Eligible participants attended a 15-minute video conference to provide oral informed consent, receive instructions for the momentary survey protocol, and clarify any questions. Directly following the video conference, participants completed a baseline survey assessing current and historical substance use and social discomfort. Beginning the following morning, participants were sent a secure web-link for a 3-minute “waking survey” (delivered at 6:00am, to

be completed upon typical waking time), three pseudorandom 2-minute "beeped surveys" (delivered at 10:30am, 2:30pm, and 6:45pm), and a 2-minute "end-of-day survey" (delivered at 10:00pm, to be completed upon typical bedtime) each day for the next 15 days, via preferred method of email or text message. This repeated daily assessment approach was necessary to capture substance use close to the moment of occurrence, and moreover to capture risk mechanisms of interest, which involve the temporal association of social interactions, affect, cannabis use, and subsequent functioning. Although survey distribution times were determined to conservatively capture typical sleep and wake times (consistent with other ecological momentary assessment studies; e.g., Chen-Sankey et al., 2019; Cooper et al., 2019), participants were instructed to complete morning and evening surveys directly upon waking and before going to bed, respectively. Surveys remained available until the next survey was distributed, thereby allowing participants a window of several hours to complete each survey. The 15-day timeframe was determined to be sufficient to observe solitary cannabis use given the eligibility criteria of at-least-twice-weekly solitary cannabis use (as necessary to capture considerable variability, and consistent with prior work indicating 58% solitary users engage in solitary use twice-weekly or more; Wedel & Park, 2023). All participants were provided monetary compensation (maximum $30), with compensation scaled according to the number of daily surveys completed.

To maximize participant adherence, several strategies were utilized: (a) at the initial meeting, all participants were provided with an individual virtual training by research staff on survey completion and problem-solving barriers to survey completion; (b) all participants received momentary surveys using their preferred method of communication (text message or email); (c) surveys were sent at the same time each day; (d) survey reminders were sent to non-responders with a maximum of two reminders per survey; (e) compensation was provided at several points throughout the survey period (after completion of baseline survey, after

completion of Week 1, and again after completion of Week 2). Completion rates were 97% for waking, 87% for the three pseudorandom mid-day surveys, and 94% for end-of-day surveys, for a total 90% completion rate (N = 4,000 out of possible N = 4,425 individual data points).

Measures

Baseline Survey

Demographic Characteristics. Using standardized items from the PhenX toolkit (Hamilton et al., 2011), participants reported sex assigned at birth (0=*female,* 1=*male*), gender, age, race, ethnicity (0=*Non-Hispanic/Latinx/Spanish origin,* 1=*Hispanic/Latinx/Spanish origin*), and sexual orientation.

Cannabis. Participants reported their current and historical cannabis use using a modified version the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use (DFAQ-CU; Cuttler & Spradlin, 2017). All existing items of the DFAQ-CU were included, but items regarding current and historical use frequency and quantity were administered separately for social cannabis use and solitary cannabis use. Participants were also asked to report whether and how often they co-used cannabis together with alcohol, combustible tobacco, and vaporized nicotine (i.e., e-cigarettes or e-vapor). Participants also reported how many problems they experienced during or after cannabis use over the last three months using the Cannabis Problems Questionnaire (Copeland et al., 2005).

Additionally, participants reported on their motives and expectancies regarding cannabis use. Specifically, they reported how often they used cannabis (1 = *Almost never/never* to 5 = *Almost always/always*) for various motives using the Comprehensive Marijuana Motives Questionnaire (Lee et al., 2009), a 36-item measure of 12 cannabis use motives, including enjoyment, conformity, coping, experimentation, boredom, alcohol, celebration, altered perceptions, social anxiety, relative low risk, sleep, and availability. They also reported how

strongly they agreed or disagreed (1 = *Strongly disagree* to 5 = *Strongly agree*) with statements regarding positive and negative expectancies about cannabis use using the Marijuana Effects Expectancy Questionnaire-Brief, a 6-item measure of cannabis expectancies (Torrealday et al., 2008). While not included in main models, descriptive statistics and bivariate correlations for cannabis use expectancies and motives are available in Supplemental Table 1.

Social Discomfort. Participants completed a brief, 8-item version of the UCLA Loneliness Scale (Hays & DiMatteo, 1987), which has been shown to have discriminant validity from depression (Matthews et al., 2016) and social anxiety symptoms (Danneel et al., 2020). Participants also completed the Interpersonal Sensitivity Measure (Boyce & Parker, 1989), which comprehensively assesses interpersonal sensitivity to produce five subscales (interpersonal awareness, need for approval, separation anxiety, timidity, and fragile inner self) as well as a total score of interpersonal sensitivity. The Interpersonal Sensitivity Measure has previously been shown to positively correlate, but have significant discriminant validity from, measures of both depression and social anxiety (Harb et al., 2002).

Mood. Participants completed the Patient Health Questionnare-9 (PHQ-9; Kroenke et al., 2001) and the Social Interaction Anxiety Scale-Short Form (Fergus et al., 2012) to assess symptoms of depression and social anxiety, respectively.

Momentary Surveys

Cannabis and Other Substance Use. At each moment, participants reported whether they had used cannabis and whether they had used cannabis with others (who were also using), with others (where they were the only one using cannabis), or alone. They also reported general route of administration from a selection of combustible marijuana/flower, concentrates (such as wax, dabs, or hash oil), edibles, or "other." They also reported on subjective high at time of use (0 = *Not at all high* to 100 = *The highest I have ever felt*) and current high at time of survey

completion. Single items were used to assess alcohol use since last survey, tobacco/nicotine use since last survey, and whether the participant had deliberately co-used alcohol and cannabis together so that their effects overlapped.

Social Discomfort. Social discomfort was assessed by loneliness and social experiences. Current loneliness was assessed with a single item ("How lonely do you feel right now?") along a visual analog scale ranging from 0 ("Not lonely at all") to 100 ("The loneliest I have ever been").

Positive and negative social experiences since the last survey were assessed with the 10-item Test of Negative Social Exchanges (Ruehlman & Karoly, 1991), which assesses the presence/absence of negative social experiences (e.g., someone got impatient with you or argued with you) and positive social experiences (e.g., someone complimented you or expressed sympathy toward you). Number of positive and negative social experiences were summed to produce separate sum scores of positive and negative social exchanges per moment (possible range = 0 to 5 for both positive and negative social exchanges).

Mood and Stress. Current mood and stress were assessed with a series of visual analog scales ranging from 0-100. Current positive and negative affect were assessed with three items each ("How joyful/content/happy do you feel right now"; "How angry/anxious/sad do you feel right now"), from which mean current positive and negative affect were calculated per moment (Kikuchi et al., 2015). Current stress was assessed with a single item ("How stressed do you feel right now?"). For all items, responses ranged from 0 ("Not at all joyful/angry/stressed/etc.") to 100 ("The most joyful/angry/stressed/etc. I have ever been").

Evening Surveys

Cannabis Use. Consistent with momentary surveys, each evening survey assessed cannabis, alcohol, nicotine, and any potential co-use since the last survey. Additionally,

participants were asked to indicate whether they had used THC-based cannabis to help them go to sleep (0 = *No*, 1 = *Yes*), consistent with prior research examining cannabis use for sleep aid (Goodhines et al., 2019).

Social Discomfort, Mood, and Stress. Consistent with momentary surveys, social discomfort (loneliness, positive and negative social exchanges), mood (positive and negative affect), and stress were likewise assessed at the evening survey.

Morning Surveys

Cannabis Use. Consistent with momentary surveys, each morning survey assessed cannabis, alcohol, nicotine, and any potential co-use since the last survey. Surveys regarding social discomfort were omitted from morning surveys, which were designed to be completed directly upon waking (i.e., before any potential interaction with other people).

Cannabis Use Consequences. Participants indicated whether they had experienced any consequences from their cannabis use over the last 24 hours. Specifically, they indicated whether they had experienced any of five general cannabis consequences ("taking foolish risks while high," "feeling foggy or sluggish," "doing something impulsive you later regretted," "using more cannabis than planned," "feeling guilty because of your cannabis use') and five interpersonal cannabis consequences ("saying or doing embarrassing things", "saying things you later regretted," "feeling antisocial," "worrying about meeting unfamiliar people while you were high," "worrying about feelings of isolation or detachment") adapted from two widely-used cannabis consequence scales (Copeland et al., 2005; Simons et al., 2012). Consequences were summed to produce two separate sum scores for daily general and interpersonal cannabis consequences. However, due to a high preponderance of zeroes and few daily consequences greater than one for each category of consequences (see Figure 2), results were dichotomized to

produce two separate logistic outcomes: any daily general consequences (30%) and any daily interpersonal consequences (32%).

Data Analytic Strategy

Descriptive statistics and bivariate correlations among all study variables were conducted in *SPSS*, Version 27 (*IBM SPSS Statistics for Windows*, 2020) to identify significant outliers, skew, kurtosis, and non-normality of distributions. Further data diagnostic tests (i.e., Shapiro-Wilk normality tests, dispersion tests, graphical inspection) were conducted in *RStudio* version 2023.06.1+524 (*RStudio*, 2023). Kurtosis scores calculated with the *e1071* package (Meyer et al., 2023) found kurtosis scores to be within the acceptable range (kurtosis <|2|) for all variables. Descriptive statistics and bivariate correlations among baseline study variables (i.e., Pearson's correlation coefficients for two continuous variables, and Spearman's coefficients for continuous and dichotomous variables) are reported in Table 1. Daily-level descriptive statistics and bivariate correlations among daily variables are reported in Table 2.

Main Analysis

Given the hierarchical nature of the data (i.e., repeated observations nested within each participant), multilevel models and multilevel path analyses were estimated in *Mplus Version 8.7* (Muthen & Muthen, 2021). Level 2 was defined by participants and Level 1 was defined alternately by moments (for Aim 1) or by days (for Aims 2-3). While a 3-level analysis was considered (i.e., moments at level 3 nested within days at level 2 within participants at level 1), moments and days within-person are likely to be more similar to one another than different, suggesting that it may be overly conservative to treat them as separate levels (Bolger & Laurenceau, 2013). This two-level approach to handling momentary affective and substance-related data has been widely used in recent years (see for example K. T. Phillips et al., 2022; Walters et al., 2023; Wardell et al., 2022).

Aim 1: Affective and Interpersonal Momentary Precipitants of Solitary Cannabis Use. First, a multilevel model assessed the predictive ability of social discomfort (loneliness and social exchanges) on same-moment and next-moment solitary cannabis use (yes/no). Unconditional models demonstrated within-person variability in solitary cannabis use (ICC = .16) moment-to-moment across the 15-day study period. Situational precipitants (positive/negative affect, loneliness, and positive/negative social exchanges) were disaggregated to separate between- and within-person effects. Effect size was calculated as the proportion of within-person variance explained compared to a null (intercept-only) model, which can be used to approximate an R^2 statistic in multiple linear regression (Raudenbush & Bryk, 2002; Snijders & Bosker, 2012). Across all models (Aims 1-3), the following covariates were included: (a) male sex, age, and Black race (fixed effects at Level 2) due to known demographic associations with solitary use (Buckner et al., 2016; Spinella et al., 2019); (b) a dichotomized weekend variable (including prompts answered on Friday, Saturday, and Sunday, as informed by exploratory analyses of day-of-week effects; fixed at level 1) to account for weekend effects among cannabis use samples (Bravo et al., 2017); (c) time-lagged within-person predictors (i.e., previous-moment loneliness and social exchanges) to establish a temporal sequence within the model, thus allowing for directional modeling of associations (Wickham & Knee, 2013); and (d) current subjective high at time of survey completion (fixed effect at Level 1, included to account for influence of potential intoxication during survey response; Chung et al., 2020).

Aim 2: General and Interpersonal Consequences of Solitary Cannabis Use. Next, two multilevel models assessed the predictive ability of total daily solitary cannabis use episodes (range = 0–4) on next-day general and interpersonal cannabis consequences. Unconditional models demonstrated little within-person variability in general (ICC = .002) and interpersonal (ICC = .002) cannabis consequences across the 15-day study period. This low within-person

variability may be partially explained by the considerable number of participants who reported no day-to-day consequences either generally (*n* = 20; 34%) or interpersonally (*n* = 23; 39%) during the study period. However, removing these participants with no reported consequences did not substantially improve ICC. An alternate explanation may be the limited number of days in which participants reported experiencing greater than one consequence. Therefore, after removing those participants who reported zero consequences throughout the study period, daily consequences were dichotomized for each day, resulting in a binary variable for any general consequences (1 = *Yes*) and any interpersonal consequences (1 = *Yes*), which substantially improved ICC for both general (ICC = .394) and interpersonal (ICC = .357) consequences but resulted in a lower sample size for Aim 2 and 3 analyses (*n* = 36). In addition to the above covariates (i.e., sex, age, Black race, weekend status, current subjective high), total daily social use was included as a covariate given known association with proximal consequences (Meisel et al., 2021; K. T. Phillips et al., 2018). Solitary use, social use, and average daily loneliness were disaggregated into between- and within-person components. Effect size was calculated as the proportion of within-person variance explained compared to a null (intercept-only) model. Consequences were modeled as dichotomous, as described above (for density plots depicting distribution of daily general and interpersonal consequences for all participants, refer to Figure 2).

