Anxiety Sensitivity and Undergraduate Drinking: A Theoretically Informed Examination of Social Norms and Drinking Motives in the Risk Trajectory

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ABSTRACT

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Young adulthood is a developmental period marked by increased alcohol use, posing risks for long-term negative consequences, such as underemployment and alcohol use disorder. Tension reduction theory suggests that those high in anxiety sensitivity (AS) may be at risk for misusing alcohol for its anxiolytic effects. Mixed evidence, however, suggests that the AS-alcohol misuse association is not straightforward. While high-AS individuals may drink to cope with negative affect, they may also avoid alcohol because its effects mimic anxious sensations. Cognitive theories and the theory of planned behaviour highlight how motivation and social perceptions may impact how AS-risk for problematic alcohol use unfolds. The present dissertation examined perceived stress, drinking motives, and injunctive norms (i.e., perceived approval of risky drinking) as mechanisms and individual-level risk factors linking AS to alcohol use and problems among young adults. Study 1 used a cross-sectional design (N=143) to test perceived stress and drinking motives as mediators of the AS–alcohol outcome association. A mediation analysis revealed that AS positively predicted alcohol problems, via coping motives, and positively predicted alcohol use, via perceived stress and enhancement/sociability motives. Study 2 utilized a longitudinal person-centered analysis (N=164) to identify AS-risk for unique patterns of injunctive norms (by referent groups) and subsequent alcohol outcomes. Latent profile analyses revealed that a higher level of AS was associated with membership in profiles characterized by high perceived approval of risky drinking. Moreover, the profile characterized by high student/neutral friends/low parent approval was associated with the least amount of alcohol misuse and problems (protective), the profile characterized by approval by all referents was associated with some risk, and the profile characterized by high students/friends and neutral parents was associated with the most risk. Study 3 employed a prospective design (N=273) to examine the link between the social concerns facet of AS (AS-SC) and alcohol outcomes, moderated by injunctive norms, and mediated by drinking to cope. Latent growth curve models

revealed that increases in coping motives were associated with increases in alcohol use and problems. Coping-related injunctive norms from friends and typical students also predicted higher alcohol outcomes. Theoretical and clinical implications of these findings are discussed.

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Contribution of Authors

The following thesis is comprised of three manuscripts:

Study 1 (Chapter 2)

Corran, C., Norman, P., & O'Connor, R. M. (2025). Young adult drinking during the COVID-19 pandemic: Examining anxiety sensitivity, perceived stress, and drinking motives in the risk pathway. *Journal of American College Health, 73*(4), 1798-1806.

Study 2 (Chapter 4)

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Study 3 (Chapter 6)

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I was responsible for the overall conceptualization of the program of research presented in this dissertation, including the development of the three empirical studies. In consultation with my supervisor, Dr. Roisin O'Connor, I selected the research questions, determined the methodological and statistical approaches, and designed the studies. With assistance from members of the Young Adult and Alcohol Research Lab (see below), I recruited, screened, and tested participants. With assistance from Dr. O'Connor and research collaborators (see below), I conducted all statistical analyses, interpreted the findings, and prepared the written dissertation. Throughout all stages of this work, I met regularly with Dr. O'Connor to receive feedback and guidance. My committee members, Drs. Mark Ellenbogen and Erin Barker, provided valuable input at the proposal stage and approved the final methodological and analytic plan at my proposal meeting on June 21, 2021.

For Study 1, I was assisted by lab managers Quinn Morris and Seffie Yip, who supported programing the study in Qualtrics, screening and recruiting participants, and cleaning the data. I independently conducted all statistical analyses and wrote the manuscript. I incorporated Dr.

O’Connor and Dr. Norman’s edits and feedback, and was also responsible for incorporating reviewers’ feedback after submission to an academic journal.

For Study 2, I joined the larger project (from which my study was derived) toward the end of data collection, where I contributed by assisting lab manager Mayesha Khan with participant recruitment and screening, and administering the third wave of the longitudinal study. Dr. Christian Hendershot assisted with the conceptualization and design of the larger project, while Dr. Alexandre Morin contributed to the development of the analytic plan, conducted analyses for the present study, and assisted with interpreting and writing up results. Drs. O’Connor and Morin provided feedback on the manuscript, and I prepared the manuscript for publication and addressed reviewer comments. Dr. O’Connor supervised and provided guidance throughout these steps.

For Study 3, I was supported by lab manager Olivia Romaro, research assistant Seffie Yip, doctoral student Sarah Hines, and master’s student Jean Nahas in programming the study in Qualtrics, recruiting and screening participants, and screening the data for bots. I was assisted by Jean Nahas in cleaning the data. I was responsible for conducting statistical analyses and interpreting the results in consultation with Dr. O’Connor. I wrote all sections of the manuscript and incorporated feedback and revisions from Dr. O’Connor.

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CHAPTER 1: General Introduction

The World Health Organization (2024) estimates that one in twenty deaths are attributable to alcohol use. Patterns of alcohol use fluctuate over the course of development (O'Malley, 2004; Stephenson et al., 2025), with alcohol use typically being at its heaviest during the young adult years, particularly during university (Arria et al., 2016; Stephenson et al., 2025). According to recent studies (National Survey on Drug Use and Health, 2020; National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2019; Substance Abuse and Mental Health Services Administration, 2024), over half of college students between the ages of 18 and 25 report drinking alcohol in the past month, 30-35% report binge drinking (i.e., consuming five or more drinks in one occasion), and almost 50% report experiencing an alcohol-related problem in the past year (e.g., academic failure, underachievement, financial problems; Chang et al., 2021; Rickwood et al., 2011; White & Hingson, 2013). These high prevalence rates are concerning given the long-term risk associated with young adult alcohol misuse, including decreased academic achievement, sexual risk taking and sexual assault, and physical injury including death – both intentional and unintentional (NIAAA, 2024; Arria et al., 2013; Dvorak et al., 2013; Hingson et al., 2009; White & Hingson, 2013). Risky drinking patterns that are established early on predispose individuals to long-term negative consequences, such as underemployment and alcohol use disorder (AUD; Pilatti et al., 2017). As such, investigating alcohol use during the critical developmental period of young adulthood could inform targeted interventions to mitigate risk for the development of long-term problems.

Risk factors for Alcohol Outcomes

Anxiety Sensitivity

A diverse set of pathways has been identified in theoretical accounts of the antecedents of problematic drinking. One such pathway is anxiety. A large body of literature links anxiety with alcohol use and problems (Burns & Teesson, 2002; Paulus et al., 2017; Puddephatt et al., 2022; Schulte & Hser, 2013; Soraya et al., 2022; Ummels et al., 2022). Alcohol use and anxiety disorders are highly comorbid, with an estimated 20-40% of individuals with AUD also meeting diagnostic criteria for an anxiety disorder (Grant et al., 2004b; Kushner et al., 2000; Lai et al., 2015; Preuss et al., 2018; Sørensen et al., 2018). In particular, AUD is comorbid with specific phobia (12%), social anxiety (11-13%), generalized anxiety (15%) and panic (15-21%; Grant et al., 2004a; Schneier et al., 2010; Tilli et al., 2012). The high comorbidity of AUD with varied

anxiety disorders suggests an underlying, transdiagnostic factor of anxiety disorders that may link anxiety with AUD. Research on mental disorder co-occurrence suggests that many anxiety disorders are manifestations of similar underlying dimensions, such that the outcomes associated with different disorders are driven by transdiagnostic variance (Dalgleish et al., 2020; Krueger & Eaton, 2015; Muñoz-Navarro et al., 2025; Pergamin-Hight et al., 2015). Thus, rather than identifying alcohol use risk within distinct anxiety disorders, risk can be understood as stemming from factors that are inherent across *all* anxiety disorders. Transdiagnostic factors are therefore key in informing clinical interventions, as the same underlying treatment principles across mental disorders can be applied without adapting the protocol to individual diagnoses (Krueger & Eaton, 2015; McEvoy et al., 2009).

Emerging evidence suggests that one potential transdiagnostic factor of anxiety disorders that may help explain anxiety-related risk for alcohol use is *anxiety sensitivity*. Anxiety sensitivity (AS) is characterized as the fear of experiencing anxious symptoms and the belief that these symptoms will lead to negative health, social, and cognitive consequences, and is one of the most recognized risk factors of anxiety psychopathology (Hovenkamp-Hermelink et al., 2021; Mahoney et al., 2015; Schmidt, Buckner, et al., 2007). Factor analytic work supports three subdimensions of AS: *physical concerns*, referring to fears about somatic symptoms signaling physical harm (e.g., palpitations indicating a heart attack); *cognitive concerns*, involving fears that anxiety-related cognitive changes (e.g., difficulty concentrating) indicate loss of mental control; and *social concerns*, reflecting fears that observable signs of anxiety (e.g., trembling, blushing) will lead to negative social evaluation (Taylor et al., 2007; Zinbarg et al., 1997). These subtypes show distinct patterns of association with psychopathology and health behaviours. For example, physical concerns are strongly linked to panic disorder (Olatunji & Wolitzky-Taylor, 2009), cognitive concerns have been associated with generalized anxiety and depression (Allan et al., 2014), and social concerns predict social anxiety symptoms (Carter et al., 1999). In the context of alcohol use, emerging evidence suggests that specific AS dimensions may differentially relate to drinking motives and alcohol-related problems (Schry & White, 2013). For example, individuals high in physical concerns may be more likely to drink to cope with somatic anxiety symptoms (e.g., sweating), whereas those with elevated social concerns may drink in social situations to reduce anxiety and fear of negative evaluation, viewing alcohol as a means to reduce discomfort and facilitate social interaction (Buckner & Heimberg, 2010).

Accordingly, AS (including its subtypes) is a fundamental transdiagnostic factor that may help bridge the anxiety and alcohol use literatures.

The expectancy model of fear (Reiss, 1991; Reiss & McNally, 1985) conceptualizes AS as an individual-level difference factor, with people varying in the extent to which they fear anxiety-related sensations. Empirical evidence suggests that AS is a relatively stable *personality trait* that is related to but *distinct* from trait anxiety (Hovenkamp-Hermelink et al., 2019), and research supports AS as a risk factor for anxiety psychopathology (Gottschalk & Domschke, 2017; Rapee & Medoro, 1994; Reiss, 1991). AS has been shown to temporally precede the onset of anxiety disorders (Gottschalk & Domschke, 2017; Hovenkamp-Hermelink et al., 2021; Krebs et al., 2020; Maller & Reiss, 1992; Schmidt, Buckner, et al., 2007; Schmidt, Eggleston, et al., 2007) above and beyond trait anxiety among both adolescents (Hayward et al., 2000) and adults (Howell et al., 2010; Schmidt et al., 1997, 1999). Moreover, individuals with anxiety disorders (vs. those without) are more likely to exhibit elevated levels of AS (Allan et al., 2023; Deacon & Abramowitz, 2006; Mohammadkhani et al., 2016; Rabian et al., 1999; Scott et al., 2000; Taylor et al., 1992). Indeed, two of the anxiety disorders most highly comorbid with AUD (i.e., panic and generalized anxiety disorder) also represent those associated with the highest levels of AS (NIAAA, 2025).

Tension reduction (Cappell & Herman, 1972) and self-medication (Khantzian, 1985) theories of addictive disorders suggest that those high in AS may use alcohol to self-medicate distressing emotional, social, or physiological states, particularly when alternative coping strategies are unavailable or ineffective. Accordingly, these individuals are motivated to use alcohol for its anxiolytic effects (Baker et al., 2004), whereby alcohol is expected to temporarily reduce or eliminate one's sensitivity to tension, arousal, and anxious thoughts and sensations (Cappell & Herman, 1972; Greeley & Oei, 1999; Logue et al., 1978; MacAndrew, 1982; Pihl & Peterson, 1995; Stewart et al., 1999). Thus, individuals high in AS have a tendency to drink to cope with anxious symptoms and feelings of distress. In turn, risky alcohol use is negatively reinforced and poses risk for long-term consequences. This negative reinforcement pathway of alcohol use has also been supported in the empirical literature. Studies have shown that individuals high in AS exhibit a tendency to pursue the arousal- and tension-reducing effects of alcohol (e.g., Allan et al., 2015; DeMartini & Carey, 2011; Schmidt, Buckner, et al., 2007). In turn, the subjective effects of alcohol reinforce continued use, and pose risk for life-long

problems (Cho et al., 2019; Howell et al., 2010; Otto et al., 2016; Stewart et al., 1999; Zack et al., 2007).

Taken together, the AS-alcohol outcome risk trajectory has been widely investigated in the empirical literature, and emerging evidence proposes that elevated AS is associated with alcohol misuse and the later development of AUD (e.g., Howell et al., 2010; Kauffman et al., 2018; Knapp et al., 2021; McCaul et al., 2017; Stewart & Zeitlin, 1995; Stewart et al., 2001). However, though cross-sectional research consistently supports the AS-alcohol use link (e.g., Stewart & Zeitlin, 1995; Stewart et al., 2001), the association is not straightforward, with empirical findings – particularly from prospective research – revealing mixed support for the association (Corran et al., 2023; Jurk et al., 2015; Malmberg et al., 2013; O'Connor et al., 2008; Stewart et al., 1999). This highlights the complexity of the risk trajectory and the need to test other contributing factors (Bartel et al., 2018).

Given that those high in AS are particularly in tune with their physiological and cognitive symptoms of anxiety, perhaps other factors are pushing these individuals past the potentially feared aversive effects of alcohol. Those who exhibit high levels of AS should logically be averse to alcohol, given that alcohol intoxication mimics certain symptoms of anxiety (e.g., sweating, redness, dizziness). Yet, research has consistently demonstrated that these individuals drink (e.g., Allan et al., 2015; Stewart et al., 2001). Thus, perhaps other factors interact with AS to push these individuals past their ambivalence and toward drinking. For example, individuals high in AS may be sensitive to what is considered normative behaviour. Accordingly, their perceptions of others' thoughts and behaviours may impact their own cognitions and behaviours, particularly if these are perceived as normative. Moreover, these perceptions may be especially salient among young adults, as this developmental period is marked by increased experimentation with alcohol and changes in social networks. Perceiving that drinking and the associated uncomfortable symptoms are normative could therefore impact an individual high in AS's motivation to drink, and in turn increase their risk for drinking, particularly if the motivation is for coping purposes.

Injunctive Norms

While AS captures an individual's sensitivity to internal cues of anxiety, social factors such as injunctive norms may also shape how this sensitivity translates into alcohol use, highlighting the need to consider both personal vulnerabilities and perceived social approval in

understanding drinking. Indeed, individuals high in AS may be particularly attuned to social cues when making decisions about their own behaviour (e.g., drinking to cope with anxiety). The power of social acceptance is well established and has been considered to be as basic of a human need as hunger and thirst (Baumeister & Leary, 1995). Accordingly, beliefs about what others do and approve of should influence behaviour. The theory of planned behaviour (Ajzen, 1991) provides a framework for understanding behavioural intentions and choices. This theoretical model proposes that intentions to perform a specific behaviour are the most proximal determinants of the behaviour itself. Predictors of intentions that are particularly relevant during young adulthood are *perceptions* about what others do (descriptive norms) and approve of (injunctive norms). Indeed, social norms theory suggests that perceptions of what comprises typical behaviour or typical beliefs of one's social group are strong influences on behaviour (Berkowitz, 2004).

With regard to alcohol consumption, though it is widely understood that alcohol misuse during university and young adulthood predicts later problems (e.g., underemployment, addiction; Miller et al., 2007), risky drinking remains normative during this developmental period (Adlaf et al., 2005; Kong & Bergman, 2010; Russell et al., 2020). This pattern is likely explained by evidence that young adults tend to both perceive drinking as normative and believe that their social group approves of such behaviour (Borsari & Carey, 2003; Neighbors et al., 2007). This is not surprising, given that humans often intend to (and subsequently) behave in ways that are destructive despite knowledge of the negative consequences (Baumeister et al., 2010; Baumeister & Leary, 1995). There is a large body of empirical research revealing many misperceptions in peer drinking norms, with university students reliably overestimating how much their peers are consuming and how much they approve of risky drinking (Cox et al., 2019; Dumas et al., 2019; Hines et al., 2024; Lewis & Neighbors, 2006; Perkins & Berkowitz, 2009; Taylor, 1998; Thrash & Warner, 2019; Wolter et al., 2021). This is problematic given that research has consistently shown that perceived drinking norms are among the strongest predictors of risky alcohol use in young adults (Graupensperger et al., 2021; Neighbors et al., 2007). A wide body of research has shown that descriptive norms (perceived use by others) predict one's own drinking (Baer et al., 1991; Larimer et al., 2004; Perkins et al., 1999; Reis & Riley, 2000; Rhodes et al., 2019). In contrast, less is known about the influence of *injunctive norms* in young adult drinking. However, given that alcohol use is pervasive in university and

that young adults desire peer approval, injunctive norms (perceived approval of risky drinking) should emerge as *particularly* relevant in predicting alcohol use. Most of the empirical work has looked at descriptive norms, yet it is unclear what the *unique effects* of injunctive norms are on young adult drinking.

Considering that those high in AS are sensitive to anxious thoughts and sensations, perhaps they are also sensitive to perceptions of what others approve of. Extant work has tested injunctive norms as moderators of the association between social anxiety and alcohol use and problems (Buckner et al., 2011). Moreover, injunctive norms have been tested as mediators of the association between personality traits (e.g., AS, impulsivity) and alcohol use and problems among young adults, but results have been mixed (e.g., Hustad et al., 2014; Pearson & Hustad, 2014). For example, one study found that AS had an indirect effect on alcohol use via injunctive norms and a double-mediated effect on alcohol problems via both injunctive norms and alcohol use (Pearson & Hustad, 2014). Yet in another study, the indirect effects of AS on alcohol use and problems did not hold up (Hustad et al., 2014). Similar mixed findings have been found in the marijuana use literature, whereby social norms inconsistently mediate the differential associations between personality traits and cannabis use problems (e.g., Pearson et al., 2018).

Extant studies have looked at injunctive norms as mediators of the association of personality traits and alcohol outcomes. Building on this literature, a key nuance worthy of further investigation is the impact of perceived approval of risky drinking by specific referent groups, including how varying levels of approval by different referent groups cluster together in creating risk profiles. Research indicates that the proximity of a referent group can influence how strongly injunctive norms relate to alcohol outcomes. Specifically, norms from more proximal groups – such as parents or close friends – tend to have a stronger association with alcohol-related problems than norms from more distal groups, such as the "typical student" or broader peer groups (LaBrie et al., 2010; Neighbors et al., 2008). Moreover, when examining specific types of injunctive norms, perceived approval of drinking to cope has been found to predict coping-motivated drinking only when those norms come from proximal sources (friends and parents), and not when they originate from more distal sources (typical students or general peers; Hines et al., 2024). This suggests that the proximity of the referent group may hold particular importance for certain aspects of injunctive norms. Despite these advances, less research has investigated how injunctive norms for distinct referent groups may influence established risk

pathways, particularly among those high in AS who may be particularly sensitive to perceived norms. Investigating the role of this key social-cognitive factor in the risk pathway could be particularly informative in young adulthood.

Taken together, extant research findings highlight a complex interplay between individual psychological vulnerabilities (e.g., AS and its subtypes), social influences (including which referent groups are perceived as approving of which types of harmful drinking), and alcohol outcomes. Given that those high in AS have a tendency to drink to cope with anxiety or to reduce tension, these individuals might also think that other people approve of drinking for negative reinforcement (e.g., to relax, unwind, take the edge off). In turn, this negatively reinforced cognitive process would lead to subsequent alcohol use and related problems, particularly in this subset of individuals. Moreover, we know that drinking patterns change during the undergraduate years as young adults gain experience with drinking, are immersed in new social situations, and form new relationships. In turn, given the strong influence of peer groups on behaviour in young adulthood, coupled with a possible increase in independence after leaving the family home (Mulder & Clark, 2002), perceiving others as approving of risky drinking could lead to changes in alcohol use (Andrews et al., 2002). However, it is unclear how this risk may uniquely play out for young adults high in AS, highlighting the need to clarify the risk trajectory in young adulthood. Unfortunately, not only is there is a dearth of empirical literature examining the interactive effect of injunctive norms with personality traits in the alcohol use and problem risk trajectory, but no studies to date have considered perceived approval of *drinking to cope* for different referent groups, which could be particularly relevant among young adults high in AS.

Mechanisms of Risk

Perceived Stress

Beyond social influences, the final component of the model that could help clarify the complex AS-alcohol pathway are *cognitive mechanisms of risk*. In particular, *how* AS leads to alcohol outcomes. Individuals high in AS tend to be hyper-aware of and reactive to anxiety-related sensations, often misinterpreting them as more serious than they are. Perceived stress is defined as one's thoughts pertaining to the amount and characteristics (e.g., predictability, controllability) of stressors experienced (Cohen et al., 1983). Thus, *perceived stress* may help further explain how AS leads to drinking to cope, and in turn increased alcohol use and

problems. This may be especially relevant during periods of acute stress, such as during the recent COVID-19 pandemic which was marked with a plethora of stressors (e.g., health-related, occupational, academic, financial, social; Molock & Parchem, 2021). Indeed, individuals high in AS would be expected to be particularly sensitized or primed to stress in their environments. Accordingly, *perceived stress* may be a cognitive mechanism that helps explain AS-risk for alcohol use and problems among young adults.

Extant empirical research has been mixed for the association between AS and perceived stress, with some studies finding support for a direct link (Batmaz & Çelik, 2024), and others not (Bardeen et al., 2013). However, the link has been more robustly supported during the COVID-19 pandemic – a time of marked acute stress – where high levels of AS have been shown to predict increased perceived stress *and* anxious arousal (Manning et al., 2021). Also during the pandemic, stress has been found to be a major contributing factor to increased drinking in order to cope with social and financial stressors (Wardell et al., 2020). Given that those high in AS are especially sensitive to anxious thoughts and sensations, added stress specifically in the pandemic context may exacerbate symptoms. Thus, the link between AS and alcohol misuse and problems may be explained by increased perceived stress and a tendency to drink to cope with negative/increase positive affect.

Drinking Motives

The final cognitive risk mechanism involves *motives* for alcohol use. Motivational models of behaviour suggest that reasons for engaging in a behaviour impact initiation and maintenance of the behaviour itself (Bindra, 1974; Weinstein, 1988). Various implementations of motivational theory to alcohol use have consistently underscored the importance of motivational factors in young adult alcohol consumption (Kassel et al., 2000; Read et al., 2003). Drinking motives – or reasons for drinking – are distinct cognitions that are embedded in personality traits (e.g., AS) and in genetic, sociocultural (e.g., drinking customs), environmental (e.g., availability of alcohol), and contextual (e.g., reinforcement from past drinking) factors (Kuntsche et al., 2007). In 1988, Cox and Klinger proposed a theoretical model that conceptualized drinking motives using a two-dimensional model mirroring the valence and source of the motive. Accordingly, Cooper (1994) posited four types of drinking motives that are linked to unique patterns of alcohol outcomes: (1) enhancement (internally sourced, positively reinforced), (2) social (externally sourced, positively reinforced), (3) coping with anxiety or depression

(internally sourced, negatively reinforced), and (4) conformity (externally sourced, negatively reinforced).

Extant research suggests that drinking motives related to affect regulation – particularly coping and enhancement motives – are especially predictive of risky alcohol use (Comeau et al., 2001; Merrill et al., 2014). For individuals high in AS, drinking to cope with negative affect may be particularly salient (e.g., Conrod et al., 1998; Keough et al., 2016; Stewart et al., 1997). For example, adolescent and young adults with elevated AS have been found to report increased alcohol use in response to anxiety or physiological arousal (Bartel et al., 2018; Schmidt, Buckner, et al., 2007) and coping motives have been found to mediate the association between AS and alcohol misuse/problems (Allan et al., 2015; Chinneck et al., 2018; Corran et al., 2025; Loxton et al., 2015). Enhancement motives – drinking to amplify positive affect (i.e., opposite valence of coping motives) – have also been found to play a role in young adult AS-risk for alcohol misuse, particularly in socially evaluative or stressful situations (Corran et al., 2023; Corran et al., 2025; DeMartini & Carey, 2011). Thus, research points to both coping and enhancement motives as being linked to heavy alcohol use. Provided that AS is a personality trait associated with alcohol misuse (Stewart et al., 1995) *and* a tendency to drink to regulate affect (Comeau et al., 2001; Conrod et al., 1998; Stewart et al., 1995), drinking to cope and for enhancement could be two particularly significant mechanisms of risk through which AS leads to alcohol use and problems.

Rationale and Current Program of Research

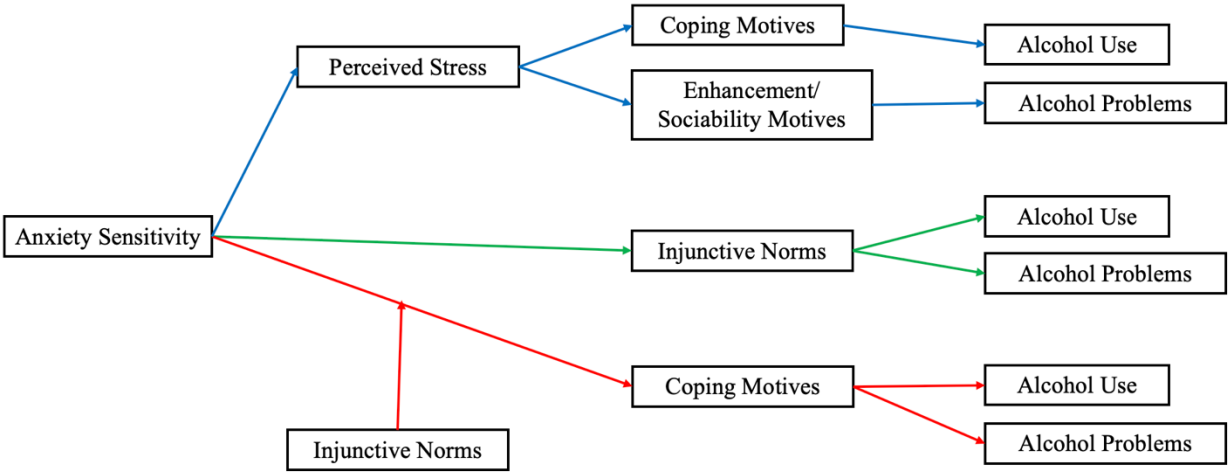
Taken together, the AS-alcohol outcome risk trajectory is complex, and more research is needed to clarify the predictors and mechanisms involved. The overarching goal of the current program of research was to clarify negative reinforcement pathways of young adult alcohol misuse and problems, by considering the roles of personality traits, social norms, and alcohol-related cognitions. In particular, cross-sectional, longitudinal person-centered, and prospective methodologies were used to test personality and cognitive risk factors (i.e., AS, injunctive norms) and mechanisms (i.e., perceived stress, drinking motives) of alcohol outcomes in young adulthood during the *COVID-19 pandemic*, during the transitions *out of CEGEP,* and *over the course of the first year* of undergraduate studies.

