The Role of Social Context and Anticipatory Anxiety in Social Anxiety Risk for Pre-drinking

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ABSTRACT

The Role of Social Context and Anticipatory Anxiety in Social Anxiety Risk for Pre-drinking

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Pre-drinking (drinking before going out) is prevalent among undergraduate students. Cognitive models of social anxiety and tension reduction theory propose that those high in social anxiety are at increased risk for pre-drinking to reduce anticipatory anxiety prior to social events. Pre-drinking occurs in various social contexts that differ in how anxiety-provoking they are for these individuals. Accordingly, those high in social anxiety may be at increased risk for pre-drinking to reduce anticipatory anxiety in specific contexts. The goal of this dissertation was to incorporate pre-drinking contexts and anticipatory anxiety into theoretically-based models of social anxiety and pre-drinking. In a daily diary study (Study 1), we tested the combined effect of in the moment social context and anxious mood on social anxiety-related pre-drinking. We hypothesized that elevated social anxiety would predict increased likelihood of pre-drinking and pre-drinking quantity when anxious mood was high in less familiar contexts. Partially supporting hypotheses, those high in social anxiety were more likely to be in less familiar contexts during pre-drinking when anxious mood was high, but did not pre-drink more heavily. Although not previously hypothesized, elevated social anxiety protected against pre-drinking when anxious mood was high in group contexts. In a laboratory experiment (Study 2), we examined the effect of social context on social anxiety-related increase in anticipatory anxiety and urge to drink prior to a social event. To provide the opportunity to pre-drink, participants completed a taste rating task in one of three social contexts and in an alcohol or no alcohol condition, following anticipatory anxious mood manipulation of an upcoming social interaction. We hypothesized that, compared to the no alcohol condition, those high in social anxiety would report increased anticipatory anxiety and urge to pre-drink when alone or with a stranger. Results indicated that those high in social anxiety reported increased anticipatory anxiety prior to the social interaction. Participants reported increased urge to pre-drink when alone and when with a stranger. Exploratory analyses suggested that social context may moderate social anxiety related increase

in anticipatory anxiety and urge to pre-drink. The findings shed light on risk factors that could be targeted in clinical interventions aimed at reducing social anxiety-motivated problem drinking.

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CONTRIBUTION OF AUTHORS

The following thesis is comprised of two manuscripts:

Study 1 (Chapter 2)

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Study 2 (Chapter 4)

Badawi, G., Mackinnon, S., & O'Connor, R. M. (2020). A lab study of pre-drinking social context: Social Anxiety risk for anticipatory anxiety and urge to drink. Manuscript in preparation for publication.

In this present dissertation, I conceptualized the research program as well as each individual study focus. In collaboration with my supervisor, Dr. Roisin O'Connor, I developed and conducted the smartphone study and the laboratory-based experiment included in this dissertation. I secured funding to support this research, including two Fonds de la Recherche en Santé du Québec graduate training awards, a CIHR Doctoral award: Frederick Banting and Charles Best Canada Graduate Scholarships, an Intersections of Mental Health Perspectives in Addiction Research Training (IMPART) doctoral award and an Institut Universitaire sur les Dépendances award: Soutien Financier pour la Rédaction Intensive d'une Thèse. Dr. Roisin O'Connor also contributed funds from a CIHR New Investigator Award and Operating Grant.

For each study, I conducted a literature review, developed the research question, acquired ethics approval, and designed the study protocols. Dr. Roisin O'Connor provided theoretical, conceptual and design-related consultation during the development of the experiment. My Dissertation committee members, Dr. Mark Ellenbogen and Dr. William Bukowski, provided conceptual input and approval of the research project and methodology during a proposal meeting in June 2015.

For Study 1, I was assisted by the lab managers, Ashley Reynold and Mayesha Khan, by my Honours thesis student, Randa Elgendy and by an undergraduate student volunteer Corina Moraru. Ashley, Mayesha, Randa, and Corina assisted with recruiting participants, collecting data, compensating participants and other administrative tasks. With the help of Ashley, I finalized study protocols and programmed measures included in the study into an online server (www.fluidsurveys.com). I was responsible for overseeing all administrative and experimental aspects of the study, writing study protocols, exporting the data from the online server to a statistical software program, screening and cleaning the data, conducting statistical analyses, interpreting the results with assistance from my supervisor Dr. Roisin O'Connor, and writing the manuscript. Dr. O'Connor contributed conceptual input for manuscript write-up, and continued to provide extensive feedback and edits on written drafts. Dr. Alexandre Morin, who is a research collaborator and a co-author on this manuscript, provided a great deal of guidance in how to run multilevel models in order to test our hypotheses. In collaboration with Dr. O'Connor and Dr. Morin, the manuscript was finalized and will be submitted for publication.

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CHAPTER 1
GENERAL INTRODUCTION

Alcohol is the most widely used drug among university students and alcohol use is a prominent and normative activity that serves as a developmental rite of passage (Johnston et al., 2009; Moffitt, 1993). Results from the Canadian Campus Survey show that over 86% of Canadian undergraduates report consuming alcohol in the past year and about 37% of all students report heavy use (Adlaf et al., 2005; Gliksman et al., 2003). Heavy drinking in university students has been an ongoing major public health concern as heavy alcohol use during this developmental stage has been linked to alcohol-related negative consequences, including poor academic performance, impaired driving, serious physical harm, and risky sexual behavior (Adlaf et al., 2005; Mallett et al., 2011; Perkins, 2002). Although many students mature out of heavy drinking, a subset go on to develop alcohol use disorders (Littlefield, Sher, & Wood, 2009; O'Malley & Johnston, 2002; O'Malley, 2004). In the past decade, prevention and intervention programs have stemmed from empirical investigations of risk factors that influence and promote problem drinking among young adults; however, these strategies remain unsuccessful (Cronce & Larimer, 2011). To further the development of effective preventions and interventions, the current dissertation aims to clarify the anxiety pathway, specifically the social anxiety (SA) pathway to pre-drinking. Pre-drinking consists of drinking prior to attending a social event. The overall aim of this two-study dissertation is to enhance understanding of problem drinking aetiology among undergraduates (Burke & Stephens, 1999).

Pre-drinking

Pre-drinking (also known as "pre-gaming" or "pre-partying) is defined as drinking alone or with people before going to an event or gathering where alcohol may or may not be consumed (Zamboanga & Olthius, 2016). Pre-drinking has attracted an increasing amount of attention in alcohol research and policy (Wells et al., 2009). Approximately two-thirds of university students pre-drink (Borsari et al., 2007; Pederson & LaBrie, 2007; Read et al., 2010). Pre-drinking is associated with overall heavy drinking (LaBrie & Pedersen, 2008; Pedersen & LaBrie, 2007; Kuntsche & Labhart, 2013), elevated blood alcohol concentration (Borsari, et al., 2007; Clapp et al., 2009; LaBrie & Pedersen, 2008; Read et al., 2010) and increased number of alcohol-related negative consequences (Brosari et al., 2007; DeJong et al., 2010, Pederson & LaBrie, 2007; Read

et al, 2010; Wahl et al., 2013; Zamboanga et al., 2011) throughout the evening. For example, LaBrie et al. (2011) found that 25% of undergraduate students who pre-drank in the past month reported blacking out on at least one night involving pre-drinking.