Aim 3: Solitary Cannabis Use as a Mediator of Social Discomfort-Consequence Relationships. Third, multilevel path models assessed whether social discomfort was positively associated with solitary cannabis use (*a* path), which was in turn associated with general and interpersonal cannabis consequences (*b* paths) within-person. Separate models were run for each of four measures of social discomfort and mood (loneliness, positive and negative social exchanges, and negative affect). Models were run separately for each of three predictors

(loneliness, positive/negative social exchanges [included in the same model due to shared construct and low covariance; $r = .21$, $p = .11$], and negative affect), each of the two mediators (solitary use, and exploratory analyses of social use) and each of the two types of consequences (general and interpersonal), resulting in a total of 12 models. Significance testing for the mediation (calculated as the product of the coefficients for *a* and *b* paths) was conducted via 95% bootstrapped confidence intervals based on 10,000 bootstrap resamples, which has demonstrated better statistical power and lower type-1 error rate as compared to traditional methods (i.e., Sobel tests; MacKinnon et al., 2002). Covariates were modeled for *a* and *b* paths consistent with Aims 1-2. Exploratory analyses assessed daily social use as a potential mediator of the social discomfort-consequences relationship. A conceptual model of the mediation tested herein, broken down by Aims 1, 2, and 3, is presented in Figure 3, and a sample model of multilevel path analyses is presented in Figure 4.

Power Analysis

A priori power analyses were conducted by simulating data using the *powerlmm* (Magnusson & Bolker, 2018) and *ematools* (Kleiman, 2021) packages in *RStudio.* Simulated data from 59 participants at 5 data points per day for 15 days was sufficiently powered (>.80) to detect both *a* and *b* indirect paths of the proposed mediation model (Aim 3, which would require the most statistical power out of all proposed analyses) at a conservative small effect size (0.10) at the .05 level after accounting for up to 25% missing data. Due to low endorsement of daily consequences (as detailed above) and resulting lower sample size ($n = 36$) for Aim 2 and 3 analyses, data from the sample was underpowered (power = .60) to detect small effect sizes.

Results

Descriptive Statistics

Sample descriptive statistics and bivariate correlations for key study variables (including baseline, average daily, and average momentary) are presented in Table 1. At baseline, 49% of participants reported typically using cannabis alone 3-4 times per week; an additional 15% reported using 5-6 times per week, 5% reported using alone daily, and 10% reported using alone multiple times per day. Participants evidenced similar trends for social cannabis use, with 44% reporting social use 3-4 times per week, 14% reporting social use 5-6 times per week, 3% reporting daily social use, and 9% reporting social use multiple times per day. At baseline, 81% of participants reported experiencing at least one cannabis-related problem over the past 3 months (M = 5.41 [SD = 5.65]; median = 3.00, 25th percentile = 1.00, 75th percentile = 7.00), with the most commonly endorsed problems including "smoking more on your own than you used to" (64%), "spending more time with smoking friends than other types of friends" (49%), "having a smoke in the morning to get yourself going" (34%), "being concerned about a lack of motivation" (29%), "feeling depressed for more than a week after smoking cannabis" (27%), and "passing out after a smoking session" (25%). On average, participants reported low to moderate levels of depression symptoms (M = 6.38 [SD = 6.51]), social anxiety (M = 6.31 [SD = 6.69]), loneliness (M = 8.56 [SD = 4.79]), and interpersonal sensitivity (M = 90.30 [SD = 23.52]), comparable to other samples of solitary cannabis users in the same age range (Wedel & Park, 2023).

Cannabis use across the study period was largely consistent with that reported at baseline, as shown in Table 1. On average, participants reported using cannabis alone about once per day (M = 0.94 [SD = 0.86]) and typically reported 0-1 daily cannabis consequences (both generally and interpersonally; M = 0.48-0.56, range = 0 - 4). On average, participants reported higher positive affect (M = 59.92 [SD = 12.74]) than negative affect (M = 28.93 [SD = 13.92]), loneliness (M = 31.26 [SD= 15.98]) and stress (M = 32.31 [SD = 14.42]), and typically reported

greater positive (M = 1.54 [SD = 1.59]) than negative social exchanges (M = 0.51 [SD = 0.61]) at any given moment.

As shown in Table 1, participants' baseline reports of solitary cannabis use frequency were significantly and positively correlated with their number of daily solitary cannabis use episodes (r = .32, p = .012). Likewise, participants' baseline reports of cannabis problems were significantly and positively correlated both with general daily cannabis consequences (r = .73, p < .001) and interpersonal daily cannabis consequences (r = .73, p < .001). Participants' average reported high at the time of each survey completion was significantly and negatively associated with baseline solitary cannabis use frequency (r = -.29, p = .024), positively associated with age (r = .26, p = .047), and positively associated with average momentary positive (r = .36, p = .005) and negative affect (r = .30, p = .020).

Main Analyses

Aim 1: Affective and Interpersonal Precipitants of Solitary Cannabis Use

Results from a multilevel model assessing whether social discomfort precipitated solitary cannabis use are presented in Table 2. Within-person (Level 1), participants had greater odds of reporting solitary use in moments of greater loneliness (OR = 1.02 [1.01, 1.03], SE = 0.004, p < .001), but not greater negative social exchanges (p = .207) or fewer positive social exchanges (p = .820) compared to their own personal average. Lagged within-person effects of previous-moment solitary use, loneliness, and social exchanges on solitary use were all nonsignificant. Also, no significant between-person (Level 2) differences were observed by demographics, loneliness, or social exchanges. Residual variances for solitary use were significant (Estimate = 0.49, SE = 0.23, p = .038), suggesting considerable variability within solitary use behavior not accounted for by the included variables.

Aim 2: General and Interpersonal Consequences of Solitary Cannabis Use

Results of a multilevel model assessing whether total daily solitary use episodes predicted subsequent general and interpersonal cannabis consequences are presented in Table 3. Within-person (Level 1), both greater daily *solitary* cannabis use (relative to person-average; OR = 1.44, $p = .025$) and greater daily *social* cannabis use (relative to person-average; OR = 1.56, $p = .012$) were associated with higher odds of general next-day cannabis consequences after controlling for other covariates; neither solitary nor social use were significantly associated with odds of next-day interpersonal consequences. Greater positive social exchanges were associated with higher odds of next-day general consequences (OR = 1.08, $p = .048$) and interpersonal consequences (OR = 1.10, $p = .014$), while greater negative social exchanges were only associated with higher odds of next-day interpersonal consequences (OR = 1.11, $p = .016$); no significant direct associations were observed from daily loneliness to either type of cannabis consequences.

Between-person (Level 2), male sex (OR = 4.13, $p = .012$), younger age (OR = 0.70, $p = .027$) and greater social cannabis use (relative to sample-average; OR = 4.52, $p = .015$) were associated with higher odds of next-day general consequences. Male sex (OR = 7.35, $p < .001$), Black race (OR = 5.61, $p = .015$) and greater social cannabis use (relative to sample-average; OR = 4.94, $p = .004$) were associated with higher odds of next-day interpersonal consequences. Although transformed 95% confidence intervals contained one (suggesting non-significance), confidence intervals of unstandardized between-person effects did not contain zero for any significant effect, indicating significance of results consistent with *p* values below an alpha of .05. Log-transformed confidence intervals may have contained one due to the statistical software's default symmetric calculation of 95% confidence interval values, which may not always be appropriate for binary outcomes (Newcombe, 2012).

Aim 3: Solitary Cannabis Use as a Mediator of Social Discomfort-Consequence Relationships

Results of separate multilevel path analyses assessing whether total daily solitary use episodes mediated associations of same-day and previous-day social discomfort with next-day general and interpersonal cannabis consequences are presented in Table 4. All between-person effects were consistent with those observed in Aim 2, and are not shown in Table 4. Thus, only within-person findings are described in detail below. Results of all following analyses should be interpreted with caution in light of insufficient power due to exclusion of participants (n = 23) who endorsed no daily consequences over the course of the study.

Regarding two models involving loneliness (X1), solitary cannabis use (M1), and general and interpersonal consequences (Y1 and Y2), within-person, no significant direct effects were observed from previous-day average loneliness to solitary cannabis use (X1 → M1; RR = 0.99 [0.99, 1.00], p = .766). Greater solitary use was directly associated with greater odds of any next-day general cannabis consequences (M1 → Y1; OR = 1.45 [1.03, 2.04], p = .036), but not associated with odds of any next-day interpersonal cannabis consequences (M1 → Y2; OR = 1.21 [0.87, 1.55], p = .190). Altogether, hypotheses that solitary use would mediate associations of same- or previous-day loneliness with next-day consequences were not supported, as the indirect pathways from loneliness to general and interpersonal consequences were nonsignificant. After accounting for the non-significant indirect/mediating effect, there were no significant direct associations of loneliness with either general or interpersonal cannabis consequences.

Regarding two models involving positive and negative social exchanges (X2 and X3), solitary cannabis use (M1), and general and interpersonal consequences (Y1 and Y2), within-person, greater same-day negative social exchanges was directly associated with greater same-day solitary cannabis use (X3 → M1; RR = 1.03 [1.02, 1.07], p = .008). Greater solitary use was

in turn directly associated with higher odds of next-day general cannabis consequences (M1 → Y1; OR = 1.41 [1.03, 1.93], p = .031), but not associated with odds of next-day interpersonal cannabis consequences (M1 → Y2; OR = 1.12 [0.84, 1.40], p = .361). No direct effects were observed from solitary use upon odds of next-day interpersonal consequences; however, greater positive (X2 → Y2; OR = 1.09 [1.01, 1.17], p = .019) and negative social exchanges (X3 → Y2; OR = 1.10 [1.01, 1.20], p = .038) were directly associated with higher odds of interpersonal consequences. Altogether, hypotheses that solitary use would mediate associations of social exchanges with next-day cannabis consequences were unsupported.

Regarding two models involving negative affect (X4), within-person, no significant direct effects were observed from previous or same-day negative affect to solitary use (X4 → M1; RR = 1.00 [0.99, 1.01], p = .991). Greater solitary use was directly associated with higher odds of next-day general cannabis consequences (M1 → Y1; OR = 1.42 [1.02, 1.99], p = .038), but not with higher odds of next-day interpersonal consequences (M1 → Y2; OR = 1.21 [0.87, 1.54], p = .180). Parallel to prior results, hypotheses that solitary use would mediate associations of negative affect with next-day cannabis consequences were unsupported.

Exploratory Analysis as part of Aim 3: Social Cannabis Use as a Mediator of Social Discomfort-Consequence Relationships

Exploratory analyses evaluated social use in place of solitary use as a potential mediator for the relationship of social discomfort with cannabis consequences. Analyses involving loneliness found that greater previous-day loneliness was directly associated with lower same-day social cannabis use (X1 → M2; RR = 0.99 [0.99, 1.00], p = .034). Greater daily social use was in turn directly associated with greater odds of next-day general cannabis consequences (M2 → Y1; OR = 1.64 [1.16, 2.33], p = .006) but not odds of any next-day interpersonal consequences (M2 → Y2; OR = 1.20 [0.87, 1.55], p = .168). Indirect effects, however, were

nonsignificant; in other words, social use was not found to mediate the relationship of loneliness with odds of any next-day general or interpersonal cannabis consequences.

Both positive (X2 → M2; RR = 1.02 [1.00, 1.04], p = .037) and negative social exchanges (X3 → M2; RR = 1.03 [1.00, 1.06], p = .042) were directly associated with greater same-day social use, which was in turn directly associated with higher odds of next-day general cannabis consequences (M2 → Y1; OR = 1.51 [1.07, 2.14], p = .018), but not interpersonal consequences (M2 → Y2; 1.20 [0.73, 1.67], p = .355); indirect effects were nonsignificant, and social use was likewise not found to mediate the relationship of social exchanges with odds of any next-day general or interpersonal cannabis consequences.

Within-person, greater same-day negative affect was directly associated with lower same-day social cannabis use (X4 → M2; RR = 0.99 [0.99, 0.99], p < .001), and greater daily social use was in turn directly associated with higher odds of next-day general cannabis consequences (M2 → Y1; OR = 1.60 [1.13, 2.26], p = .008), but not interpersonal consequences (M2 → Y2; OR = 1.33 [0.80, 1.86], p = .163). Social use significantly and negatively mediated associations of same-day negative affect with next-day general consequences (Estimate = -0.003, SE = 0.001, p = .016).

Discussion

This 15-day experience sampling study tested temporal associations of solitary cannabis use with interpersonal precipitants and general and interpersonal cannabis-related consequences. Multilevel analysis showed that same-moment loneliness was associated with greater odds of solitary cannabis use. Greater daily solitary cannabis use, in turn, was associated with greater odds of next-day general, but not interpersonal, cannabis consequences. Solitary cannabis use was not found to mediate associations of same-day loneliness (or negative affect or negative social exchanges) with next-day general or interpersonal cannabis consequences. However,

social cannabis use was found to mediate associations of same-day negative affect with next-day general consequences.