There is a dearth of research investigating young adult personality risk factors for alcohol outcomes, *through* their influence on various cognitions (e.g., perceived stress, drinking

motives). As such, understanding how these risk pathways unfold in young adults as their cognitions begin to solidify is critical to the advancement of aetiological models of alcohol misuse. Injunctive norms as predictors of alcohol outcomes in young adults have also been widely understudied, and it is unclear how they change over time as a function of AS level. Extant research has also not considered the role of distinct injunctive norm referent groups within the context of the *other* referent groups (i.e., person-centered approach) in how they relate to drinking patterns over time. Moreover, the distinct associations between AS and injunctive norms each with alcohol use and problems have only been tested cross-sectionally – without considering drinking motives – and their *interaction* has not been tested as a predictor of alcohol outcomes.

The current dissertation addresses these gaps through a series of three theoretically grounded, empirically rigorous studies. Each study adopts a unique methodological and analytic approach – cross-sectional, person-centered longitudinal, and prospective latent growth modeling – to examine how AS contributes to young adult alcohol use and problems, and how this risk is shaped by both internal (e.g., perceived stress, drinking motives) and external (e.g., injunctive norms) factors. Study 1 tested a mediation model to understand how perceived stress and drinking motives explain AS-risk for alcohol use and problems during the COVID-19 pandemic – a period of heightened stress and social disruption. Study 2 utilized a person-centered longitudinal approach to identify profiles of injunctive norms and test how AS predicted profile membership and subsequent alcohol outcomes over time. Study 3 applied a moderated mediation framework within a latent growth model to test how social-related AS interacts with perceived approval of drinking to cope to predict coping-motivated drinking and subsequent alcohol use and problems. The overarching conceptual model guiding this dissertation is presented in Figure 1, which integrates personality, cognitive, and social pathways linking AS to alcohol use and problems across the three studies.

Figure 1. Conceptual model illustrating hypothesized pathways linking anxiety sensitivity to alcohol use and problems.



Note. The model depicts hypothesized pathways through which anxiety sensitivity influences alcohol use and problems through internal (e.g., perceived stress, coping and enhancement/sociability motives) and external (e.g., injunctive norms) pathways. Blue paths represent Study 1, green paths represent Study 2, and red paths represent Study 3.

CHAPTER 2: Young Adult Drinking During the COVID-19 Pandemic: Examining the Role of Anxiety Sensitivity, Perceived Stress, and Drinking Motives

The start of the COVID-19 pandemic in December 2019 led to abrupt and significant changes across the world (Brooks et al., 2020; Sharma et al., 2020). Public health measures aimed at curbing the spread of the virus (e.g., stay-at-home orders) led to financial and social hardship for everyone, regardless of age. However, young adults were particularly impacted by the restrictions, given their unique financial and social situations (Government of Canada, 2021; Clark et al., 2021; Cuervo et al., 2022). Indeed, young adults often have student loan debt, a lack of investments, and unsecure or entry level jobs (de Bassa Scheresberg, 2013; Grant et al., 2017; Terriquez & Gurantz, 2015). Moreover, social restrictions were especially challenging for young adults, given the importance of peer relationships in this demographic (Reitz et al., 2014; Swenson et al., 2008). The public health emergency unfolded rapidly and posed a significant threat to young adults' mental health (Schmits & Glowacz, 2022). Empirical data revealed elevated distress, anxiety, and depression, particularly among young adults (Cao et al., 2020; Schmits & Glowacz, 2022). Additionally, the social isolation limited available coping strategies, such as seeking social support or engaging in recreational activities (Budimir et al., 2021; Rahman et al., 2020).

Beyond impacts on mental health and wellbeing, several reports suggest that the COVID-19 pandemic had an impact on young adult *alcohol use and related problems* (Grossman et al., 2020; Schmits & Glowacz, 2022). Pre-pandemic, it was widely accepted that alcohol consumption was at its highest during young adulthood (O'Malley, 2004) and heavy consumption in this age group was linked to a range of alcohol related problems and outcomes (e.g., poor academic performance, risky sexual encounters, physical injury, and the development of alcohol use disorder; McCambridge et al., 2011; Miller et al., 2007; Pilatti et al., 2017). However, research on young adult alcohol consumption during the pandemic has produced mixed results, with some studies showing increased alcohol use and related problems among this demographic during the pandemic (Capasso et al., 2021), but others showing reductions in alcohol use (Steffen et al., 2021). Thus, perhaps only certain groups of young adults are at risk for increased alcohol use during the pandemic. The aim of this study was to identify some of the risk factors for alcohol use, and related-problems, among young adults during the COVID-19 pandemic. Findings may also be relevant to the anxiety/stress and alcohol literature outside of

the pandemic context and add to or solidify what is already known about alcohol use aetiology in young adults.

Anxiety Sensitivity and Drinking Motives

Pre-pandemic, anxiety has been linked with alcohol misuse among young adults (Paulus et al., 2017; Smith & Randall, 2012) and anxiety disorders and alcohol use disorders have been shown to be highly comorbid (Kushner et al., 2001). The high comorbidity rates suggest a transdiagnostic factor of anxiety disorders that links them with alcohol use disorders. One such transdiagnostic factor is *anxiety sensitivity* (AS), which empirical research has shown links anxiety to alcohol misuse (Smits et al., 2019). AS is characterized as the fear of experiencing anxious symptoms and the belief that they will lead to negative physical (e.g., heart attack), social (e.g., humiliation), and cognitive (e.g., insanity) consequences (Reiss & McNally, 1985). Tension reduction theory (Cappell & Herman, 1972) suggests that those high in AS drink to reduce tension and symptoms of social/emotional distress. Previous research indicates that those high in AS are more likely to drink to cope (Allan et al., 2015; Corran et al., 2023; DeMartini & Carey, 2011; McCaul et al., 2017), and that drinking to cope predicts alcohol misuse, including the development of alcohol use disorder (Kauffman et al., 2018; McCaul et al., 2017). Similarly, AS has been positively associated with sociability motives (Comeau et al., 2001) and both enhancement and sociability motives has been found to mediate the association between AS and alcohol use (Cooper, 1994; Schmidt et al., 2010). Thus, *both* coping *and* enhancement/sociability drinking motives have been consistently linked to a number of measures of alcohol consumption, including risky use and related consequences (Corran et al., 2023; Kenney et al., 2018; Kuntsche et al., 2005; Merrill & Read, 2010; Stewart et al., 1996). This is problematic given that coping and enhancement/sociability drinking motives have been consistently identified as the riskier motives (Kuntsche et al., 2005; Wicki et al., 2017).

AS-risk has been linked to drinking to cope and alcohol misuse during the COVID-19 pandemic (for a review see Zvolensky et al., 2022) and during other outbreaks/pandemics (for a review see McKay & Asmundson, 2020). Recent data suggest that high AS in the context of the COVID-19 pandemic leads to drinking to cope and, in turn, risk for alcohol use. For example, one study found that AS positively predicted alcohol use, mediated by drinking to cope, in a sample of high school students (Cho et al., 2021), and another found that AS positively predicted drinking to cope among young adults during the COVID-19 pandemic, mediated by internalizing

symptoms (anxiety, depression, COVID-19 distress; Lambe et al., 2023). However, previous studies have only focused on alcohol use, and not problems; thus, testing subsequent risk for alcohol problems would build on this work. Moreover, the effects of positively reinforced drinking motives (i.e., sociability, enhancement) have not been tested during the COVID-19 pandemic. Yet, social enhancement motives have been linked to increased solitary drinking during the COVID-19 pandemic (McBride et al., 2022), which is a known risk factor for alcohol misuse and problems (for a review see Skrzynski & Creswell, 2021).

Perceived Stress

Individuals high in AS are known to have a predisposition for hypervigilance and fearing and/or overinterpreting symptoms of anxiety, and may therefore be particularly sensitized or primed to stress in their environment. There are a plethora of stressors inherent to the pandemic, including health, occupational, academic, financial, and social stressors (Molock & Parchem, 2021). As such, *perceptions of stress* – or one's thoughts pertaining to the amount and characteristics (e.g., predictability, controllability) of stressors experienced (Cohen et al., 1983) – may help further explain how AS leads to drinking to cope and, in turn, increased alcohol use and problems during the COVID-19 pandemic. Indeed, recent work has shown that high levels of AS were related to increased perceived stress and anxious arousal during the COVID-19 pandemic (Manning et al., 2021). Moreover, stress has been found to be a major contributing factor to increased drinking during the pandemic in order to cope with social and financial stressors (Wardell et al., 2020). Given that those high in AS are especially sensitive to anxious thoughts and sensations, added stress in the pandemic context may exacerbate symptoms. Thus, *perceived stress* may be a cognitive mechanism that helps explain AS-risk for drinking to cope with negative/increase positive affect among young adults during the pandemic.

Current Study

The aim of the current study was to test the effect of AS on alcohol use and problems via its influence on perceived stress and drinking motives (i.e., drinking to cope, for enhancement/sociability) among young adults during the COVID-19 pandemic. We hypothesized that high AS would lead to elevated alcohol use and problems, and that perceived stress and affective drinking motives (coping, enhancement/sociability) would mediate this pathway (see Figure 2). Findings from this study could also add to the broader, non-pandemic, literature on these variables.

Material and Methods

Participants

Data were collected between May 2020 and April 2021. Participants (N = 143, M_{age} = 21.86, SD_{age} = 2.375) were young adults recruited from local Montreal universities and by snowball method (e.g., via advertisements shared on social media). Inclusion criteria required participants to be 18-to-29 years old (i.e., young adults above the legal drinking age in the study's host Canadian province) and fluent in English. Of the total sample, 121 (84.6%) participants identified as women, 17 (11.9%) as men, three (2.1%) as gender fluid/bigender/2-spirit, and two (1.4%) as "unsure." Ninety-three (65%) identified as White, 18 (12.6%) as Asian, 14 (9.8%) as Arab, six (4.2%) as Black, six (4.2%) as multiracial, five (3.5%) as Latin American, and one as Indigenous (0.7%).

Procedure

Participants accessed the online study via a university-based Participant Pool website or directly via a link on our advertisements. Participants gave informed consent and completed self-report questionnaires, which took approximately 35 minutes. At study completion, participants were provided with a list of mental health resources and those in the Participant Pool were compensated with course credit, while community members were entered into a $50 draw. This study was approved by the research ethics committee of the last author's institution prior to data collection (certificate # 30013024).

Measures

The *Anxiety Sensitivity Index* (ASI; Reiss et al., 1986) is a 16-item self-report questionnaire assessing sensitivity to anxious symptoms and fear of negative consequences (e.g., "It scares me when I feel faint"). Participants rated items on a five-point scale (0 = not at all to 4 = very much). A composite mean score was derived. The ASI has shown adequate internal consistency (α = .86-.88) and retest reliability (r = .71-.75; Peterson & Heilbronner, 1987). In the current study, the ASI demonstrated excellent scale score reliability (see Table 1).

The *Perceived Stress Scale-4* (PPS-4; Cohen et al., 1983) is a four-item self-report questionnaire assessing subjective stress (e.g., "In the last month, how often have you felt that things were going your way"). Items were rated on a five-point scale (0 = never to 4 = very often). A sum score was derived. The PPS-4 has demonstrated good reliability and convergent

validity, and adequate internal reliability and validity (Cohen et al., 1983; Mitchell et al., 2008). In the current study, the PPS-4 demonstrated acceptable scale score reliability (see Table 1).

The *Modified Drinking Motives Questionnaire-Revised* (MDMQ-R; Grant et al., 2007) was adapted for the current study to capture COVID-19-specific drinking motives. The MDMQ-R is a 28-item measure of drinking motives in undergraduates that comprises five subscales: coping-anxiety (e.g., "You drink because it helps you when you feel nervous"), coping-depression (e.g., "You drink because it helps you when you feel depressed"), enhancement (e.g., "You drink because you like the feeling"), sociability (e.g., "You drink to be sociable") and conformity (e.g., "You drink to fit in with a group you like"). The measure was modified to fit the context of the COVID-19 pandemic to ensure that we captured motives relevant to alcohol use during this unique period. This was achieved through a consultation process that involved a series of three focus groups with undergraduate and graduate students in our research lab (roughly 4-5 undergraduate and 3-4 graduate students per focus group). Using an iterative approach comprising two cycles, focus group members were asked to review all MDMQ-R items and identify those that were *not relevant* to the COVID-19 pandemic. They were also asked to seek feedback from friends and family in the community who were within the targeted age range (18-29 years). Focus group members were also invited to generate *new items* that better reflected reasons for drinking during the pandemic, which were then reviewed by a group of lab members. Altogether, items that were unanimously identified as irrelevant were removed, and votes were cast on items with mixed feedback and the proposed items to be added.

Through this consultation process, 15 items were removed from the MDMQ-R as they were deemed irrelevant to the pandemic context. Specifically, one item was removed from the coping-anxiety subscale ("You drink because you feel more self-confident and sure of yourself"), two items were removed from the coping-depression subscale (e.g., "You drink to forget painful memories"), three items were removed from the enhancement subscale (e.g., "You drink because it's fun"), four items were removed from the sociability subscale (e.g., "You drink because it helps you enjoy a party"), and all five items were removed from the conformity subscale (e.g., "You drink so you won't feel left out"). In addition, three items were added: [You drink] "because you are lonely," "because it is difficult to distinguish weekdays from weekends," and "because there is no structure to the days." Thus, the final scale used in the current study consisted of 16 items comprising 10 coping items, two enhancement items, one sociability item,

and three COVID-19-specific items. For each item, participants were asked to indicate on a 5-point scale (1 = almost never/never to 5 = almost always/always) how often their drinking in a typical week during the COVID-19 pandemic (i.e., since March, 2020) was motivated by that reason. Exploratory factor analyses, reported below, resulted in two drinking motives subscales: Coping and Enhancement/Sociability. Both subscales demonstrated excellent scale score reliability (see Table 1).

The *Alcohol Use Questionnaire* (AUQ; Cahalan et al., 1969; Read & O'Connor, 2006) was adapted for the current study to assess alcohol use since the start of the COVID-19 pandemic (i.e., since March 2020). Participants were asked to self-report the number of drinks they consume during a typical week since the start of the pandemic. A composite score summing the quantity of drinks consumed on each day of a typical week (i.e., quantity-by-frequency) provided a measure of total weekly alcohol use. Similar quantity-by-frequency variables have been widely used in alcohol research and demonstrate good convergent validity and reliability (O'Connor et al., 2008).

The *Brief Young Adult Alcohol Consequences Questionnaire* (B-YAACQ; Kahler et al., 2005) is a 24-item self-report questionnaire assessing alcohol problem severity in young adults. Using a dichotomous yes/no response format, participants indicated whether they had experienced a particular alcohol-related problem (e.g., "I passed out from drinking") in a typical week since the start of COVID-19 pandemic (i.e., since March 2020). A sum score was derived. The B-YAACQ has shown good internal consistency (α = .83-.89) and retest reliability (r = .95; Kahler et al., 2008). In the current study, the B-YAACQ demonstrated good scale score reliability (see Table 1).

Results

Preliminary Exploratory Factor Analyses

EFAs were conducted on the 16-item COVID-19 adapted MDMQ-R to examine the factor structure. Using the unstandardized residual scores, factors were extracted using principal axis factoring with an oblique rotation (i.e., Promax with Kaiser Normalization). First, eigenvalues and scree plots were examined to identify the optimum number of factors to be retained in the final solution. We also examined the percentage of variance criteria to identify the percentage of variance that can be attributed to each specific factor relative to the total variance

in all the factors. Typically, factors that have an eigenvalue greater than one and, together, explain over 60% of the variance are included in the final measurement model.

The Kaiser criterion indicated a one-factor solution for our drinking motives measure, as only one factor had an eigenvalue larger than one (13.328). This one-factor solution was also supported by visually inspecting the elbow of the scree plot which defined the point where the eigenvalues form a liner descending trend. Thus, the single factor included all of the coping (10 items), enhancement (two items), sociability (one item), and COVID-19 specific items (three items). The identified factor accounted for 83.3% of the variance, with factor loadings ranging from .760 to .966, and communalities from .578 to .932. However, given that we were developing a revised measure of drinking motives during a unique and unprecedented pandemic context, we also tested alternative factor structures that better aligned with the current study's theoretical model (i.e., grounded in motivation and tension reduction theories). Such theoretically informed decisions to explore alternative factor structures are common in the literature (e.g., see Ahmad, 2010; Brown, 2015; Youngblut, 1993).

We contrasted the original one-factor solution with two- (coping, enhancement/sociability) and three- (coping, enhancement/sociability, COVID-19) factor solutions, by fixing the number of factors to two and three, respectively. This comparison process revealed that the two-factor solution was optimal, wherein the first factor (coping subscale) included the original MDMQ-R coping items that were retained *in addition to* the COVID-19-specific items that were added, and the second factor combined items that were retained from the enhancement and sociability subscales. Despite being highly correlated (r = .850), the two-factor solution had well-defined factor loadings above .400 (Stevens, 2012). Factor loadings ranged from .636 to 1.077 for the drinking to cope subscale (13 items), and from .637 to .969 for the enhancement/sociability subscale (three items), and communalities ranged from .677 to .947. See Table 2 for factor loadings and communalities of the two-factor structure for our 16-item drinking motives measure.

Data Screening

Data were cleaned and screened for violations of regression assumptions according to the procedures outlined in Kline (2010). Collinearity diagnostics were in the normal range (i.e., no evidence of multicollinearity). Histograms were examined to determine whether variables were continuous and normally distributed. Variables were indeed continuous and relatively normally

distributed, except for alcohol outcomes which had a slight positive skew. Based on a priori power analysis (conducted in G*Power), a sample size of 85 or more had sufficient power (>.80) to detect a medium effect size of $f^2 = .15$ (with $\alpha = .05$) for our hypothesized model. Similar effect sizes are common in the anxiety and alcohol use literature (Cooper et al., 1995; Montes et al., 2016; O'Connor et al., 2008).

Next, descriptive statistics and correlations were inspected for all variables (see Table 1). Only participants who self-reported as drinkers were retained for analyses ($N = 143$). This resulted in the exclusion of data from 17 participants. No outliers (z-score ±3.33; Cooper et al., 1995) were identified for the AS, perceived stress, coping, or enhancement/sociability variables. However, the alcohol use and problems variables had two and four outliers (z-score >3.33), respectively. These values were not excluded because this observation is consistent with prior research, such that a small proportion of students drink heavily and experience elevated problems compared to peers (Day-Cameron et al., 2009; Gill, 2002).

Hypothesis Testing

Mediation analyses were conducted within a structural equation modeling framework, using robust maximum likelihood procedures in Mplus 8.4 (Muthén, 1998-2017). Partial mediation was tested using indirect effects via bias-corrected bootstrapped confidence intervals. While controlling for gender, we tested the indirect effects of AS on alcohol use and problems, via perceived stress and drinking motives (i.e., coping, enhancement/sociability), as well as direct effects of AS on drinking motives. Model fit for our statistical model was excellent (CFI = 1.000, TLI = 1.000, RMSEA = 0.000).

Results from preliminary correlation analyses are reported in Table 1. AS was positively correlated with drinking to cope and for enhancement/sociability motives, as well as alcohol problems. Perceived stress was also positively correlated with drinking to cope. Moreover, coping and enhancement/sociability drinking motives were positively correlated with use and problems, and use and problems were positively correlated with one another. Model results are reported in Table 3. As hypothesized, AS positively predicted drinking to cope and drinking for enhancement/sociability motives. Drinking to cope also positively predicted alcohol problems, and enhancement/sociability motives positively predicted alcohol use. All other direct paths were not statistically significant. Drinking motives were also correlated with one another, as were alcohol use and problems. Consistent with hypotheses, AS positively predicted alcohol problems,

mediated by drinking to cope, and positively predicted alcohol use, mediated by enhancement/sociability motives. Moreover, AS positively predicted drinking for enhancement/sociability motives, mediated by perceived stress. Contrary to hypotheses, perceived stress did not mediate the association between AS and drinking to cope. Consistent with hypotheses, AS positively predicted alcohol use, partially mediated by enhancement/sociability motives *and* perceived stress. All other indirect effects were not statistically significant.

Discussion

The goal of this study was to test young adult AS-risk for alcohol use and problems, as mediated by perceived stress and drinking to cope and for enhancement/sociability motives, during the COVID-19 pandemic. A better understanding of young adult AS risk trajectories for alcohol use and problems in this unprecedented context may help inform targeted intervention strategies in the aftermath of the pandemic, as well as mitigation strategies to prevent *long-term* risk post-pandemic, and during future pandemics.

Anxiety Sensitivity Risk for Alcohol Use

Consistent with hypotheses, AS positively predicted alcohol-related problems, via drinking to cope. This finding is consistent with theoretical and empirical evidence, which shows a robust link between AS and alcohol problems, as explained by negatively-reinforced drinking motives (Allan et al., 2015; DeMartini & Carey, 2011; Stewart et al., 2001). The direct associations between AS and drinking to cope, drinking to cope and alcohol problems, and AS and alcohol problems were also all positive, which supports tension reduction (Cappell & Herman, 1972) and negative reinforcement theories (Baker et al., 2004; Wikler, 1948), and are consistent with pre-pandemic (Kauffman et al., 2018) and recent (Bollen et al., 2021) young adult alcohol misuse research. Contrary to hypotheses, AS was not associated with alcohol use via drinking to cope. However, this is not necessarily surprising given that AS is often linked with problems – but *not* use – in the anxiety and alcohol literature (Armeli et al., 2010; Labhart et al., 2017; Schelleman-Offermans et al., 2011).

Moreover, perceived stress did not help explain the association between AS and drinking to cope, and subsequent alcohol use or problems. This finding was unexpected given the literature linking AS to a heightened perception of stress (Bardeen et al., 2013; Manning et al., 2021; Zvolensky et al., 2002) and the literature linking stress, AS and anxiety more generally

with drinking to cope (Allan et al., 2015; Sloan et al., 2003; Wardell et al., 2020) and, in turn, alcohol use (Mackinnon et al., 2014; Temmen & Crockett, 2020). This null finding may suggest that those high in AS are at increased risk for drinking to cope and subsequent problematic drinking *regardless* of how they perceive stress, perhaps due to the pandemic and/or a baseline hypervigilance/sensitivity to stress. Future studies should continue examining the role of perceived stress in negative-reinforcement drinking to clarify the AS-alcohol outcome pathway.

Consistent with hypotheses, AS positively predicted alcohol use, via drinking for enhancement/sociability. This finding is consistent with pre-pandemic literature which supports the link between AS and drinking for enhancement and, in turn, increased risk for alcohol use (Merrill & Read, 2010). Specifically, our findings are consistent with extant empirical research suggesting that the association between AS and alcohol use may be partially or fully mediated by drinking to increase positive affect (Cooper, 1994; Schmidt et al., 2010). In the context of the pandemic, our results may suggest that young adults high in AS used alcohol as a way to increase positive affect, perhaps due to decreased opportunities to engage in other mood-enhancing activities. The direct effects from AS to enhancement/sociability motives, and the latter to alcohol use were also positive, which is consistent with pre-pandemic literature linking AS with enhancement and sociability motives (Comeau et al., 2001), and linking enhancement and sociability motives with alcohol use (Cooper et al., 1992; Halim et al., 2012; O'Connor & Colder, 2005). This is the first study to our knowledge that supports enhancement-motivated drinking among those high in AS during the COVID-19 pandemic. Interestingly, perceived stress also helped explain the association between AS, enhancement/sociability motives, and alcohol use. Indeed, AS predicted increased in perceived stress during the pandemic which, in turn, led to drinking to increase positive affect. Thus, perceived stress may be an additional mechanism of risk for enhancement/sociability motivated drinking during the COVID-19 pandemic.

Taken together, the current study supports distinct AS-risk pathways for alcohol use and problems, such that those high in AS may be at risk for alcohol use and problems, and this risk may play out via a cognitive process involving reasons for drinking (i.e., motives for use). Specifically, drinking to cope may help explain how risk for alcohol-related problems unfolds among those high in AS, while drinking to enhancement/sociability motives may help explain how risk for alcohol use unfolds. AS is typically understood as a relatively stable personality trait and transdiagnostic factor of anxiety disorders (Dalgleish et al., 2020; Norton & Paulus, 2017).

Tension reduction theory (Cappell & Herman, 1972) and a large body of empirical evidence (Allan et al., 2015; Corran et al., 2023) suggest that drinking to cope helps explain how AS-risk for alcohol-related problems unfolds. However, the current study adds to the literature by highlighting that drinking to cope and for enhancement/sociability motives differentially explain risk for distinct alcohol outcomes (alcohol problems versus alcohol use, respectively). The current study suggests that those high in AS are at risk coping-motivated problematic drinking, but when stress is perceived in the context of the pandemic, attention may shift from drinking to cope to using alcohol to *distract and enhance* one's mood, thus posing risk for increased alcohol use, but not problems.