Students pre-drink for reasons that are distinct from general reasons for consuming alcohol (LaBrie et al., 2012; Read et al., 2010; Bachrach et al., 2012). Reasons for pre-drinking are generally strategic (e.g., to save money) and are associated with the goal of intoxication (DeJong et al., 2010). They include situation-specific aspects such as getting in the mood for partying, socializing with friends before going out to more crowded environments, and personality-related aspects such as boosting self-confidence and alleviating the anxiety and stress associated with meeting new people later in the night (Bachrach et al., 2012; LaBrie et al., 2012; Read et al., 2010; Zamboanga et al., 2011). Enhancing our understanding of pre-drinking may contribute to the development of the broader aetiological risk model of alcohol misuse.

Social Anxiety

Social Anxiety (SA) is an individual-level factor that may be particularly relevant to pre-drinking among university students. SA describes a specific type of anxiety experienced in situations that involve interacting with, being observed by, or performing in front of others. SA consists of a fear of acting in a way that would lead to feelings of embarrassment, humiliation, or negative evaluation by others (American Psychiatric Association [APA], 2013). SA is the third most common psychiatric disorder with a lifetime prevalence of 13.3% (Kessler et al., 1994). The majority of university students experience some level of SA from time to time, with 10-20% meeting diagnostic criteria for social anxiety disorder (Russell & Shaw, 2009; Strahan, 2003). Socially anxious individuals are typically shy when meeting new people, quiet in groups, and withdrawn in unfamiliar social settings. Although those high in SA are thought to crave the company of others, they avoid speaking in public, expressing opinions, and socializing with peers for fear of being negatively judged by others (Stein & Stein, 2008). Socially anxious individuals have a tendency to hold a number of maladaptive beliefs about themselves, including that they have poor social skills and will be unable to meet their own expectations (Rapee & Heimberg, 1997). When entering a social situation, those high in SA shift their attention to self-monitoring; this produces interoceptive information that is used to construct a negative self-impression (Hofmann, 2000; 2007; Spurr & Stopa, 2002).

Like most personality characteristics, SA is normally distributed. Most people experience moderate levels of anxiety in certain social situations occasionally and relatively few people fall at the extremes, either experiencing no anxiety at all or experiencing intense anxiety so frequently that they may be diagnosed with social anxiety disorder (previously known as social phobia) (Ruscio, 2010). Individuals with social anxiety disorder experience fear and anxiety that is out of proportion to actual threat posed by the situation. These individuals attempt to avoid situations that are anxiety-provoking or endure them with great distress and experience marked impairment in everyday functioning (e.g., interpersonal difficulties, difficulties at work) (APA, 2013).

Social Anxiety and Alcohol Use

In clinical populations, social anxiety disorder is highly comorbid with substance use disorders (Sareen et al., 2006; Kushner et al., 2000; Moutier & Stein, 1999; Kessler et al., 1997). The lifetime prevalence of alcohol use disorder is more than double among individuals with social anxiety disorder compared to the general population (Davidson et al., 1993; Kushner et al., 2000; Kushner et al., 1990). It is argued that SA is a precursor to problem drinking as a diagnosis of social anxiety disorder typically precedes the onset of alcohol use disorder in individuals with comorbid conditions (Buckner, Schmidt et al., 2008; Buckner, Timpano et al., 2008; Buckner & Turner, 2009; Falk et al., 2008; Abrams, et al., 2001).

SA may be a particularly relevant risk factor for problem alcohol use among undergraduates. Social situations (e.g., parties, clubs, bars, social gatherings), which may be feared by those high in SA, are common in the university context. Notably, alcohol is also readily available on university campuses and drinking heavily is a socially condoned behaviour (Johnston et al., 1999; Kushner et al., 1990). Kushner and Sher (1993) found that undergraduates with a clinical diagnosis of social anxiety disorder were at increased risk of also having a diagnosis of alcohol use disorder. Moreover, prospective studies indicate that both clinical and subclinical levels of SA predict the development of alcohol use disorder (Buckner & Schmidt, 2009; Buckner, Schmidt et al., 2008; Crum & Pratt, 2001; Zimmerman et al., 2003). Students with elevated SA experience more alcohol-related consequences (Buckner et al, 2011; Buckner et al., 2006; Buckner & Heimberg, 2010; Gilles et al., 2006; Norberg et al., 2009) and problem drinkers report higher SA than non-problems drinkers (Lewis & O'Neill, 2000). Many studies have found that in both university and non-university students, socially anxious individuals are

more likely to drink as a way to reduce anxiety in social situations (Buckner & Heimberg, 2010; Thomas et al., 2003). SA is therefore an individual level factor that merits careful attention as it has been linked to alcohol misuse in undergraduate students.

Social Anxiety and Pre-drinking

Studies indicate that those high in SA learn to use alcohol to reduce their anxiety, leading them to consume alcohol prior to social events (Ham & Hope, 2005; Pedersen et al. 2009, DeJong et al., 2010; Pedersen & LaBrie, 2007). Students report pre-drinking to loosen up, to reduce tension or to relax prior to going out (DeJong et al., 2010; Pedersen & LaBrie, 2007; Pederson et al., 2009). Pre-drinking to reduce anxiety has been associated with heavy drinking throughout the evening and alcohol-related negative consequences, but only for women (Kuntsche & Labhart, 2013). Only two studies to our knowledge have focused on SA risk for pre-drinking specifically; this work used retrospective reports and cross-sectional designs (Buckner et al., 2020; Keough et al., 2016). Keough et al. (2016) examined pre-drinking context (i.e., alone and social contexts) as mediating SA risk for problem drinking. SA was a positive predictor of pre-drinking alone, which in turn predicted elevated alcohol-related problems whereas SA was a negative predictor of social pre-drinking, which in turn reduced risk for problem drinking. In the second study, which is a very recent investigation, Buckner et al. (2020) tested whether SA was related to increased drinking before, during, or after a social event and whether alcohol use was related to anticipatory anxiety. Results indicated that those with clinically elevated SA reported more anticipatory anxiety and more pre-drinking to manage anxiety compared to those with lower levels of SA. They also found an indirect effect of SA on pre-drinking via anticipatory anxiety. Taken together, findings highlight that both the role of social context and anticipatory anxiety seem pivotal to understanding SA risk for pre-drinking. To understand how social context and anxious mood play out to promote pre-drinking risk for those high in SA, we need ecological momentary assessments and experimental studies that tap these risk factors in the moment.