Aim 1: Affective and Interpersonal Momentary Precipitants of Solitary Cannabis Use

Consistent with hypotheses, moments of solitary cannabis use were significantly predicted by greater same-moment loneliness, over and above individual within-person averages (see Table 2). Specifically, results indicated that for each one-unit increase in loneliness, participants were at 2% higher odds of engaging in solitary cannabis use at the same moment. Given the wide range of momentary loneliness (0-100) and frequent steep increases in loneliness from moment to moment (for visual representation, see Supplemental Figure 1), findings indicate a significant momentary association between current elevations in loneliness and solitary cannabis use. Contrary to hypotheses, however, no lagged associations were observed between loneliness and next-moment solitary cannabis use, precluding the ability to draw conclusions about the temporal relationship of loneliness with solitary use. There are several possible explanations for this finding. First, loneliness fluctuated considerably both within- and between-person (see Supplemental Figure 1), suggesting that feelings of acute loneliness may have naturally resolved in the hours between momentary assessments. Alternatively, participants may have self-medicated for loneliness by using cannabis alone in close temporal proximity to comparatively greater feelings of loneliness, thereby preventing effects of loneliness from being associated with subsequent solitary use. Third, using cannabis alone may have prompted feelings of loneliness, as engaging in and being repeatedly assessed for a solitary behavior may have drawn participants' attention to their own solitude. Qualitative assessment may help clarify momentary motives for solitary cannabis use, as well as self-perceived association of solitary use with proximal affective experiences (McQuoid et al., 2019, 2021). Additionally, momentary assessment of expectancies that cannabis use may resolve or reduce feelings of loneliness may

help to clarify the nature of this relationship. Despite their limitations, these results are novel to the literature, which has previously evaluated associations of loneliness with cannabis and other substance use only at the daily level (e.g., Bragard et al., 2022; Kuerbis et al., 2018) and never by social context. Moreover, they are consistent with recent recommendations that research further explore associations of discrete affective states (such as loneliness) with cannabis use (Dora et al., 2023).

Aim 2: General and Interpersonal Consequences of Solitary Cannabis Use

Overall, results highlight greater solitary and social cannabis use (relative to personal average) as predictive of greater odds of general cannabis consequences the next day, and that greater social use relative to others was associated with greater odds of both general and interpersonal consequences. Within-person findings that cannabis use across social contexts was associated with greater odds of next-day consequences is consistent with prior literature demonstrating association of greater within-person cannabis use with proximal consequences (Brown et al., 2018; Stevens et al., 2021). This finding adds incrementally to the literature by demonstrating that *both* solitary and social use are associated with greater next-day consequences, and that solitary use is not predictive of consequences over and above social use.

Findings regarding interpersonal consequences require further attention. Within-person, neither solitary nor social cannabis use were directly associated with interpersonal cannabis consequences. However, both positive and negative social exchanges were significantly and positively associated with odds of interpersonal cannabis consequences. While null associations of cannabis use with interpersonal consequences are unexpected, associations of social exchanges with interpersonal consequences are logical: days with relatively greater social involvement would naturally be associated with greater odds of experiencing interpersonal consequences. Additionally, between-person findings highlight that greater social use relative to

other participants was associated with greater odds of interpersonal consequences. While this finding runs contrary to hypotheses that *solitary* use would be more closely associated with interpersonal consequences, this finding may also reflect that greater social involvement (including socializing that involves cannabis) would naturally be more closely associated with social consequences. However, all results involving interpersonal consequences should be interpreted with caution, as endorsement of any interpersonal consequences was lower than for general consequences (for visual representation, see Figure 2). Furthermore, necessary dichotomization of consequences and decomposition of consequences into categories (general vs. interpersonal) may run counter to recent evidence that cannabis problems exist on a continuum rather than a series of problem categories (Earleywine et al., 2021).

Aim 3: Solitary Cannabis Use as a Mediator of Social Discomfort-Consequence Relationships

Regarding mediation, associations of social discomfort with cannabis consequences were not explained by solitary cannabis use within-person. Within the context of this study, this null finding can largely be explained by inadequate power: due to insufficient endorsement of daily consequences, the total number of participants included in mediation analyses fell short of the estimated $N = 60$ necessary to detect small effect sizes. However, there may be some alternate explanations in addition to the underpowered nature of the sample. First, this study found null associations of social discomfort (and loneliness in particular) with *daily*-level solitary cannabis use (*a* path). While loneliness was associated with greater odds of same-*moment* solitary use (see Aim 1), this finding did not extend to same-*day* solitary use. That is, participants were more likely to use cannabis alone at a given moment if they were feeling acutely lonely, but not to use cannabis alone more on a given day during which they overall felt lonelier on average. This unexpectedly discrepant finding may be partially explained by relatively greater variability in

loneliness moment-to-moment versus day-to-day (consistent with prior literature examining variability in affect; Scott et al., 2020). Prior literature has demonstrated that variability in affect (both positive and negative) is more strongly predictive of substance use behavior (i.e., alcohol use) than average affect over the course of the day (Duif et al., 2019). While not tested in this study, it is possible that participants' fluctuations in affect (including loneliness) are most strongly associated with their total daily solitary use and associated consequences.

Consistent with findings from Aim 2, associations of solitary use with general consequences (*b* path) were significant across models. Measures of social discomfort were not directly associated with general consequences, further weakening arguments for mediation. Altogether, findings suggest that while loneliness is associated with momentary solitary use and that overall daily solitary use is associated with general cannabis consequences, solitary use does not necessarily link loneliness with daily cannabis consequences. However, future research should replicate in a better-powered sample to fully understand this relationship, potentially by assessing alternate consequences, assessing daily consequences tailored to those endorsed at baseline by each participant, or by assessing interpersonal consequences more broadly (i.e., without explicitly associating interpersonal consequences to cannabis use in questions posed to participants).

Ancillary analyses testing *social* cannabis use as a mediator demonstrated that social use negatively mediated associations of negative affect with general consequences within-person. Specifically, on days with lower negative affect, participants tended to use cannabis socially more, and in turn were at greater odds of experiencing general cannabis consequences on the next day. This finding highlights potential mitigation of negative affect (though not more interpersonally-specific negative affect such as loneliness) via social cannabis use, consistent with existing literature on momentary associations of negative affect with social and coping

motives (Buckner et al., 2015). Alternatively, participants may have been motivated to engage in social cannabis use as a means of celebration, enhancement, or expansion on days when negative affect was already lower than average (Jackson et al., 2021). Whether it occurred as a means of self-regulation or as a social facilitator, this strategy comes at the cost of greater odds of general cannabis consequences the next day, further implicating heavier social use as a risk factor for poor cannabis outcomes (Buckner et al., 2015; K. T. Phillips et al., 2018). It is notable that this sample consisted of frequent *solitary* users, for whom social use may be divergence from routine solitary use behavior. It is possible that in this population in particular, greater cravings and/or withdrawal symptoms during periods of social use (e.g., Buckner et al., 2015) may have prompted use of greater quantities or via routes of administration that diverged from users' typical cannabis use experiences.

Clinical Implications

Findings of this study may inform individualized intervention for emerging adults' cannabis use behavior. In particular, identifying loneliness as a close proximal precipitant of cannabis use behavior is critical for the development of targeted interventions (Perski et al., 2021). Solitary cannabis users may benefit particularly from upstream interventions to counteract subjective feelings of loneliness (such as use of cognitive reappraisal strategies; Waizman et al., 2023) or to reduce sensitivity to rejection (such as dialectical behavior therapy or cognitive bias modification; Panepinto et al., 2015; Rowlands et al., 2022). These upstream approaches may be better suited to reduce risky cannabis use than interventions that focus solely on the cannabis use itself (Lees et al., 2021). While no direct associations appear to exist between loneliness and cannabis consequences, lowering overall daily solitary use via alternate mitigation of feelings of loneliness may reduce daily cannabis consequences, further improving cannabis-related outcomes. Additionally, findings implicating social use in greater risk for daily consequences

suggest that, even among individuals who endorse frequent or predominantly solitary use, inclusion of social and substance use refusal skills may be a beneficial addition to treatment (Paz Castro et al., 2022).

Findings may also inform adaptations of group intervention for cannabis use disorder among emerging adults. Psychosocial interventions for substance use are often delivered in group format, both to reduce costs and to foster mutual social support among those undergoing treatment (for a comprehensive review, see Lo Coco et al., 2019). For cannabis use in particular, recent findings show promise for group delivery of combined motivational enhancement therapy (MET) and cognitive-behavioral therapy (CBT) for adults in an outpatient setting, including improvements in both cannabis and mood (Trick et al., 2023). Individuals who use cannabis alone in conjunction with feelings of loneliness may benefit particularly from group involvement, as group treatment would provide built-in social support in addition to structured intervention on affective and cognitive components of cannabis use. At the same time, given findings here that between-person greater-frequency social use is associated with greater daily consequences, group treatment would run the risk of facilitating creation of social cannabis use circles (a common concern regarding group treatment in substance use settings; Lo Coco et al., 2019). Despite this risk, however, Trick and colleagues' (2023) preliminary findings showed significant harm reduction in days and quantity of cannabis used, as well as diminished cannabis problems, suggesting that social facilitation should not be a deterrent to implementation of group treatment for cannabis use disorder. Concerns about social facilitation could be further mitigated with inclusion of treatment components targeting social networks. Treatments devoted to reducing exposure to social substance use networks, while expanding and reinforcing engagement with non-using peers (including those in recovery alongside them) have demonstrated benefits for treatment of cannabis use disorder (Vederhus et al., 2022) and may be

particularly well-received when implemented among communities of color (Kennedy et al., 2022).**Strengths and Limitations**

This study had several key methodological strengths due to its intensive longitudinal design. First, repeated sampling allowed for estimation of both within- and between-person effects, allowing for clarification not only of sample-level trends but also of fluctuations in use and affect around individual averages. Capturing loneliness, affect, and cannabis use multiple times per day in the natural environment more closely approximated ecological validity by eliminating recall bias (M. M. Phillips et al., 2014). Additionally, findings have highlighted the importance of examining moment-to-moment in addition to day-to-day differences in associations of affect with substance use. Second, the brief assessment approach taken in this study limited the burden of repeated questionnaires to participants, while maintaining comprehensive assessment of affect and cannabis use by social context throughout the day. While the brevity of assessment has some limitations (see below), it may be responsible for the high assessment compliance rate (90% across all surveys) and suggests that intensive longitudinal assessment that takes into account social-contextual factors is feasible to explore further in future research.

Findings should be interpreted within the context of several limitations. First, data were drawn from an online sample that was predominantly Black and female; results may not generalize to samples with more racial or gender diversity. Participants were also all residents of New York state, where cannabis is legal for both medical and recreational use. Replication is needed in states with differing legal landscapes, as solitary use may be strongly motivated by privacy concerns in states without legal access to cannabis (as observed with solitary use of other illicit substances; Rosen et al., 2023). Alternatively, in states with more advanced legal access or even designated social gathering spaces for cannabis use (i.e., cannabis “speakeasies” or social

clubs; Obradors-Pineda et al., 2021), solitary use may represent a particularly notable departure from normative use given opportunities to use elsewhere. Additionally, replication may be worthwhile even within the state of New York, as the legal market for recreational cannabis shifted considerably over the data collection period. Although cannabis was legalized for recreational use in New York in 2021, the first legal dispensaries did not open until late December 2022, and then only in New York City (Southall & Parnell, 2022); rollout of legal cannabis marketplaces to other metropolitan areas in the state of New York is still ongoing. Second, repeated assessments were intentionally kept brief to improve response rate, resulting in a lack of momentary data on potentially relevant constructs such as motives, craving, impulsivity, or boredom (Okey et al., 2022; Waddell et al., 2023). Moreover, this brief assessment approach limited response variability for some constructs, most notably consequences. More comprehensive assessment of daily consequences (including consequences which individuals may not consciously associate with cannabis use given low insight into adverse effects of cannabis use among cannabis users; Kay-Lambkin et al., 2017) may help to elucidate short-term harm associated with daily cannabis use across social contexts. Third, despite improved ecological validity due to environmental experience sampling, subjective assessments are vulnerable to self-report errors (e.g., memory impairment due to cannabis use; Broyd et al., 2016). Although these concerns are somewhat mitigated by this study's statistical control of current subjective high in all analyses, self-reports of current high could likewise be impacted by intoxication at the time of survey completion. Fourth, this study intentionally recruited a sample of cannabis users who reported frequent solitary use (which was shown to be a majority of solitary users; Wedel & Park, 2023). Momentary associations of affect and loneliness with solitary use, and in turn of solitary use with consequences, may differ considerably for individuals for whom solitary use is a new or unusual cannabis use behavior.