Strengths, Limitations, and Future Directions

Despite the novelty of our study, we recognize several limitations. First, our sample of women was disproportionately large (compared to men) and consisted primarily of white university students. Although our findings may not generalize to men, other racial backgrounds, or young adults who are not in university, they still contribute meaningfully to our understanding of alcohol use risk in university students, who typically drink more than age-matched peers and are therefore a critical at-risk group. Nonetheless, future research should consider recruiting a gender-balanced, more diverse (race/ethnicity, occupationally/academically) sample of young adults. Second, this study was conducted during the COVID-19 pandemic and may therefore limit generalizability of findings outside of the pandemic context. However, findings could still be relevant to the more general alcohol risk literature as risk factors pre-pandemic were also found during the pandemic (DeMartini & Carey, 2011). Similarly, because this study was conducted during the *earlier months* of the pandemic, results may not generalize to other periods of the pandemic. However, while early months of the pandemic may have been different from later months, this may be in terms of the *type* of stress (e.g., related to its novelty and unpredictability), but not necessarily the *intensity* of stress, making our results informative. Third, the current study was cross-sectional, therefore future research should consider a prospective design to capture *change* in young adult AS-risk for alcohol outcomes as the pandemic evolves. Nevertheless, our results showcase a snapshot of young adult risk for alcohol use during a *distinct* period of the pandemic. Finally, there are limitations to examining mediators in a cross-sectional study, as one of the assumptions of mediation is that the temporal ordering of the variables that make up the causal chain are accurate (Fairchild & McDaniel,

2017). Given that we cannot test how the process unfolds over time with cross-sectional data, findings are therefore correlational and not causal. As such, interpretations of results should consider this caveat.

Conclusion

The current study tested AS risk for alcohol use and problems, via perceived stress and drinking motives, among young adults during the COVID-19 pandemic. This study contributes to the anxiety and alcohol use literatures by clarifying AS-risk for young adult alcohol use/problems during the unique pandemic context. Our results support negative reinforcement drinking pathways during the pandemic, and the role of perceived stress in explaining different alcohol-risk trajectories. The study findings contribute to our understanding of risk factors for young adult alcohol use during this unique time, thereby adding to the aetiological empirical literature and informing clinical interventions for alcohol use and problems in young adults. For example, targeting *specific* drinking motives in cognitive-behavioural therapy, such as by teaching skills to cope with anxiety in a more adaptive way (e.g., mindfulness and distress tolerance skills), or helping people achieve a sense of enhancement through behavioural activation, could help mitigate problematic alcohol use. Similarly, helping young adults better manage stress and cope with anxiety during pandemics or other stressful events (e.g., by using skills, cognitive restructuring, and behavioural experiments) may also prevent the development of more long-term drinking problems. These targeted interventions may be particularly useful among those high in AS.

Table 1. Descriptive statistics and correlations for hypothesized model variables

Variable	M	*SD*	Skew	Kurt	α	1	2	3	4	5	6
1. AS	1.562	0.759	0.313	-0.666	.900	-					
2. PS	2.212	0.410	-0.292	0.145	.734	.164	-				
3. Cope	2.144	1.236	1.305	0.980	.987	.373**	.167*	-			
4. EnhSo	3.035	1.212	0.208	-0.645	.907	.178*	.170	.512**	-		
5. Use	4.664	5.598	2.958	13.215	-	.012	.092	.172*	.266**	-	
6. Probs	2.285	3.618	2.070	4.464	.891	.182*	.044	.337**	.248**	.552**	-

Note. AS = anxiety sensitivity (possible range of scores 0 = not at all to 4 = very much, PS = perceived stress (possible range of scores 0 = never to 4 = very often; Cope = drinking to cope motives (possible range of scores 1 = almost never/never to 5 = almost always/always; EnhSo = enhancement/sociability motives (possible range of scores 1 = almost never/never to 5 = almost always/always); Use = alcohol use (number of drinks they consume during a typical week since the start of the pandemic); Probs = number of alcohol-related problems (0 = no, 1 = yes). M = mean; SD = standard deviation; Skew = skewness; Kurt = kurtosis; α = Cronbach's alpha; *p < .05, ** p < .01

Table 2. Factor Analysis Results of the Drinking Motives Measure adapted from the Modified Drinking Motives Questionnaire-Revised (MDMQ-R)

MDMQ-R item	Factor loading		Communalities
	1	2	
Factor 1: Drinking to Cope			
1. To relax.	**.637**	.183	.637
3. To forget your worries.	**.966**	-.016	.908
5. Because it helps you when you feel nervous.	**.750**	.199	.855
7. To cheer up when you are in a bad mood.	**.879**	.077	.893
8. Because it helps when you feel depressed.	**1.077**	-.110	.959
9. To reduce your anxiety.	**.914**	.033	.888
10. To stop from dwelling on things.	**1.077**	-.084	.937
11. To turn off negative thoughts about yourself/family/friends.	**1.039**	-.084	.939
12. To help feel more positive about things in your life.	**.883**	.083	.911
13. To stop from feeling so hopeless about the future.	**.974**	-.010	.934
14. *Because you are lonely.*	**.891**	.064	.894
15. *Because it is difficult to distinguish weekdays from weekends.*	**.636**	.278	.782
16. *Because there is no structure to the days.*	**.724**	.207	.823
Factor 2: Drinking for Enhancement/Sociability			
2. Because you like the feeling.	.189	**.696**	.743
4. To be sociable.	.192	**.637**	.652
6. Because it's fun/exciting.	-.034	**.969**	.884

Note. Factor loadings above .40 are in bold. Items in italics were generated for this study and therefore not from the original MDMQ-R. Adapted from "Psychometric evaluation of the five-factor Modified Drinking Motives Questionnaire — Revised in undergraduates" by V. V. Grant, S. H. Stewart, R. M. O'Connor, E. Blackwell, and P. J. Conrod, 2007, Addictive Behaviors, 32, pp. 2611-2631

Figure 2. Hypothesized partial mediation model for alcohol use and problems regressed on drinking to cope and for enhancement/sociability motives, perceived stress, and anxiety sensitivity. Paths statistically supported by 95% CI are bolded.

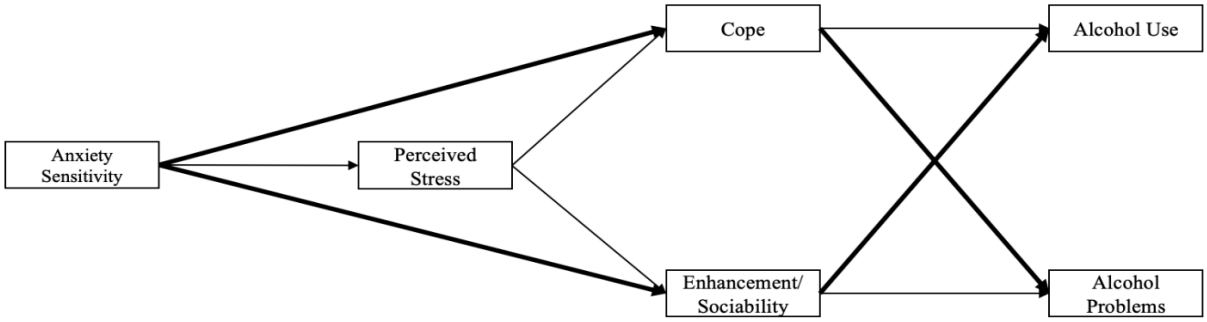


Table 3. Regression paths and correlations for the hypothesized model

Parameter	Unstandardized Estimate	Confidence Intervals (CI)
Direct paths		
AS_PS	0.008	95% CI (-0.028, 0.179)
AS_Cope	**0.578**	**95% CI (0.247, 0.890)**
AS_EnhSo	**0.247**	**90% CI (0.015, 0.510)**
PS_Cope	0.329	95% CI (-0.204, 0.768)
PS_EnhSo	0.428	95% CI (-0.070, 0.953)
Cope_Use	0.216	95% CI (-1.030, 1.065)
Cope_Probs	**0.836**	**95% CI (0.114, 1.681)**
EnhSo_Use	**1.084**	**95% CI (0.215, 2.232)**
EnhSo_Probs	0.332	95% CI (-0.274, 0.933)
Indirect paths		
AS_Cope_Use	0.125	95% CI (-0.647, 0.604)
AS_Cope_Probs	**0.484**	**95% CI (0.078, 1.220)**
AS_EnhSo_Use	**0.267**	**95% CI (0.002, 0.966)**
AS_EnhSo_Probs	0.082	95% CI (-0.035, 0.428)
AS_PS_Cope_Use	0.006	95% CI (-0.015, 0.089)
AS_PS_Cope_Probs	0.027	95% CI (-0.011, 0.136)
AS_PS_EnhSo_Use	**0.041**	**90% CI (0.001, 0.216)**
AS_PS_EnhSo_Probs	0.082	95% CI (-0.035, 0.428)
Covariances (Correlations)		
Cope_EnhSo	**0.640 (0.480)**	**95% CI (0.392, 1.002)**
Use_Probs	**10.455 (0.527)**	**95% CI (6.032, 16.504)**
R- Square	Standardized Estimate	*p*-value
PS	0.027	0.448
Cope	**0.151**	**0.013**
EnhSo	0.052	0.192
Use	0.073	0.058
Probs	0.121	0.059

Note. Paths statistically supported by 95% CI are bolded. AS = anxiety sensitivity; PS = perceived stress; Cope = drinking to cope motives; EnhSo = enhancement/sociability motives; Use = alcohol use; Probs = alcohol-related problems.

CHAPTER 3: Bridge

Study 1 laid the foundation for this dissertation by clarifying cognitive mechanisms of AS-risk for alcohol use and problem, particularly during a period of heightened stress and social disruption (i.e., the COVID-19 pandemic). Specifically, mediation analyses indicated that AS was associated with increased alcohol-related problems through its effect on coping motives, and with increased alcohol use as explained by elevated perceived stress and enhancement/sociability motives. This study supported tension reduction and motivational models of alcohol use, highlighting the internal cognitive-affective processes that may drive young adults with elevated AS to use alcohol as a coping mechanism. However, this model was tested within a unique, context-bound period marked by increased stress, reduced peer interaction, and increased isolation, which may have limited the influence of social-contextual factors—particularly peer norms.

To build on these findings and expand our understanding of the AS–alcohol risk pathway in more typical young adult contexts, Study 2 targeted *social influences*. Specifically, Study 2 focused on injunctive norms – perceptions of approval of risky drinking by various referent groups – and how these perceptions might vary according to levels of AS. Study 1 examined a within-person emotional/cognitive process involved in alcohol use risk during a unique historical period (COVID-19 pandemic). In contrast, Study 2 examined how AS might shape profiles of injunctive norms – characterized by varying levels of perceived approval across referent groups – among final-year CEGEP students preparing to transition to university or the workforce. Using a person-centered longitudinal approach, Study 2 explored whether AS predicted membership into distinct profiles of injunctive norms that differed by referent group (i.e. perceived approval of risky drinking of friends, peers, and parents) and, in turn, whether those profiles were linked to subsequent alcohol outcomes.

This transition from Study 1 to Study 2 reflects a shift toward incorporating the broader social context and perceptions of others' approval of risky drinking into aetiological models of young adult alcohol risk. Doing so allowed for a more nuanced understanding of how cognitive risk factors or vulnerabilities like AS may influence perceived social approval and subsequent drinking. While Study 1 emphasized intrapersonal processes – how AS may lead to alcohol outcomes via perceived stress and drinking motives – the goal of Study 2 was to consider a more *social* process of risk. In particular, a person-centered framework allowed for the identification

of distinct injunctive norm profiles, capturing variation in perceived approval of risky drinking across multiple referent groups. This approach not only provides a more nuanced view of how AS relates to social perceptions but also offers insight into the types of normative climates that may perpetuate or buffer against alcohol misuse in young adulthood. The person-centered approach adopted in Study 2 also addresses limitations in the variable-centered design of Study 1, offering a complementary lens through which to study heterogeneity in risk environments and social perceptions. In doing so, Study 2 helped to clarify whether individuals high in AS are more likely to perceive approval versus disapproval of risky drinking and how these perceptions may sustain, exacerbate, or protect against alcohol misuse.

CHAPTER 4: A Longitudinal Person-Centered Analysis of Anxiety Sensitivity Risk for Young Adult Alcohol Misuse: Examining the Role of Injunctive Norms

The World Health Organization (2018) estimates that roughly 5% of deaths are attributable to alcohol. Though trends of young adult alcohol use are declining (Livingston et al., 2020), heavy drinking peaks in young adulthood, particularly during the early undergraduate years (Arria et al., 2016). Young adulthood is marked by multiple biopsychosocial changes; this is at a time of increased independence, freedom, and peer influence (Bonnie et al., 2015). These changes may explain elevated risk for a host of negative alcohol consequences among young adults, including poor academic performance, risky sexual encounters, injuries, disease, underemployment, and alcohol use disorder (AUD; Pilatti et al., 2017; White & Hingson, 2014). Yet risky drinking remains normative (Stone et al., 2012), which is problematic given that behaviour is influenced by estimates of what others do (Neighbors et al., 2007) and approve of (Neighbors et al., 2008). Examining risk factors during this critical developmental period should facilitate a better understanding of alcohol misuse aetiology thereby helping to inform targeted interventions and mitigate long-term problems.

Anxiety Sensitivity and Alcohol Use

Extant research links anxiety with alcohol use, finding comorbidity rates of 20-40% (Grant et al., 2004; Lai et al., 2015) and higher prevalence of anxiety in individuals with AUD compared to the general population (Preuss et al., 2018). Anxiety sensitivity (AS) is an individual difference characterized by fear of anxiety and the belief that it will lead to negative health-related, social, and cognitive consequences (Schmidt et al., 2010). AS stabilizes and predicts the development of anxiety during young adulthood (Schmidt et al., 2010). Tension reduction theory (Logue et al., 1978) suggests that high-AS individuals drink to reduce/avoid symptoms of anxiety or distress (i.e., to cope; Stewart et al., 1999) and research has shown that AS increases the risk for alcohol misuse and problems (Corran et al., 2023).

Subjective Norms and Drinking Behaviours

The theory of planned behaviour (Ajzen, 1985) proposes that one's intention to engage in a behaviour is the critical proximal predictor of the behaviour itself, and that intentions are predicted by attitudes, perceptions of control, and subjective norms (i.e., perceptions of others approval). This theory thus positions attitudes toward drinking, perceived control over drinking, and perceptions that others engage in, and approve of, drinking (i.e., subjective norms) as core

drivers of intention to drink (Cooke et al., 2016). Subjective drinking norms seem especially relevant among young adults, who are known to overestimate peer use and approval of risky drinking (Neighbors et al., 2007). Normative overestimation is concerning given that social influences – especially from close friends – are known to influence young adult drinking (Cooke et al., 2016).

Subjective norms can be delineated into perceptions about the *amount* (descriptive norms) versus *approval* (injunctive norms) of risky drinking (Fishbein & Ajzen, 2011). While young adult drinking has been consistently linked to descriptive norms (Cooke et al., 2016; Neighbors et al., 2007), links with injunctive norms remain inconclusive, with studies showing positive (Perkins, 2002), negative (Pearson & Hustad, 2014), and null (Werch et al., 2000) associations. Results seem to depend on the *referent group* (e.g., friends, parents, peers) considered in each study. LaBrie et al. (2010) found that associations between injunctive norms and alcohol-related consequences were stronger for proximal (i.e., parents, close friends) versus distal (i.e., typical students/peers) referents. Neighbors et al. (2008) found that perceptions of friends' and parents' approval of risky drinking were positively associated with alcohol misuse, whereas those of typical students were negatively associated with it. Based on previous research (Patrick et al., 2012), young adults with more risky drinking profiles *should* report high injunctive norms across proximal, or perhaps all, referent groups.

Anxiety Sensitivity, Injunctive Norms, and Drinking Behaviours

Individuals high in AS are prone to experiencing distress due to hyperawareness and over-interpretation of (often ambiguous) internal (e.g., increased heart rate) and external (e.g., social evaluation) cues as threatening or negative (Olthuis et al., 2012). Accordingly, theoretical (Cox & Klinger, 1988) and empirical (Corran et al., 2023) research has noted that individuals high in AS present an increased risk for drinking to avoid or cope with negative affect. Drawing on cognitive models (Zvolensky & Schmidt, 2007), attentional biases may push those high in AS to rely on internal information (e.g., anxious thoughts) to infer others' beliefs and behaviours (Keogh et al., 2001). When anxious thoughts are interpreted as threatening (biased interpretation of threat), they may heighten psychological distress and promote coping-motivated drinking. At the same time, those high in AS may be especially attuned to social cues and more likely to perceive that others approve of drinking to cope. Consistent with the broader social norms and anxiety research (Buckner et al., 2011; Neighbors et al., 2007), the combination of a biased threat

interpretation and heightened sensitivity to injunctive norms – driven by a desire to reduce anxiety and avoid negative social evaluation – may increase risk for alcohol misuse and problems.

Thus far, AS has been tested as a correlate of injunctive norms, with mixed results. Some have reported negative associations between AS and injunctive norms (Pearson & Hustad, 2014), while others have reported null associations (Hustad et al., 2014). Indirect associations between AS and alcohol outcomes, via injunctive norms, have also been inconsistently reported (Hustad et al., 2014; Pearson & Hustad, 2014), with AS only sometimes predicting injunctive norms and subsequent alcohol misuse. These mixed findings are not surprising given that specific referent groups were not considered in these studies. For this reason, research considering referent groups should help us achieve a clearer understanding of associations between AS, injunctive norms, and risky drinking.

A Person-Centered Approach to Understanding the Role of Injunctive Norms

Previous research on associations between AS, injunctive norms, and risky drinking has been *variable-centered*. Variable-centered studies focus on the predictive role of variables on their own or in interaction, assuming that associations generalize to the whole sample (Morin et al., 2018). *Person-centered* (or typological) studies identify profiles of individuals differing in their configuration on a set of variables, without assuming that results generalize to the whole sample (Morin et al., 2018).

Alcohol use typologies have emerged as a useful framework for understanding the heterogeneity of young adult alcohol misuse (Rhew et al., 2017). Their advantages lie in their identification of *profiles* (i.e., subpopulations) of young adults with their drinking patterns and outcomes. In this study, we adopt a person-centered approach to examine the configurations of injunctive norms associated with different referent groups for distinct profiles of young adults.

Rather than investigating the role of each referent group in isolation, the person-centered approach allows us to jointly consider all referent groups. This approach recognizes that the influence of each referent group on injunctive norms may be impacted by the context created by other groups. In doing so, it builds upon previous research by seeking to clarify how these profiles, displaying distinct levels of approval across referent groups (typical students, friends, parents), relate to young adult drinking over time. This approach should help inform aetiological models of alcohol misuse by clarifying *who* it at risk (Cadigan et al., 2015). Moreover, better

understanding how AS influences young adults' correspondence to distinct injunctive norm profiles can help inform targeted preventive interventions by clarifying which social groups, alone or in combination, seem most influential.

Current Study

This study relies on a person-centered approach to identify the multi-referent (i.e., typical students, friends, and parents) injunctive norm profiles observed among young adults attending college to assess how AS relates to profile membership and the level of alcohol use and problems associated with each profile. First, we hypothesized that injunctive norms would be represented as a discrete set of profiles. Lacking prior person-centered evidence on injunctive norm profiles, we leave as an open research question the number and nature of these profiles. Second, we hypothesized that higher levels of AS would predict membership into profiles characterized by higher and more widespread perceived approval of risky drinking. Third, we expected that profiles characterized by higher and more widespread perceived approval of risky drinking would predict higher levels of alcohol use and problems.

Moreover, to help document the replicability of these profiles and of their associations with AS and alcohol use and problems, we rely on a one-year longitudinal study incorporating three time points taken six months apart. We consider their replicability (i.e., within-sample similarity) and stability (i.e., within-person stability) over time (Gillet et al., 2017). Within-sample similarity focuses on the replicability of the profiles (i.e., number, structure, variability, and size) over time. Failure to replicate the same number of profiles with the same structure limits practical utility, as they represent transient phenomena. However, changes in variability or size supports malleability and the idea that intervention is possible. These tests can be extended to assess the replicability of associations between profiles, predictors, and outcomes. Within-person stability focuses on the equivalence of profile membership over time. Too little or too much stability are inconsistent with intervention, respectively suggesting ephemerality or rigidity. Moderate stability (50% to 75%) is ideal to support intervention. Rooted in theory of planned behaviour, previous longitudinal research supports the temporal stability of injunctive norms (r=.568 to .826; Angosta et al., 2023) and meta-analytic findings underscore the role of stability for enhancing robustness of associations between intentions and behaviours, including alcohol use (Hagger & Hamilton, 2024). However, lacking person-centered evidence, we consider within-sample similarity and within-person stability as open research questions.

Method

Participants

This study involved 164 students (M_{age}=18.82, *SD*=1.037) recruited from three English-language CEGEPs located in Montreal (Canada) between Fall 2014 and Winter 2017. CEGEPs are specific to the province of Quebec and offer terminal (three-year technical diploma) or transitional (two-year general diploma before undergraduate studies) postsecondary education. Of the total sample, 159 completed the questionnaires at Time 1 (T1), 138 at T2, and 129 at T3. Attrition was therefore 21% by T3. At baseline, 102 (62.2%) identified as women, 56 (34.1%) as men, and six (3.7%) as nonbinary, trans, intersex, or "other." Seventy-two (43.9%) identified as White, 50 (30.5%) as Asian, 11 (6.4%) as Middle Eastern, eight (4.7%) as Hispanic/Latino, four (2.3%) as Black, three (1.8%) as "other", and 16 (9.8%) did not specify their ethnicity.

Procedure

Participants were recruited via online ads and flyers posted around Montreal. Interested individuals completed an online eligibility questionnaire. Eligible individuals (i.e., over legal drinking age of 18, final year of CEGEP, ≥ one drink in past year) were invited to complete online questionnaires after consenting (T1) and then again six (T2) and twelve (T3; after graduating) months later. Participants were compensated with a $20 gift card at each time point. This study was approved by the research ethics committee of the last author's institution.

Measures

Anxiety Sensitivity Index. The Anxiety Sensitivity Index (ASI; Reiss et al., 1986) is a 16-item self-report measure used at T1 to assess sensitivity to anxiety and fear of negative consequences. The decision to administer the ASI only at T1 was predicated on the high level of stability of this construct (e.g., Hovenkamp-Hermelink et al., 2019). The ASI includes three subscales: (1) Physical Concerns (eight items; e.g., "it scares me when my heart beats rapidly"), (2) Cognitive Concerns (four items; e.g., "it scares me when I am unable to keep my mind on a task"), and (3) Social Concerns (four items; e.g., "it is important for me not to appear nervous"). We relied on a global AS score (α=.910; Ebesutani et al., 2014; Reise et al., 2010), described in preliminary analyses. All items were rated using a five-point scale (0=very little to 4=very much).

Injunctive Norms. The Injunctive Norms Questionnaire (INQ; Neighbors et al., 2008) was used to assess perceived approval of risky drinking by four referent groups (typical students,

friends, mother, father) at all time points. For each referent, participants responded to five items (e.g., "how much do you think [typical students/your friends/your mother/your father] approve of [e.g., drinking enough to pass out]") using a seven-point scale (1=strong disapproval to 7=strong approval). The original INQ includes six items per referent, but the first item, "drinking every weekend," was not included as prior research suggests this is not predictive of risky drinking and is instead viewed as a typical, socially acceptable behaviour (Lewis et al., 2010; Krieger et al., 2016). Moreover, the "mother" and "father" referents were combined into a more parsimonious "parent" referent based on evidence of high correlations (r=.718 at T1, .749 at T2, and .876 at T3). Our final measure thus focuses on: typical students (five items; α_{T1}=.807, α_{T2}=.855, α_{T3}=.790), friends (five items; α_{T1}=.854, α_{T2}=.857, α_{T3}=.797), and parents (ten items, including two sets of five matching items; α_{T1}=.887, α_{T2}=.919, α_{T3}=.934).

Alcohol Use. The Daily Drinking Questionnaire (DDQ; Collins et al., 1985)was used to assess past-30-day alcohol consumption at all time points. Participants were provided with the definition of a standard drink (i.e., 12 oz of beer/wine cooler, 4 oz of wine, or 1 oz of spirits) and asked to indicate how many they consumed per day in a typical week over the past month. Responses were summed in a composite measure of alcohol use in a typical week. Similar quantity-by-frequency or timeline follow-back methods have demonstrated good convergent validity and are widely used in research (O'Connor et al., 2008; Hustad et al., 2014).

Alcohol-Related Problems. The Alcohol Use Identification Test (AUDIT; Saunders et al., 1993) is a 10-item self-report measure that was used to assess hazardous/harmful alcohol use (consumption, drinking behaviours, adverse reactions, problems) at all time points. To avoid conceptual redundancy with our alcohol use measure, the first two items related to alcohol consumption were excluded. The eight remaining items were used to obtain a global measure of alcohol-related problems (α_{T1}=.757, α_{T2}=.809, α_{T3}=.735).

Analyses

Attrition Analysis

Our data showed that 118 of the original 164 participants had complete data for all three time points. A dummy variable was created to distinguish those who completed 1, 2, or 3 time points, and a regression analysis was conducted on the Time 1 variables of interest (i.e., missingness as dependent variable). Results suggested that those with complete data did not differ statistically significantly at Time 1 from those with incomplete data regarding age

(*p*=.119), biological sex (*p*=.787), ethnicity (*p*=.207), anxiety sensitivity (*p*=.299), student (*p*=.082) and parent (*p*=.433) injunctive norms, alcohol use (*p*=.775), and alcohol-related problems (*p*=.249). However, those with complete data showed a statistically significant difference at Time 1 from those with incomplete data regarding friend injunctive norms (B=-0.146, *p*=.024), such that higher perceived approval of risky drinking by friends was associated with lower likelihood of completing all three time points.

Preliminary Analyses

The psychometric properties and measurement invariance (over time and across referent; Millsap, 2011) of our multi-item measures were assessed in preliminary Confirmatory Factor Analyses (CFA). These analyses, reported in the online supplement (Tables S1, S2, S3, and S4), support the factor structure, composite reliability, and measurement invariance (over time for injunctive norms and alcohol-related problems, and across referent group for injunctive norms) of our factors: (a) AS (ω=.950 at T1); (b) alcohol-related problems (ω=.923 at all time points); (c) typical students' injunctive norms (ω=.922 at all time points); (d) friends' injunctive norms (ω=.922 at all time points); (e) parents' injunctive norms (ω=.959 at T1, .980 at T2, and .978 at T3). The complete invariance of factor loadings, intercepts and uniquenesses was supported. Factor scores were saved from the most invariant models in standardized units (*M*=0; *SD*=1). Scores on the injunctive norms measure had more variability at T2 and T3 than T1 in relation to parents, and average levels of injunctive norms (relative to the grand mean of 0) were systematically higher for typical students (.698 SD), followed by friends (.179 SD), and lowest for parents (-.877 SD). Relative to manifest scale scores, factor scores preserve measurement structure and invariance and afford a partial correction for unreliability (Morin et al., 2016).