Theoretical Framework

A number of theories have been proposed to help explain the relation between SA and pre-drinking. The tension reduction theory (Conger, 1956) suggests that individuals consume alcohol to alleviate or cope with negative affect, thus drink to reduce tension. Accordingly, socially anxious students consume alcohol during social events to reduce negative cognitions and

physiological symptoms of anxiety (Morris et al., 2005). These individuals may rely on alcohol as a way to endure distressing social situations, which increases risk for problem drinking and developing alcohol use disorders (Kushner et al., 1990). The self-medication hypothesis (Carrigan & Randall, 2003; Khantzian, 1985) stems from the tension reduction theory and posits that socially anxious individuals are at risk for continued use or misuse of alcohol if it is consumed for its anxiety-alleviating effects. Taken together, these theories propose that those with elevated SA will be particularly motivated to consume alcohol to decrease anxiety in anticipation of and during an anxiety-provoking situation (see review by Carrigan & Randall, 2003; Chutuape & de Wit, 1995). In other words, those high in SA will be more likely to drink prior to attending social events (i.e., to pre-drink) as a way to reduce anxiety associated with upcoming social interactions. Cognitive-behavioural models of SA suggest that prior to a social event, socially anxious individuals engage in anticipatory processing, a cognitive process theorized to be an integral maintenance factor for SA (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). Anticipatory processing consists of thinking about the situation in detail and primarily focusing on past failures, negative images of themselves in the situation, and making predictions of poor performance and rejection (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). The tension reduction theory, the self-medication hypothesis, and cognitive models of SA suggest that pre-drinking may serve to reduce anticipatory anxiety and dampen anticipatory processing associated with upcoming social interactions, thus disrupting the ruminative, negative self-appraisal process, reducing self-focus and increasing the likelihood of attending the social event. Given the theoretical support linking SA to pre-drinking, risk factors involved in the SA risk for pre-drinking merit careful attention.

Drinking Context

Pre-drinking occurs in a variety of social contexts and can take place either alone or in the presence of others (e.g., with friends or with acquaintances) and in various places, including at home, at a get together, or at a party (LaBrie et al., 2011; Pedersen et al., 2009; Zamboanga et al., 2011). Research examining the role of contexts in SA risk for pre-drinking is scarce, however studies have investigated how negative affect varies as a function of social context among socially anxious individuals. Findings from a smartphone-based ecological momentary assessment study indicated that young adults high in SA experienced reduced negative affect, anxiety, and depression when they were with close companions (i.e., close friends, family

members, romantic partners); this was not the case when they were with strangers, co-workers, and acquaintances (Hur et al., 2019). The presence of a friend compared to being alone has been shown to normalize behavioral signs of anxiety and reduce negative self-focused thoughts in socially anxious adults exposed to an experimental speech challenge (Pontari, 2009). Kashdan and Roberts (2006) found that those high in SA randomly assigned to a small talk interaction with an individual of the opposite sex reported greater negative affect compared to those assigned to an intimate closeness-generating interaction. Being in a group of friends compared to being alone has also been associated with decreased SA due to diffusion of evaluation and perceptions of security among women (Carron et al., 1999). Taken together, findings from this body of research suggest that being in familiar social contexts (e.g., with close friends) compared to being alone or being in unfamiliar contexts (e.g., with strangers, co-workers) helps to decrease anxious mood for those high in SA.

In addition to research examining changes in mood across social contexts for those high in SA, there is some research that has investigated SA risk for problem drinking across different drinking contexts. Findings suggest that individuals' use of alcohol depends on the context in which drinking takes place (Harford 1983; O'Hare & Sherrer, 2005). SA has been linked to heavier drinking in contexts where individuals drink to cope with unpleasant emotions (Buckner et al., 2006) and to avoid social scrutiny (Stewart et al., 2006). Those who view alcohol as a means to reduce anxiety are twice as likely as those without such beliefs to drink alone (Bourgault & Demers, 1997). Drinking alone has been associated with the tendency to use alcohol to manage and/or escape negative emotions in a way that leads to elevated frequency and quantity of alcohol use and future alcohol problems (Christiansen et al., 2002; Holyfield et al., 1995). Such findings suggest that drinking alone and drinking to cope with negative affect may increase risk for problem drinking among those high in SA. Despite research indicating that risk for problem drinking differs across social contexts, research investigating the role of drinking context in the SA risk for pre-drinking specifically remains in its infancy. This is surprising as pre-drinking occurs in a variety of contexts (Pedersen et al.; 2009) - contexts that may differ in how anxiety-provoking they are for individuals high in SA.

According to tension reduction theory (Conger, 1956) and to research examining the effect of social context on mood (e.g., Hur et al., 2019; Pontari, 2009), and on alcohol use among those high in SA (Christiansen et al., 2002; Holyfield et al., 1995), these individuals may be at

decreased risk for pre-drinking in familiar contexts or when with a close friend as they may experience decreased anticipatory anxiety, and may thus be less likely to pre-drink to cope. Similarly, those high in SA may experience increased anticipatory anxiety when alone or in unfamiliar contexts (e.g., with strangers) and may thus be more likely to pre-drink to cope prior to encountering others at social events. Indeed, the Keough et al. (2016) work supported pre-drinking alone as a risk factor for negative alcohol-related consequences among undergraduates with elevated SA. While this investigation considered alone compared to social contexts (i.e, "pre-drinking with others"), they did not consider various types of social contexts, such as pre-drinking with close friends or companions and pre-drinking with strangers, coworkers or acquaintances. As such, there is no study to our knowledge that has examined SA risk for pre-drinking across social pre-drinking contexts. To advance understanding of SA risk for pre-drinking, the role of social context as a moderator should be explored.

Anticipatory Anxiety

Theory points to the pivotal role of in the moment anxiety suggesting that those high in SA may pre-drink to reduce anticipatory anxiety and cope with anticipatory processing prior to attending social events (Clark & Wells, 1995, Conger, 1956). Consistently, evidence indicates that when those high in SA experience elevated anticipatory anxiety, they engage in a detailed review of what might happen in a feared situation, have biased recall of past perceived failures rather than successes, focus on thoughts about how they might look to others, overly prepare for what they thought might happen, and have thoughts about ways in which to avoid or escape the situation (Hinrichsen & Clark, 2003). Elevated SA is associated with increased engagement in prolonged anticipatory processing (Vassilopoulos, 2004) and with reported anticipatory anxiety before social events (Buckner et al., 2020). To date, some experimental studies have examined drinking *prior* to an anxiety-provoking task in the laboratory (e.g., Abrams et al., 2002; McNair, 1996; Bernstein, 2014; Kidorf and Lang, 1999); however, these studies were not specifically designed to examine pre-drinking and many studies were not specific to SA.

Research investigating the effect of anxiety on alcohol use prior to a social event has provided mixed results. Consistent with theory, some studies have found that anxiety is positively related to alcohol use prior to social interactions (Kidorf & Lang, 1999; Samoluk & Stewart, 1996). One study found that participants with elevated SA drank more alcohol when anticipating a speech task on their most undesirable characteristics (Kidorf & Lang, 1999).

Another study found that individuals high in anxiety sensitivity drank more than those low in anxiety sensitivity when anticipating a task resembling small talk (Samoluk & Stewart, 1996). In these two studies, participants were provided the opportunity to ad lib drink as part of a taste-rating task and did so alone prior to the social interaction. Buckner et al. (2020), using retrospective self-report questionnaires, found that anticipatory anxiety was related to increased drinking before a social event among individuals with clinically elevated SA; however, this study did not collect data on the context in which drinking occurred. Despite these findings, Abrams et al. (2002) found a negative relation between anxiety and drinking. Individuals diagnosed with social anxiety disorder drank less alcohol and selected weaker drinks before a social anxiety challenge (i.e., engaging in a dialogue to resolve a moral dilemma) compared to a control task. Interestingly, participants in this study consumed alcohol in groups (i.e., with other participants) prior to the social challenge. Last, some studies show no difference in drinking patterns related to anxiety prior to social events. McNair (1996) did not find an effect of anticipatory anxiety on alcohol use in moderate or heavy drinking college women prior to giving a self-disclosing speech. In this study, drinking prior to the speech task was completed alone as part of a taste rating task. Last, Bernstein (2014) found that anticipatory anxiety did not moderate the link between SA and drinking before an anxiety-provoking task. However, the drinking portion of the experiment was completed in a lab space designed to look like a bar and in the presence of other participants and confederates, thus this may have been more reflective of the main social event, rather than pre-drinking. This body of research examined the effect of anticipatory anxiety on drinking prior to an anxiety-provoking task. However, the effect of anticipatory anxiety on pre-drinking specifically and moreover on SA-risk for pre-drinking remains unclear. Studies have provided mixed results highlighting the importance of considering moderators in the link between anticipatory anxiety and drinking.