Future Directions

Results of this study may inform future research into social-contextual factors in cannabis use behavior. First, continued efforts in characterizing cannabis use patterns across varying social contexts are needed, including: (a) examination of solitary use in other age groups, including adolescents (for whom solitary use may be a salient risk indicator; Terry-McElrath et al., 2022) and older adults (for whom loneliness and social isolation are particularly important, and who have evidenced higher rates of solitary use both quantitatively and qualitatively; Dahlberg & McKee, 2014; Lau et al., 2015); (b) examination of changes in social-contextual cannabis use patterns across the lifespan, particularly given qualitative evidence that motives for solitary use among older adults may differ considerably from motives for use recalled earlier in life (Lau et al., 2015); (c) characterization of potential differences in cannabis use patterns (e.g., route of administration, strain of cannabis, ratio of THC to CBD) between social contexts; (d) replication in larger, more diverse samples to explore potential moderators such as race or gender; (e) replication with longer-term follow-up, potentially including measurement burst designs (i.e., multiple periods of repeated assessment; Walukevich-Dienst et al., 2023); and (f) inclusion of qualitative items to more accurately capture solitary and social use and their precipitants as perceived by the individual cannabis user. Second, results should be replicated across diverse sociodemographic and clinical populations, including groups with greater loneliness such as LGBTQ+ individuals (Eres et al., 2021; Mereish & Poteat, 2015) and clinical populations with known elevations in both social discomfort and cannabis use, such as those with social anxiety (Buckner et al., 2016; Garrison et al., 2021). Third, while the current study focused on the relationship of solitary and social cannabis use with social discomfort and *negative* cannabis use consequences, future research should expand this focus to include *positive* consequences of cannabis (Grigsby et al., 2024), which may reinforce certain social-contextual

patterns of cannabis use. Third, objective ambulatory assessment of physiological arousal, such as skin conductance or heart rate variability (Stange et al., 2023), would allow for more comprehensive biopsychosocial assessment of stress reactivity (including but not limited to interpersonal stress), affect, and substance use without placing undue burden on the participant. Finally, current findings may inform the development of targeted prevention and intervention research efforts, potentially including mobile-based brief interventions leveraging daily engagement and assessment similar to the research protocol employed in this study (Colonna & Alvarez, 2022; Olthof et al., 2023).

Summary

Results of this 15-day ecological momentary assessment study of emerging adults reporting twice-weekly or more frequent solitary cannabis use highlight frequent cannabis use across both solitary and social contexts, as well as proximal consequences of relatively greater cannabis use day-to-day within person. Consistent with hypotheses, findings provide support for acute loneliness as a potential precipitant of solitary cannabis use in the moment, which may inform development of interventions for individuals with concurrent cannabis use disorder and interpersonal concerns. Likewise, further research is necessary to expand scientific understanding of the relationship between solitary use and short- and long-term cannabis consequences.

Table 1. Means, standard deviations, and bivariate correlations for key study variables.

		r																			
Variables (possible range)	*M* (SD) or %	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Baseline																					
1. Solitary cannabis use frequency (0-12)	9.03 (2.11)	-																			
2. Social cannabis use frequency (4-12)	8.90 (1.57)	**.42**	-																		
3. Age (18-25)	22.88 (1.79)	-.25	**-.26**	-																	
4. Male sex (1 vs. 0)	39%	.06	**.31**	.14	-																
5. Black race (1 vs. 0)	66%	-.02	.19	-.22	-.23	-															
6. Hispanic ethnicity (1 vs. 0)	2%	-.03	.16	**-.28**	.20	-.20	-														
7. Depression symptoms (0-21)	6.38 (6.51)	-.03	.15	-.01	**.66**	**-.29**	.06	-													
8. Social anxiety symptoms (0-21)	6.31 (6.69)	.05	.19	.03	**.57**	**-.35**	-.01	**.77**	-												
9. Loneliness (0-17)	8.56 (4.79)	-.09	-.02	-.07	.07	.17	.17	.26	.08	-											
10. Interpersonal sensitivity (42-128)	90.30 (23.52)	-.02	.20	.05	**.45**	**-.28**	-.24	**.59**	**.69**	-.19	-										
11. Cannabis problems (0-23)	5.41 (5.65)	**.28**	**.44**	**-.29**	.21	**.31**	-.01	**.32**	.19	-.07	**.36**	-									
Daily																					
12. Solitary cannabis use episodes (0-4)	0.94 (0.86)	**.32**	**.34**	-.18	.05	**.33**	.20	.00	.10	-.12	.18	**.45**	-								
13. Social cannabis use episodes (0-2)	0.46 (0.47)	.25	**.49**	-.23	.01	**.39**	.11	-.02	.04	-.12	.07	**.59**	**.50**	-							
14. General cannabis consequences (0-1)	0.29 (0.29)	.01	**.52**	-.25	**.32**	.24	-.07	.21	.14	-.12	.27	**.73**	**.43**	**.52**	-						
15. Interpersonal consequences (0-1)	0.24 (0.29)	-.05	**.34**	-.06	**.38**	**.31**	-.08	.25	.18	.09	.20	**.73**	**.40**	**.53**	**.85**	-					
Momentary																					
16. Positive affect (22-90)	59.92 (12.74)	.13	.14	**.42**	**.62**	-.15	**-.27**	**.30**	**.45**	-.11	**.40**	-.13	-.13	**-.30**	-.18	-.11	-				
17. Negative affect (2-63)	28.93 (13.92)	**-.41**	-.05	-.07	-.07	**.34**	.01	.15	.03	.07	.13	.21	-.04	-.05	**.29**	**.38**	**-.33**	-			
18. Loneliness (1-72)	31.26 (15.98)	-.21	.15	-.15	-.04	**.46**	-.05	.07	.09	.08	.26	**.34**	**.28**	.12	**.51**	**.51**	**-.26**	**.75**	-		
19. Positive social exchanges (0-5)	1.54 (1.59)	.19	**.30**	.22	**.53**	**-.32**	-.07	**.53**	**.62**	-.19	**.56**	.25	.03	.03	.03	.08	**.62**	-.15	-.21	-	
20. Negative social exchanges (0-3)	0.51 (0.61)	.11	**.30**	**-.27**	**.30**	.19	.01	**.26**	.21	.01	.15	**.71**	**.26**	**.44**	**.80**	**.89**	-.09	**.37**	**.40**	.21	-
21. High at time of survey (0-83)	53.67 (18.58)	**-.29**	.03	**.26**	-.02	.09	-.19	.14	.10	-.13	.22	-.04	-.12	-.15	-.26	-.24	**.36**	**.30**	.19	.17	-.12

Note. $N = 59$. Pearson's correlation coefficients are reported for two continuous variables. Spearman's coefficients (r_s) are reported for continuous and dichotomous variables; Phi coefficients (r_Φ) are reported for two dichotomous variables. Significant correlation coefficients at $p < .05$ are denoted in bold.

Table 2

Aim 1. Multilevel models estimating loneliness and interpersonal exchanges as situational precipitants of solitary cannabis use.

	Solitary cannabis use (yes/no)	
	Estimate (*SE*)	OR [95% CI]
Level 2 (Between-Person)		
Sex	-0.18 (0.27)	0.84 [0.39, 1.29]
Age	-0.01 (0.10)	0.99 [0.80, 1.19]
Black race (Ref = non-Black)	0.36 (0.54)	1.44 [-0.09, 2.96]
Loneliness	0.01 (0.01)	1.01 [0.99, 1.03]
Negative social exchanges	-0.14 (0.28)	0.96 [0.67, 1.25]
Positive social exchanges	-0.04 (0.15)	0.87 [0.40, 1.34]
Level 1 (Within-Person)		
Loneliness (same-moment)	**0.02 (0.004)*** **	**1.02 [1.01, 1.03]**
Loneliness (lagged)	-0.003 (0.003)	0.99 [0.99, 1.00]
Negative social exchanges (same-moment)	-0.11 (0.09)	0.89 [0.75, 1.07]
Negative social exchanges (lagged)	-0.004 (0.08)	0.99 [0.86, 1.15]
Positive social exchanges (same-moment)	-0.02 (0.08)	0.98 [0.84, 1.14]
Positive social exchanges (lagged)	0.08 (0.08)	1.08 [0.93, 1.25]
Solitary use (lagged)	0.19 (0.27)	1.21 [0.72, 2.03]
Social use (lagged)	-0.20 (0.20)	0.82 [0.55, 1.21]
Current high (same-moment)	-0.01 (0.01)	0.99 [0.98, 1.00]

Note. $N = 59$. Between-person effects for loneliness and negative/positive social exchanges are grand-mean-centered; within-person effects for loneliness and negative/positive social exchanges are person-mean-centered. Lagged predictors represent effects on solitary cannabis use at the following moment. Random effects are omitted for simplicity of presentation.

***$p < .001$

Table 3

Aim 2. Multilevel logistic models estimating associations of solitary and social cannabis use with next-day general and interpersonal consequences.

	Odds of any next-day consequences	
	Estimate (*SE*)	OR [95% CI]
General consequences		
Level 2 (Between-Person)		
Sex (ref = female)	**1.42 (0.56)***	**4.13 [-0.43, 8.71]**
Age	**-0.36 (0.16)***	**0.70 [0.48, 0.92]**
Black race (ref = non-Black)	1.25 (0.73)	3.48 [-1.51, 8.47]
Solitary cannabis use	0.50 (0.34)	1.66 [0.54, 2.77]
Social cannabis use	**1.51 (0.62)***	**4.52 [-0.97, 10.00]**
Level 1 (Within-Person)		
Solitary cannabis use	**0.36 (0.16)***	**1.44 [1.05, 1.97]**
Social cannabis use	**0.45 (0.18)***	**1.56 [1.10, 2.22]**
Mean daily loneliness	0.01 (0.01)	1.01 [0.99, 1.02]
Positive social exchanges	**0.08 (0.04)***	**1.08 [1.00, 1.17]**
Negative social exchanges	0.09 (0.05)	1.09 [0.99, 1.21]
Weekend (ref = weekday)	0.16 (0.22)	1.18 [0.76, 1.82]
Mean high at time of survey	0.00 (0.00)	1.00 [0.99, 1.00]
Interpersonal consequences		
Level 2 (Between-Person)		
Sex (ref = female)	**1.20 (0.52)*** **	**7.35 [-0.17, 14.87]**
Age	-0.20 (0.16)	0.82 [0.56, 1.08]
Black race (ref = non-Black)	**1.73 (0.71)***	**5.61 [-2.16, 13.39]**
Solitary cannabis use	0.45 (0.31)	1.57 [0.61, 2.52]
Social cannabis use	**1.60 (0.55)****	**4.94 [-0.43, 10.31]**
Level 1 (Within-Person)		
Solitary cannabis use	0.11 (0.13)	1.12 [0.86, 1.45]
Social cannabis use	0.23 (0.19)	1.26 [0.86, 1.85]
Mean daily loneliness	0.01 (0.01)	1.01 [0.99, 1.03]
Positive social exchanges	**0.09 (0.04)***	**1.10 [1.02, 1.18]**
Negative social exchanges	**0.10 (0.04)***	**1.11 [1.02, 1.21]**
Weekend (ref = weekday)	0.13 (0.17)	1.13 [0.82, 1.58]
Mean high at time of survey	0.00 (0.00)	1.00 [0.99, 1.01]

Note. $N = 59$. Between-person effects for solitary and social use are grand-mean-centered; within-person effects for solitary and social use and loneliness are person-mean-centered. Predictors represent effects on odds of consequences on the following day. Random effects are omitted for simplicity of presentation.

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

Table 4

Aim 3. Multilevel models testing solitary and social cannabis use as mediators of within-person social discomfort-consequence relationships

Same-day social discomfort (X) – solitary cannabis use (M1)	Next-Day General Cannabis Consequences (Y1)				Next-day Interpersonal Cannabis Consequences (Y2)			
	Path a (X → M1)	Path b (M1 → Y1)	Path c' (X → Y1)	Indirect Effect (Path a*Path b)	Path a (X → M1)	Path b (M1 → Y2)	Path c' (X → Y1)	Indirect Effect (Path a*Path b)
	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)
Loneliness (X1)	-0.001 (0.003)	**0.368 (0.175)**	0.012 (0.009)	0.000 (0.001)	-0.001 (0.003)	0.190 (0.145)	0.011 (0.008)	0.00 (0.001)
Negative social exchanges (X2)	**0.038 (0.014)**	**0.344 (0.159)**	0.084 (0.050)	0.013 (0.008)	**0.038 (0.014)**	0.116 (0.127)	**0.093 (0.045)**	0.004 (0.005)
Positive social exchanges (X3)	0.020 (0.015)	**0.344 (0.159)**	0.074 (0.042)	0.007 (0.006)	0.020 (0.015)	0.116 (0.127)	**0.083 (0.036)**	0.002 (0.003)
Negative affect (X4)	0.00 (0.003)	**0.352 (0.170)**	-0.003 (0.012)	0.000 (0.001)	0.000 (0.003)	0.190 (0.141)	0.003 (0.011)	0.000 (0.001)
Same-day social discomfort (X) – social cannabis use (M2)	Next-Day General Cannabis Consequences (Y1)				Next-day Interpersonal Cannabis Consequences (Y2)			
	Path a (X → M2)	Path b (M2 → Y1)	Path c' (X → Y1)	Indirect Effect (Path a*Path b)	Path a (X → M2)	Path b (M2 → Y2)	Path c' (X → Y2)	Indirect Effect (Path a*Path b)
	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)	γ (*SE*)
Loneliness (X1)	-0.004 (0.002)	**0.496 (0.179)**	0.012 (0.009)	-0.002 (0.001)	-0.004 (0.002)	0.278 (0.201)	0.011 (0.008)	-0.001 (0.001)
Negative social exchanges (X2)	**0.030 (0.015)**	**0.415 (0.176)**	0.084 (0.050)	0.013 (0.008)	**0.030 (0.015)**	0.184 (0.199)	**0.093 (0.045)**	0.006 (0.007)
Positive social exchanges (X3)	**0.020 (0.010)**	**0.415 (0.176)**	0.074 (0.042)	0.008 (0.005)	**0.020 (0.010)**	0.184 (0.199)	**0.083 (0.036)**	0.004 (0.004)
Negative affect (X4)	**-0.007 (0.002)**	**0.468 (0.177)**	-0.003 (0.012)	**-0.003 (0.001)**	**-0.007 (0.002)**	0.285 (0.204)	0.003 (0.011)	-0.002 (0.001)

Note. $N = 59$. A total of 12 mediation models were analyzed. Separate models were conducted for mean daily number of solitary use episodes (M1) and mean daily number of social use episodes (M2) as the mediator between each of the four social discomfort and mood variables (X, predictors) and the two types of cannabis consequences (Y, outcomes). Positive and negative social exchanges ($r = .21$, $p = .11$) were included together in the same models.