Latent Profile Analyses (LPA)

Our main analyses were realized using *Mplus* 8.9 (Muthén & Muthén, 2023), the Maximum Likelihood Robust estimator (MLR), and Full Information Maximum Likelihood (FIML; Enders, 2023) to retain all participants who completed at least one time point (*n*=164). Solutions including one to eight profiles were first estimated separately at each time point, using injunctive norms factor scores as profile indicators, and allowing the means and variance of these indicators to vary across profiles (Morin & Litalien, 2019). These models were estimated using 10,000 random starts, 1,000 iterations, 1,000 second optimizations, and 100 final optimizations (Morin & Litalien, 2019).

To select the optimal number of profiles at each time point, we considered the heuristic interpretation, theoretical consistency, and statistical adequacy of each solution (Morin & Litalien, 2019). The range of viable solutions was roughly guided by statistical indicators. Lower values on the Akaïke Information Criterion (AIC), consistent AIC (CAIC), Bayesian Information Criterion (BIC), and sample-size Adjusted BIC (ABIC) suggest better fitting models. Likewise, a statistically significant adjusted Lo, Mendell and Rubin's (2001) Likelihood Ratio Test (aLMR) and Bootstrap Likelihood Ratio Test (BLRT) support a solution relative to one including fewer profiles. Simulation studies have revealed that the CAIC, BIC, ABIC, and BLRT were useful indicators, whereas the AIC and aLMR were not (Morin & Litalien, 2019) and are thus only reported to ensure full disclosure. As these indicators often failed to converge on a specific solution, a graphical display (i.e., elbow plot) can be used to see where the decrease in the value of these indicators reaches a plateau (Morin & Litalien, 2019). Finally, we also report the entropy, as a descriptive indicator of classification accuracy (ranging from 0 to 1, with higher values suggesting more accuracy) that should not be used to guide model selection.

Profile Similarity and Latent Transition Analyses (LTA)

Assuming that time-specific solutions converged on the same number of profiles, all three solutions (T1, T2, and T3) were combined into a longitudinal LPA of configural similarity. The similarity of this solution over time was tested in sequence (Morin & Litalien, 2017; Morin et al., 2016): (i) configural (same number of profiles); (ii) structural (same shape); (iii) dispersion (same within-profile variability); (iv) distributional (same size). Similarity is supported when two or three out of the CAIC, BIC, and ABIC are lower in a model relative to the previous one (Morin et al., 2016). The most similar model was converted to LTA (Morin & Litalien, 2019) to assess within-person stability and change in profile membership over time using the manual three-step approach (Morin & Litalien, 2017).

Demographics and Predictors

Demographics (gender, ethnicity, and age) and our predictor (AS), all measured at T1, were included in the LTA using a multinomial logistic regression to assess their role in predicting profile membership. Three models were contrasted (Morin et al., 2016). First, the relation between predictors and profile membership was free to vary over time and across profiles estimated at the previous time point (to assess effects on profile transitions). Second, predictions were only allowed to differ over time. Third, predictions were constrained to be equivalent over

time (i.e., predictive similarity; Morin et al., 2016).

Outcomes

Outcomes (i.e., alcohol use and problems, measured at all time points) were incorporated into the final LTA solution and associated with profile membership at the matching timepoint (Morin et al., 2016). Two models were contrasted in which outcome levels were allowed to differ across profiles and time points, or only across profiles (i.e., explanatory similarity; Morin et al., 2016). Mean differences across profiles were tested in a single step using the multivariate delta method implemented via the MODEL CONSTRAINT function (Morin & Litalien, 2019).

Results

LPA Solutions and Longitudinal Tests of Profile Similarity

The results of the time-specific LPA are reported in Table 4 and displayed in Figure S1 of the online supplement. The CAIC supported four profiles at T1 and T2, but three at T3. The BIC supported five profiles at T1, four at T2, and three at T3. The ABIC kept on suggesting the addition of profiles at all time points. Although the BLRT did not converge on a specific solution at T2, it suggested four profiles at T1 and three at T3. The elbow plots were consistent with solutions including two-to-three profiles at all time points, especially when considering the CAIC and BIC. Solutions including two-to-five profiles were more thoroughly inspected. This inspection first revealed a high level of similarity in the nature of the profiles at all time points, providing preliminary evidence of configural similarity. Adding a third profile resulted in the estimation of a meaningfully distinct profile (Profile 1 in Figure 3). However, adding a fourth or fifth profile resulted in the arbitrary division of one existing profile (Profile 3 in Figure 3) into very small profiles (n=2-3) with an extreme shape. We thus retained the three-profile solution at all time points. The results from the longitudinal tests of profile similarity are reported in Table 5 and support the structural, dispersion, and distributional similarity of this solution.

The results from the final model of distributional similarity are illustrated in Figure 3, and parameter estimates are reported in Tables S5 and S6 of the online supplement. As shown in Table S6, this solution had reasonable classification accuracy (72.8%-91.2%). One should keep in mind that the mean level of injunctive norms was higher for typical students (.698 SD), followed by friends (.179 SD), and lowest for parents (-.877 SD) relative to a grand mean of 0. Thus, profiles should be interpreted keeping in mind that a score of 0 corresponds to the sample average across informants. We use the descriptor *High* to refer to scores generally falling above

the sample mean (.5 SD and above), *Low* to refer to scores generally falling under the sample mean (-.5 SD and below), and *Moderate* to refer to scores close to the sample average.

Profile 1 reported a moderately high level of injunctive norms for typical students, moderate levels for friends, and low levels for parents. This *Mixed Tolerance* profile was the largest (49.12%). Profile 2 reported moderately low to very low levels of injunctive norms across referents. This *Low Tolerance* profile represented 19.18% of the sample. Profile 3 reported average to high levels of injunctive norms across referents. This *High Tolerance* profile represented 31.70% of the sample.

Latent Transitions

Within-person stability and change in profile membership are reported in Table 6. Membership into the *Mixed Tolerance* (1: 80.6% between T1 and T2; 86.3% between T2 and T3) and *High Tolerance* (3: 79.4% between T1 and T2; 93.5% between T2 and T3) profiles was highly stable over time, while membership into the *Low Tolerance* profile (2: 51.2% between T1 and T2; 65.7% between T2 and T3) was only moderately stable over time. Stability increased over time (51.2% to 80.6% between T1 and T2; 65.7% to 93.5% between T2 and T3). Members of the *Mixed Tolerance* (1) profile were more likely to transition to the *Low Tolerance* profile (2: 16.4% between T1 and T2; 8.8% between T2 and T3) than to the *High Tolerance* profile (3: 3.1% between T1 and T2; 4.8% between T2 and T3) over time. Members of the *Low Tolerance* (2) profile were more likely to transition to the *Mixed Tolerance* profile (1: 33.3% between T1 and T2; 34.3% between T2 and T3) than to the *High Tolerance* profile (3: 15.5% between T1 and T2; 0% between T2 and T3) over time. Finally, members of the *High Tolerance* (3) profile were more likely to transition to the *Mixed Tolerance* (1) profile at T2 (18.0%) but to the *Low Tolerance* (2) profile at T3 (6.5%). This *High Tolerance* profile (3) experienced few transitions toward the *Low Tolerance* profile (2) at T2 (2.7%) and no transitions toward the *Mixed Tolerance* (1) profile at T3.

Predictors

The results from the predictive models are reported in Table 5 and support the model of predictive similarity. The results from this model are reported in Table 7, and reveal a lack of association between the demographics and profile membership. We also estimated a second similar set of models to verify whether the relations between AS and profile membership were moderated as a function of gender but found no evidence of interaction. These results also

indicate that higher AS was associated with membership into the *High Tolerance* profile (3) relative to the *Low Tolerance* profile (2).

Outcomes

The results from the outcome models are reported in Table 5 and support the model of explanatory similarity. The results from this model are reported in Table 8 and show that the *Mixed Tolerance* (1) profile consumes less alcohol and displays fewer alcohol-related problems than the *Low Tolerance* (2) and *High Tolerance* (3) profiles, which do not differ.

Discussion

This is the first study to rely on a typological approach to assess associations between AS, norms, and alcohol outcomes in young adults. Results suggest that AS increases likelihood of membership into an injunctive norms profile characterized by high perceived approval of risky drinking by students and friends, and in turn that membership into this profile increases risk of alcohol use and problems. By helping to clarify the role of multi-referent injunctive norm profiles in the pathway linking AS to alcohol outcomes during this critical developmental period, we hoped to contribute to young adult alcohol misuse aetiology and inform intervention mitigating long-term harm.

Multi-Referent Injunctive Norm Profiles

Consistent with our first hypothesis, three injunctive norm profiles were identified. Whereas the *High Tolerance* and *Low Tolerance* profiles respectively entailed a high and low level of perceived approval of risky drinking by most referents, the *Mixed Tolerance Profile* involved high perceived approval of risky drinking by typical students, neutral for friends, and low for parents. Across all profiles, however, parents were seen as less supportive of risky drinking (only reaching an average level in the *High Tolerance* profile) than friends, who themselves were seen as less supportive than typical students. These profiles were unrelated to demographics (i.e., binary sex, ethnicity, age), supporting their generalizability and the relevance of universal interventions.

Anxiety Sensitivity and Injunctive Norm Profiles

Only a handful of studies have examined personality risk factors for alcohol use and problems (Hustad et al., 2014; Pearson & Hustad, 2014), and marijuana use (Pearson et al., 2018), via effects of injunctive norms. These studies have yielded mixed results for AS, although the effects of other personality traits were more consistent. We expected this lack of support for

an association between AS and injunctive norms to reflect a lack of differentiation between referent groups. Consistent with this expectation and our second hypothesis, higher AS was associated with membership into a profile characterized by higher perceived approval of risky drinking across *all* referents. These results are consistent with research demonstrating links between AS and conformity drinking motives (DeMartini & Carey, 2011) and with drinking in response to perceived social pressure (Pérez-Fuentes et al., 2020). Together, our study adds to this evidence by suggesting that young adults with AS may be at risk for alcohol misuse because they perceive others' approval of risky drinking.

Our results are consistent with theoretical models of cognitive bias (Zvolensky & Schmidt, 2007) that suggest that individuals high in AS tend to experience increased levels of distress in response to perceived threat, which in turn may prompt actions to reduce this negative affect (e.g., drinking to cope). In turn, our results support a tendency for these individuals to develop perceptions of their social network as supporting risky drinking, or alternatively, to self-select into more supportive social networks (primarily friends and other students, keeping in mind that perceived parental approval remains average in this profile). By increasing their likelihood of corresponding to a *High Tolerance* profile, AS may in turn increase vulnerability for risky drinking, especially if perceptions align with intention to drink to cope. Given the dearth of research on the link between AS and injunctive norms, our results open an interesting research possibility as further efforts are needed to unpack the mechanisms proposed to underpin these associations.

Injunctive Norm Profiles and Alcohol Use and Problems

Consistent with our third hypothesis, profile membership was associated with alcohol use and problems. As expected, the highest levels of alcohol use and problems were observed in the *High Tolerance* profile. However, these levels unexpectedly did not differ between the *Low* and *High Tolerance* profiles, although both profiles displayed higher levels on both outcomes than the *Mixed Tolerance* one. Thus, perceiving that approval differs markedly across referents – or that despite a high level of approval from typical students, peers and parents either frown upon or barely tolerate risky drinking – seemed the most *protective* scenario. In contrast, perceiving that no one (*Low Tolerance* profile) or everyone (*High Tolerance Profile*) approves of risky drinking seemed to make little difference. One possible explanation is that the *Low Tolerance* profile may be less influenced by social referents altogether, perhaps due to limited social engagement, low

identification with normative groups, or a general disregard for peer approval. As such, their behaviour may be guided more by other factors (e.g., drinking motives, personality) than by injunctive norms, making normative influence less relevant for predicting drinking patterns.

Mixed Tolerance Profile. When there is an incompatibility between referent groups in terms of approval of risky drinking, current research suggests that more distal (versus proximal) referents should have less influence on drinking (e.g., Labrie et al., 2010). A study by Neighbors et al. (2008) even found a negative association between perceived approval of risky drinking of distal social groups (e.g., typical university students) and drinking. In this study, it was not possible to identify which referent group had the most impact for members of the *Mixed Tolerance* profile. However, our results suggest that when one proximal referent group (i.e., parents) disapproves of risky drinking, but another proximal one (i.e., friends) has a neutral stance, then young adults seem to be most protected against risky drinking and thereby drink less. This finding held regardless of perceptions of typical students' support for risky drinking. Fortunately, this profile was also the largest (49.12%), supporting the idea that injunctive norms might help protect a substantial number of young adults against problematic drinking.

High Tolerance Profile. Results are also consistent with current research suggesting that perceived approval of risky drinking by proximal (versus distal) referents are stronger predictors of risky drinking (LaBrie et al., 2010; Neighbors et al., 2008) and marijuana use (LaBrie et al., 2011). Like ours, previous results suggest that peers may play a particularly significant role in this association. Indeed, when we contrast the *High* and *Mixed Tolerance* profiles, we see that typical students' perceptions have virtually no impact on risky drinking, whereas peer approval seemed critical. Parents, who frowned upon risky drinking in most profiles, or were neutral towards it in the *High Tolerance* profile, fell in between. This last observation is consistent with the developmental stage of our participants, during which peer influence progressively increases relative to that of parents (Booth et al., 2011). More problematic was the observation that this profile represented close to one third of the sample (31.70%), highlighting the need to devise interventions to help members of this profile avoid developing problematic drinking habits.

Low Tolerance Profile. Consistent with the widespread social acceptability of drinking (Stone et al., 2012), this profile was the smallest (19.18%). The small size of this profile, and contrasting nature compared to prevailing norms, can help explain unexpected associations between this profile and higher-than-ideal levels of alcohol use and problems. Previous research

suggests that young adults who perceive low levels of perceived approval of risky drinking across referents should be protected against alcohol use and problems (Mrug & McCay, 2013). In contrast, and despite widespread perceived disapproval of risky drinking, members of the *Low Tolerance* profile went against normative perceptions and drank anyway. These findings are consistent with those from one previous study which found that students who perceived social disapproval of alcohol use (despite perceiving frequent use) drank the most (Rimal & Real, 2003). The authors interpreted these findings as a reactance phenomenon, such that students were deliberately defiant and rebellious against perceived social norms. Similarly, La Greca et al. (2001) found that adolescents who identified as nonconformists had the highest level of alcohol use. Moreover, studies from policy (Gilligan et al., 2012), social norms (La Greca et al., 2001), and religion (Bodford & Hussong, 2013) research revealed a tendency for increased alcohol use among young adults who *rebel* against perceived disapproval of drinking. It would be interesting for future research to test this hypothesis by incorporating additional measures of personality (e.g., conformism, rebelliousness) and social context (e.g., religiosity, structure, control).

Another potential explanation for these findings is that those with increased alcohol use and problems might evoke negative reactions/disapproval from those around them, which may be reflected in injunctive norms. This may suggest a person-environment effect, whereby subjective feedback from referent groups (environment) may reinforce or shape injunctive norms (person), in turn leading to increased alcohol use and problems. These types of person-environment effects have been observed in drug use, business, and social psychology (Gul et al., 2018; Reid et al., 2022). Testing this specific hypothesis would require a longitudinal design, as it entails a reversed pathway whereby drinking impacts injunctive norms.

Replicability and Stability Over Time

Our study provided evidence supporting the longitudinal within-sample stability of our profiles across a one-year period. The same three profiles were identified at all time points and shared similar associations with predictors and outcomes. This strong evidence of generalizability supports the idea that these profiles capture core psychological mechanisms rather than ephemeral phenomena, and can be used to support person-centered interventions (Morin et al., 2016). Moreover, profile membership remained moderately-to-highly stable over time (51.2% to 93.5%). These results show that profile membership captures relevant processes unlikely to randomly fluctuate, yet remains flexible enough to respond to intervention.

Profile membership also became increasingly stable over time, with stability ranging from 51.2% to 80.6% between T1 and T2, and between 65.7% to 93.5% between T2 and T3. Particularly worrisome was the observation that membership into the most problematic profile (*High Tolerance*) was increasingly stable over time. This highlights the need for early intervention to help young adults from this profile to transition to more adaptive profiles as they progress through their studies. Those who moved away from this profile between T1 and T2 primarily transitioned toward the most desirable *Mixed Tolerance* profile (18%), further highlighting the utility of early intervention designed to support this transition. Indeed, six months later (i.e., by T3), this desirable transition became virtually non-existent (0%).

Consistent with the idea that this profile may represent a more extreme phenomenon than the others, members of the *Low Tolerance* profile were more likely than their peers to transition to another profile over time. Fortunately, most members of this profile transitioned to the *Mixed Tolerance* profile (33.3% by T2, and 34.3% by T3) rather than the *High Tolerance* profile (15.5.% by T2 and 0% by T3). Thus, low perceptions of risky drinking at the outset are more likely to diversify over time. However, the higher rates of transition toward the *High Tolerance* profile observed within the first six months of the study add to previous evidence suggesting the need for early intervention. Finally, it was encouraging to note that membership into the most desirable *Mixed Tolerance* profile remained highly stable over time (80.6% to 86.3%) and was accompanied by a very low risk of transitioning to the *High Tolerance* profile (3.1% to 4.8%). Thus, if perceptions of others' approval of risky drinking are mixed at the outset, perceptions are more likely to collectively decrease than increase over time.

It is important to consider that, despite our reliance on state-of-the-art missing data procedures, the transitions themselves (within-person stability) could only be inferred based on information obtained from the subsample who responded to each pair of time points, relative to the total sample. Having to infer transitions for people with missing transition information could potentially explain part of the increased rates of stability observed over time in this study.

Limitations and Future Directions

This study is not without limitations. First, the study relied entirely on self-report measures. Though the measures used are psychometrically sound and widely used in research (Corran et al., 2023; Neighbors et al., 2008), future studies should supplement self-reports with more objective measures. For example, AS could be measured in the laboratory by presenting

participants with a physiological stimulus (e.g., CO_2-enriched air) and measuring physiological (i.e., heart rate, skin conductance) and affective (i.e., valence, arousal, distress) responses (Feldner et al., 2006), and breathalysers could be used to measure alcohol intoxication. Relatedly, alcohol use was reported retrospectively, and may be subject to memory bias. Future studies should consider using diary-type approaches (ecological momentary assessment) to measure alcohol use in vivo. Moreover, since data were collected for this study, a new measure of injunctive norms, the *Perceived Approval of Risky Drinking Inventory* (PARDI; Hines et al., 2024) has become available. The PARDI is a reliable and valid measure of injunctive norms providing a more nuanced (and psychometrically stronger) perspective (Robinson et al., 2014). Future studies should therefore consider replicating our results using this new measure.

Second, despite the strength of this longitudinal design, our reliance on a year-long, three time-point design only captured a relatively short period of young adult development. Although this design allowed us to test stability and change in profile membership over time and revealed that intervention should occur sooner rather than later, it makes it challenging to fully grasp how injunctive norm profiles evolve over the young adult years as social networks change and drinking experience increases. Developmental research (Merline et al., 2008) suggests that young adulthood is a crucial stage in alcohol use aetiology, making it optimal to rely on longer time spans and more frequent measurement. It would thus be highly informative for future studies to investigate how injunctive norms trajectories evolve within, and across, developmental periods, and how these trajectories vary across profiles (e.g., Morin & Litalien, 2019).

Third, the current study is limited by an inability to generalize findings to populations beyond CEGEP students. Evidence showing that demographic characteristics had no effect on profile membership lends support for the robustness and generalizability of our findings but does not offset sampling homogeneity. Person-centered evidence is cumulative and requires multiple studies to differentiate profiles that are common, those that are specific to some contexts or populations, and those that may reflect random variations. Although our longitudinal tests of profile similarity allow us to discard the last possibility, it remains critical to systematically assess the generalizability of results to more diversified samples of young adults from other areas, cultures, and educational placements.

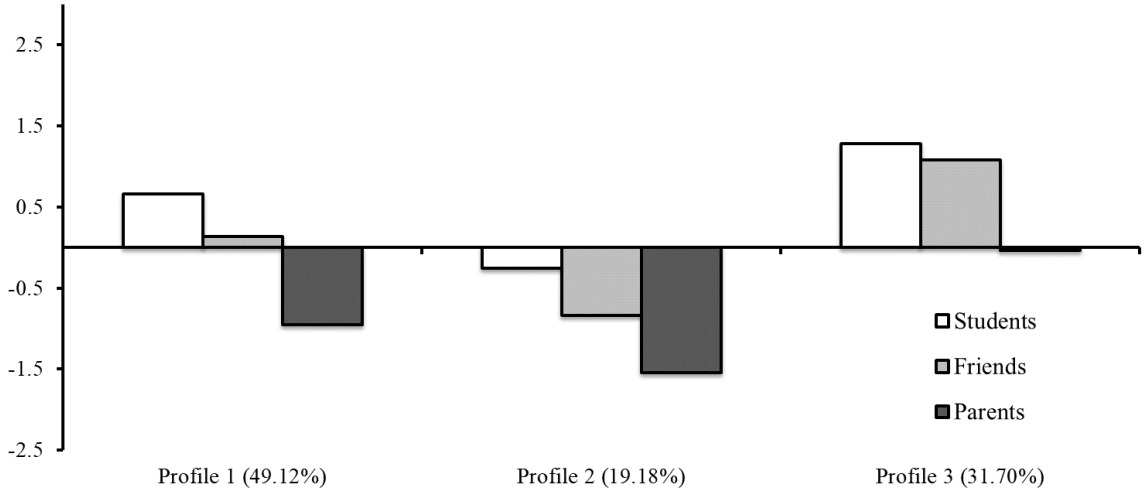
Conclusion

The results of the current study contribute meaningfully to young adult alcohol misuse

research by identifying AS and injunctive norms as two central factors that may influence risky drinking. The current study also highlights the value of a person-centered approach to understanding this risk. By demonstrating that AS predicted profile membership, which in turn predicted alcohol use and problems, this study supports the construct validity of our profiles in better understanding alcohol-risk trajectories.

Beyond aetiological contributions, our results also have practical implications. The identification of discrete profiles of young adults differing in unique injunctive norm configuration allows for the creation and implementation of more holistic, targeted, and potentially more effective interventions for young adult alcohol misuse. Detection and support for young adults high in AS who perceive approval of risky drinking should be included in strategies of early prevention and mitigation of long-term harm.

Figure 3. Final Three-Profile Solution (Distributional Similarity): Injunctive Norms Across Referent.



Note. Profile indicators are factor scores with grand mean of 0 and standard deviation of 1 (across referents and over time); Profile 1 = *Mixed Tolerance*; Profile 2= *Low Tolerance*; Profile 3= *High Tolerance*.

Table 4. Results from the Latent Profiles Analyses

Model	LL	#fp	Scaling	AIC	CAIC	BIC	ABIC	Entropy	aLMR	BLRT
Time 1										
1-Profile	-588.940	6	.933	1189.880	1214.293	1208.293	1189.300	Na	Na	Na
2-Profile	-526.931	13	1.153	1079.862	1132.758	1119.758	1078.605	.908	≤ .001	≤ .001
3-Profile	-503.343	20	1.107	1046.685	1128.064	1108.064	1044.752	.800	.186	≤ .001
4-Profile	-481.137	27	1.039	1016.275	1126.135	1099.135	1013.665	.824	≤ .001	≤ .001
5-Profile	-462.171	34	.940	992.342	1130.685	1096.685	989.056	.853	.102	≤ .001
6-Profile	-448.361	41	.902	978.723	1145.548	1104.548	974.760	.870	0.038	.051
7-Profile	-433.913	48	.885	963.827	1159.134	1111.134	959.188	.885	.081	≤ .001
8-Profile	-421.167	55	.977	952.334	1176.124	1121.124	947.018	.906	≤ .001	≤ .001
9-Profile	-411.300	62	.797	946.600	1198.872	1136.872	940.608	.919	.013	≤ .001
10-Profile	-401.212	69	.878	940.424	1221.178	1152.178	933.755	.866	.504	.375
Time 2										
1-Profile	-540.754	6	.952	1093.509	1117.072	1111.072	1092.090	Na	Na	Na
2-Profile	-496.318	13	1.187	1018.635	1069.689	1056.689	1015.562	.721	.068	≤ .001
3-Profile	-470.211	20	1.066	980.422	1058.967	1038.967	975.694	.950	.159	≤ .001
4-Profile	-448.862	27	1.001	951.723	1057.759	1030.759	945.340	.848	.084	≤ .001
5-Profile	-433.612	34	.921	935.224	1068.750	1034.750	927.186	.852	.103	.023
6-Profile	-419.732	41	.904	921.463	1082.481	1041.481	911.771	.886	.218	.023
7-Profile	-406.947	48	.860	909.894	1098.402	1050.402	898.546	.898	.190	≤ .001
8-Profile	-394.070	55	.890	898.140	1114.139	1059.139	885.137	.900	.208	≤ .001
9-Profile	-381.439	62	.759	886.878	1130.368	1068.368	872.221	.945	.047	≤ .001
10-Profile	-372.145	69	.822	882.290	1153.271	1084.271	865.978	.923	.071	≤ .001
Time 3										
1-Profile	-480.999	6	.899	973.999	997.158	991.158	972.182	Na	Na	Na
2-Profile	-425.069	13	.978	876.137	926.315	913.315	872.200	.832	≤ .001	≤ .001
3-Profile	-402.630	20	.967	845.260	922.457	902.457	839.203	.904	.015	≤ .001
4-Profile	-388.702	27	.958	831.404	935.619	908.619	823.227	.938	.139	.0505
5-Profile	-374.104	34	1.032	816.208	947.442	913.442	805.911	.880	.330	.333
6-Profile	-361.344	41	.937	804.688	962.940	921.940	792.270	.890	.231	≤ .001
7-Profile	-351.555	48	.909	799.111	984.381	936.381	784.573	.869	.039	≤ .001
8-Profile	-341.110	55	.844	792.220	1004.510	949.510	775.563	.919	.032	.020
9-Profile	-335.648	62	.798	795.296	1034.605	972.605	776.519	.909	.242	.222
10-Profile	-325.710	69	.841	789.419	1055.746	986.746	768.522	.861	.382	.200

Note. LL = model loglikelihood; #fp = number of free parameters; AIC = Akaïke information criterion; CAIC = consistent AIC; BIC = Bayesian information criterion; ABIC = sample-size adjusted BIC; ICL-BIC = Integrated classification likelihood BIC; aLMR = Lo-Mendel and Rubin's likelihood ratio test; BLRT = bootstrap likelihood ratio test; NA = not applicable.