Although pre-drinking context is central to SA related risky pre-drinking (Buckner et al., 2006, Conger, 1956), research examining the link between anticipatory anxiety and drinking prior to a social interaction task has yet to investigate the role of context. In these experiments, participants completed the drinking portion in different contexts, some drank alone (Kidorf & Lang, 1999; McNair, 1996; Samoluk & Stewart, 1996), others drank in the presence of other participants (Abrams et al., 2002) and others drank in contexts where other participants and confederates were present and in non-neutral lab spaces (i.e., a room designed to resemble a bar)

(Bernstein, 2014). As individuals' use of alcohol depends on the context in which drinking takes place (Harford 1983; O'Hare & Sherrer, 2005), mixed findings in this literature may be clarified by considering context. Generalizability of findings from this research is also limited as some studies included non-representative samples (i.e., clinical populations) (Abrams et al., 2002; Buckner et al., 2020) and some included either only men or only women (e.g., McNair, 1996). Most studies were not specific to SA but considered anxiety more broadly (McNair, 1996; Samoluk & Stewart, 1996). Moreover, most studies used performance-based tasks (e.g. giving a speech in front of a panel, Kidorf & Lang, 1999) to induce anticipatory anxiety rather than interaction-based tasks (e.g., a task resembling small talk, Samoluk & Stewart, 1996). Individuals with social phobia drink to cope with social interactions more so than performance situations (Thomas et al., 1999), and drinking decreases SA in anticipation of a social interaction rather than a speech task (Ham, 2009). Using interaction-based tasks to induce anticipatory anxiety among individuals high in SA is therefore more ecologically valid. Last, the effect of in the moment anticipatory anxiety and pre-drinking contexts in the SA-risk for pre-drinking has yet to be captured. Daily-diary and experimental studies are needed to examine pre-drinking contexts and anticipatory anxiety as risk factors in SA-related pre-drinking among undergraduate students.

Current Project

The aim of the present two-study dissertation is to enhance our understanding of risk factors relevant to the SA pathway to pre-drinking among undergraduates. To tap into the role of in the moment processes, we aimed to test theory-driven models of SA and pre-drinking using 1) a daily diary study and 2) a controlled laboratory experiment. In Study 1, we utilized ecological momentary assessments using smartphones to identify pre-drinking contexts and measure anticipatory anxiety as they occurred in real time. Pre-drinking context and anticipatory anxiety were tested as moderators of the association between SA and pre-drinking. In Study 2, we used an experimental design to manipulate pre-drinking contexts and anticipatory anxiety in the laboratory. We were interested in examining context effects on SA risk for increased anticipatory anxiety and urge to drink. Taken together, these studies provide complementary methodologies that can further enhance our understanding of the aetiology of SA and pre-drinking.

By identifying risk factors for pre-drinking, the present dissertation aims to inform prevention efforts aimed at reducing undergraduate problem drinking. Education about factors

that increase risk for pre-drinking could be incorporated into psycho-education programs that inform undergraduate students of risky drinking practices. This research also aims to inform clinical interventions that target co-morbid alcohol misuse and anxiety disorders. By identifying cognitive processes associated with pre-drinking, clinical interventions can target cognitions associated with risky pre-drinking (e.g., cognitive restructuring, challenging beliefs about self and others, challenging negative predictions about upcoming interactions). Last, these studies could point to coping skills (e.g., distress tolerance, emotion regulation) that could be fostered through clinical interventions in order to provide undergraduate students high in SA with more adaptive strategies to cope with anticipatory anxiety.

Study 1

According to theory and recent evidence, undergraduates high in SA may pre-drink for negative reinforcement purposes (Carrigan & Randall, 2003; Conger, 1956; Khantzian, 1985) and may be less likely to pre-drink to decrease anxiety in anticipation of anxiety-provoking social situations in intimate contexts (Clark & Wells, 1995; Harford 1983; Hur et al., 2019). Although research has begun to investigate the role of pre-drinking contexts in the association between SA and problem drinking (e.g., Keough et al., 2016) and although one study has examined the role of anticipatory anxiety in the SA-pre-drinking link (e.g., Buckner et al., 2020), studies have used cross-sectional study designs, and retrospective self-report questionnaires. Research has examined the impact of anxious mood on drinking prior to an anxiety-provoking task (e.g., Abrams et al., 2002), however studies were neither specific to pre-drinking nor to SA-related pre-drinking, and findings were inconsistent across studies. Mixed findings in the literature may be due to the various social contexts in which drinking took place across experiments and could be clarified by considering the role of social context as a moderating variable. Evidence (e.g., Hur et al., 2019; Pontari, 2009) supported by cognitive models of SA (Clark & Wells, 1995) suggest that those high in SA may be at increased risk for pre-drinking in response to anticipatory anxiety in less familiar social contexts (e.g., pre-drinking with strangers, co-workers, acquaintances) and may be at decreased risk for doing so in intimate contexts. However, studies have yet to test the role of pre-drinking social contexts as moderating the link between SA and pre-drinking. Furthermore, research has yet to capture both anticipatory anxiety and pre-drinking contexts in real time and as they proximally predict pre-drinking in participants' natural environments.

The aim of the first study was to capture *in-the-moment* pre-drinking contexts, anticipatory anxiety, and pre-drinking as they occurred in real time in a daily-diary study. The goal was to examine the combined effect of pre-drinking contexts and anticipatory anxiety as moderators of the relation between SA and pre-drinking. The study utilized state of the art Ecological Momentary Assessments (EMA) procedures through smartphones to capture hourly snapshots of participants while pre-drinking and throughout entire evenings. Momentary assessments provide the unique opportunity to tap sequential processes as they unfold. We hypothesized that undergraduates with elevated SA would be at increased risk for pre-drinking in less familiar pre-drinking contexts (e.g., with unfamiliar others) and when anxious mood state was high. In contrast, we hypothesized that pre-drinking in intimate contexts would be somewhat protective, such that the risk of SA for heavy pre-drinking would be dampened. The effect of anxious mood on pre-drinking within this contexts is however less clear.