Path a: direct association of social discomfort with same-day solitary/social use episodes. Path b: direct association of solitary/social use episodes on next-day consequences. Path c': direct association of social discomfort with cannabis consequences. Indirect effect (Path a*Path b): indirect association of social discomfort with cannabis consequences via cannabis use context. Weekend variable and subjective high at time of survey were accounted for in all models, but as all weekend and subjective high effects were nonsignificant, they are omitted from this table for simplicity of viewing. Direct and indirect paths significant at $p < .05$ are denoted in bold.

Table S1. Means, standard deviations, and bivariate correlations for social contextual variables, cannabis use expectancies, cannabis use motives, and cannabis problems.

		r																		
Variables (possible range)	*M* (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
1. Baseline solitary cannabis use frequency (0-12)	9.03 (2.11)	-																		
2. Baseline social cannabis use frequency (4-12)	8.90 (1.57)	**.42**	-																	
3. Daily solitary cannabis use episodes (0-4)	0.94 (0.86)	**.32**	**.34**	-																
4. Daily social cannabis use episodes (0-2)	0.46 (0.47)	.25	**.49**	**.50**	-															
5. Positive expectancies (7-15)	13.05 (2.37)	-.04	-.25	.05	-.16	-														
6. Negative expectancies (4-15)	8.88 (2.63)	.14	**.36**	-.06	-.04	-.23	-													
7. Enjoyment motives (0-5)	3.88 (0.78)	.22	.08	.17	.05	**.31**	.15	-												
8. Conformity motives (0-5)	2.47 (1.01)	.11	**.44**	.15	.01	**-.36**	**.47**	.09	-											
9. Coping motives (1-5)	3.11 (1.13)	.09	**.34**	.22	.07	.21	**.35**	**.44**	**.50**	-										
10. Expansion motives (0-5)	2.50 (1.18)	**.29**	**.46**	.12	-.02	-.18	**.56**	**.27**	**.70**	**.46**	-									
11. Boredom motives (1-5)	2.73 (0.97)	.05	**.33**	-.10	.04	-.02	**.53**	**.47**	**.64**	**.58**	**.63**	-								
12. Alcohol motives (1-5)	2.15 (1.18)	.12	**.40**	-.02	.07	**-.27**	**.64**	.20	**.71**	**.42**	**.73**	**.71**	-							
13. Celebration motives (1-5)	3.19 (1.10)	**.29**	**.58**	.24	.23	-.06	**.43**	**.47**	**.61**	**.67**	**.67**	**.70**	**.62**	-						
14. Altered perceptions motives (0-5)	3.14 (0.99)	.05	**.46**	.07	.06	.09	**.31**	**.41**	**.66**	**.66**	**.56**	**.72**	**.54**	**.72**	-					
15. Social anxiety motives (0-5)	3.38 (1.16)	-.01	**.30**	.14	.01	.24	.19	**.42**	**.42**	**.67**	**.43**	**.62**	**.27**	**.66**	**.76**	-				
16. Relative low risk motives (0-5)	3.10 (1.07)	.18	.22	-.06	-.23	.11	**.27**	**.41**	**.38**	**.28**	**.60**	**.55**	**.40**	**.50**	**.50**	**.48**	-			
17. Sleep motives (1-5)	3.34 (1.17)	-.11	.003	.09	-.10	.23	.16	**.66**	**.31**	**.66**	.24	**.52**	**.29**	**.53**	**.58**	**.57**	**.37**	-		
18. Availability motives (1-5)	2.80 (1.09)	.14	**.41**	.05	.07	-.01	**.41**	**.38**	**.76**	**.59**	**.58**	**.78**	**.64**	**.72**	**.69**	**.56**	**.58**	**.53**	-	
19. Cannabis problems (0-23)	5.41 (5.65)	**.28**	**.44**	**.45**	**.59**	-.07	.22	**.39**	.13	**.29**	**.36**	**.29**	**.32**	**.48**	.22	**.31**	.13	.20	**.27**	-

Note. $N = 59$. Pearson's correlation coefficients (r) are reported for bivariate correlations between all variables. Significant correlations at $p < .05$ are denoted in bold.

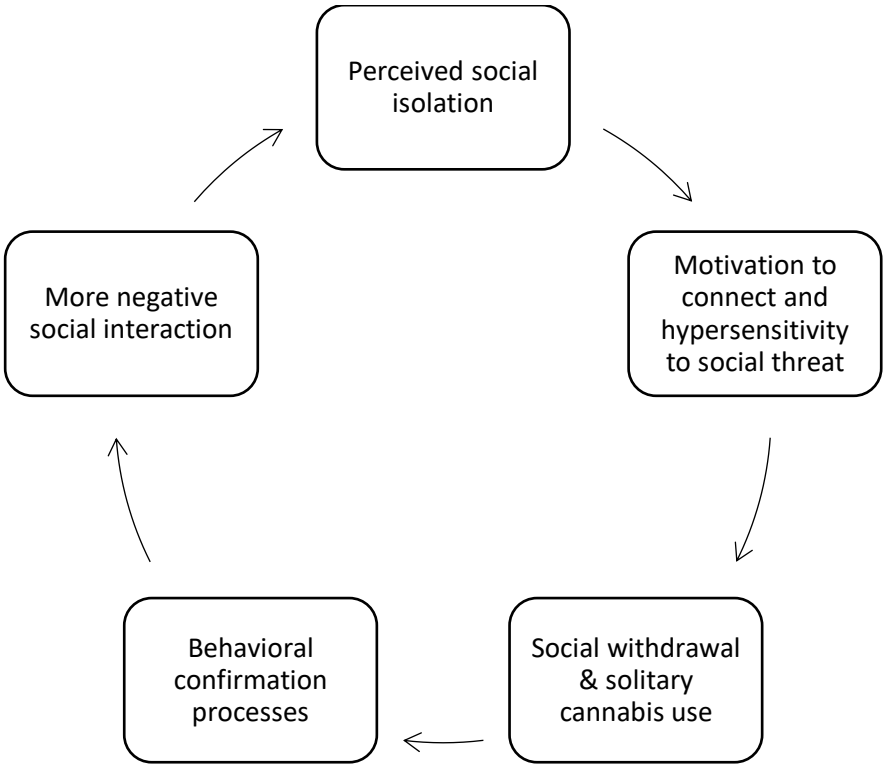

Figure 1. Conceptual model of cyclical social discomfort-solitary use relationship adapted from the Socio-cognitive Model of Loneliness & Health (Cacioppo & Hawkley, 2012)

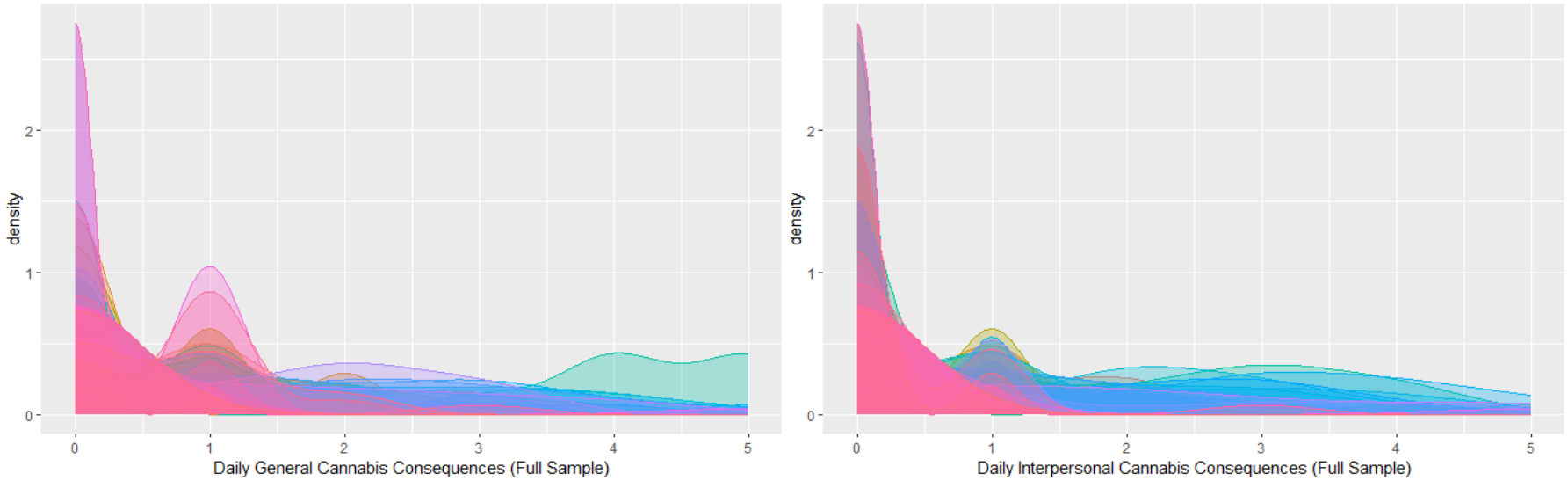

Figure 2. Density of daily general and interpersonal cannabis consequences across all participants.

Note. $N = 59$. Density plots are presented for both general (left) and interpersonal (right) daily cannabis consequences for all participants across all 15 days. Different colors represent different individual participants' instances of consequences across all days. Color opacity reflects frequency of response across participants (i.e., more opaque colors reflect responses that are more common within-day across all participants).

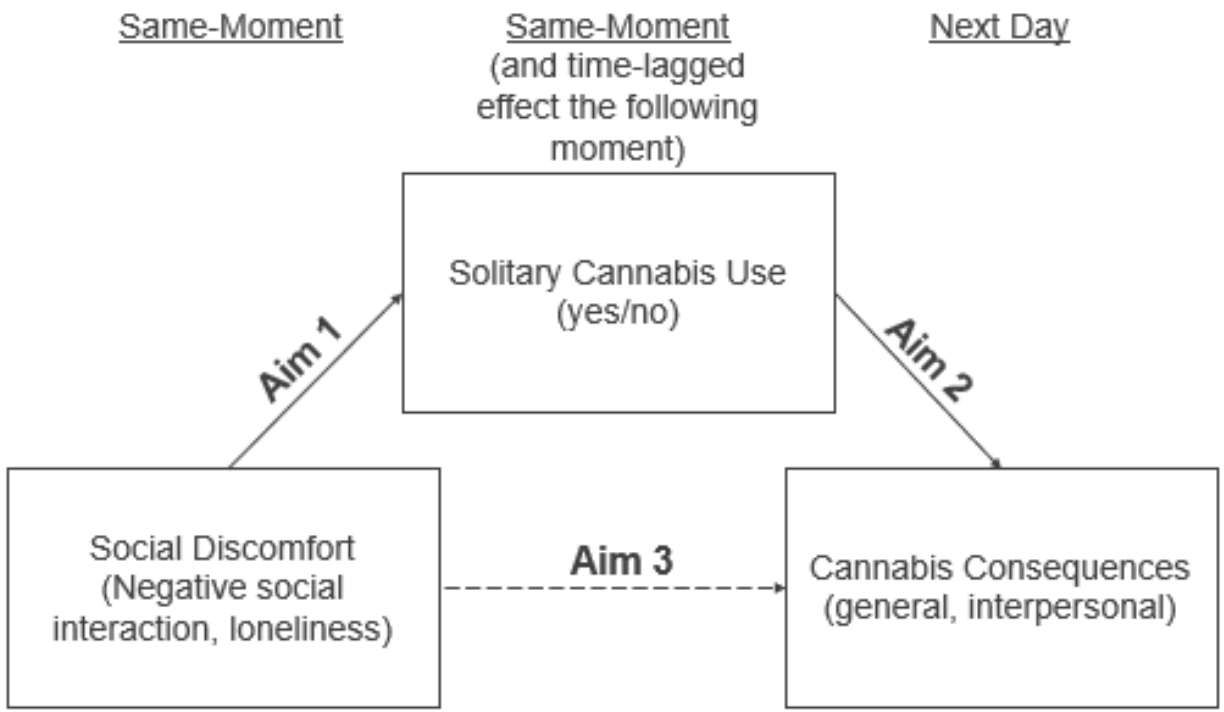

Figure 3. Conceptual mediation model. Parallel exploratory models were conducted with social cannabis use.