Table 5. Results from the Longitudinal Latent Profile Analyses and Latent Transition Analyses with Predictors and Outcomes

Model	LL	#fp	Scaling	AIC	CAIC	BIC	ABIC	Entropy
Longitudinal Tests of Profile Similarity								
Configural Similarity	-1376.184	60	1.0467	2872.368	3118.360	3058.360	2868.404	.804
Structural Similarity	-1396.798	42	1.1725	2877.596	3049.790	3007.790	2874.821	.671
Dispersion Similarity	-1421.784	24	1.4010	2891.569	2989.966	2965.966	2889.983	.637
Distributional Similarity	-1421.853	20	1.5416	2883.706	2965.704	2945.704	2882.385	.637
Predictors								
Effects Free – Profiles and Time	-1051.447	100	.5242	2302.894	2717.060	2617.060	2300.417	.838
Effects Free – Profiles	-1068.485	52	.8249	2240.971	2456.337	2404.337	2239.683	.822
Predictive Similarity	-1095.209	36	.9322	2262.419	2411.519	2375.519	2261.527	.713
Outcomes								
Effects Free – Profiles and Time	-2022.250	50	1.1007	4144.501	4351.584	4301.584	4143.262	.860
Explanatory Similarity	-2033.659	38	1.4072	4143.318	4300.702	4262.702	4142.378	.853

Note. LL: loglikelihood; #fp: free parameters; S.C.: scaling correction; AIC: Akaïke information criterion; CAIC: consistent AIC; BIC: Bayesian information criterion; ABIC: sample-size adjusted BIC.

Table 6. Transition Probabilities for the Final Latent Transition Analysis Model

	Transition Probabilities to Time 2 Profiles		
	1: Mixed Tolerance	2: Low Tolerance	3: High Tolerance
Time 1 Profiles			
1: Mixed Tolerance	.806	.164	.031
2: Low Tolerance	.333	.512	.155
3: High Tolerance	.180	.027	.794
	Transition Probabilities to Time 3 Profiles		
	1: Mixed Tolerance	2: Low Tolerance	3: High Tolerance
Time 2 Profiles			
1: Mixed Tolerance	.863	.088	.048
2: Low Tolerance	.343	.657	.000
3: High Tolerance	.000	.065	.935
	Transition Probabilities to Time 2 Profiles		
	1: Mixed Tolerance	2: Low Tolerance	3: High Tolerance
Time 1 Profiles			
1: Mixed Tolerance	.806	.164	.031
2: Low Tolerance	.333	.512	.155
3: High Tolerance	.180	.027	.794
	Transition Probabilities to Time 3 Profiles		
	1: Mixed Tolerance	2: Low Tolerance	3: High Tolerance
Time 2 Profiles			
1: Mixed Tolerance	.863	.088	.048
2: Low Tolerance	.343	.657	.000
3: High Tolerance	.000	.065	.935

Table 7. Results from the Multinomial Logistic Regressions Predicting Profile Membership (Predictive Similarity)

Predictors	1 (Mixed) Vs 2 (Low) *Coeff* (SE)	*OR*	1 (Mixed) Vs 3 (High) *Coeff* (SE)	*OR*	2 (Low) Vs 3 (High *Coeff* (SE)	*OR*
Gender (0 = Male; 1 = Female)	-.519 (.378)	.595	.012 (.401)	2.221	.530 (.435)	.887
Ethnicity (0 = White; 1 = Other)	-.089 (.347)	.915	-.181 (.360)	1.690	-.093 (.385)	3.990
Age (M = 0, SD = 1)	-.142 (.173)	.867	-.205 (.176)	1.150	-.063 (.186)	1.938
Anxiety Sensitivity (M = 0, SD = 1)	.215 (.188)	1.240	-.307 (.192)	1.072	-.521 (.205)**	1.352

Note. **: $p < .01$; *: $p < .05$. SE: standard error of the coefficient; OR: Odds Ratio. The coefficients and OR reflects the effects of the predictors on the likelihood of membership into the first listed profile relative to the second listed profile.

Table 8. Time-Invariant Associations between Profile Membership and the Outcomes (Explanatory Similarity)

	1: Mixed Tolerance		2: Low Tolerance		3: High Tolerance		Summary of Significant
	M	CI	M	CI	M	CI	Differences
Frequency of Alcohol Use (0 to 44)	1.328	.951; 1.706	5.307	2.822; 7.791	7.518	5.033; 10.002	1<2=3
Alcohol-Related Problems (M = 0; SD = 1)	-.372	-.520; -.225	.524	.090; .957	.869	.602; 1.135	1<2=3

Note. M: Mean; CI: 95% Confidence Interval.

CHAPTER 5: Bridge

Study 2 advanced the research program by identifying distinct injunctive norms profiles based on perceived approval of risky drinking across multiple referent groups. These profiles captured meaningful variability in young adults' perceived approval from friends, typical students, and parents. Building on this, the study then examined AS as a predictor of membership in these injunctive norms profiles. Using a person-centered, longitudinal design, the study revealed that individuals high in AS were more likely to belong to profiles characterized by high perceived approval of risky drinking, particularly from peers and friends. These profiles were in turn associated with elevated levels of alcohol use and related problems over time. Specifically, the profile characterized by high typical students and friends and neutral parents' approval was associated with the highest risk for alcohol use and problems, while the profile characterized by low typical students, friends, and parents' approval of risky drinking was associated with some risk, and the profile characterized by high typical students, neutral friends, and low parents' approval of risky drinking was found to be *protective* against alcohol outcomes such that it was associated with the least amount of alcohol use and problems.

The findings from Study 2 extended the findings of Study 1 by considering the impact of perceived social norms in young adult alcohol use. While Study 1 highlighted the role of AS in shaping cognitive processes of alcohol risk during the COVID-19 pandemic, Study 2 demonstrated that AS also predicts membership into risky injunctive norm profiles and, in turn, elevated alcohol use and problems during the transition to university under non-pandemic conditions. Importantly, this study established that both individual cognitive-affective vulnerabilities and socially constructed perceptions coalesce in shaping long-term alcohol risk during the critical developmental period of young adulthood.

While Study 2 took a person-centered approach and focused on identifying latent profiles and assessing their predictive utility, it did not directly test the processes of change over time or assess how these mechanisms interact prospectively. Thus, Study 3 was designed to extend this work by testing the interplay between AS and injunctive norms on alcohol outcomes, via its influence on drinking to cope across multiple timepoints. Specifically, Study 3 used a latent growth curve modeling framework to test a moderated mediation model, allowing for the simultaneous examination of change in coping motives over time (as a mediator) and the

influence of perceived social approval of risky drinking (as a moderator) on trajectories of alcohol use and problems in first year university students.

This transition marks a move toward understanding longitudinal mechanisms of young adult alcohol use across time. Study 3 also refined the conceptual model by focusing on the social concern subtype of AS, which may be especially sensitive to peer influence during young adulthood. Thus, instead of testing AS as a global construct, the most relevant subtype to the current study was extracted in the conceptual model. By incorporating both internal changes and external context, Study 3 aimed to provide a more comprehensive and temporally grounded test of the full AS-coping-alcohol pathway during the critical developmental period of young adulthood.

CHAPTER 6: Anxiety Sensitivity Risk for Alcohol Use and Problems During the Transition to University: Testing the Roles of Injunctive Norms and Drinking to Cope

Young adulthood is marked by increased alcohol use and related problems (Hingson et al., 2017; Lee et al., 2018; White et al., 2011). For many, this developmental period coincides with the transition to university – a time characterized by new academic demands and stressors, and changes in social roles and associated pressures (Harris, 2019; Lee et al., 2018; Worsley et al., 2021). Though young adults in general have been shown to engage in hazardous drinking, university students have been found to consume larger quantities and experience more alcohol-related problems than their same-aged peers not attending post-secondary education (Colby et al., 2012; Hingson et al., 2005). Alcohol-related problems include interpersonal problems, academic and employment difficulties, legal problems, and the development of alcohol use disorder (AUD; Carter et al., 2010; Johnston, 2016; Lee et al., 2018; Wall et al., 2012). Despite these risks, drinking during the undergraduate years is often ingrained within the social fabric such that it is perceived as a normative behaviour. This is especially problematic for vulnerable young adults who may be susceptible to drinking alcohol to avoid or cope with negative thoughts and feelings (Abrams & Niaura, 1987; Maisto et al., 1999). Thus, understanding *who* is at risk and *how* the risk unfolds in young adulthood is critical for mitigating long-term problems.

Anxiety Sensitivity and Alcohol Use and Problems

One known risk factor for alcohol use and related problems is *anxiety* (Anker & Kushner, 2019). The high comorbidity rates of AUD and varied anxiety disorders (Smith & Randall, 2012) suggest that shared mechanisms across anxiety disorders may increase risk for alcohol use and associated problems. Research on comorbidity in mental health suggests that many anxiety disorders reflect common underlying dimensions of negative affectivity and heightened sensitivity to threat or uncertainty (Dalgleish et al., 2020; Norton & Paulus, 2017). These dimensions are thought to operate as *transdiagnostic* mechanisms, meaning that they cut across specific diagnostic categories and help explain why anxiety disorders often co-occur with each other and with alcohol misuse. An understanding of these shared factors may help us better characterize alcohol use risk in young adulthood.

One key transdiagnostic factor of anxiety disorders is *anxiety sensitivity* (AS), or the fear of experiencing anxious symptoms and the belief that they will result in negative consequences (Dalgleish et al., 2020; Norton & Paulus, 2017). Individuals high in AS are

therefore not only distressed by the symptoms themselves (e.g., racing heart, trembling, difficulty concentrating) but also interpret these sensations as signals of impending harm, loss of control, or social rejection. AS is typically conceptualized in three subtypes that correspond to distinct categories of feared negative consequences: *physical concerns* (e.g., having a heart attack), *cognitive concerns* (e.g., going crazy), and *social concerns* (e.g., being judged by others; Reiss et al., 1986). Of these, the social concern subtype (AS-SC) may be particularly relevant to alcohol use, as fears of negative social evaluation may heighten vulnerability to drinking as a coping strategy in social contexts. This relevance may be especially pronounced in young adults who face increased exposure to novel social contexts during this developmental period and for whom peer relationships are especially important (Bonnie et al., 2015).

According to tension reduction (Cappell & Herman, 1972; Greeley & Oei, 1999) and negative reinforcement (Cooper et al., 1995; Cox & Klinger, 1988) theories, tension is an aversive emotional state that can be reduced by the consumption of alcohol, and in turn leads to increased risk for alcohol use and problems through a learned process of negative reinforcement (Stewart et al., 2014). These frameworks suggest that those high in AS consume alcohol for its anxiolytic effects, thereby temporarily avoiding or reducing the emotional reactivity that is experienced as a consequence of feared anxious symptoms (MacDonald et al., 2000). Empirical research provides converging support for these theoretical accounts. For example, Zack and colleagues (2007) showed that alcohol reliably dampened stress reactivity and decreased state anxiety among individuals high in AS, but not those low in AS; this suggests that people high in AS are particularly sensitive to alcohol's stress response dampening effects. Furthermore, research has shown that those high (vs. low) in AS present an increased risk for alcohol misuse and related problems, including the development of AUD (e.g., Allan et al., 2015; Chavarria et al., 2015; Schmidt, Buckner, et al., 2007; Stewart et al., 1995; Stewart et al., 2001). More specifically, one foundational study by Stewart and colleagues (1999) found that participants high in AS reported a higher frequency of weekly drinking than did participants low and moderate in AS, which was explained by a tendency to use alcohol as a way to cope with negative emotions and anxious arousal (i.e., reduce anxious thoughts/tension). Similarly, a critical review supported the association between AS and increased alcohol use and drinking to cope and highlighted the function that AS plays in negative-reinforcement risk pathways of alcohol use (DeMartini & Carey, 2011). While ample research has supported the AS-alcohol

link, a contrasting set of studies points to a lack of evidence supporting AS risk for alcohol outcomes (e.g., Jurk et al., 2015; Malmberg et al., 2013). Thus, research is needed to clarify the nuances of the complex risk trajectory, including who is at risk and how risk unfolds.

Mediator of Risk: Coping Motives

Cognitive models (Kuntsche et al., 2007; Maisto et al., 1999) extend tension reduction theory by suggesting that one's beliefs about the effects of alcohol – such as its capacity to reduce tension – shape expectations and decisions around drinking. In particular, motivational theory suggests that people drink for specific reasons, which are typically conceptualized using a two-dimensional model mirroring the valence and source of the motive (Cox & Klinger, 1988). Accordingly, there are four types of drinking motives: enhancement (internally sourced) and social (externally sourced) positive reinforcement motives, and coping (internally sourced) and conformity (externally sourced) negative reinforcement motives (Cooper, 1994). These theoretically and empirically distinct drinking motives are linked to unique alcohol patterns, and those that relate to affect regulation – such as drinking to cope – have been found to be particularly risky (Merrill et al., 2014; Stevenson et al., 2019).

Consistent with these theories, empirical studies have shown that those who drink to manage distress – that is, for coping motives – tend to engage in riskier patterns of alcohol use and experience more negative consequences (Carey & Correia, 1997; Merrill et al., 2014; Shuai et al., 2022). In the context of AS more specifically, cross sectional studies have shown that individuals high in AS are at increased risk for drinking to cope with negative affect (Conrod et al., 1998; DeMartini & Carey, 2011; Stewart et al., 1997; Stewart et al., 1999; Stewart et al., 2001). For example, Stewart and colleagues (2001) found that individuals high (versus low) in AS were more likely to endorse drinking to cope as the primary reason for drinking. Similarly, longitudinal studies have provided evidence for direct effects of AS on coping motives as well as indirect effects of AS on alcohol problems, via drinking to cope (Allan et al., 2015; Corran et al., 2023). For example, Allan and colleagues (2015) employed cross-sectional single- and chained-mediation models to test the effects of AS on alcohol problems via generalized anxiety and coping motives and found that coping motives mediated the AS-alcohol problem risk pathway. More recently, a longitudinal study by the current researchers found that AS positively predicted coping motives, and in turn contributed to greater alcohol use and problems (Corran et al., 2023).

Together, theoretical and empirical literatures underscore the significance of affective motives (e.g., coping motives) as explanatory mechanisms linking AS to alcohol use and problems, which may be especially problematic for young adults attending university who are already at increased risk. However, the physiological effects of alcohol are complex and suggest that drinking to reduce tension may not be sufficient to account for the association between AS and alcohol use and problems. It makes sense that on the one hand, those high in AS use alcohol to cope, but on the other hand, those high in AS may *avoid* drinking, as the effects of alcohol mimic anxiety symptoms (e.g., dizziness, increased heart rate, blushing, distorted bodily perceptions; Amelang, 1997). Accordingly, effects of alcohol should be aversive to those high in AS, leading to decreased risk for alcohol use and problems. Thus, other factors might be at play in the association which push young adults high in AS past their ambivalence and toward alcohol use. Perhaps the novel social landscape that accompanies the transition to university further sets the stage for unique risk pathways among those high in AS at baseline.

One potential nuance worth further examination is the distinction between subtypes of AS, notably AS-SC. Individuals high in AS-SC may use alcohol to temporarily reduce or avoid sensitivity to anxious symptoms or emotional distress (i.e., for its anxiolytic effects) that they fear will lead to *social embarrassment or scrutiny*. This learned process may lead to increased risk for alcohol use and problems, and may be especially prevalent in young adults high in AS-SC if they *also* perceive that drinking to cope is normal and/or encouraged by their friends and peers. Indeed, given the importance of social approval (and/or the avoidance of negative scrutiny or judgement) among young adults, social perceptions may be especially influential in whether and how alcohol is used. Thus, if a young adult fears that their anxious symptoms will lead to negative social evaluation *and* they perceive that their social network approves of drinking to reduce tension/cope with anxiety, then they may be at particular risk for seeking out alcohol for its anxiolytic effects and subsequently misusing alcohol.

Moderator of Risk: Injunctive Norms

The theory of planned behaviour (Ajzen, 1985, 1991) suggests that an individual's intentions to engage in any given behaviour are the most proximal predictors of the behaviour itself, and these intentions are shaped by one's attitudes, perceived control, as well as perceptions of others' engagement (descriptive norms) and approval (i.e., injunctive norms) of the behaviour (Cooke et al., 2016). Specifically, injunctive norms pertain to judgments about whether the

behaviour is perceived as acceptable or unacceptable by others (Cialdini et al., 1991; Fishbein & Ajzen, 2011), including friends, peers or typical students, and parents. In the context of alcohol use, this theory positions one's perceptions of others' approval of drinking as core drivers of the intention to drink (i.e., injunctive norms for drinking).

Theoretical and empirical work converge to show that *social influences* are key contributors to one's own behaviour (Salazar et al., 2013; Smyth et al., 2017), including alcohol use (Sudhinaraset et al., 2016; Wood et al., 2001). This may be especially true during young adulthood when peer relationships are particularly salient (Borsari & Carey, 2001; White & Jackson, 2004). Research has suggested that injunctive norms are especially relevant among young adults who overestimate how much peers engage in risky drinking and *approve* of doing so (Kypri & Langley, 2003; Neighbors et al., 2007; Perkins, 2007; Perkins et al., 1999). This ubiquitous overestimation is worrisome given the known and pervasive link between social influences and drinking during the undergraduate years (Collins & Spelman, 2013; Cooke et al., 2016; Dumas et al., 2019; LaBrie et al., 2010; Norman, 2011).

Individuals high in AS tend to experience distress due to the misinterpretation of internal (e.g., racing heart) and external (e.g., being judged by peers) stimuli as threatening (Olthuis et al., 2012). They may therefore be particularly influenced by perceptions of others' (dis)approval of drinking, in turn impacting their own drinking. Consistent with cognitive models of alcohol use, if an individual high in AS relies on internal cues – such as anxious thoughts – when interpreting others' beliefs [e.g., (dis)approval of risky drinking], they may be at increased risk for risky drinking themselves, such as drinking to cope with the associated emotional distress. High AS individuals may be particularly responsive to perceived *social approval of coping-motivated drinking*. This combination of distorted threat perception and heightened awareness of injunctive norms – especially when motivated by a desire to alleviate anxiety and avoid negative social evaluation (i.e., high AS-SC) – has been implicated in increased vulnerability to problematic drinking (Buckner et al., 2011; Neighbors et al., 2007).

The perceived approval of different referent groups has been shown to impact the strength of the association between injunctive norms and alcohol outcomes, such that more proximal referent groups (i.e., parents, friends) are more strongly linked to alcohol-related consequences than more distal groups (i.e., typical student, peers; e.g., LaBrie et al., 2010; Neighbors et al., 2008). In terms of the *types* of injunctive norms, perceived approval of drinking

to cope *specifically* has been linked to increased drinking to cope for proximal (friends and parents), but not distal (typical students and peers) referent groups (Hines et al., 2024). Thus, proximity may be particularly relevant when considering specific drinking contexts or motives (e.g., coping-related norms vs. general risky drinking norms), as some facets of injunctive norms appear to show stronger behavioural links than others. Taken together, the intricate association between psychological vulnerabilities (e.g., AS and/or type of AS), social influences (including perceptions of which specific referent groups), and alcohol-related outcomes, highlights the need for targeted interventions tailored to address the unique needs of at-risk groups of young adults.

Current Study

The transition to university is a time of significant change for young adults, which is often accompanied by new stressors in the context of navigating new peer groups and interpersonal relationships. Tension reduction theory points to AS as a potential risk factor for alcohol misuse, such that those high in AS are motivated to use alcohol to reduce social and emotional distress. Mixed evidence, however, suggests that the association between AS and alcohol outcomes is not straightforward. During the unique developmental period of young adulthood – particularly the early undergraduate years – one's same-age peers and friends tend to have strong influences on one's own behaviour (Andrews et al., 2002; Overbeek et al., 2011; Thrul & Kuntsche, 2015). Given that those high in AS fear anxious symptoms and hold the belief that their symptoms will lead to negative consequences, including *social consequences*, perhaps perceptions of others' approval of drinking for coping motives are particularly saliant for this group of young adults. If an individual high in AS-SC believes that their same-age peers and friends approve of drinking for coping motives, then they may be inclined to drink to cope themselves, and subsequently be at risk for alcohol misuse and problems.

The goal of the current study was to test injunctive norms (perceived approval of risky drinking by friends and typical students) as moderators of the association between AS and alcohol use and problems, as explained by coping motives for drinking (see Figure 4). Given the unique social context inherent to the transition to university for young adults, *perceived approval of drinking to cope* among those *specifically high in AS-SC* were of particular interest. We hypothesized that AS-SC would positively predict alcohol use/problems, but only when perceived approval of drinking to cope by friends and typical students (injunctive norms) was high, and that coping motives would mediate this pathway. Thus, both *perceptions of approval*

of drinking to cope and *actual* drinking to cope were examined in the current study, which prospectively followed a sample of first year university students across four time points.

Method

Participants

Participants ($N = 379$, $M_{age} = 19.85$, $SD_{age} = 1.733$) were first year undergraduate students from a large North American University. Of the total sample, 260 (68.6%) participants identified as women, 94 (24.8%) as men, and 16 (4.2%) as non-binary (i.e., gender non-conforming, genderqueer, genderfluid, gender variant, and agender). The remaining eight participants identified as two-spirit, transgender, or "unsure." The sample was ethnically diverse, with 146 (38.9%) participants reporting multiethnic origins, 66 (17.7%) Asian or Middle Eastern, 61 (16.2%) European, 40 (10.7%) North American, 38 (10.1%) Latin, Central or South American, 21 (5.5%) African, and 3 (0.8%) as Aboriginal or "other."

Procedure

As part of a larger four-year longitudinal study, students entering their first year of university ($N = 1126$) were recruited via digital and print advertisements around campus, which included a link to a survey to determine eligibility. To be eligible, participants had to be between the ages of 18 and 25 years, fluent in English, in their first year of undergraduate studies, and current drinkers (i.e., having consumed at least one alcoholic drink in the past year). Eligible participants were then sent a link to complete a battery of self-report questionnaires assessing AS, drinking motives, injunctive norms, and alcohol use and problems. When completing the consent form, participants were asked if they were interested in participating in a separate study consisting of three additional monthly assessments (i.e., the current study). This subset of interested participants ($n = 379$) was contacted on a rolling basis and completed three additional questionnaire batteries, each at one-month intervals (i.e., four total time points). Participants were compensated with Amazon gift cards for their participation in the study ($15 at baseline, and $25 for subsequent time points). Those who completed all four time points received an additional $15 gift card.

Measures

The *Anxiety Sensitivity Index-3* (ASI-3; Taylor et al., 2007) is an 18-item self-report questionnaire that assesses the fear of anxious symptoms and the associated negative consequences (e.g., "when I tremble in the presence of others, I fear what people might think of

me"). Participants rated items on a five-point scale (0=very little to 4=very much). The "social concerns" subscale was of interest for the current study (6 items). Mean scores were calculated for each participant on the social concerns subscale for descriptive purposes only (see Table 9); whereas, item-level data were used to model latent constructs at each time point for the primary analyses. The psychometrics of the ASI-3 are well supported (Hilton et al., 2022; Taylor et al., 2007). In the current study, the ASI-3 social concerns subscale demonstrated good scale score reliability at Time 1 (Table 9).

The *Perceived Approval of Risky Drinking Inventory* (PARDI; Hines et al., 2024) is a 30-item self-report questionnaire that assesses injunctive drinking norms. Participants rated items on a five-point scale (1=strongly disapprove to 5=strongly approve) indicating how much they believed each referent group (friends, typical students from their university, and parents) approved of 30 behaviours associated with risky drinking. The PARDI has four subscales: (1) Heavy Drinking, (2) Drinking-Related Problems, (3) Coping-Motivated Drinking, and (4) Sexual-Risk Taking. The 7-item coping-motivated drinking subscale (coping with aversive thoughts or feelings) was of interest in the current study (e.g., "you drank to forget about your problems). Moreover, referent groups of interest were friends and typical students (i.e., perceived approval of coping-motivated drinking by friends and typical students). The current study used data from an early 30-item version of the measure that was being developed in our lab. In this version, the coping-motivated drinking subscale contained 7 items, whereas the published 20-item PARDI includes a 6-item coping subscale. The additional item in the early version was "you drank because it helps you when you feel nervous." Mean scores were calculated for each referent group for descriptive purposes only; whereas, item-level indicators were used to model the latent constructs at each time point in the primary analyses. Though a relatively new measure, the initial psychometric properties of the PARDI have been well supported. In the current study, the PARDI coping-motivated drinking subscale demonstrated good scale score reliability at Time 1 for the friend referent group, and excellent for the typical student referent group (Table 9).

The *Modified Drinking Motives Questionnaire-Revised* (MDMQ-R; Grant et al., 2007) is a 28-item self-report questionnaire that assesses motives for drinking alcohol. Participants rated items on a 5-point scale (1=almost never/never to 5=almost always/always). The 13-item coping subscale was of interest in the current study (e.g., "you drink because it helps you when you feel

nervous"). This global coping subscale, which combines the coping with anxiety and coping with depression subscales, is widely used in the literature given the high correlation between subscales (Dyar et al., 2021). Mean scores were calculated for descriptive purposes only; whereas, item-level data were used to estimate the latent coping motives constructs at each time point in the primary analyses. The psychometrics of the MDMQ-R are well supported (Grant et al., 2007) and in the current study, the coping subscale demonstrated excellent scale score reliability at Time 1 (Table 9).