Study 2

Pre-drinking is a risky practice among undergraduates (e.g., Pederson & LaBrie, 2007) and can occur in a variety of social contexts (LaBrie et al., 2011; Pedersen et al., 2009). According to tension reduction theory and to cognitive behavioral models of SA and drinking, those high in SA are at risk for pre-drinking to reduce anticipatory anxiety prior to upcoming social events and pre-drinking risk may be magnified when done alone or in the presence of unfamiliar individuals (Clark & Wells, 1995; Conger, 1956). Some laboratory studies have examined the role of anxious mood on drinking *before* a social-anxiety provoking task (Abrams et al., 2002; McNair, 1996), however these studies have limitations. First, studies did not operationalize and mimic pre-drinking specifically in the laboratory, but rather examined drinking prior to a performance or interaction-based task. Second, studies examining the effect of mood on drinking differ in the social context in which drinking took place (e.g., some participants drank alone, others drank in groups). Findings have provided mixed results, which may be due to the lack of consideration of drinking context. Third, experimental studies have not focused on SA risk specifically (e.g., McNair, 1997, Samoluk and Stewart, 1996) and have included non-representative samples (e.g., Abrams et al., 2002; Buckner et al., 2020), limiting generalizability of results. Fourth, some studies have used performance-based task (Kidorf & Lang, 1999) rather than ecologically valid interaction-based tasks to induce anxious mood for those high in SA (e.g., Samoluk & Stewart, 1996). To date, retrospective studies have provided

preliminary understanding of SA risk for pre-drinking (e.g., Buckner et al., 2020; Keough et al., 2016), however daily diary studies are needed to investigate the effect of both pre-drinking context and anticipatory anxiety in the link between SA and pre-drinking.

Laboratory studies are critical to etiological models as they permit a controlled examination of how SA would lead to pre-drinking. Thus, we still do not have strong evidence to understand how SA relates to pre-drinking across pre-drinking contexts and in response to anticipatory anxiety. To investigate theory-driven models of SA and pre-drinking, experimental designs are needed to manipulate in the moment anticipatory anxiety and pre-drinking contexts to understand the SA pathway to pre-drinking. The goal of the second study was to use a controlled experimental design to mimic pre-drinking in the laboratory prior to an ecologically-valid social-anxiety provoking task. Our objective was to manipulate in the moment anticipatory anxiety and pre-drinking contexts in order to examine how they relate to SA across social contexts. We provided undergraduates the opportunity to ad lib pre-drink as part of a taste rating task in one of three randomly assigned pre-drinking contexts (alone, with a friend or with an unfamiliar person) as they anticipated a social interaction task. For comparison purposes, undergraduates were also randomly assigned to an alcohol or no alcohol condition. We hypothesized that elevated SA would be associated with increased anticipatory anxiety, increased urge to pre-drink, increased pre-drinking for coping motives, and heavy pre-drinking, but that this effect would be strongest for those in the pre-drink alone and unfamiliar alcohol conditions. We also hypothesized that elevated SA would predict decreased anticipatory anxiety and urge to drink for those in the familiar condition regardless of alcohol condition. To our knowledge, this is the first study to examine SA risk for pre-drinking in the laboratory.

CHAPTER 2

STUDY 1

A Smartphone Study: The Role of In-The-Moment Anxious Mood and Context in the Social Anxiety Pathway to Pre-drinking

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Pre-drinking (also known as "pre-gaming" or "pre-partying") is the practice of drinking alcohol before a primary social event (Pederson & LaBrie, 2007). Pre-drinking is a common practice among undergraduate students with approximately two-thirds of students reporting that they pre-drink (Brosari et al., 2007; Pederson & LaBrie, 2007; Read et al., 2010). Those who pre-drink (compared to those who do not) consume greater quantities of alcohol (LaBrie & Pedersen, 2008; Pedersen & LaBrie, 2007), have higher blood alcohol concentration (Borsari et al., 2007; Clapp et al., 2009; LaBrie & Pedersen, 2008; Read et al., 2010), and experience more alcohol-related negative consequences such as intoxication, blackouts and drunk driving (Brosari et al., 2007; DeJong, et al., 2010, LaBrie, et al., 2011; Pederson & LaBrie, 2007; Read et al, 2010). To develop effective interventions and improve policy, research aimed at identifying the risk factors and mechanisms of pre-drinking is needed.

Social Anxiety (SA) is the persistent fear of negative evaluation by others in the context of social situations (American Psychiatric Association [APA], 2013). Nearly all undergraduates experience some level of SA from time to time, with 10-20% of students experiencing marked to severe levels of SA and nearly 10% showing clinical levels of social phobia (Russell & Shaw, 2009; Strahan, 2003). The tension-reduction theory (TRT; Conger, 1956; Kushner et al., 1990) and the self-medication hypothesis (Khantzian, 1985) both propose that individuals high in SA should be particularly responsive to the anxiolytic effects of alcohol, and therefore drink for negative reinforcement purposes (Sher, 1987). Models of risk derived from this theory posit that socially anxious individuals come to expect that alcohol will reduce their anxiety, and this leads to increased use when anticipating or experiencing anxiety-provoking social situations (Ham & Hope, 2005; Morris et al., 2005). Research provides empirical support for these theoretical propositions by revealing high comorbidity rates of social phobia and alcohol use disorder in clinical samples (Magee et al., 1996), and systematic associations between elevated SA and alcohol-related problems among undergraduates (Buckner et al., 2011; Buckner et al., 2013).

Clark and Wells' (1995) cognitive model of social phobia suggests that socially anxious individuals engage in an anticipatory negative self-appraisal process prior to going to a social event. They think about the situation in detail, primarily focusing on past social failures and negative images of themselves in these situations, and make predictions of poor performance and rejection from peers, which in turn leads to increased SA (Clark & Wells, 1995; Clark 2001; Hofmann, 2007; Rapee & Heimberg, 1997; Eckman & Shean, 1997). Anticipatory processing

leads either to avoidance of the social event or critical appraisal of social performance and social competence if the event is attended (Battista & Kocovski, 2010). Activation of SA may represent a central trigger for pre-drinking. More precisely, alcohol is used to cope with anticipatory anxiety, reduce negative self-appraisals, and disrupt overthinking tendencies, making it more likely for people high in SA to attend the social event (Carrigan & Randall, 2003; Ham & Hope, 2005; Morris et al., 2005). Consistent with theory, research supports the relation between SA and pre-drinking. SA has been endorsed as a common reason for pre-drinking (e.g., DeJong et al., 2010; Pederson & LaBrie, 2007; Pederson et al., 2009; Read et al., 2010) and has been shown to predict pre-drinking in specific contexts (Keough et al., 2016). Pre-drinking to reduce anxiety has been associated with heavy drinking and alcohol-related problems throughout the evening (Kuntsche & Labhart, 2013). This is concerning as pre-drinking to cope with anticipatory anxiety in specific pre-drinking contexts may increase SA risk for problem drinking.