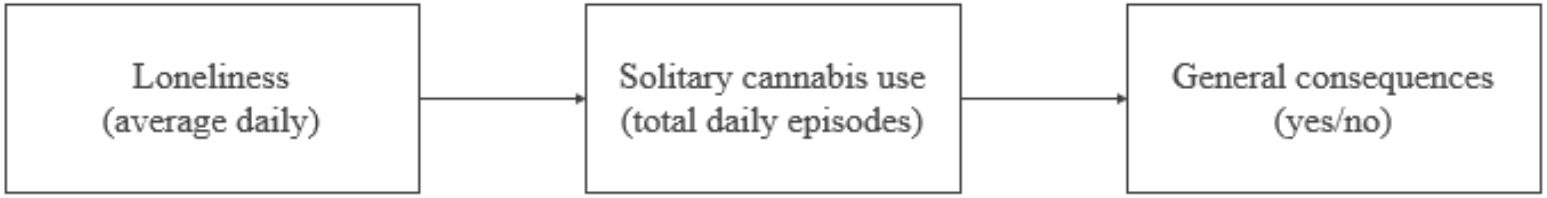

Figure 4. Example multilevel path model for analyses involving loneliness, solitary cannabis use, and general consequences. Separate path models were run with negative affect, positive social exchanges, and negative social exchanges in place of loneliness, and interpersonal consequences in place of general consequences. Exploratory path analyses replicated all of the aforementioned analyses with social cannabis use tested as the mediator in place of solitary cannabis use. All path models included between-person (i.e., Level 1) fixed effects of race, sex, age, social cannabis use, and solitary cannabis use; these effects are omitted from this figure for ease of understanding.

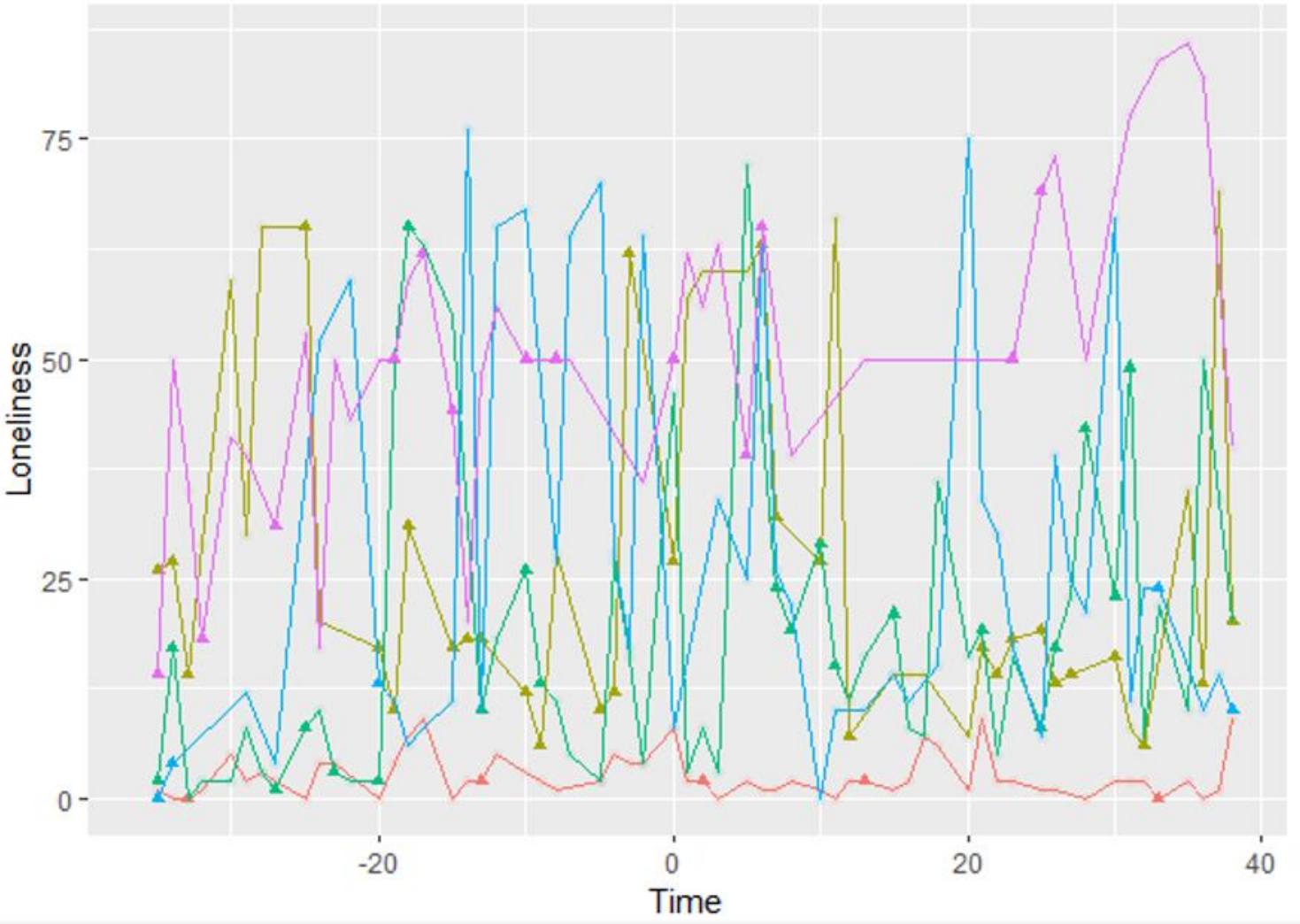

Figure S1. Moment-to-moment variability in loneliness for select participants. Different colors represent different individual participants, and triangles represent episodes of solitary cannabis use. Time was mean-centered (ranging from -40 to 40). For simplicity of demonstration, only the first five participants are shown here.

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CURRICULUM VITAE

Amelia V. Wedel, M.S.

Department of Psychiatry & Behavioral Sciences
Medical University of South Carolina
amw251@musc.edu | (650) 861-0935

EDUCATION

Expected 2024	**Doctor of Philosophy, Clinical Psychology** Syracuse University, Syracuse, NY (APA Full Accreditation) Dissertation: *Momentary Precipitants and Consequences of Solitary Cannabis Use Among Emerging Adults* Advisor: Aesoon Park, Ph.D.
2023-2024	**Pre-Doctoral Clinical Psychology Intern** Charleston Consortium Internship (APA Full Accreditation) Track: Substance Use Emphasis Mentor: Erin McClure, Ph.D.
2021	**Master of Science, Psychology** Syracuse University, Syracuse, NY (APA Full Accreditation) Thesis: *Solitary Alcohol and Cannabis Use among College Students during the COVID-19 Epidemic: Concurrent Social and Affective Correlates and Substance-Related Consequences* Advisor: Aesoon Park, Ph.D.
2016	**Bachelor of Arts, Psychology with High Honors** Oberlin College, Oberlin, OH Thesis: *Vaping to Lose Weight: Predictors of Adult E-Cigarette Use for Weight Management*

HONORS AND AWARDS

2023	Graduate Poster Award, Neuroscience Research Day, Syracuse University
2022	Interdisciplinary Graduate Neuroscience Consortium Research Travel Award ($500), Syracuse University
2022	Graduate Student Organization Research Travel Award ($500), Syracuse University
2022	Research Society on Alcoholism Student Merit Award ($225)
2016	Associate Member, Sigma Xi, Oberlin College
2016	Raymond H. Stetson Award for Research in Psychology and Psychobiology ($500), Oberlin College
2016	Departmental High Honors in Psychology, Oberlin College

RESEARCH INTERESTS

- Progression from recreational cannabis use to cannabis use disorder
- Role of social relationships and loneliness in substance use
- Social determinants of disparities in substance use, particularly among sexual minority populations
- Intensive longitudinal designs and advanced statistical techniques for measurement and modeling of temporal associations between affect, social behavior, and substance use

PUBLICATIONS

Mentored undergraduate co-authors are underlined.

Peer-Reviewed Journal Publications

1. Goodhines, P. A., Rathod, K., LaRowe, L. R., & **Wedel, A. V.** (2024). Sleep-related cannabis expectancy questionnaire (SR-CEQ): Factor analysis replication, reliability, and validity. *Journal of Psychoactive Drugs.* http://dx.doi.org/10.1080/02791072.2024.2308803

2. Patterson, J. G., Keller-Hamilton, B., **Wedel, A.,** Vázquez-Otero, C., Liu, J., Lee, D. N., Stevens, E. M., & Wagener, T. L. (2023). Absolute and relative e-cigarette harm perceptions among young adult lesbian and bisexual women and nonbinary people assigned female at birth. *Addictive Behaviors.* https://doi.org/10.1080/02791072.2024.2308803

3. **Wedel, A. V.,** Patterson, J. G., Lee, D., Stevens, E. M., Wagener, T. L., & Keller-Hamilton, B. (2023). E-cigarette use among sexual minoritized women and nonbinary people assigned female at birth: Assessing the role of discrimination, perceived stress, and social support. *Substance Use & Misuse, 58*(9), 1102-1109. https://doi.org/10.1080/10826084.2023.2212056

4. **Wedel, A. V.,** & Park, A. (2023). Solitary cannabis use and related consequences among college students during the COVID-19 pandemic. *Journal of Psychoactive Drugs.* https://doi.org/10.1080/02791072.2023.2184735

5. Lee, D. N., Stevens, E. M., Patterson, J. G., **Wedel, A. V.,** Wagener, T. L., & Keller-Hamilton, B. (2023). Associations of perceived stress and social support on health behavior changes in sexual minoritized women during the COVID-19 pandemic. *Women's Health Reports, 4*(1), 182-190. https://doi.org/10.1089/whr.2022.0095

6. Liu, J., Keller-Hamilton, B., Patterson, G., Lee, D. N., **Wedel, A. V.,** Vázquez-Otero, C., & Stevens. E. M. (2023). How age and e-cigarette use status interact to influence e-cigarette ad perceptions. *Substance Use & Misuse, 58*(2), 257-265. https://doi.org/10.1080/10826084.2022.2155479

7. **Wedel, A. V.,** Cabot, E. P., Zaso, M. J., & Park, A. (2022). Alcohol and cannabis use milestones in diverse urban adolescents: Associations with demographics, parental rule setting, sibling and peer deviancy, and outcome expectancies. *Substance Use & Misuse, 57*(11), 1708-1719. https://doi.org/10.1080/10826084.2022.2108547

8. Goodhines, P. A., **Wedel, A.,** Dobani, F., Zaso, M. J., Gellis, L. A., & Park, A. (2022). Cannabis use for sleep aid among high school students: Concurrent and prospective associations with substance use and sleep problems. *Addictive Behaviors, 134,* 107427. https://doi.org/10.1016/j.addbeh.2022.107427

9. Patterson, J. G., Keller-Hamilton, B., **Wedel, A. V.,** Wagener, T. L., & Stevens, E. M. (2022). Young adult sexual minority women's responses to e-cigarette health messages: Assessing the influence of message theme and format. *Drug and Alcohol Dependence, 231,* 109249. https://doi.org/10.1016/j.drugalcdep.2021.109249

10. Lee, D., Keller-Hamilton, B., Patterson, J., **Wedel, A. V.,** Wagener, T. L., & Stevens, E. M. (2022). Minoritized sexual identity and perceptions of effectiveness of Instagram public health messaging about e-cigarettes. *Journal of Health Communications, 27*(2), 115-124. https://doi.org/10.1080/10810730.2022.2059724

11. Lee, D. N., Liu, J., Keller-Hamilton, B., Patterson, J. G., Vázquez-Otero, C., **Wedel, A. V.,** & Stevens, E. M. (2022). Associations between perceived source credibility, e-cigarettes, and e-cigarette ad perceptions. *Preventive Medicine Reports, 28.* https://doi.org/10.1016/j.pmedr.2022.101682

12. **Wedel, A. V.,** Goodhines, P. A., Zaso, M. J., & Park, A. (2021). Prospective Associations of Discrimination, Race, and Sexual Orientation with Substance Use in Adolescents. *Substance Use & Misuse.* https://doi.org/10.1080/10826084.2021.2002904

13. Keller-Hamilton, B., Stevens, E. M., **Wedel, A. V.,** LaPolt, D., Miranda, A., Wagener, T. L., & Patterson, J. G. (2021). Associations of race and ethnicity with tobacco messaging exposures and tobacco use among bisexual and pansexual women. *Preventive Medicine Reports, 25,* 101657. https://doi.org/10.1016/j.pmedr.2021.101657

14. Stevens, E. M., Cohn, A. M., Villanti, A. C., Leshner, G., **Wedel, A.**, & Wagener, T. L. (2019). Perceived effectiveness of anti-marijuana messages in adult users and non-users: An examination of responses to messages about marijuana's effects on cognitive performance, driving, and health. *Journal of Studies on Alcohol and Drugs, 80*(4), 415-422. PMID: 31495378

15. **Wedel, A. V.**, Stevens, E. M., Molina, N., Leavens, E. L. S., Roberts, C., & Wagener, T. L (2018). Examining pregnant smokers' attitudes toward cessation aids and electronic nicotine delivery systems. *Journal of the Oklahoma State Medical Association, Vol. 111*(8), 812-818. PMID:31404418

16. Morean, M. E., & **Wedel, A. V.** (2017). Vaping to lose weight: Predictors of adult e-cigarette use for weight management. *Addictive Behaviors, 66,* 55-59. https://doi.org/10.1016/j.addbeh.2016.10.022. PMID:27875790.