The *Daily Drinking Questionnaire* (Collins et al., 2018) was used to assess the typical number of drinks consumed in a typical week in the past month. Participants were asked to indicate the number of drinks they consumed for each day of the week (Monday through Sunday). A composite score that summed the quantity consumed on each day was derived for each time point. These measures of total alcohol use in a typical week are commonly used in alcohol research (Keough & O'Connor, 2014; Nitka & O'Connor, 2017; O'Connor et al., 2008).

The *Brief Young Adult Alcohol Consequences Questionnaire* (B-YAACQ; Kahler et al., 2005) is a 24-item self-report questionnaire that assesses alcohol-related problems. Participants responded dichotomously (yes/no) to questions asking whether they had experienced a particular alcohol-related problem (e.g., "I have taken foolish risks when I have been drinking") in the past month. A sum score was derived for each participant. As with the other measures, this sum score was used only for descriptive purposes; whereas, item-level data were used to model latent constructs at each time point for the primary analyses. The B-YAACQ has demonstrated excellent psychometric properties and is considered one of the best measures of alcohol-related problems in young adults (Kahler et al., 2008; Read et al., 2007). In the current study, the B-YAACQ demonstrated good scale score reliability at Time 1 (see Table 9).

Data Analytic Overview

Data Integrity

Prior to analyses, all data were screened for violations of the assumptions of regression. Multicollinearity was assessed by examining bivariate correlations, tolerance values, conditioning indexes, and variance proportions. Bivariate correlations greater than 0.9 and tolerance values lower than 0.1 were indicative of multicollinearity, and a conditioning index greater than 30 with two variance proportions greater than 0.5 was indicative of multicollinearity (Tabachnick & Fidell, 2007). All collinearity diagnostics were in the normal range, suggesting

the absence of multicollinearity. Although MLR is robust to non-normality, distributions were examined and were found to be continuous and relatively normally distributed (skewness < .30; kurtosis < 10; Kline, 2009). We also screened for multivariate outliers which were detected at each time point (n = 11 at Time 1; n = 9 at Time 2; n = 8 at Time 3; n = 5 at Time 4). Sensitivity analyses conducted with and without these cases yielded equivalent results; therefore, all data were retained for hypothesis testing. Linearity and homoscedasticity were evaluated by examining scatterplots of residuals. Data appeared randomly and evenly dispersed, consistent with linear relationships and constant variance. No patterns indicative of non-linearity (e.g., curvilinear or cone-shaped distributions) were observed. Finally, normality of residuals was also supported through inspection of P–P plots for all outcome variables.

Measurement Invariance Testing

Confirmatory factor analysis (CFA) using robust maximum likelihood (MLR) and full information likelihood (FIML) procedures in Mplus 8.4 (Muthén & Muthén, 1998-2017) was used to test the longitudinal invariance (i.e., factor structure invariance across 4 time points) of our latent factors [i.e., AS (social concerns subscale), injunctive norms (coping subscale for friend and typical student referent groups), and coping motives]. Model fit was evaluated using established guidelines: a Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) above 0.95 were considered indicative of excellent fit, while values above 0.90 but below 0.95 were deemed acceptable, and scores below 0.90 reflected poor fit (Hu & Bentler, 1999; Marsh et al., 2005). For the Root Mean Square Error of Approximation (RMSEA), values under 0.05 indicated excellent fit, those below 0.08 were viewed as adequate, and values exceeding 0.08 suggested poor model fit (Hu & Bentler, 1999; Marsh et al., 2005).

Measurement invariance was assessed for each latent construct by sequentially testing configural, weak, strong, and strict invariance using the referent indicator method (Millsap, 2011). This involved a stepwise procedure in which additional constraints were imposed at each level. The configural models allowed all factor loadings, intercepts, and residual variances to be freely estimated across time, with factor variances fixed to one and factor means fixed to zero. In the weak invariance models, loadings were constrained to equality across time, while variances were fixed to one at Time 1 and estimated freely at Times 2-4. For strong invariance, item intercepts were held equal over time, and factor means were fixed at zero for Time 1 but freely estimated for Times 2-4. Finally, strict invariance models added constraints on residual

variances across time. These nested models were compared using changes in model fit indices (CFI, TLI, RMSEA), with a decline of ≥ .01 in CFI or TLI or an increase of ≥ .015 in RMSEA indicating a meaningful reduction in fit (Chen, 2007). From our measurement models, latent scores were extracted for hypothesis testing.

Preliminary Latent Curve Models

Prior to testing the hypothesized mediation models, a series of preliminary latent curve models (LCMs) were conducted to identify the most appropriate growth functions for each construct based on comparative fit and parameter interpretability. We tested intercept-only models for our predictors (AS-SC, injunctive norms), and linear models for our outcomes (coping motives, alcohol use, and alcohol problems). LCMs for each variable with the best fit were then used to build the final models for hypothesis testing.

Hypothesis Testing: Latent Growth Curve Models

Full Mediation. Latent growth curve modeling (LGCM) was used to assess the interactive effect of AS-SC and injunctive norms on the longitudinal trajectories of coping motives and subsequent alcohol use and problems. Direct paths from AS-SC, coping injunctive norms, and their interaction effect on alcohol use and problems were fixed to zero, such that only indirect effects through coping motives (mediator) were estimated. Specifically, the slopes of alcohol use and problems were regressed on the slope of coping motives, and the slope of coping motives was regressed on the intercept of AS-SC, the intercept of coping injunctive norms, and the intercept of the interaction term between the intercepts of AS-SC and coping injunctive norms. Two models were run separately, one using coping injunctive norms for *friends*, and one using coping injunctive norms for *typical students*.

Partial Mediation. Given the lack of support for full mediation, the direct effects of AS-SC and coping injunctive norms on alcohol use and problems (i.e., partial mediation) were tested. Specifically, the slopes of alcohol use and problems were regressed on the intercepts of AS and coping injunctive norms, and the interaction between the intercepts of AS and coping injunctive norms. Again, two models were run separately; one using coping injunctive norms for *friends*, and one using coping injunctive norms for *typical students*.

Results

Descriptive Statistics

Descriptive statistics and correlations for all variables are presented in Table 9.

Missing Data

Out of the total sample of 379 participants at T1, 352 participated at T2, 326 participated at T3, and 270 participated at T4. Thus, 270 participants had complete data across the four time points. Of those who participated at each time point, 92 participants (24.27%) omitted at least one full measure at T1, 101 participants (28.69%) at T2, 107 participants (32.82%) at T3, and 93 participants (34.44%) at T4. Participants were not excluded from a time point if they missed a single questionnaire; they were retained as long as they provided responses on at least one of the five measures central to current study hypothesis testing. Participants were only considered to have "incomplete data" at a given time point if they were missing all five focal measures at that time point. Two groups were created to represent participants with complete versus incomplete data. T-tests were then conducted to compare means across groups.

Results suggested that those with complete data did not differ statistically significantly from those with incomplete data in terms of Time 1 measures of AS-SC ($t(361) = -1.24$, $p = .216$), friend injunctive norms ($t(346) = -0.27$, $p = .791$), or typical student injunctive norms ($t(342) = -0.93$, $p = .351$). They also did not differ in terms of biological sex ($t(377) = -.074$, $p = .941$), age ($t(375) = -.143$, $p = .886$), gender ($t(376) = -.159$, $p = .874$), or in terms of self-reported mental health diagnoses (e.g., anxiety, depression, substance use disorder; $t(376) = -1.105$, $p = .270$). However, those with complete data showed a statistically significant difference at Time 1 from those with incomplete data in terms of coping motives ($t(283) = -2.37$, $p = .018$), alcohol use ($t(357) = -3.30$, $p = .001$), and alcohol-related problems ($t(323) = -2.23$, $p = .026$), such that participants with complete data reported lower levels of coping motives ($M = 1.82$), alcohol use ($M = 4.21$), and alcohol-related problems ($M = 3.98$) compared to those with incomplete data ($M = 2.14$, $M = 5.63$, and $M = 5.43$, respectively).

Measurement Invariance Testing

Configural, weak, strong, and strict invariance were tested for each latent construct to see if the factor structure held up across the four time points. Strict invariance was achieved for all our latent factors, and all results are reported in Table 10. The referent indicator method was used to test our most invariant models, and latent factor scores from the final, strict measurement models were extracted for use in hypothesis testing.

Preliminary LCMs

Alcohol use and alcohol-related problems were modeled with linear slopes with equal residuals across waves, coping motives were modeled with linear slopes, and baseline predictors (AS and injunctive norms) were treated as intercept-only latent factors. These selected forms were then retained for the full and partial mediation models.

Hypothesis Testing: Latent Growth Curve Models

Full Mediation

Friends. In the full mediation model with friends as the referent group of interest, AS-SC, injunctive norms, and their interaction (AS-SC × injunctive norms) were specified as prospective predictors of the slope of coping motives, which in turn predicted changes in alcohol use and alcohol-related problems. Results indicated that the intercepts of AS-SC, injunctive norms, and the interaction term were not statistically significant predictors of the slope of coping motives (Table 11). However, the slope of coping motives was a statistically significant predictor of the slope of alcohol problems (Table 11), such that increases in coping motives over time were associated with increases in alcohol problems. Of note, although the parameter estimate reached statistical significance at $p = 0.05$, the 95% CI included zero, suggesting that the effect should be interpreted with caution. All latent covariances among study constructs were statistically significant (Table 13). In contrast, all indirect effects were not statistically significant (see Table 12). That is, the hypothesized mediating role of coping motives on the association between AS-SC and alcohol outcomes as moderated by friend injunctive norms was not supported.

Typical Students. The full mediation model with typical students as the referent group of interest produced a similar pattern. Again, intercepts of AS-SC, injunctive norms, and the interaction term were not statistically significant predictors of the slope of coping motives (Table 11). However, the slope of coping motives was a statistically significant prospective predictor of both the slopes of alcohol use and problems (Table 11), such that increases in coping motives over time were associated with increases in both alcohol use and problems. In addition, all latent covariances among study constructs were statistically significant (Table 13). In contrast, but consistent with the friend injunctive norms model, all indirect effects were not statistically significant (Table 12). That is, the proposed mediating role of coping motives on the association between AS-SC and alcohol outcomes as moderated by injunctive norms was not supported.

Partial Mediation

Friends. To test partial mediation with friends as the referent group, direct paths from the intercepts of AS-SC, injunctive norms, and the AS-SC × injunctive norms interaction term to the slopes of alcohol use and problems were added. The indirect paths through coping motives were retained. As in the test of full mediation, the intercepts of AS-SC, injunctive norms, and the interaction term were not statistically significant predictors of the slope of coping motives (Table 11). Also, consistent with the full mediation model, the slope of coping motives was a positive prospective predictor of alcohol problems, and now also alcohol use (Table 11). Again, the nature of the effect suggests that increases in coping motives over time were associated with increases in both alcohol use and problems. What is also revealed with partial mediation is support for the intercept of injunctive norms as a statistically significant positive predictor of both alcohol use and alcohol problems (Table 11), such that participants who were relatively higher on injunctive norms at baseline subsequently showed greater increases in both alcohol use and problems over time. Indirect effects remained not statistically significant, as in the test of full mediation (Table 12). Significant latent factor covariances were observed, including positive associations between coping motives and both AS and injunctive norms, as well as significant covariances between alcohol use and problems (Table 13).

Typical Students. To test partial mediation with typical students as the referent group, direct paths from intercepts of AS-SC, injunctive norms, and the AS-SC × injunctive norms interaction term to the slopes of alcohol use and problems were added. The indirect paths through coping motives were retained. As in the test of full mediation, the intercepts of AS-SC, injunctive norms, and the interaction term were not statistically significant predictors of the slope of coping motives (Table 11). Also, consistent with the full mediation model, the slope of coping motives was a positive prospective predictor of alcohol use and problems (Table 11). Again, the nature of the effect suggests that increases in coping motives over time were associated with increases in both alcohol use and problems. Notably, unlike the friends model, none of the direct effects of AS-SC, injunctive norms, and their interaction on alcohol use and problems were statistically significant. Indirect effects, as in the test of full mediation remained statistically unsupported (Table 12). Significant latent factor covariances were observed, including positive associations between coping motives and both AS-SC and injunctive norms, as well as significant correlations between alcohol use and problems (Table 13).

Discussion

The goal of the current study was to prospectively test young adult AS-risk for alcohol use and problems, via coping motives, and as moderated by injunctive norms. Specifically, in a sample of first-year university students, we examined whether perceived approval of coping-motivated drinking by friends and typical students moderated the link between the social concern facet of AS (AS-SC; i.e., fear that anxious symptoms will lead to negative social consequences) and changes in alcohol use and problems. We further tested whether these effects were explained by changes in coping motives. Understanding how AS-SC poses risk for alcohol use and problems while considering the impact of coping-related injunctive norms and drinking motives may help inform targeted interventions for young adults to mitigate risk for long-term consequences later in life.

Tests of the Mediated Moderation Hypothesis

The primary hypothesis was that AS-SC would prospectively predict alcohol outcomes through coping motives, as moderated by perceived approval of coping-motivated drinking (injunctive norms). This hypothesis was not supported for either referent group (friends or typical students). Indeed, the indirect pathway from the AS-SC by injunctive norms interaction term through coping motives to alcohol outcomes was not observed, whether under a full mediation model or when direct paths were added in the partial mediation models. These null findings were somewhat surprising given theoretical expectations that young adults with heightened fears of social evaluation would be at elevated risk for drinking to cope, particularly when perceiving their peers as approving of drinking to reduce tension, ease emotional distress, and blunt anxious arousal in social situations. It was further expected that this motivation for drinking would account for, and thus explain, AS-SC risk for elevated alcohol use and associated problems. To clarify where the model diverged from and aligned with these hypotheses, we next examined the direct effects of the AS-SC and injunctive norms on coping motives (front end of the model), as well as the effects of coping motives on drinking outcomes (back end of the model).

Direct Effects of Predictors on the Mediator

Across prospective models, AS-SC, injunctive norms, and their interaction did not predict changes in coping motives, suggesting that AS-SC and injunctive norms did not have first order effects on coping motives and, central to hypotheses, the effect of AS-SC on coping motives was

not contingent on level of injunctive norms. This pattern was consistent across both friends and typical student referent groups. The direct, first order effects of AS-SC and injunctive norms on coping motives were not hypothesized, as the expectation was that perceived approval of drinking to cope would moderate the association between AS-SC and coping motives rather than exert main effects on their own. Accordingly, the absence of significant direct effects is consistent with theoretical expectations. For injunctive norms, the null findings suggest that perceptions of others' approval may shape drinking more directly rather than indirectly through motives, a pattern consistent with prior research showing that norms reliably predict alcohol use but demonstrate weaker or inconsistent links with motives (Borsari & Carey, 2003; Lee et al., 2007). For AS-SC, the null findings may reflect the tendency of individuals high in AS-SC to rely on avoidance-based coping strategies (e.g., withdrawal) rather than approach-oriented strategies such as alcohol use. This is in line with social anxiety research showing null or inverse associations with alcohol outcomes, potentially reflecting disengagement from drinking contexts (Buckner et al., 2006; Gilles et al., 2006; Lewis et al., 2008; Schry & White, 2013). Moreover, other research indicates that drinking context (e.g., solitary vs. social drinking) may determine whether social anxiety leads to increased or decreased alcohol use, with social anxiety linked to more solitary but less social drinking (Buckner & Terlecki, 2016)

Turning to the interactive effect, the hypothesized moderation of AS-SC by injunctive norms on coping motives was also unsupported. Even if individuals high in AS-SC perceive approval of coping-motivated drinking among typical students, they may be too preoccupied with fears of negative consequences to act on such perceptions. Cognitive models of social anxiety suggest that attentional biases toward internal threat cues (e.g., increased heart rate, blushing) limit the processing of external social cues such as peer approval (Amir et al., 2003; Clark & Wells, 1995). Thus, heightened self-focus and internal threat monitoring may impair responsiveness to injunctive norms. Supporting this interpretation, adolescent and emerging adult research indicates that individuals high in internalizing symptoms may be less sensitive to normative influence due to social disengagement (Prinstein & Giletta, 2016).

Direct Effects of Mediator on Outcomes

One core element of the hypothesized model was supported; coping motives themselves predicted increases in alcohol use and problems. This pattern was consistent across models and referent groups, with the exception of alcohol use in the friends model. These findings align with

prior cross-sectional and longitudinal research linking coping-motivated drinking to heavier and more problematic alcohol use (Corbin et al., 2013; Corran et al., 2023; Labhart et al., 2017; Merrill et al., 2014; Park & Levenson, 2002). The present study extends this literature by showing that growth in coping motives over time prospectively predicts escalating alcohol risk, underscoring coping motives as a central mechanism of problematic drinking in emerging adulthood.

Direct Effects of Predictors on Outcomes

When direct paths from predictors to alcohol outcomes were included in the partial mediation models, this allowed for a test of whether AS-SC and injunctive norms – as well as their interaction – predicted alcohol use and problems, independent of coping motives. For AS-SC, no direct effects on alcohol use or problems were observed in either referent group, and there was also no evidence that injunctive norms moderated the effect of AS-SC on alcohol outcomes. Thus, support for the hypothesized moderation pathway was not observed, even when examining outside of the mediation model. This lack of direct or moderated effects is in line with prior work showing that AS is not consistently linked to drinking outcomes. Some studies have found that AS directly predicts alcohol use (e.g., Corran et al., 2023) or problems (e.g., Schmidt, Buckner, et al., 2007), whereas others have not (see Schry & White, 2013 for a review).These inconsistencies suggest that the link between AS and alcohol outcomes is not well defined and may depend on both the AS dimension assessed and the presence of additional moderators. The current findings point to this complexity; a moderator likely plays a role in AS-SC-risk for drinking outcomes, but it does not appear to be injunctive norms, at least as they were measured in the present study. Another explanation lies in the dimensionality of AS itself. In particular, the current study focused on the social concerns facet of AS, which reflects fears of negative social evaluation. Compared to other facets of AS (e.g., physical or cognitive concerns), AS-SC may be less directly linked to drinking and more strongly tied to avoidance-oriented coping and withdrawal from social contexts. Accordingly, it is not surprising that neither direct effects of AS-SC on alcohol outcomes, nor the moderated effect by injunctive norms were observed, despite theoretical expectations that peer approval would amplify AS-SC risk. As discussed earlier, avoidance-oriented coping and reduced engagement in social drinking contexts likely further diminish the likelihood that AS-SC directly predicts alcohol use and problems.

In contrast, distinct patterns emerged for injunctive norms, depending on the referent group. For *friends*, higher perceived approval of coping-related drinking was prospectively associated with greater alcohol use and related problems. This finding underscores the influence of proximal peers and is consistent with prior research showing that approval from close social referents (e.g., friends, parents) exerts a stronger impact on drinking than more distal groups (e.g., typical students, same-aged peers; Borsari & Carey, 2003; Neighbors et al., 2007). Such effects likely reflect young adults' tendency to align their drinking with social expectations in order to gain acceptance and avoid rejection (Prinstein & Dodge, 2008). For *typical students*, however, higher perceived approval of coping-related drinking did *not* predict either alcohol use or problems. These null findings further strengthen the evidence that proximal referents exert a greater influence than distal ones, as found in prior research (LaBrie et al., 2010; Neighbors et al., 2008). In other words, close social relationships seem to be more influential on young adults than broader peer groups such as typical students. This distinction has implications for preventive interventions, which may be most effective when they target proximal social referents, particularly for young adults already at risk for drinking to cope.

Other Significant Associations

Beyond the hypothesized and direct effects described above, several additional associations among study constructs reinforce the broader risk pathways examined in this study. Positive covariances reinforced the interrelatedness of constructs, with positive correlations observed among AS-SC, coping motives, and alcohol outcomes. Means of coping motives were positively associated with alcohol use and problems, further underscoring their role as a robust risk mechanism. Notably, these associations were consistent across referent groups, supporting the stability of these relationships despite the absence of mediated moderation effects.

Strengths, Limitations, and Future Directions

Taken together, the current study provides support for the robust role of coping motives in predicting changes in alcohol outcomes over time, as well as the prospective link between perceived approval (by friends) of drinking to cope and subsequent increases in alcohol use and problems. By capturing growth processes across the transitional first year of university, these findings clarify distinct risk pathways for alcohol use and problems in young adults. They also highlight potential intervention targets – particularly perceived peer approval and coping-related drinking motives – that may help prevent harmful alcohol use and related problems later in life.

The main strength of the current study is our use of a prospective design (four time points, each one month apart) to capture changes in risky drinking patterns during the unique and transitional first year of university. Despite this, we recognize several limitations of this study. First, our sample of women was disproportionately large compared to men, and consisted exclusively of first year university students (albeit by design). Future studies should aim to utilize a more gender-balanced sample that includes same-age young adults who are in a different but equally pivotal transitional stage, such as entering the work force (i.e., characterized by meeting new coworkers, navigating power dynamics, socializing at versus outside of work). Nevertheless, while the findings may not extend to men or young adults outside of the university setting, they offer valuable insight into alcohol use and problems among first year university students who are at a unique and pivotal time in their social development.

Second, the current study had a high attrition rate, with many participants missing data at various time points or not completing the study in full. Although attrition rates from the current study are similar to other web-based studies in the literature (Radtke et al., 2017), future research should employ strategies to increase retention of study participants throughout the entirety of the study. Importantly, results of the missing data analysis suggested that participants with complete data reported lower coping motives and alcohol use and problems at baseline compared to those with incomplete data. This pattern may suggest that individuals with higher-risk profiles were more likely to have missing data, raising concerns that the analytic sample may underrepresent heavier drinkers or those experiencing more alcohol-related problems. Such differences could bias estimates and reduce the ability to fully test the hypothesized model. Nevertheless, to mitigate missing data, FIML was employed which utilized all available information without omitting participants with incomplete data (Enders, 2001; Enders & Bandalos, 2001).

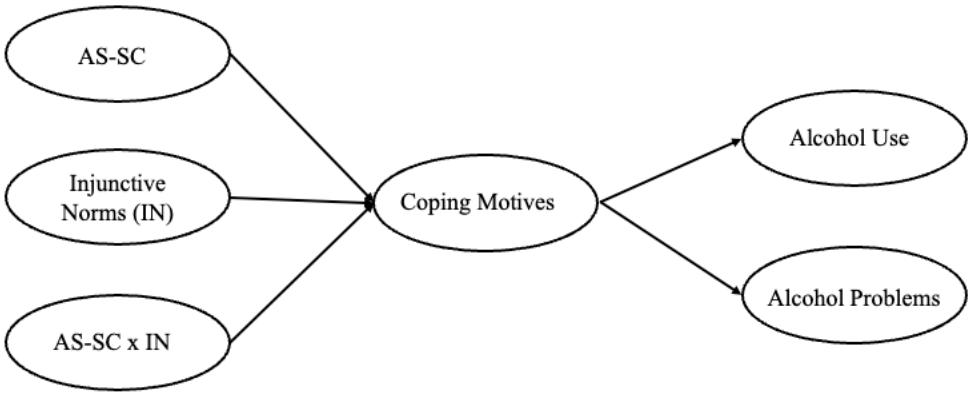
Third, the current study relied exclusively on self-report measures. Although the measures used are empirically sound and widely used in research, they are inherently subject to biases (e.g., social desirability) and recall errors (Latkin et al., 2017), and rely on the assumption that participants have insight into their cognitions and behaviours. Nevertheless, the current study utilized repeated assessments and the extraction of factor scores from tests of measurement invariance across time to minimize measurement error. Moreover, the current study utilized a novel measure, the *Perceived Approval of Risky Drinking Inventory* (PARDI), which was

recently developed and rigorously validated by members of the current research team (Hines et al., 2024).

Conclusion

This prospective study tested whether AS – specifically its social concerns facet – posed risk for alcohol use and problems in young adults through coping motives, moderated by injunctive norms. Findings demonstrated that coping motives predicted increases in alcohol use and problems across referent groups (with the exception of alcohol use in the friends model), and perceived approval of drinking to cope for friends – but not typical students – was associated with greater use and problems. These results clarify distinct developmental risk pathways, suggesting that proximal peer approval and coping-motivated drinking represent particularly salient targets for prevention and intervention. Future research is needed to further examine the role of AS in these pathways, especially given its well-documented links to alcohol outcomes in young adults (Allan et al., 2015; Chinneck et al., 2018; Stewart et al., 1995). By highlighting the mechanisms through which young adults transition into riskier patterns of drinking, this study contributes to aetiological models of alcohol misuse (Comeau et al., 2001; Merrill et al., 2014) and points to clinical strategies – such as addressing injunctive norms and coping motives in cognitive-behavioural interventions – that may help mitigate long-term harms (Borsari & Carey, 2003; Neighbors et al., 2007).

Figure 4. Conceptual Model of Full Mediation



Note. AS-SC = Anxiety Sensitivity - Social Concerns subtype. Injunctive norms (IN) = perceived peer approval of drinking to cope. The latent interaction (AS-SC × Injunctive Norms) and both predictors are specified as predicting Coping Motives, which in turn predict Alcohol Use and Alcohol Problems. Arrows depict hypothesized paths for the full mediation model.

Table 9. Descriptive statistics and correlations for hypothesized model variables at Time 1

Variable	Mean	SD	Skew	Kurt	α	1	2	3	4	5	6
1. AS-SC	1.943	1.002	.217	-.873	.812	-					
2. IN-Fri	3.251	1.421	.354	-.420	.899	.159**	-				
3. IN-Stud	3.835	1.313	-.177	-.256	.909	.083**	.052	-			
4. Coping	1.921	.8944	1.292	1.436	.942	.281**	.276**	.197**	-		
5. Use	4.859	5.507	1.945	5.171	-	.017	.005	.020	.008	-	
6. Problems	4.391	4.671	1.322	1.655	.891	.117*	.054	.065	.263**	.333**	-

Note. M = mean; SD = standard deviation; α = Cronbach's alpha; AS-SC = anxiety sensitivity (social concerns); IN-Fri = perceived approval of drinking to cope for friends (injunctive norms); IN-Stud = perceived approval of drinking to cope for students (injunctive norms); Use alcohol use; Problems = alcohol problems. * $p < .05$, ** $p < .01$.