Central to SA risk for pre-drinking appears to be pre-drinking contexts and anticipatory anxiety (Conger, 1956; Clark & Wells, 1995), however, studies have yet to test the combined effect of these factors in the link between SA and pre-drinking. Pre-drinking occurs in a variety of contexts including at home, at parties, and at restaurants (LaBrie et al., 2011; Pedersen et al., 2009). Socially anxious individuals would be more likely to pre-drink in contexts where they experience increased anticipatory anxiety prior to attending social events (Conger, 1956; Clark & Wells, 1995). Empirical evidence supports this theoretical proposition as SA has been linked to heavier drinking in contexts where individuals drink to cope with unpleasant emotions (Buckner et al., 2006). Research examining pre-drinking contexts in the SA pathway to pre-drinking is scarce. Studies have however investigated how negative affect varies as a function of social context among those high in SA. These studies suggest that being in intimate contexts (e.g., with close friends) compared to being alone or being in less familiar contexts (e.g., with strangers, co-workers or acquaintances) helps to decrease anxious mood for those high in SA (Carron et al., 1999; Hur et al., 2019; Pontari, 2009). Social contexts that are anxiety-provoking may lead to increased alcohol use by those high in SA. Indeed, evidence demonstrates that those high in SA who expect that alcohol will reduce their anxiety drink (and pre-drink) alone (Bourgault & Demers, 1997), which in turn predicts more alcohol-related problems (Keough et al., 2016). Although pre-drinking alone has been shown to increase SA risk for problem drinking, risk associated with social pre-drinking contexts remains unclear. Drinking in social situations has

been linked to problem drinking (Neff, 1997; O'Hare 1990), however elevated SA has been found to decrease risk for pre-drinking with others in turn reducing risk for problem drinking (Keough et al., 2016). To date, studies examining pre-drinking contexts have tested participants in environments which are removed from real world drinking contexts, have assessed contexts retrospectively (e.g., Christiansen et al., 2002) and have yet to test pre-drinking contexts as proximal predictors of pre-drinking. To tailor effective prevention and intervention strategies that respond effectively to contextual risk factors, it is necessary to gain insight into how in-the-moment situation characteristics operate to affect pre-drinking.

According to cognitive models of SA, those high in SA would be more likely to pre-drink to reduce anticipatory anxiety to take the edge off prior to going out (Clark & Wells, 1995; Conger, 1956). Anticipatory anxiety has been related to increased amount of alcohol consumed before a social event among individuals with clinically elevated SA (Buckner et al., 2020). Research has also investigated the impact of mood as an antecedent of alcohol use, however findings have been mixed. Some studies support anxious mood as a positive predictor of drinking through daily diary methods (Grant et al., 2009; Mohr et al., 2005) and laboratory experiments (Birch et al., 2004; Kidorf and Lang; 1999; Samoluk and Stewart, 1996). Participants with elevated SA consume more alcohol when anticipating a speech task (Kidorf and Lang; 1999). Other studies have provided support for a negative relation between anxious mood and drinking (Abrams et al., 2002; Collins, Pencer & Stewart, 2017) and some have found no relation at all (McNair, 1997). These studies are limited as they were not designed to investigate anticipatory anxiety as a predictor of pre-drinking, and only few studies were specific to SA (Abrams et al., 2002; Kidorf and Lang; 1999). Second, as part of these experiments, participants drank in different contexts, some drank alone (Kidorf & Lang, 1999; McNair, 1996; Samoluk & Stewart, 1996), others drank in the presence of other participants (Abrams et al., 2002) and others drank in contexts where other participants and confederates were present and in non-neutral lab spaces (Bernstein, 2014). Mixed findings in the literature may be clarified by considering pre-drinking context. Pre-drinking occurs in a variety of contexts (e.g., LaBrie, et al., 2011) and risk for pre-drinking differs as a function of context (e.g., Keough et al., 2016). Pre-drinking to cope with anticipatory anxiety would thus be expected to vary across contexts. Research examining pre-drinking in response to anticipatory anxiety across pre-drinking contexts is needed to clarify mechanisms underlying SA risk for pre-drinking.

To date, pre-drinking has been measured through cross-sectional retrospective self-report surveys (Abrams et al., 2002; Bachrach et al., 2012; DeJong et al., 2010; Labhart & Kuntsche, 2017; LaBrie et al., 2012; Pederson & LaBrie, 2007; Pederson et al., 2009; Read et al., 2010; Zamboanga et al., 2011) and only two cross-sectional studies, to our knowledge, have investigated SA directly as a risk factor of pre-drinking (Buckner et al., 2020; Keough et al., 2016). Although Kuntsche and Labhart (2013) found that pre-drinking to cope predicted heavy drinking throughout the night in a daily diary study, this link was not tested for people high in SA. Thus, studies on SA and pre-drinking have only allowed for the examination of between-person levels of analyses limiting our understanding of causal mechanisms underlying the SA-pre-drinking risk. Although experimental studies have examined the impact of mood on drinking (e.g., Birch et al., 2004), daily diary studies are needed. These methods will enable the assessment of alcohol use as it occurs in real time in response to momentary levels of anxious mood in real-world drinking contexts among those high in SA. To date, studies are needed to examine the effect of SA on in the moment pre-drinking in response to momentary levels of anxiety across real world pre-drinking contexts. Longitudinal daily diary studies would allow us to test both between-person and within-person processes posed by theoretical models of pre-drinking among socially anxious individuals.

The aim of the current study was to investigate pre-drinking context and anticipatory anxiety as moderating the relation between SA and two pre-drinking outcomes: (1) pre-drinking or not pre-drinking on a given occasion; (2) among those who pre-drink, amount of alcohol consumed while pre-drinking. Based on theory, we propose that the combined effect of pre-drinking contexts and momentary levels of anxiety moderate the association between SA and pre-drinking. Specifically, we hypothesized that elevated SA will be associated with (1) Increased likelihood of pre-drinking (i.e., pre-drink vs. not) and (2) increased alcohol use when pre-drinking. These associations are expected to be more pronounced (1) when momentary levels of anxiety are high, and (2) when individuals pre-drink in less familiar contexts. In contrast, we hypothesized that pre-drinking in intimate contexts would be somewhat protective, such that the risk of SA for heavy pre-drinking would be dampened. The effect of anxious mood on pre-drinking in these contexts is however less clear.

The current study uses Ecological Momentary Assessments (EMA) procedures via participants' smartphones. EMA minimize recall bias, maximize ecological validity, and capture

micro-processes occurring over time, thus providing unique insights into the dynamics that characterize pre-drinking and mood in social and environmental contexts (Bolger et al., 2003; Shiffman et al., 2008; Stone, et al., 2007; Trull & Ebner-Priemer, 2009). Given our interest in the first decision to pre-drink or not, we considered anxious mood ratings collected from the first drinking event of the night. Alcohol use during pre-drinking consisted of the sum of the number of drinks consumed while pre-drinking.

Methods

Participants

A sample of 233 undergraduate students from the Montreal area were recruited through university participant pools and around campuses within Montreal universities. To be able to participate, students had to be: fluent in English (as all questionnaires are in English), enrolled full-time as university undergraduate students, and not be alcohol abstainers (i.e., drinking at least once a week in the past month). Participants provided informed consent and were compensated with either course credit or with $15 for the baseline assessment and then paid at a rate equivalent to $15 per completed day of diary reports. Participants responding to 90% or more of diaries were given an extra $20 bonus.

Of those who were recruited to participate in the study, four participants completed the baseline questionnaire without completing the daily diary assessments. These participants were excluded from the study. The final sample consisted of 229 participants. These individuals completed at least one daily diary assessment and were included in the analyses. The sample included 63.8% of women (36.2% men; only binary gender options were included in this study), had a mean age of 20.54 (*SD* = 1.67) years, and included 53.5% of students who were enrolled either in their first year or second year of undergraduate studies. The majority of the sample was White (68%), while the remaining participants self-identified as follows: 3.9% Black, 3.5% South Asian, 9.6% East Asian, 3.1% Hispanic, 5.3% Middle Eastern and 6.6% “Other”. The majority of the sample reported having grown up in Canada (61.4%), and 67.5% reported living in a house or apartment without their parents.