Manuscripts under Review

1. Stevens, E. M., Lee, D. N., Liu, J., Patterson, J. G., **Wedel, A. V.,** Vázquez-Otero, C., Wagener, T. L, & Keller-Hamilton, B. (Submitted). Examining the role of popular e-cigarette ad features on product and ad perceptions among tobacco non-users and adult smokers. *Journal of Studies on Alcohol and Drugs.*

Manuscripts in Preparation

1. **Wedel, A. V.,** Walters, K., & McClure, E. (In preparation). Racial disparities in patient-provider communications among cannabis-using cancer patients in a state with no legal cannabis market.

2. **Wedel, A. V.,** Walters, K., & McClure, E. (In preparation). Sex differences in the association of affect and craving with tobacco and cannabis co-use among adults preparing for tobacco cessation.

3. Dobani, F., **Wedel, A. V.,** & Park, A. (In preparation). Multiracial college student alcohol consumption: Role of racial discrimination and depressive and anxiety symptoms.

4. Dobani, F., Umbach, A., **Wedel, A. V.,** & Park, A. (In preparation). Sleep, impulsivity, and past-month alcohol use among high school students.

5. Cabot, E. P., Zhao, J., **Wedel, A. V.,** & Park, A. (In preparation). Reciprocal associations between parental involvement and adolescent alcohol use frequency: The role of race.

6. Zhao, J., Ramos, J., **Wedel, A. V.,** & Park, A. (In preparation). Racial microaggressions, cultural mistrust, and mental health help-seeking attitudes among Asian college students.

PRESENTATIONS

Oral Presentations (Peer-reviewed)

1. Lee, D. N., Schulz, J. A., Villanti, A. C., Liu, J., Keller-Hamilton, B., Patterson, J. G., **Wedel, A. V.,** Vázquez-Otero, C., & Stevens, E. M. (2023, March 1-4). *E-cigarette purchase task responses in young adult tobacco non-users and adult smokers.* Panel Session: Substitutability of Alternative Products among Smokers: Examining the Impact of Accessibility and Appeal. [Oral presentation]. 29th Annual Meeting of Society for Research on Nicotine and Tobacco, San Antonio, TX.

2. Patterson, J. G., Liu, J., Keller-Hamilton, B., Lee, D., **Wedel, A. V.,** Vázquez-Otero, C., Stevens, E. (2023, March 1-4). *Sexual orientation and gender differences in ad perceptions*

and product appeal in response to ENDS advertising [Paper presentation]. 29th Annual Meeting for the Society of Research on Nicotine and Tobacco, San Antonio, TX.

3. Lee, D. N., Stevens, E. M., Keller-Hamilton, B., **Wedel, A. V.,** Wagener, T. L., & Patterson, J. G. (2022, May). *Minoritized sexual identity and perceived effectiveness of Instagram public health messaging about e-cigarettes* [Paper presentation]. 2022 Annual Conference of the International Communication Association, Paris, France.

4. **Wedel, A. V.,** & Park, A. (2021, May 26-27). *Solitary cannabis use mediates associations of pandemic-related stress with cannabis use consequences* [Virtual flash talk]. 2021 Association for Psychological Science Virtual Convention.

5. Stevens, E. M., Johnson, A., Wander, N., Mehta, T., Smith, C., **Wedel, A.,** Tackett, A. P., Leavens, E. L. S., Leshner, G., & Wagener, T. L. (2020, May). *Influence of Regulated vs. Unregulated E-Cigarette Advertising on E-Cigarette Use: A Laboratory Vaping Lapse Task Study* [Paper presentation]. 2020 Annual Conference of the International Communication Association, Gold Coast, Australia. (Conference canceled)

6. **Wedel, A. V.**, & Ansell, E. B. (2019, July 26-28). *Solitary cannabis use moderates the relationship between use frequency and hazardous cannabis use* [Symposium]. 2019 Meeting for the Research Society of Marijuana, Vancouver, WA, United States.

7. **Wedel, A. V.**, & Morean, M. E. (2016, May). *Vaping to lose weight: Predictors of adult e-cigarette use for weight management* [Symposium]. Oberlin College Senior Symposium, Oberlin, OH, United States.

National Poster Presentations (Peer-reviewed)

Mentored undergraduate co-authors are underlined.

1. **Wedel, A. V.,** & Park, A. (2024, June 15-19). *Me, Myself, and High: Momentary Precipitants and Daily Consequences of Solitary Cannabis Use.* [Abstract accepted for presentation]. 86th Annual Meeting for the College of Problems on Drug Dependence, Montreal, Canada.

2. Goodhines, P. A., Rathod, K., LaRowe, L. R., & **Wedel, A. V.** (2023, July 21-23). *Sleep-related cannabis expectancy questionnaire (SR-CEQ): Factor analysis replication, reliability, and validity*. [Poster presentation]. 2023 Meeting for the Research Society on Marijuana, Long Beach, CA, United States.

3. **Wedel, A. V.,** Omomhenle, O., & Park, A. (2023, June 24-28). *Associations of loneliness and pandemic factors with solitary binge drinking and drinking consequences.* [Poster presentation]. 2023 Meeting for the Research Society on Alcoholism, Bellevue, WA, United States.

4. Cabot, E. P., **Wedel, A. V.,** Dobani, F., & Park, A. (2023, June 24-28). *Changes in solitary alcohol use during the COVID-19 pandemic.* [Poster presentation]. 2023 Meeting for the Research Society on Alcoholism, Bellevue, WA, United States.

5. **Wedel, A. V.,** Schillinger, E. S., & Park, A. (2022, June 25-29). *Associations of loneliness and sleep with solitary drinking and drinking consequences.* [Poster presentation]. 2022 Meeting for the Research Society on Alcoholism, Orlando, FL, United States.

6. Schillinger, E. S., **Wedel, A. V.,** & Park, A. (2022, June 25-29). *Interaction between morning circadian preference and race as predictive of alcohol use behaviors in adolescents.* [Poster presentation]. 2022 Meeting for the Research Society on Alcoholism, Orlando, FL, United States.

7. Cabot, E. P., Zhao, J., **Wedel, A. V.,** & Park, A. (2022, June 25-29). *Reciprocal association between parental involvement and adolescent alcohol use frequency: moderation by race.* [Poster presentation]. 2022 Meeting for the Research Society on Alcoholism, Orlando, FL, United States.

8. Keller-Hamilton, B., Stevens, E. M., **Wedel, A.,** LaPolt, D. T., Miranda, A., Wagener, T. L., & Patterson, J. G. (2022, March 15-18). *Associations of race and ethnicity with tobacco messaging exposures and tobacco use among bisexual women.* [Poster presentation]. 28th Annual Meeting for the Society of Nicotine and Tobacco, Baltimore, MD, United States.

9. Patterson, J. G., Keller-Hamilton, B., **Wedel, A.,** Wagener, T. L., & Stevens, E. M. (2022, March 15-18). *Assessing the impact of message theme and format on cognitive and affective responses to e-cigarette health messages among young adult sexual minority women.* [Poster presentation]. 28th Annual Meeting for the Society of Nicotine and Tobacco, Baltimore, MD, United States.

10. Lee, D. N., Keller-Hamilton, B., Patterson, J. G., Liu, J., **Wedel, A.**, Vázquez-Otero, C., & Stevens, E. M. (2022, March 15-18). *The effects of ENDS ad features on young adults' perceptions of ad effectiveness and liking.* [Poster presentation]. 28th Annual Meeting for the Society of Nicotine and Tobacco, Baltimore, MD, United States.

11. **Wedel, A. V.,** & Park, A. (2021, July 23). *Solitary cannabis use among college students during the COVID-19 pandemic: Associations with affect, social factors, and pandemic-related stress* [Virtual poster presentation]. 2021 Meeting of the Research Society for Marijuana, online.

12. Schwarz, A. A., Goodhines, P. A., **Wedel, A.**, LaRowe, L. R., & Park, A. (2021, July 23). *Sleep-Related Cannabis Expectancy Questionnaire (SR-CEQ): Replication and Psychometric Validation among College Students using Cannabis for Sleep Aid.* [Virtual poster presentation]. 2021 Meeting of the Research Society for Marijuana, online.

13. Cabot, E. P., **Wedel, A. V.,** & Park, A. (2021, May 26-27). *Progression through alcohol use milestones in urban adolescents: Associations with race, alcohol expectancies and family deviancy* [Virtual poster presentation]. 2021 Association for Psychological Science Virtual Convention, online.

14. Zhao, J., **Wedel, A. V.,** Goodhines, P. A., & Park, A. (2021, May 26-27). *Race and neighborhood conditions prospectively associated with adolescent risky behaviors* [Virtual poster presentation]. 2021 Association for Psychological Science Virtual Convention, online.

15. **Wedel, A. V.,** Zhao, J., & Park, A. (2020, June 20-24). *Everyday discrimination experiences exacerbate LGBTQ adolescents' alcohol consumption* [Poster presentation]. 43rd scientific meeting for the Research Society on Alcoholism, New Orleans, LA, United States. (Conference canceled)

16. Joseph, V., Sun, R., **Wedel, A. V.**, & Ansell, E. B. (2019, July 26-28). *Childhood emotional abuse and hazardous use of cannabis and alcohol: The mediating role of emotion dysregulation* [Poster presentation]. 2019 Meeting for the Research Society of Marijuana, Vancouver, WA, United States.

17. Shaikh, R., Carroll, D., Leavens, E. L., **Wedel, A. V.**, Molina, N., Beebe, L., & Wagener, T. L. (2018, February 21-24). *Are there differences in vape shop point-of-sale marketing as a function of proximity to schools?* [Poster presentation]. 24th Annual Meeting for the Society of Research on Nicotine and Tobacco, Baltimore, MD, United States.

18. Frank, D., Stevens, E. M., Wooten, A., **Wedel, A.,** & Versace, F. (2017, October 11-15). *ERPs to monetary reinforcement in individuals with high and low hedonic capacity.* [Poster presentation]. 57th Annual Meeting of the Society for Psychophysiological Research, Vienna, Austria.

19. **Wedel, A. V.**, Leavens, E. L., Wagener, T. L., & Molina, N. (2017, March 8-11). *Examining pregnant smokers' interest in using electronic nicotine delivery systems, smoking cessation medications, and nicotine replacement during and after pregnancy to reduce or quit smoking* [Poster presentation]. 23rd Annual Meeting for the Society of Research on Nicotine and Tobacco, Florence, Italy.

20. Shaikh, R., Mowls, D., Leavens, E. L., **Wedel, A. V.**, Molina, N., Beebe, L., & Wagener, T. L. (2017, March 8-11). *Vape shop location: Neighborhood socio-demographic characteristics and proximity to schools* [Poster presentation]. 23rd Annual Meeting for the Society of Research on Nicotine and Tobacco, Florence, Italy.

21. Shaikh, R., Leavens, E. L., **Wedel, A. V.**, Molina, N., Driskill, L., & Wagener, T. L. (2017, March 8-11). *Point-of-sale marketing and practices in vape shops* [Poster presentation]. 23rd Annual Meeting for the Society of Research on Nicotine and Tobacco, Florence, Italy.

22. **Wedel, A. V.**, & Morean, M. (2016, March 2-5). *E-juice or fruit juice: A novel, forced-choice product paradigm based on health, weight concerns, and price* [Poster presentation].

22nd Annual Meeting for the Society of Research on Nicotine and Tobacco, Chicago, IL, United States.

Local Poster Presentations

1. Sanders, S., **Wedel, A. V.,** Dobani, F., & Park, A. (2023, November 17-19). *Distinguishing motives of solitary versus social cannabis use* [Poster presentation]. 2023 Meeting of the Carolina Cannabinoid Collaborative.

2. Davies, R. O., **Wedel, A. V.,** & Park, A. (2023, April 7). *Anxiety, Depression, and Impulsivity in Relation to Drinking Behavior in Adolescence* [Poster presentation]. 2023 Syracuse University Neuroscience Research Day.

3. Omomhenle, O., **Wedel, A. V.,** & Park, A. (2023, April 7). *Associations of loneliness and pandemic factors with solitary binge drinking and drinking consequences* [Poster presentation]. 2023 Syracuse University Neuroscience Research Day.

4. Umbach, A., Dobani, F., **Wedel, A. V.,** & Park, A. (2022, August 10). *Impulsivity and its relationship to risky drinking behavior and sleep in adolescents* [Poster presentation]. 2022 Syracuse SOURCE Undergraduate Research Symposium.