Table 10. Model Fit Indices Associated with the Measurement Models

Description	χ^2 (*df*)	CFI	TLI	RMSEA	90% CI	CM	$\Delta\chi^2$ (*df*)	ΔCFI	ΔTLI	ΔRMSEA
Anxiety Sensitivity – Social Concerns										
M1. Configural	241.970 (210)*	.993	.991	.020	[.000; .031]	-				
M2. Weak	271.781 (225)*	.990	.987	.023	[.010; .033]	M1	26.991 (15)	-.003	-.004	+.003
M3. Strong	282.337 (231)*	.989	.986	.024	[.012; .033]	M2	9.654 (6)	-.001	-.001	+.001
M4. Strict	329.446 (240)*	.980	.977	.031	[.022; .039]	M3	43.292 (9)	-.009	-.009	+.007
Injunctive Norms (Friends) -- Coping										
M1. Configural	572.446 (210)*	.916	.889	.068	[.061; .075]	-				
M2. Weak	594.503 (225)*	.914	.895	.066	[.060; .073]	M1	25.501 (15)	-.002	+.006	-.002
M3. Strong	621.744 (240)*	.911	.898	.065	[.059; .072]	M2	22.073 (15)	-.003	+.003	-.001
M4. Strict	649.271 (258)*	.909	.903	.064	[.058; .070]	M3	14.550 (18)	-.002	+.005	-.001
Injunctive Norms (Typical Students) -- Coping										
M1. Configural	467.038 (210)*	.939	.920	.057	[.050; .064]	-				
M2. Weak	490.565 (225)*	.937	.923	.056	[.049; .063]	M1	26.910 (15)	-.002	+.003	-.001
M3. Strong	514.618 (240)*	.935	.925	.055	[.049; .062]	M2	24.580 (15)	-.002	+.002	-.001
M4. Strict	528.818 (258)*	.936	.931	.053	[.047; .059]	M3	8.233 (18)	+.001	+.006	-.002
Coping Motives										
M1. Configural	1728.236 (830)	.906	.893	.053	[.050; .057]	-				
M2. Weak	1755.667 (860)	.907	.897	.052	[.049; .056]	M1	20.864 (30)	+.001	+.004	-.001
M3. Strong	1825.142 (890)	.902	.896	.053	[.049; .056]	M2	53.821 (30)	-.005	-.001	+.001
M4. Strict	1937.193 (923)	.894	.892	.054	[.050; .057]	M3	65.640 (33)	-.008	-.004	+.001

Note. * $p < .01$; χ^2: WLSMV chi-square test of exact fit; *df*: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval; CM: Comparison model; and Δ: Change in fit relative to the CM.

Table 11. Parameter Estimates of Direct Effects for Tests of Full and Partial Mediation Models

Path	B	*SE*	*p*	LL (2.5%)	UL (2.5%)
Full mediation					
Friends					
IAS-SC → SCOPE	-0.004	0.006	0.471	-0.016	0.007
IFIN → SCOPE	0.010	0.007	0.152	-0.004	0.025
IAS-SC×IFIN → SCOPE	0.001	0.009	0.912	-0.016	0.018
SCOPE → SUSE	6.650	3.912	0.089	-1.018	14.318
SCOPE → SPROB	**10.195**	**5.205**	**0.050**	**-0.007**	**20.397**
Students					
IAS-SC → SCOPE	-0.002	0.006	0.727	-0.014	0.010
ISIN → SCOPE	-0.009	0.008	0.298	-0.025	0.008
IAS-SC×ISIN → SCOPE	0.002	0.007	0.814	-0.013	0.016
SCOPE → SUSE	**6.906**	**2.731**	**0.011**	**1.553**	**12.260**
SCOPE → SPROB	**9.651**	**4.229**	**0.022**	**1.363**	**17.940**
Partial mediation					
Friends					
IAS-SC → SCOPE	-0.005	0.010	0.629	-0.024	0.014
IFIN → SCOPE	-0.022	0.013	0.079	-0.047	0.003
IAS-SC×IFIN → SCOPE	0.005	0.015	0.747	-0.025	0.035
SCOPE → SUSE	**4.826**	**2.380**	**0.043**	**0.160**	**9.491**
IAS-SC → SUSE	-0.008	0.104	0.942	-0.212	0.196
IFIN → SUSE	**0.341**	**0.141**	**0.016**	**0.064**	**0.618**
IAS-SC×IFIN → SUSE	0.022	0.093	0.812	-0.160	0.204
SCOPE → SPROB	**8.187**	**3.187**	**0.010**	**1.941**	**14.432**
IAS-SC → SPROB	-0.002	0.096	0.980	-0.191	0.186
IFIN → SPROB	**0.413**	**0.151**	**0.006**	**0.117**	**0.710**
IAS-SC×IFIN → SPROB	-0.064	0.136	0.639	-0.331	0.203
Students					
IAS-SC → SCOPE	-0.006	0.010	0.520	-0.026	0.013
ISIN → SCOPE	-0.022	0.013	0.093	-0.047	0.004
IAS-SC×ISIN → SCOPE	0.014	0.013	0.278	-0.011	0.040
SCOPE → SUSE	**7.170**	**2.969**	**0.016**	**1.350**	**12.990**
IAS-SC → SUSE	0.055	0.126	0.665	-0.192	0.302
ISIN → SUSE	0.083	0.162	0.608	-0.235	0.401
IAS-SC×ISIN → SUSE	-0.076	0.118	0.523	-0.308	0.156
SCOPE → SPROB	**10.818**	**4.256**	**0.011**	**2.476**	**19.160**
IAS-SC → SPROB	0.064	0.127	0.615	-0.186	0.314
ISIN → SPROB	0.229	0.182	0.208	-0.128	0.587
IAS-SC×ISIN → SPROB	-0.190	0.168	0.257	-0.518	0.138

Note. Paths statistically supported by 95% CI are bolded. SCOPE = slope of coping motives; IAS-SC = intercept of anxiety sensitivity (social concerns); IFIN = intercept of perceived approval of drinking to cope for friends (injunctive norms); SUSE = slope of alcohol use; SPROB = slope of alcohol problems; ISIN = intercept of perceived approval of drinking to cope for students (injunctive norms).

Table 12. Parameter Estimates of Indirect Effects for Tests of Full and Partial Mediation Models

Effect Label	B	SE	p	LL (2.5%)	UL (2.5%)
Full mediation					
Friends					
AS-SC_COPE_USE	-0.029	0.037	0.439	-0.102	0.044
FIN_COPE_USE	0.070	0.078	0.369	-0.083	0.222
ASxFIN_COPE_USE	0.006	0.058	0.913	-0.108	0.120
AS-SC_COPE_PROB	-0.044	0.058	0.446	-0.159	0.070
FIN_COPE_PROB	0.107	0.107	0.318	-0.103	0.317
ASxFIN_COPE_PROB	0.010	0.086	0.910	-0.158	0.177
Students					
AS-SC_COPE_USE	-0.015	0.041	0.720	-0.094	0.065
SIN_COPE_USE	-0.059	0.054	0.269	-0.164	0.046
ASxSIN_COPE_USE	0.012	0.052	0.817	-0.090	0.115
AS-SC_COPE_PROB	-0.020	0.056	0.718	-0.131	0.090
SIN_COPE_PROB	-0.083	0.067	0.217	-0.214	0.049
ASxSIN_COPE_PROB	0.017	0.068	0.249	-0.117	0.151
Partial mediation					
Friends					
AS-SC_COPE_USE	-0.023	0.047	0.629	-0.116	0.070
FIN_COPE_USE	-0.108	0.081	0.186	-0.267	0.052
ASxFIN_COPE_USE	0.024	0.076	0.754	-0.125	0.172
AS-SC_COPE_PROB	-0.039	0.083	0.638	-0.201	0.123
FIN_COPE_PROB	-0.183	0.126	0.148	-0.430	0.065
ASxFIN_COPE_PROB	0.040	0.128	0.753	-0.210	0.290
Students					
AS-SC_COPE_USE	-0.046	0.074	0.535	-0.190	0.099
SIN_COPE_USE	-0.154	0.112	0.166	-0.373	0.064
ASxSIN_COPE_USE	0.102	0.107	0.342	-0.108	0.312
AS-SC_COPE_PROB	-0.069	0.114	0.545	-0.292	0.154
SIN_COPE_PROB	-0.233	0.168	0.165	-0.562	0.096
ASxSIN_COPE_PROB	0.153	0.161	0.340	-0.162	0.469

Note. AS-SC = anxiety sensitivity (social concerns); COPE = coping motives; FIN = perceived approval of drinking to cope for friends (injunctive norms); SIN = perceived approval of drinking to cope for students (injunctive norms); USE = alcohol use; PROB = alcohol problems; ISIN = intercept of perceived approval of drinking to cope for students (injunctive norms); ASxFIN = interaction term for AS-SC and FIN; ASxSIN = interaction term for AS-SC and SIN.

Table 13. Latent Covariances for Full and Partial Mediation Models

Covariance	B	*SE*	*p*	LL (2.5%)	UL (2.5%)
Full mediation					
Friends					
IAS-SC WITH IFIN	0.105	0.039	0.007	0.029	0.181
IAS-SC WITH ICOPE	0.280	0.043	0.000	0.196	0.364
IFIN WITH ICOPE	0.276	0.043	0.000	0.191	0.360
SCOPE WITH ICOPE	0.027	0.009	0.003	0.009	0.045
IUSE WITH SUSE	0.775	0.144	0.000	0.493	1.058
IPROB WITH SPROB	0.414	0.112	0.000	0.195	0.634
SUSE WITH SPROB	0.334	0.114	0.003	0.110	0.558
Students					
IAS-SC WITH ISIN	0.083	0.041	0.040	0.004	0.162
IAS-SC WITH ICOPE	0.280	0.043	0.000	0.196	0.364
ISIN WITH ICOPE	0.197	0.042	0.000	0.116	0.279
SCOPE WITH ICOPE	0.031	0.007	0.000	0.017	0.046
IUSE WITH SUSE	0.775	0.144	0.000	0.494	1.057
IPROB WITH SPROB	0.411	0.115	0.000	0.186	0.637
SUSE WITH SPROB	0.333	0.108	0.002	0.122	0.544
Partial mediation					
Friends					
IAS-SC WITH IFIN	0.105	0.039	0.007	0.029	0.181
IAS-SC WITH ICOPE	0.287	0.044	0.000	0.201	0.373
IFIN WITH ICOPE	0.312	0.045	0.000	0.223	0.401
ICOPE WITH SCOPE	0.031	0.007	0.000	0.017	0.045
IUSE WITH SUSE	0.783	0.145	0.000	0.498	1.067
IPROB WITH SPROB	0.414	0.110	0.000	0.198	0.629
SUSE WITH SPROB	0.293	0.092	0.002	0.112	0.474
Students					
IAS-SC WITH ISIN	0.083	0.041	0.040	0.004	0.163
IAS-SC WITH ICOPE	0.287	0.044	0.000	0.201	0.373
ISIN WITH ICOPE	0.215	0.044	0.000	0.128	0.301
ICOPE WITH SCOPE	0.029	0.008	0.000	0.014	0.044
IUSE WITH SUSE	0.777	0.143	0.000	0.496	1.058
IPROB WITH SPROB	0.412	0.113	0.000	0.190	0.634
SUSE WITH SPROB	0.341	0.113	0.003	0.120	0.563

Note. SCOPE = slope of coping motives; ICOPE = intercept of coping motives; IAS-SC = intercept of anxiety sensitivity (social concerns); IFIN = intercept of perceived approval of drinking to cope for friends (injunctive norms); SUSE = slope of alcohol use; IUSE = intercept of alcohol use; SPROB = slope of alcohol problems; IPROB = intercept of alcohol problems; ISIN = intercept of perceived approval of drinking to cope for students (injunctive norms).

CHAPTER 7: General Discussion

This program of research was aimed at extending and refining our understanding of AS as a transdiagnostic risk factor for alcohol use and related problems in young adults. Research has consistently shown that AS contributes to heightened emotional reactivity and subsequent maladaptive coping behaviours, including drinking to cope (Allan et al., 2015; Chandley et al., 2014; DeMartini & Carey, 2011). Existing theoretical frameworks, including tension reduction theory (Greeley & Oei, 1999) and the theory of planned behaviour (Ajzen, 1991), have provided a foundation for understanding how individual vulnerabilities can translate into risky young adult drinking. Yet, key aspects remain underexplored and lack empirical consistency. Therefore, this dissertation investigated how AS contributes to alcohol use and problems in young adulthood, with a focus on injunctive norms, perceived stress, and drinking motives in the risk trajectory. Across three complementary studies, the work tested this model at varying levels of analysis and in differing contexts. Findings consistently supported the relevance of coping motives in explaining AS-risk for alcohol use and problems and highlighted the role of perceived peer approval in shaping these behaviours.

Study 1 established that AS leads to alcohol use and problems as explained by drinking motives and perceived stress, thereby highlighting intrapersonal cognitive-affective mechanisms during the unique context of the COVID-19 pandemic. Building on this, Study 2 shifted focus to social influences by examining how AS relates to injunctive norms (perceived approval of risky drinking from various referent groups) and subsequent alcohol outcomes using a person-centered, longitudinal design with young adults transitioning to university. To deepen our understanding of how internal vulnerabilities and external social influences jointly shape alcohol risk, Study 3 examined coping motives as a potential mediator of the interactive effects of AS and injunctive norms on alcohol use and problems over time. A latent growth curve model was employed to capture these dynamic processes across the first year of university, with a particular focus on the *social concern subtype* of AS. Together, these studies progress from examining internal vulnerabilities to social-contextual perceptions, and finally their dynamic interplay over time, offering a comprehensive view of alcohol risk during young adulthood.

Summary of Findings

Study 1

During the early-to-mid stages of the COVID-19 pandemic (May 2020-April 2021), young adult participants ($N = 221$) completed three online questionnaires at six-month intervals assessing AS, perceived stress, drinking motives, and alcohol use and problems. Mediation analyses showed that AS positively predicted alcohol-related problems through increased coping motives, and alcohol use though enhancement/sociability motives. Perceived stress was positively associated with coping motives and partially accounted for the link between AS and enhancement/sociability motives in predicting alcohol use. However, it did not explain the AS-coping-alcohol use pathway as expected, suggesting instead that individuals high in AS may be at elevated risk for drinking to cope and subsequent alcohol problems regardless of their perceived stress. The pandemic context provided a unique opportunity to observe these internal risk processes, illustrating how heightened stress and reduced social contact may amplify negative reinforcement pathways central to motivational models of alcohol use. In sum, Study 1 demonstrated that AS operates as a transdiagnostic vulnerability that shapes alcohol risk primarily through internal affect-regulation pathways, underscoring motives as a central mechanism in the broader AS-alcohol risk model.

Study 2

Final-year CEGEP students ($N = 164$) completed three online questionnaires at six-month intervals assessing AS, injunctive norms, alcohol use, and alcohol-related problems. Confirmatory factor analyses supported the factor structure, composite reliability, and measurement invariance (over time for injunctive norms and alcohol-related problems, and across referent group for injunctive norms) of the latent factors. Latent profile analyses identified three stable profiles (across three time points) of injunctive norms characterized by mixed levels of perceived approval across referent groups (friends, typical students, parents). The three profiles identified were: a *Mixed Tolerance* profile (high approval from typical students, neutral from friends, and low from parents), a *Low Tolerance* profile (low approval across referents), and a *High Tolerance* profile (high approval for typical students and friends, and neutral approval from parents). Profile membership showed moderate to high stability over time, with transitions most common between *Mixed* and *Low* Tolerance profiles. Higher AS predicted greater likelihood of belonging to the *High Tolerance* profile versus the *Low Tolerance* profile.

Unexpectedly, individuals in the *Mixed Tolerance* profile consumed less alcohol and reported fewer alcohol-related problems than those in the *Low* or *High Tolerance* profiles. The *Low* and *High Tolerance* profiles were both associated with some level of risk for alcohol outcomes. Situated within the developmental transition to university, these findings demonstrated the nature and stability of injunctive norm profiles and highlighted how individual vulnerabilities and social-contextual perceptions converge to shape alcohol outcomes. Together, they extend the AS-alcohol risk model beyond individual processes to include normative perceptions and reinforce the impact of social learning perspectives on risky drinking.

Study 3

First-year undergraduate students ($N = 270$) completed online questionnaires four times, at one-month intervals, assessing AS, injunctive norms (for drinking to cope), coping motives, alcohol use, and alcohol-related problems. Confirmatory factor analyses supported the measurement invariance over time of injunctive norms and drinking motives. Latent growth curve models showed that increases in coping motives positively predicted increases in alcohol use and problems over time. Injunctive norms for friends and typical students also positively predicted alcohol outcomes. Contrary to hypotheses, the interaction between the social concern subtype of AS (AS-SC) and injunctive norms for drinking to cope did not significantly predict alcohol use or problems via coping motives. Situated within the developmental context of first year of undergraduate studies, these findings reinforced coping motives as central mechanisms linking AS to alcohol outcomes. They also clarified that perceived peer approval may shape alcohol outcomes more directly, rather than by moderating the link between AS-SC and coping motives. This refined the conceptual model and aligning with the theory of planned behaviour's emphasis on direct normative influences on behaviour.

Strengths, Limitations, and Future Directions

Despite its notable contributions, this dissertation has several limitations. First, all three studies relied exclusively on self-report measures. Although the instruments used were psychometrically validated, self-report data are inherently susceptible to recall bias, where participants may inaccurately remember past experiences (Bradburn et al., 1987), and to social desirability bias, where responses may be shaped by the motivation to present oneself favourably (Latkin et al., 2017). Such biases can attenuate or inflate associations between psychological constructs and alcohol-related outcomes. Future research could reduce these limitations by

incorporating multi-method, objective approaches. Examples include implicit association measures of alcohol-related attitudes (Ostafin & Palfai, 2006), physiological indices of anxiety (e.g., heart rate variability, skin conductance; Feldner et al., 2006; Thayer et al., 2012), and alcohol intoxication (e.g., breathalysers). Utilizing diary-based methods such as ecological momentary assessment could also allow for in-vivo measures of alcohol use and real-time reporting of perceptions and coping behaviours, for example. Combining self-reports with these methods would strengthen construct and ecological validity and provide a more comprehensive understanding of the processes linking AS to alcohol risk.

Second, the samples across studies were composed primarily of CEGEP/undergraduate students, who – depending on the study – were primarily women and of White/European background. While the young adult developmental period is marked by elevated alcohol consumption and related harms (White & Hingson, 2013), the homogeneity of the sample limits the generalizability of findings to non-student populations, older adults, and individuals from different cultural, socioeconomic, and occupational backgrounds. Given that patterns of alcohol use and coping motives may differ across life stages and social contexts (Kuntsche et al., 2005; Maggs & Schulenberg, 2004; Patrick & Terry-McElrath, 2017), future research should examine whether these associations generalize to more diverse and representative samples. Recruiting from community settings, workplaces, or treatment programs could clarify whether the AS-alcohol risk pathway generalizes beyond the university context to other populations.

Third, although Study 2 employed three waves and Study 3 employed four – an improvement over the more common two-wave designs – adding further measurement points would be valuable. More measurement points would provide greater insight into whether the observed patterns persist over time, such as throughout the entire undergraduate period and further into adulthood. Developmental research has emphasized that young adulthood represents a pivotal period for the onset and escalation of alcohol use and related problems (Merline et al., 2008; Schulenberg & Maggs, 2002). Consequently, examining longer time spans with more frequent assessments would enhance our understanding of both stability and change in these associations, and allow for the examination of longer-term consequences.

Fourth, although the statistical models employed in this program of research were both comprehensive and conceptually grounded, not all proposed associations were supported. Specifically, the lack of support for injunctive norms moderating the AS-alcohol outcome

pathway in Study 3 raises questions about the nature of moderation effects, suggesting the need for further research into additional *moderators*. For example, more proximal moderators such as alcohol expectancies (O'Connor et al., 2008), perceived control of anxiety (Kearns et al., 2018), state anxiety (Torres & Mata-Greve, 2017), negative urgency (Keough et al., 2015), psychological distress (Cable & Sacker, 2007), and emotion regulation (Chandley et al., 2014) could help better characterize the risk pathway while increasing generalizability of results. Similarly, only a limited range of potential *mediators* in the AS–alcohol pathway was examined in this program of research. Although perceived stress and drinking motives were found to be key mechanisms of risk, other processes such as emotion regulation (including cognitive reappraisal and suppression; Aldao et al., 2010; Gross & John, 2003; Paulus et al., 2017), and generalized anxiety and depression (Allan et al., 2015; Kushner et al., 2001; Lechner et al., 2014) may also play critical roles. Importantly, examining a broader set of moderators and mediators may clarify for whom and under what conditions AS confers the greatest risk (Conrod et al., 2013; DeMartini & Carey, 2011), while also identifying specific psychological processes that represent viable intervention targets (Allan et al., 2015; Lechner et al., 2014). In doing so, future work can help bridge theoretical frameworks of AS, self-regulation, and substance use, leading to more comprehensive and clinically meaningful models of alcohol risk during young adulthood.

Despite these limitations, a key strength of this dissertation is its multi-method, longitudinal approach. By employing cross-sectional, person-centered, and latent growth modeling techniques across three studies, this program of research provided a robust and nuanced picture of AS-risk for alcohol use and problems among young adults in different contexts (i.e., pre-pandemic CEGEP students, young adults during the pandemic, and first-year university students after the pandemic). The use of a person-centered approach in Study 2 offers novel insights into how combinations of perceived norms co-occur and relate to AS and alcohol use. Similarly, the longitudinal designs of Studies 2 and 3 allow for inferences about temporal ordering and change over time, addressing limitations of prior cross-sectional work. This dissertation also advances the literature by differentiating between referent groups in the measurement of injunctive norms, and with the use of a novel and robust measure (PARDI; Hines et al., 2024). This level of specificity is often overlooked but is crucial given evidence that norms from close others (e.g., friends) often exert greater influence on behaviour than those from

distal groups (Hines et al., 2024; Neighbors et al., 2008). This methodological refinement enhances the ecological validity of the findings and points to important directions for future research.

Theoretical Implications

The findings from this dissertation contribute meaningfully to theoretical models of alcohol use risk in young adulthood. They advance our understanding of how AS – a transdiagnostic cognitive-affective risk factor for alcohol misuse – interacts with motivational and social-contextual processes to influence alcohol use and related problems. Across the three studies, results both support and refine existing frameworks such as tension reduction theory (e.g., Cappell & Herman, 1972; Greeley & Oei, 1999), motivational models of alcohol use (e.g., Cooper et al., 1995; Cox & Klinger, 1988), social norms theory (Berkowitz, 2004), and theory of planned behaviour (Ajzen, 1991), offering nuanced insights into the complex pathways that link AS to risky young adult drinking.

First, Study 1 provided evidence that AS is linked to alcohol-related problems primarily through coping motives, consistent with tension reduction and self-medication theories (Cappell & Herman, 1972; Khantzian, 1985). This corroborates extant theoretical and empirical work suggesting that those high in AS may be motivated to use alcohol to alleviate distress arising from heightened sensitivity to anxious symptoms (Corran et al., 2023; Stewart et al., 1999). The link observed between enhancement/sociability motives and alcohol use also underscores the multifaceted nature of drinking motives, suggesting that AS may not only contribute to negative reinforcement-driven drinking but also to positive reinforcement pathways during periods of elevated stress, such as the COVID-19 pandemic. This dual pathway perspective enriches motivational models (Cooper, 1994; Cox & Klinger, 1988), highlighting that high AS individuals may engage in drinking for both relief and pleasure.

The unique social and environmental context of the pandemic in Study 1, marked by reduced peer interaction and increased isolation, likely constrained the influence of social factors on alcohol outcomes. To address this, Study 2 incorporated injunctive norms – perceptions of approval of risky drinking by parents, friends, and typical students – as key social-contextual factors in the AS–alcohol risk pathway. Using a longitudinal, person-centered approach, this study identified distinct and stable injunctive norm profiles. This finding offered theoretical refinement to the theory of planned behaviour's (Ajzen, 1991) social norms component by

showing that such perceptions may represent enduring cognitive structures rather than transient situational appraisals. Importantly, AS predicted profile membership, suggesting that anxiety-related cognitive biases may extend into the social-evaluative domain, shaping how individuals perceive others' drinking attitudes. By linking AS to specific profiles of injunctive norms and demonstrating their downstream influence on alcohol use and problems (i.e., can exacerbate or mitigate risk), Study 2 advances social norms models and aetiological frameworks of young adult drinking. In turn it highlights how internal vulnerabilities and external social influences jointly shape risk trajectories.

Furthermore, this dissertation advances transdiagnostic models of psychopathology (Dalgleish et al., 2020; Krueger & Eaton, 2015). It demonstrated that AS's influence on alcohol use is not confined to anxiety disorders as discrete categories but operates through underlying affective and cognitive vulnerabilities that intersect with social learning mechanisms. Moreover, Study 3's focus on the social concern subtype of AS – characterized by heightened fear of negative evaluation – refines the theoretical model by pinpointing which aspects of AS may be particularly salient for susceptibility to peer influence and coping-motivated drinking during the transition to university. This subtype-specific approach encourages future research to move beyond global AS constructs and investigate nuanced pathways by which different AS facets interact with social environments to influence alcohol outcomes. Additionally in Study 3, the mixed support for some hypothesized moderation effects highlights the complexity of the AS-alcohol risk pathway and the potential role of additional moderators and mediators (discussed previously). These findings invite refinement of existing theoretical models of young adult alcohol misuse to incorporate broader, multi-level influences and temporal dynamics, moving toward more ecologically valid and developmentally sensitive frameworks.

Clinical Implications

The findings from this program of research lend themselves to implications for prevention and intervention strategies targeting alcohol misuse in young adulthood, particularly among individuals with elevated AS. Across the three studies, AS consistently emerged as a transdiagnostic risk factor for both alcohol use and related problems via multiple pathways, including coping and enhancement/sociability motives and social-contextual factors such as injunctive norms. These results suggest that prevention and intervention strategies would be most effective by addressing not only the behavioural manifestations of risky drinking (e.g., binge

drinking) but also the underlying cognitive-affective and motivational vulnerabilities and broader social-normative environments that can amplify or mitigate risk.