Procedure

Participants came to the research laboratory, located at Concordia University, to complete baseline measures. During this visit, they were instructed on how to complete the daily diary assessments on their smartphones. They then completed daily assessments covering Thursday,

Friday and Saturday evenings over four consecutive weeks. These evenings were selected given that over 75% of students' alcohol consumption occurs on Thursday, Fridays and Saturdays (Del Boca et al., 2004; O'Connor & Colder, 2005). On each evening of data collection, participants received short text messages by means of Short Messaging Services (SMS) providing them with a hyperlink every hour between 6 pm and 1 am. By clicking on the link, participants accessed the questionnaires and were asked every hour to indicate whether they were pre-drinking and where they were. Participants also rated their current mood, and reported on their use of alcohol over the past hour. In addition, each Friday, Saturday, and Sunday morning, participants completed a brief questionnaire at 11 am on which they were asked to report the total number of drinks consumed the night before.

Measures

Pre-drinking. Alcohol use was assessed every hour from 6 pm to 1 am. Participants were asked to indicate the amount of drinks consumed in the last hour by choosing a number between "1" and "25 or more" drinks. In responding to the question, participants were instructed to consider a drink of alcohol as 12 oz. of beer or wine cooler, 4 oz. of wine or 1 oz. of hard liquor (straight or in a mixed drink) (Cahalan et al., 1969; Read & O'Connor, 2006). When participants reported drinking in the past hour, they were asked to respond with either "yes" or "no" to "Are you pre-drinking?" Given our interest in capturing the first decision to consume alcohol, the first drinking event for each evening of data collection and pre-drinking status were included in the analyses.

Data for participants who did not complete a daily assessment was coded as missing. Those that did not report drinking throughout the evening were excluded from the analysis. When participants responded "yes" to "Are you pre-drinking?", they were asked to report the number of drinks consumed over the past hour. The number of drinks consumed over consecutive assessments identified as pre-drinking were summed to obtain the total number of drinks consumed during pre-drinking. When participants answered "No" but reported consuming one or more drinks on the first drinking event, they were considered to be drinking but not pre-drinking. The pre-drinking outcome variable was coded as 1 or more (Total number of drinks consumed while pre-drinking) and 0 (Drinking but not pre-drinking). Higher scores on the pre-drinking outcome variable indicate elevated quantities of drinks consumed during pre-drinking.

Social Anxiety. The Fear of Negative Evaluation scale (FNE) is a 30-item self-report

social anxiety questionnaire that assesses fear and anticipation of being negatively evaluated by others (Watson & Friend, 1969). Participants indicated whether each statement (e.g., "I worry about what people will think of me even when I know it doesn't make a difference") was true (*1* = True; *0* = False) for them. Reverse worded items were reversed coded. A mean score of all items was computed with higher scores indicating elevated fear of negative evaluation. The FNE has been shown to have high scale score reliability ($\alpha = 0.94$), good test-retest reliability ($r = 0.78$) and good discriminant validity when compared to a measure of social desirability (Crowne & Marlowe, 1964) in a sample of undergraduates (Watson & Friend, 1969). In the present study, scale score reliability was satisfactory ($\alpha = .91$).

Drinking Context. When participants responded "Yes" to "Are you pre-drinking?", they were directed to the pre-drinking context questionnaire. In the present study, an adapted version of Cooper's (1994) compiled drinking context items was used to assess pre-drinking context. Every hour, students were asked to report where they were in that moment (i.e., at home, at a friend's home, at a party, bar/club, at a restaurant, at a work function, at a school function, at a boyfriend's/girlfriend's/significant other's house, other). Pre-drinking context from the first drinking event of the evening was included in the analysis. At home, friend's home, as well as boyfriend/girlfriend/significant other's house were all recoded into one category to represent *intimate drinking contexts*. At a party, bar, or club were recoded into a second category to represent *group contexts*, and restaurants, work functions, school functions, and other were recoded into the third category reflecting *other contexts*. Given the categorical nature of this measure, pre-drinking contexts were included in the model as a set of two dummy variables coded (1) 1 for Group contexts and 0 otherwise and (2) 1 for Other contexts and 0 otherwise so that the referent context when both dummy variables were included was Intimate contexts.

Mood. A Visual Analogue Scale (VAS; Martin, 1990) was adapted to assess momentary (state, hourly fluctuations) levels of anxious mood. In order to assess anxious mood, participants rated their anxiety by responding to "At this moment I feel…" on a scale from 0 (Not at all anxious) to 100 (Very anxious). This item is consistent with those used in other anxious/negative mood manipulations and drinking motives work (e.g., Abrams, Kushner, Lisdahl, et al., 2001; Grant et al., 2007). For purposes of analyses, ratings were divided by 10 to obtain scores ranging from 0 to 10. As we were interested in capturing the first decision to consume alcohol, the anxious mood rating assessed at the first drinking event for each evening of data collection was

included in the analyses.

Analyses

Data Screening

Overall 229 participants completed a total of 16,820 assessments across 12 days and 8 possible assessments per evening. Seven hundred and thirty seven assessments were not completed within the hour (e.g., between 6 pm and 7 pm for the 6 pm assessment) and were excluded from the study. The first drinking event of the evening for each participant, for each day was selected - this was the first event in the evening when they indicated "yes" to consuming alcohol. Out of 2748 assessment days across all participants, 79 days of assessments across different participants were incomplete and excluded from the analyses. A total of 1407 assessment days (52.7%) consisted of non-drinking days. The minimum number of days included in the analyses where at least one alcoholic beverage was consumed was one and the maximum number of days was 12 with an average of 5.53 days (*SD* = 2.48) of assessments where at least one drink was consumed.

The final data analyzed comprised of 1262 assessment days where participants reported consuming alcohol. Of these assessment days, 919 assessments (34.4%) consisted of drinking days (i.e., evenings where they reported drinking but not pre-drinking). Participants consumed on average 3.90 drinks (*SD* = 3.52) on these days. Excluding pre-drinking, 12.2% of participants only had one drinking day (*N* = 28), 15.3% had two drinking days (*N* = 35), 16.2% had three drinking days (*N* = 37), 16.2% had four drinking days (*N* = 37), 9.6% had 5 drinking days (*N* = 22), 10.9% had six drinking days (*N* = 25), 7.9% had seven drinking days (*N* = 18) and 9.1% had eight to eleven drinking days. Three hundred and forty three assessments (12.8%) consisted of pre-drinking days. Participants consumed on average 3.69 drinks (*SD* = 2.72) while pre-drinking on a given evening and drank on average an additional 3.51 drinks (*SD* = 3.79) during the rest of the night. In total, participants consumed an average of 7.20 drinks (*SD* = 4.81) throughout the evening on pre-drinking days. For 153 participants who pre-drank at least once throughout the study, 48.4% had one pre-drinking day (*N = 74*), 16.3% had two pre-drinking days (*N* = 25), 15.7% had three pre-drinking days (*N*= 24) and 17.9% had four to seven pre-drinking days (*N* = 30). Out of all drinking days included in the analyses, 2.6% of participants only had pre-drinking days and no drinking days (*N* = 6). Descriptive statistics and bivariate correlations for variables included in the statistical analyses are presented in Table 2.1.