5. Umbach, A., Dobani, F., **Wedel, A. V.,** & Park, A. (2022, April 1). *Social interaction anxiety and past-month alcohol consequences among college students* [Poster presentation]. 2022 Syracuse University Neuroscience Research Day.

6. Sanders, S., **Wedel, A. V.,** Dobani, F., & Park, A. (2022, April 1). *Coping-motivated solitary cannabis use: Distinguishing social context and motives* [Poster presentation]. 2022 Syracuse University Neuroscience Research Day.

7. Lee, D., Keller-Hamilton, B., Patterson, J., **Wedel, A.,** & Stevens, E. (2021, October 28). *Sexual identity and perceived effectiveness of social media messages to discourage e-cigarette use in young adult sexual minority women* [Virtual poster presentation]. 26th Annual University of Massachusetts Medical School Research Retreat.

8. **Wedel, A. V.,** & Park, A. (2021, May 26-27). *Solitary cannabis use mediates associations of pandemic-related stress with cannabis use consequences* [Virtual poster presentation]. 2021 Syracuse University Neuroscience Research Day.

9. **Wedel, A. V.**, Rodgers, C., & Steinberg, E. (2015, May). *Attachment style and perceptions of social support in adolescent romantic relationships* [Poster presentation]. Annual meeting of the Cleveland Psychological Association, Cleveland, OH, United States.

RESEARCH EXPERIENCE

2022-2024 **Dissertation Research**
Department of Psychology, Syracuse University | Advisor: Aesoon Park, Ph.D.

Responsibilities: Recruit, collect, and analyze ecological momentary assessment data from $N = 60$ young adult solitary cannabis users; prepare data for dissemination via publication and presentation.

2023-2024 **Pre-Doctoral Intern**
Charleston Consortium Internship | Preceptor: Erin McClure, Ph.D.
Responsibilities: Conduct data analysis and prepare manuscripts. Collaborate with faculty, postdoctoral fellows, and research staff to develop and refine existing research protocols examining momentary processes of tobacco and cannabis use.

2021-2023 **Graduate Research Assistantship** (NIH R01AA027677-01; PI: Park)
Department of Psychology, Syracuse University | Advisor: Aesoon Park, Ph.D.
Responsibilities: Conduct data analysis and prepare manuscripts; manage and coordinate a team of undergraduate and post-baccalaureate research assistants. Coordinate with external recruitment company to arrange for recruitment of adolescents via social media. Prepare large multimethod longitudinal study for data collection.

2020-2021 **Thesis Research**
Department of Psychology, Syracuse University | Advisor: Aesoon Park, Ph.D.
Responsibilities: Study design, recruit and collect two-wave survey data from $N = 198$ college alcohol and cannabis users. Conduct data analysis and prepare manuscripts pertaining to solitary alcohol and cannabis use during the COVID-19 pandemic.

2018-2019 **Graduate Research Assistantship** (NIH R01DA039924-03; PI: Ansell)
Department of Psychology, Syracuse University | Advisor: Emily Ansell, Ph.D.
Responsibilities: Conduct assessment interviews (WASI-II, SCID-5, SCID-5-PD) and behavioral tasks (QST, Inquisit) to assess pain tolerance and cognitive performance. Collect and manage large ecological momentary assessment dataset, integrating across multiple survey software (Redcap, Qualtrics, MetricWire).

2016-2018 **Post-Baccalaureate Research Assistantship** (NIH R21DA038001-02; PI: Versace | NIH R01CA194158-02; PI: Wagener)
Oklahoma Tobacco Research Center | Mentors: Francesco Versace, Ph.D., Theodore L. Wagener, Ph.D.
Responsibilities: Recruit and conduct EEG sessions with adolescent e-cigarette users and non-users (PI: Versace); recruit and conduct participant sessions (including initial consent, motivational interviewing, and biospecimen collection) with adult smokers interested in transitioning to e-cigarette use (PI: Wagener). Prepared and analyzed data pertaining to low-income pregnant smokers' interest in various smoking cessation strategies (PI: Wagener). Disseminated findings via manuscripts and posters at national conferences.

2015-2016 **Undergraduate Honors Thesis Research**
Department of Psychology, Oberlin College | Advisor: Meghan Morean, Ph.D.
Responsibilities: Collected and analyzed online survey data from $N = 600$ e-cigarette users and prepared manuscript on e-cigarette use for weight loss and weight management.

2014 **Undergraduate Research Assistant**
Department of Psychology, Oberlin College | Advisor: Nancy Darling, Ph.D.
Responsibilities: Coded observational data of adolescent peer and romantic relationships; used hierarchical linear modeling to analyze and prepare poster presentation on role of attachment style in social support/conflict-resolution interactions.

RESEARCH AND STATISTICAL TRAINING AND COURSEWORK

Statistical Training & Advanced Coursework

2023 *Introduction to Multilevel Models for Clustered Data,* Lesa Hoffman, Ph.D.
Workshop presented to APA Science Training Session

Adding Level 1 Predictors to Multilevel Models for Clustered Data, Lesa Hoffman, Ph.D.
Workshop presented to APA Science Training Session

Introduction to Group Iterative Multiple Model Estimation (GIMME), Katie M. Gates, Ph.D.
Workshop presented to APA Science Training Session

Introduction to Artificial Intelligence for Psychological Scientists, Charreau Bell, Ph.D.
Workshop presented to APA Science Training Session

Introduction to Missing Data Analyses, Craig Enders, Ph.D.
Workshop presented to APA Science Training Session

2020 *Introduction to Structural Equation Modeling,* Aesoon Park, Ph.D.
Syracuse University

2018-2019 *Statistics & Research Design I & II,* David Kellen, Ph.D.
Syracuse University

Workshops and Seminars

Applying for Training Grants October 2021

Workshop presented to the Society of Behavioral Medicine by Rachel Goode, Ph.D., Courtney Stevens, Ph.D., Rowan Hunt, B.A., & Bridgette Do, MPH

Scientific Writing January 2022
Workshop presented to Syracuse University Women in Stem and Engineering by Elizabeth Paley, Ph.D.

Understanding Alcohol and Other Substance Use among Black Americans through a Socio-Ecological Lens March 2022
Seminar presented to Syracuse University Psychology Department by Tamika Zapolski, Ph.D.

Software Skills
Statistical languages: R (tidyverse); introductory fluency in Python
Software: RStudio, SPSS, Excel, MPlus
Research and Data Management: RedCap, Qualtrics, MetricWire
Citation management: EndNote, Zotero

TEACHING EXPERIENCE

Instructor of Record

Summer 2020 Summer 2019	PSY 382	*Health Psychology* Syracuse University Developed syllabus and course assignments, delivered lecture in-person (Summer 2019) and via asynchronous recording (Summer 2020) to small sections (15-20 students) of undergraduate students. Facilitated discussion both in-class and online, commensurate with course delivery method.
Summer 2023	PSY 395	*Mental Health Disorders* Syracuse University Developed syllabus and delivered lecture via synchronous online instruction to a small section (8 students) of upper-level undergraduate students. Facilitated discussion in online synchronous class.

Teaching Assistantships

2019-2020	PSY 335	*Psychology of Childhood* Syracuse University Supervisors: Shannon Sweeney, Ph.D., & Joshua Felver, Ph.D. Provided individualized tutoring and test feedback to students in office hours, graded assignments and exams for large undergraduate course sections (300 students/semester), and proctored exams. Assisted with emergency transition to online asynchronous course instruction.

Research Mentorship

Undergraduate Mentees

Vanessa Joseph*	2018 – 2019
Shockey Sanders	2021 – 2023
Ashlyn Umbach*	2021 – 2023
Ethan Hadley	2022 – 2023
Anthony Apantenco*	2022 – 2023
Oseaghe Omomhenle*	2022 – 2023
Richard Davies	2023

*Denotes mentee from background underrepresented in psychological science

Postbaccalaureate Mentees

Elisabeth P. Cabot	2022 – 2022

TEACHING INTERESTS

- Introductory psychology, psychopathology, health psychology, etiology of substance use disorders, substance use and human behavior
- Introductory statistics and research methods

CLINICAL INTERESTS

- Evidence-based treatment of substance use disorders and co-occurring psychopathology (e.g., trauma-related disorders, depression, anxiety) among emerging adults
- Integrative approaches to psychotherapy, drawing from both directive (e.g., cognitive-behavioral therapy) and non-directive (e.g., psychodynamic) theoretical orientations
- Comprehensive assessment and case conceptualization, including consideration of marginalization (e.g., experiences of racism, homophobia) in symptom presentation
- Consideration and sensitivity toward multicultural concerns, including working with diverse socioeconomic, racial/ethnic, and LGBTQ+ identities

CLINICAL EXPERIENCE

2023-2024 *Predoctoral Clinical Psychology Resident, Substance Use Track*
Charleston Consortium
Placements: Tobacco Treatment Program, Center for Drug and Alcohol Use Programs, Women's Reproductive Behavioral Health, Hollings Cancer Center

Clinical Interventionist
Empowering Queer Identities in Psychotherapy, Yale LGBTQ Mental Health Initiative
Yale School of Public Health (R01: AA029088; MPI: Pachankis/Hughes)

2022-2023 *Graduate Student Therapist*

Liberty Resources, Department of Integrated Behavioral Health and Substance Use Services

2021-2022 *Clinical Interventionist*
Cognitive Behavioral Therapy (CBT) by Phone to Promote Use of Alcohol Related Care and Reduce Drinking
Medical University of South Carolina (R01AA026815; MPI: Conner/Stecker)

Graduate Student Therapist
Addiction Psychiatry, Upstate Medical University

2020-2021 *Graduate Student Therapist*
Psychological Services Center, Syracuse University

Invited Clinical Presentations

Wedel, A. V. (2024, January 12). *Rolling Assessment and Brief Intervention for Forensic Substance Use Cases.* Clinical case presented to the Charleston Consortium internship, Medical University of South Carolina, Charleston, SC.

Wedel, A. V. (2023, April 14). *LGBTQ+-Affirmative Psychotherapy for Anxiety and Alcohol Use Disorder in Sexual Minority Women.* Clinical case and overview of clinical trial presented to the Department of Psychology, Syracuse University, Syracuse NY.

Clinical Training Workshops and Coursework

2023 *Prolonged Exposure Therapy for PTSD,* Ursula S. Myers, Ph.D. & Stephanie Keller, Ph.D.
Ralph H. Johnson Health Care System (VACHS)

Tobacco Treatment Specialist Training, Stephanie Stansell, Ph.D.
Hollings Cancer Center, Medical University of South Carolina

Issues of Intersectionality in LGBTQ+ Affirmative Treatment for Mood and Alcohol Use Disorders, Skylar Jackson, Ph.D.
Yale LGBTQ Mental Health Initiative

Helping Clients Succeed with ADHD: Strategies for Mental Health Professionals, Abigail Levrini, Ph.D.
American Psychological Association Webinar

2022-2023 *Practicum in Clinical Supervision,* Afton Kapuscinski, Ph.D.
Syracuse University

2022 *The Body Project: Disordered Eating Prevention for Adolescent Girls,* Afton Kapuscinski, Ph.D.
Syracuse University

2021	*Perspectives on Being a Culturally Responsive Psychologist: Insights for Research and Clinical Practice,* Jessica Desalu, Ph.D. Syracuse University
	Cognitive Behavioral Therapy for Cannabis Use Disorders, Igor Yakovenko, Ph.D. Association for Cognitive and Behavioral Therapies
	Trauma Informed Care: Culturally Sensitive Work with Indigenous Communities, Nayla Khoury, M.D. Syracuse University
2020	*Group Psychotherapy and Interpersonal Processes,* Sangmoon Kim, Ph.D. Syracuse University
	Intensive Short-term Dynamic Psychotherapy: State of Evidence and Video Illustration; Allan Abbass, M.D. Upstate Medical University
	Clinical Suicidology Seminar provided by National Register of Health Service Psychologists
2019-2020	*Practicum in Psychotherapy,* Afton Kapuscinski, Ph.D. & Kevin Antshel, Ph.D. Syracuse University
2019	*Dynamic Deconstructive Psychotherapy,* Robert Gregory, Ph.D. Syracuse University
2018-2019	*Assessment I & II,* Kevin Antshel, Ph.D. & Emily Ansell, Ph.D. Syracuse University

PROFESSIONAL AND DEPARTMENTAL AFFILIATION

Professional Affiliation

Sigma Xi, Associate member	2016 – 2017
Research Society on Marijuana, Student member	2019 – 2023
Association for Behavioral and Cognitive Therapies, Student member	2020 – 2021
Association for Psychological Science, Student member	2021 – 2022
Research Society on Alcoholism, Student member	2021 – 2023
College on Problems of Drug Dependence, Member-in-training	2024 – Present

Departmental Affiliation

Women in Science and Engineering (by faculty nomination), Student member	2019 – 2021
Future Professoriate Program, Student member	2019 – 2021
Committee for Diversity and Inclusion, Student member	2020 – 2023

FIELD AND COMMUNITY SERVICE

Peer Review
Nicotine & Tobacco Research
Journal of Psychoactive Drugs
Journal of Cannabis Research
Psychology of Addictive Behaviors
Addictive Behaviors
Cannabis