The role of coping motives in AS-risk for alcohol problems supports the use of transdiagnostic treatments that target maladaptive emotion regulation, such as Cognitive Behavioral Therapy (CBT; Beck et al., 2024; Beck, 2020; Hofmann et al., 2012) and Acceptance and Commitment Therapy (ACT; Hayes et al., 2006; Hayes et al., 2011; Ruiz, 2010). AS-specific CBT protocols, which reduce catastrophic interpretations of anxious sensations, may be particularly beneficial for high-AS individuals, lowering the perceived need to drink for tension reduction/relief. Similarly, targeting specific subtypes of AS may improve effectiveness of clinical intervention. For young adults high in social concern, for example, intervention elements such as social skills training, exposure-based exercises for feared social situations, and psychoeducation about normative misperceptions may be especially impactful. These could reduce both social anxiety symptoms and perhaps susceptibility to perceived approval of risky drinking. Motivational Interviewing techniques could further strengthen these interventions by addressing ambivalence toward change, particularly for individuals who also drink for enhancement and/or sociability reasons.

Findings pertaining to distinct injunctive norm profiles may also inform more widespread psychoeducational initiatives like Personalized Normative Feedback (PNF; see Saxton et al., 2021, for review). Traditional PNF approaches (e.g., disseminating graphics and charts reporting on actual alcohol consumption at a given university) could be adapted to also include information about approval of risky drinking across multiple referent groups simultaneously, rather than focusing exclusively on peers. This may be particularly important for high-AS individuals whose drinking-related decision-making is especially sensitive to perceptions of social approval. Relatedly, embedding prevention within campus health and wellness infrastructures could increase accessibility and reduce stigma. Group-based coping skills workshops and peer-led information sessions (e.g., psychoeducation on the negative consequences of risky alcohol use) could also enhance reach and reduce risk. Leveraging peer influence positively – through mentorship programs, student organizations, and peer groups – may further strengthen prevention initiatives and counteract pro-drinking normative pressures or implicit messaging.

Finally, the stability of norm profiles across the first year of university underscores the importance of delivering prevention programs *early* in transitional periods. Interventions implemented during orientation or the initial semester could target both maladaptive perceived norms and poor coping strategies (i.e., managing anxiety with the use of substances), potentially mitigating the consolidation or solidification of risky drinking patterns. Thus, findings from this program of research underscore both the *timing* of preventive intervention (i.e., as soon as possible) as well as the *content* (e.g., adaptive coping skills training) that is delivered and *to who* (e.g., high-AS individuals).

Conclusion

The overarching goal of this program of research was to clarify AS-risk for young adult alcohol use and problems by integrating cognitive-affective processes with social-contextual influences. Future research is needed to continue clarifying the unique and evolving risk trajectories during this critical developmental period. Nevertheless, this dissertation advances aetiological models of young adult alcohol use by demonstrating that AS functions within an interconnected system of motivational, cognitive, and social-contextual processes that jointly influence alcohol use and problems. By utilizing both variable- and person-centered approaches, this program of research demonstrated heterogeneity in risk trajectories and the persistence of social-cognitive patterns over time. Theoretically, this work refines existing models by illustrating that AS not only drives intrapersonal coping processes but also shapes social-normative perceptions, aligning with and extending tension reduction theory, motivational models, and the theory of planned behaviour. Clinically, it points to the need for integrated prevention and intervention strategies that address maladaptive cognitive appraisals and social perceptions, as well as risky motivational patterns, especially during critical developmental periods and transitions.

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APPENDIX A: Supplementary Material for Study 2

Supplementary Material For:

A Longitudinal Person-Centered Analysis of Anxiety Sensitivity Risk for Young Adult Alcohol Misuse: Examining the Role of Injunctive Norms

Authors' note:

These online technical appendices are to be posted on the journal website and hot-linked to the manuscript. If the journal does not offer this possibility, these materials can alternatively be posted on one of our personal websites (we will adjust the in-text reference upon acceptance).

We would also be happy to have some of these materials brought back into the main manuscript or included as published appendices if you deem it useful. We developed these materials to provide additional technical information and to keep the main manuscript from becoming needlessly long.

Preliminary Measurement Models

Specification

Preliminary measurement models were estimated in Mplus 8.9 (Muthén & Muthén, 2023) using the Weighted Least Square estimator with Mean and Variance adjusted statistics (WLSMV) to account for the ordinal nature and asymmetric response thresholds of the rating scales used to assess our constructs (Finney & DiStefano, 2013). At each time point, missing responses obtained at the item level Time 1: 0% to 8.18%, M = 1.8%; Time 2: 2.17% to 11.59%, M = 5.90%; Time 3: 0.78% to 11.63%, M = 5.56%) were handled using the standard procedures implemented for WLSMV estimation in Mplus which allowed us to retain all participants (Asparouhov & Muthén, 2010). However, WLSMV estimation is less efficient at handling missing data related to attrition than the Full Information Maximum Likelihood (FIML) procedures implemented in our main analyses (Enders, 2023). Accordingly, time-specific factor scores were only saved for those who participated at the target time points, which allowed us to rely on FIML to handle attrition in our main analyses.

Due to the complexity of our complete measurement models, these tests were conducted separately for the injunctive norms measure and for the other multi-item measures (anxiety sensitivity and alcohol-related problems). For the injunctive norms measure, we relied on a confirmatory factor analytic (CFA) representation including three factors at each time points to reflect participants' perceptions of the injunctive norms held by typical students from their institution, their friends, and their parents (i.e., a single factor combining their perceptions of the mother and father injunctive norms, based on evidence of high correlations between them: r = .718 at Time 1, .749 at Time 2, and .876 at Time 3). These models incorporated *a priori* correlated uniquenesses at each time point to account for identical wording of items used to represent participants' injunctive norms of their mother, father, friends, and typical students (Marsh et al., 2013; Morin et al., 2020). Within each time point, we conducted tests of measurement invariance to verify whether the items used to represent the perceptions of approval by all four referents (over mother, father, friends, and typical students) were able to capture similar constructs. These tests were conducted in the following sequence (Millsap, 2011): (1) configural invariance; (2) weak invariance (factor loadings); (3) strong invariance (response thresholds); (4) strict invariance (item uniquenesses); (5) invariance of the latent variances and covariances; and (6) invariance of the latent means. Next, the three time-specific models were

combined into a single longitudinal model to assess measurement invariance of ratings across referents and time points, following the same sequence. In these longitudinal models, another set of *a priori* correlated uniquenesses were included to account for parallel wording of matching indicators over time (Marsh et al., 2013; Morin et al., 2020).

For the other measures, we also relied on a CFA specification, and estimated one global model. This model included three correlated factors representing alcohol-related problems at Time 1, Time 2, and Time 3, as well as a bifactor-CFA (Morin et al., 2020) representation of anxiety sensitivity at Time 1. The decision to rely on a bifactor-CFA specification of anxiety sensitivity is based on empirical evidence supporting the superiority of this type of representation for this construct (e.g., Ebesutani et al., 2014; Osman et al., 2010; Reise et al., 2010). This representation made it possible to estimate one global anxiety sensitivity factor (G-factor) from all items included in our measure of anxiety sensitivity (for use as our predictor in our main analyses), while accounting for the presence of subscale specificity (S-factors) left unexplained by the G-factor. These orthogonal S-factors reflected participants' specific level of AS relating to physical, cognitive, and social concerns (i.e., the three ASI subscales). This model included a priori correlated uniquenesses to account for parallel wording of matching indicators over time (Marsh et al., 2013; Morin et al., 2020), and was used to test invariance of the measure of alcohol-related problems over time.

The fit of all models was examined using the comparative fit index (CFI; excellent fit ≥ .95; acceptable fit ≥ .90), the Tucker-Lewis index (TLI: excellent fit ≥ .95; acceptable fit ≥ .90), and the root mean square error of approximation (RMSEA; excellent fit ≤. 06; acceptable fit ≤.08) with its 90% confidence interval (e.g., Hu & Bentler, 1999; Marsh et al., 2005; Yu, 2002). For tests of measurement invariance, model comparisons relied on an examination of change (Δ) in these fit indices, where decreases in CFI/TLI ≤ .01 and increases in RMSEA ≤. 015 between one model and the next were taken to support measurement invariance (Chen, 2007; Cheung & Rensvold, 2002). We also report McDonald's (1970) omega (ω) as an estimate of the composite reliability of each factor.

Results

Measurement model fit results are reported in Table S1 of this document. For all constructs,-results supported the configural, weak, strong, and strict invariance (as none of these steps ever resulted in a decrease in model fit superior to the recommended guidelines). The

results also supported invariance of the latent variances, covariances, and means of the alcohol-related problems measure over time, but revealed differences across referent groups in terms of latent variance and means for the injunctive norms measure. More precisely, the variance associated with the parental injunctive norms factor was two times higher at Times 2 and 3 (2.073) than at Time 1 and for the other referents over time (all fixed to 1 for identification purposes), consistent with an increasing level of variability in perceived parental tolerance over time. Moreover, the average level of injunctive norms (i.e., perceived approval of drinking behaviors) did not differ over time, but was systematically higher for typical students (.698 SD relative to a grand mean of 0), followed by friends (.179 SD), and lowest for parents (-.877 SD).

The parameter estimates from these most invariant longitudinal models are reported in Tables S2 (anxiety sensitivity and alcohol-related problems) and S3 (injunctive norms). These results further support the adequacy of our measurement models, revealing that our main constructs appear to be well-defined by satisfactory factor loadings and estimates of reliability: (a) anxiety sensitivity (λ = .282 to .879; M_{λ} = .679; ω = .950 at Time 1); (b) alcohol-related problems (λ = .315 to .853; M_{λ} = .743; ω = .923 at Time 1, Time 2, and Time 3); (c) perceptions of typical students' injunctive norms (λ = .633 to .986; M_{λ} = .832; ω = .922 at Time 1, Time 2, and Time 3); (d) perceptions of friends' injunctive norms (λ = .633 to .986; M_{λ} = .832; ω = .922 at Time 1, Time 2, and Time 3); (e) perceptions of parents' injunctive norms (λ = .633 to .993; M_{λ} = .881; ω = .959 at Time 1, .980 at Time 2, and .978 at Time 3). Correlations among all variables are reported in Table S4.

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Table S1. Model Fit Indices Associated with the Measurement Models

Description	χ^2 (*df*)	CFI	TLI	RMSEA	90% CI	CM	$\Delta\chi^2$ (*df*)	ΔCFI	ΔTLI	ΔRMSEA
Anxiety Sensitivity (Time 1) + Alcohol-Related Harm (Longitudinal Invariance)										
M1. Configural invariance	795.507 (685)*	.970	.965	.031	[.020; .040]	-	-	-	-	-
M2. Weak invariance	813.539 (699)*	.968	.965	.031	[.020; .040]	M1	24.218 (14)*	-.002	.000	.000
M3. Strong invariance	839.280 (721)*	.967	.965	.031	[.020; .040]	M2	37.376 (22)*	-.001	.000	.000
M4. Strict invariance	859.686 (737)*	.966	.964	.031	[.021; .040]	M3	28.736 (16)*	-.001	-.001	.000
M5. Variance-covariance invariance	865.173 (739)*	.965	.963	.032	[.021; .040]	M4	6.286 (2)*	-.001	-.001	+.001
M6. Latent means invariance	867.202 (741)*	.965	.963	.032	[.021; .040]	M5	3.051 (2)*	.000	.000	.000
Injunctive Norms (Time 1: Invariance Across Referent)										
M1. Configural invariance	261.533 (137)*	.984	.978	.076	[.062; .089]	-	-	-	-	-
M2. Weak invariance	296.412 (150)*	.981	.976	.078	[.065; .091]	M1	56.917 (13)*	-.003	-.002	+.002
M3. Strong invariance	359.790 (193)*	.979	.979	.074	[.062; .085]	M2	78.921 (43)*	-.002	+.003	-.004
M4. Strict invariance	433.289 (208)*	.971	.974	.083	[.072; .093]	M3	97.832 (15)*	-.008	-.005	+.009
M5. Latent variance invariance	440.331 (210)*	.971	.973	.083	[.072; .094]	M4	9.472 (2)*	.000	-.001	.000
M6. Latent means invariance	1100.154 (212)*	.886	.898	.162	[.153; .172]	M5	195.866 (2)*	-.085	-.075	+.079
Injunctive Norms (Time 2: Invariance Across Referent)										
M1. Configural invariance	276.008 (137)*	.985	.979	.087	[.072; .102]	-	-	-	-	-
M2. Weak invariance	299.706 (150)*	.984	.980	.087	[.072; .101]	M1	36.383 (13)*	-.001	+.001	.000
M3. Strong invariance	365.982 (193)*	.982	.982	.082	[.069; .095]	M2	87.651 (43)*	-.002	+.002	-.005
M4. Strict invariance	419.304 (208)*	.977	.979	.087	[.075; .099]	M3	84.950 (15)*	-.005	-.003	+.005
M5. Latent variance invariance	528.255 (210)*	.966	.969	.107	[.095; .118]	M4	55.743 (2)*	-.011	-.010	+.020
M5'. Partial latent variance invar.	423.473 (209)*	.977	.979	.088	[.076; .100]	M4	4.124 (1)	.000	.000	-.001
M6. Latent means invariance	941.104 (211)*	.922	.930	.161	[.151; .172]	M5'	200.941 (2)*	-.055	-.049	+.073
Injunctive Norms (Time 3: Invariance Across Referent)										
M1. Configural invariance	307.882 (137)*	.982	.975	.101	[.086; .116]	-	-	-	-	-
M2. Weak invariance	345.290 (150)*	.979	.974	.103	[.089; .118]	M1	81.495 (13)*	-.003	-.001	-.002
M3. Strong invariance	402.083 (193)*	.978	.978	.094	[.081; .107]	M2	86.895 (43)*	-.001	+.004	-.009
M4. Strict invariance	419.858 (208)*	.978	.980	.091	[.079; .104]	M3	37.966 (15)*	.000	+.002	-.003
M5. Latent variance invariance	596.786 (210)*	.959	.963	.123	[.111; .135]	M4	59.370 (2)*	-.019	-.017	+.032
M5'. Partial latent variance invar.	426.435 (209)*	.977	.979	.092	[.080; .105]	M4	6.026 (1)	-.001	-.001	+.001
M6. Latent means invariance	1144.520 (211)*	.902	.911	.190	[.180; .201]	M5'	220.884 (2)*	-.075	-.052	+.098
Injunctive Norms (Invariance Across Referent and Over Time)										
M1. Configural invariance	2105.279 (1692)*	.975	.974	.039	[.033; .044]	-	-	-	-	-
M2. Weak invariance	2110.207 (1700)*	.975	.974	.038	[.033; .044]	M1	6.924 (8)	.000	.000	-.001
M3. Strong invariance	2148.738 (1738)*	.975	.975	.038	[.032; .043]	M2	43.691 (38)	.000	+.001	.000
M4. Strict invariance	2244.099 (1783)*	.972	.973	.040	[.034; .045]	M3	156.474 (45)*	-.003	-.002	+.002
M5. Correl. uniqu. invariance	2306.198 (1843)*	.972	.973	.039	[.034; .044]	M4	90.929 (60)*	.000	.000	-.001
M6. Latent var.-covar. invariance	2449.475 (1857)*	.965	.966	.044	[.039; .049]	M5	71.034 (14)*	-.007	-.007	+.005
M6'. Partial var.-covar. invariance	2337.832 (1856)*	.971	.973	.040	[.035; .045]	M5	34.529 (13)*	-.001	.000	+.001
M7. Latent means invariance	3093.092 (1864)*	.927	.930	.063	[.059; .067]	M6'	386.060 (8)*	-.044	-.043	+.023
M7'. Partial latent means invariance	2346.514 (1862)*	.971	.972	.040	[.035; .045]	M6'	12.658 (6)	.000	-.001	.000

Note. *p<.01; χ^2: WLSMV chi-square test of exact fit; *df*: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval; CM: Comparison model; and Δ: Change in fit relative to the CM.

Table S2. Standardized Factor Loadings (λ), Uniquenesses (δ), and Composite Reliability (ω) from the Measurement Models for Global Anxiety Sensitivity and Alcohol-Related Harm (Complete Invariance)

	Global Anxiety Sensitivity (Time 1 Only)		Alcohol-Related Harm (Invariant over Time)	
Item	λ	δ	λ	δ
1	.416	.479	.709	.497
2	.747	.411	.841	.293
3	.879	.001	.853	.273
4	.721	.473	.845	.286
5	.282	.621	.792	.373
6	.736	.454	.799	.362
7	.505	.728	.315	.901
8	.669	.489	.726	.472
9	.767	.261	.709	.497
10	.718	.394	.841	.293
11	.701	.415		
12	.688	.002		
13	.706	.487		
14	.704	.284		
15	.812	.337		
16	.817	.326		
ω	.950		.923	

Note. All parameters are statistically significant ($p \leq .05$).

Table S3. Standardized Factor Loadings (λ), Uniquenesses (δ), and Composite Reliability (ω) from the Measurement Models of Injunctive Norms (Partial Latent Variance and Latent Means Invariance)

Item	λ_{t1}	δ_{t1}	λ_{t2}	δ_{t2}	λ_{t3}	δ_{t3}
Students						
1	.633	.599	.633	.599	.633	.599
2	.782	.388	.782	.388	.782	.388
3	.819	.330	.819	.330	.819	.330
4	.986	.028	.986	.028	.986	.028
5	.938	.120	.938	.120	.938	.120
ω	.922		.922		.922	
Friends						
1	.633	.599	.633	.599	.633	.599
2	.782	.388	.782	.388	.782	.388
3	.819	.330	.819	.330	.819	.330
4	.986	.028	.986	.028	.986	.028
5	.938	.120	.938	.120	.938	.120
ω	.922		.922		.922	
Parents						
1 (mom)	.633	.599	.762	.419	.762	.419
2 (mom)	.782	.388	.875	.234	.875	.234
3 (mom)	.819	.330	.899	.192	.899	.192
4 (mom)	.986	.028	.993	.014	.993	.014
5 (mom)	.938	.120	.969	.062	.969	.062
1 (dad)	.633	.599	.875	.234	.762	.419
2 (dad)	.782	.388	.875	.234	.875	.234
3 (dad)	.819	.330	.899	.192	.899	.192
4 (dad)	.986	.028	.993	.014	.993	.014
5 (dad)	.938	.120	.969	.062	.969	.062
ω	.959		.980		.978	

Note. $_{t1\text{-}t3}$: Time 1 to Time 3: All parameters are statistically significant ($p \leq .05$).

Table S4. Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	AS (T1)	-															
2.	Alcohol Related Harm (T1)	.064	-														
3.	Alcohol Use (T1)	.007	.474**	-													
4.	IN – Typical Students (T1)	.024	-.066	-.075	-												
5.	IN – Friends (T1)	.042	.095	-.022	.620*	-											
6.	IN - Parents (T1)	-.062	.128	.077	.401**	.574**	-										
7.	Alcohol Related Harm (T2)	.070	.841**	.502**	.023	.099	.140	-									
8.	Alcohol Use (T2)	.081	.500**	.689**	-.078	.118	.078	.616**	-								
9.	IN – Typical Students (T2)	.331**	-.103	.061	.428**	.420**	.020	-.033	-.010	-							
10.	IN – Friends (T2)	.193*	.030	.163	.432**	.457**	.247**	.085	.152	.665**	-						
11.	IN – Parents (T2)	.096	-.009	.112	.324**	.296**	.665**	.098	.091	.270**	.525**	-					
12.	Alcohol Related Harm (T3)	-.001	.749**	.359**	-.042	.080	.139	.835**	.474**	-.123	-.056	-.023	-				
13.	Alcohol Use (T3)	.020	.354**	.353**	.023	.176	.035	.506**	.608**	.076	.122	.161	.438**	-			
14.	IN – Typical Students (T3)	.201*	-.162	.010	.421**	.416**	.198*	-.112	.033	.459**	.426**	.103	-.119	-.043	-		
15.	IN – Friends (T3)	.119	-.053	-.020	.411**	.525**	.290**	-.031	.156	.407**	.594**	.201*	-.065	.078	.758**	-	
16.	IN – Parents (T3)	.045	.010	.152	.097	.189*	.592**	.114	.220*	.026	.473**	.759**	.017	.130	.338**	.476**	-

Note. AS = anxiety sensitivity; IN = injunctive norms; T1 = time 1; T2 = time 2; T3 = time 3; **$p < .01$; *$p < .05$

Figure S1. Elbow Plot of the Information Criteria for the Time-Specific Latent Profile Analyses

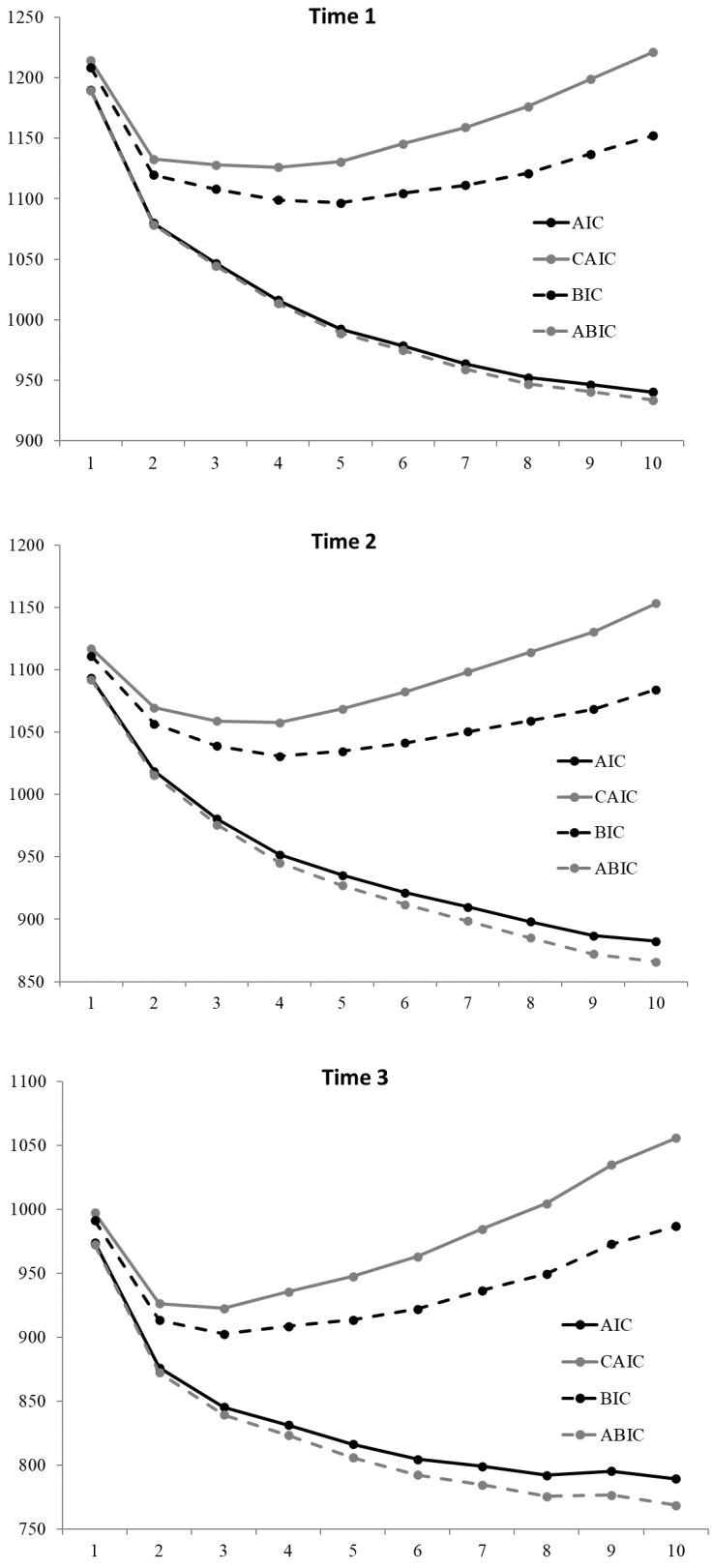

Table S5. Parameter Estimates from the Final Three-Profile Solution (Distributional Similarity)

	1: Mixed Tolerance		2: Low Tolerance		3: High Tolerance	
	Mean	CI	Mean	CI	Mean	CI
Injunctive Norms: Typical Students	.661	[.453; .869]	-.260	[-.479; -.042]	1.278	[.933; 1.623]
Injunctive Norms: Friends	.133	[-.212; .478]	-.840	[-.975; -.705]	1.082	[.695; 1.469]
Injunctive Norms: Parents	-.953	[-1.363; -.543]	-1.548	[-1.844; -1.253]	-.036	[-.425; .352]
	Variance	CI	Variance	CI	Variance	CI
Injunctive Norms: Typical Students	.285	[.229; .341]	.209	[.110; .308]	.421	[.275; .567]
Injunctive Norms: Friends	.222	[.150; .294]	.048	[.013; .082]	.304	[.216; .392]
Injunctive Norms: Parents	.576	[.263; .888]	.511	[.204; .819]	.989	[.698; 1.280]

Note. CI: 95% Confidence Interval; Profile indicators are factor scores with mean of 0 and a standard deviation of 1.

Table S6. Classification Accuracy: Average Probability of Membership into Each Latent Profile (Column) as a Function of the Most Likely Profile Membership (Row)

	1: Mixed Tolerance	2: Low Tolerance	3: High Tolerance
Time 1			
1: Mixed Tolerance	.836	.036	.127
2: Low Tolerance	.093	.906	.000
3: High Tolerance	.122	.000	.878
Time 2			
1: Mixed Tolerance	.768	.063	.169
2: Low Tolerance	.088	.912	.000
3: High Tolerance	.130	.000	.870
Time 3			
1: Mixed Tolerance	.728	.091	.182
2: Low Tolerance	.095	.905	.000
3: High Tolerance	.149	.000	.851