Model Estimation

These analyses were conducted with Mplus 8.0 (Muthén & Muthén, 2018), using the Maximum Likelihood Robust (MLR) estimator, which is appropriate for count variables and more generally robust to non-normality. We used Full Information Maximum Likelihood (FIML) procedures to handle missing data (Enders, 2010). To be able to disaggregate relations occurring at the within-person (Level 1, day-to-day variations) and between-person (Level 2) levels, all analyses were conducted via the multilevel analytic framework.

We used a multilevel Zero-Inflated Poisson (ZIP) regression model to account for the specific nature of the pre-drinking measure, which followed a count (i.e. Poisson) distribution with a large stack of data points at zero (i.e., zero-inflated). This is a common characteristic of the distribution of alcohol and substance use outcomes. Data points at zero indicate events without pre-drinking. To account for this characteristics of this key outcome variable, we thus relied on ZIP regression models (Atkins et al., 2013; Atkins & Gallop, 2007; Coxe et al., 2009; Hilbe, 2011; Neal & Simons, 2007; Simons et al., 2006). The standard ZIP model allows researchers to disaggregate two types of predictions: (1) whether a behavior occurred ("pre-drinking occurrence": not pre-drinking vs. pre-drinking), and (2) frequency of the behavior when the behaviour occurred ("pre-drinking quantity": quantity of drinks consumed while pre-drinking). This approach has been used in other studies examining drug and alcohol use (McCarthy et al., 2007; Murray et al., 2008; Simons et al., 2006).

In the present study, we were interested in understanding whether level 1 variables (pre-drinking context, anxious mood) moderated the relation between SA (level 2 predictor) and pre-drinking occurrence and quantity. Analyses were conducted in three steps. In the first step (Model 1), we regressed pre-drinking occurrence (dichotomous, pre-drinking vs. not pre-drinking) and quantity (continuous, if pre-drinking, how much consumed) on SA (mean FNE score) (Level 2), anxious mood (single item on VAS) (Level 1), and pre-drinking context (two dummy-coded variables) (Level 1). In the second step (Model 2), we added two-way interactions between SA and mood, SA and context, and mood and context. In the third step (Model 3), we also included three-way interactions between SA, mood, and context. The identification of statistically significant interaction effects was followed by an examination of simple slopes (Aiken & West, 1991), conditioning the effect of SA predicting at high (+1 *SD*) and low (-1 *SD*) anxious mood and pre-drinking contexts. To facilitate the interpretation of the results, and given

our interest on level-2 relations (i.e., SA) after adjustment for level-1 relations (i.e., anxious mood and pre-drinking contexts), SA scores were grand-mean centered, whereas anxious mood was group-mean centered, prior to the analyses (Heck & Thomas, 2015).

Results

We were interested in examining the combined effect of anxious mood and pre-drinking context as moderators of the relation between SA and pre-drinking occurrence and quantity. The anxious mood rating assessed at the first drinking event for each evening of data collection was included in the analyses. We hypothesized that SA would predict increased pre-drinking occurrence and pre-drinking quantity. We also hypothesized that the effects of SA on pre-drinking occurrence and quantity would be moderated by anxious mood and pre-drinking context. As such, elevated SA would predict increased occurrence of pre-drinking and increased quantity of alcohol consumed during pre-drinking, and these associations would be more pronounced for those experiencing anxious mood and for those pre-drinking in less familiar (i.e., other) contexts. In contrast, we hypothesized that elevated SA would predict decreased occurrence of pre-drinking and decreased quantity of alcohol consumed during pre-drinking, for those pre-drinking in intimate contexts. The effect of anxious mood on pre-drinking in intimate contexts was less clear.

Outcome: Pre-drinking Occurrence

Coefficients and 95% CI for three regression models predicting the occurrence of pre-drinking (pre-drinking vs. not pre-drinking) are reported in Table 2.2. In the first step, SA was not a statistically significant ($p > .05$) predictor of pre-drinking occurrence. Results indicated that pre-drinking in both group and other contexts predicted likelihood of pre-drinking vs. not when compared to drinking in intimate contexts. However, findings did not support anxious mood as a predictor of likelihood of pre-drinking vs. not. In the second step, the two-way interaction terms were not statistically significant ($p > .05$), thus, both context and anxious mood were not supported as independent moderators of the SA-pre-drinking association. In the final step, the three-way interactions between SA, anxious mood, and pre-drinking contexts were statistically significant, suggesting that the combined effects of anxious mood and pre-drinking contexts moderated the effect of SA on likelihood of pre-drinking.

The results from simple slope analyses underpinning these interactions are graphically presented in Figure 2.1 Panel A (Intimate contexts), Panel B (Group contexts), and Panel C

(Other contexts). Results indicated that none of the simple slopes were statistically significant ($p > .05$). Interestingly, the simple slopes showed that the direction of the effect of SA on pre-drinking occurrence changed across pre-drinking contexts and anxious mood. Compared to intimate contexts and when anxious mood was high, elevated SA predicted increased likelihood of pre-drinking in other contexts and decreased likelihood of pre-drinking in group contexts. Complementary analyses were realized using alternate codings of the dummy variables in order to assess possible differences between group and other contexts. These analyses revealed that these two contexts did not differ from one another either in terms of likelihood of pre-drinking vs. not ($B = -.05$, $S.E. = .36$, $p > .05$) (refer to Figure 2.1 Panels B and C).

Outcome: Pre-drinking Quantity

Results from the three regression models predicting pre-drinking quantity are reported in Table 2.3. In the first step, SA was not a statistically significantly predictor of pre-drinking quantity ($p < .05$). Similarly, results did not support pre-drinking contexts and anxious mood as predictors of pre-drinking quantity. In the second step, the two-way interactions between SA and anxious mood were not statistically significant ($p < .05$), thus anxious mood was not supported as an independent moderator of the SA-pre-drinking quantity association. While the two-way interaction term between SA and pre-drinking context when coded as group contexts compared to intimate contexts was statistically significant, this interaction was not statistically significant when pre-drinking context was coded as other contexts compared to intimate contexts. Thus, group context compared to intimate context was supported as a moderator of the SA-pre-drinking association, but other context was not. In the final step, three-way interactions between SA, anxious mood and pre-drinking contexts were statistically significant, suggesting that the combined effects of anxious mood and pre-drinking contexts moderated the effect of SA on pre-drinking quantity.

The results from simple slope analyses underpinning these interactions are graphically presented in Figure 2.2 Panel D (Intimate contexts), Panel E (Group contexts), and Panel F (Other contexts). Results indicated that only simple slopes in group contexts were statistically significant ($p < .001$). When anxious mood was high, elevated SA negatively predicted pre-drinking quantity in group contexts compared to intimate contexts. Complementary analyses were realized using alternate codings of the dummy variables in order to assess possible differences between group and other contexts. These analyses revealed that these two contexts

did not differ from one another in terms of pre-drinking quantity (B = -.05, $S.E.$ = .25, $p > .05$) (refer to Figure 2.2 Panels E and F)

Discussion

The present study set out to overcome gaps in the SA-pre-drinking literature by testing a cognitive model of SA and pre-drinking among undergraduates. We were interested in examining the combined role of pre-drinking contexts and anticipatory anxiety in the SA-pre-drinking association using ecologically valid daily diary methods. Fitting with cognitive theory and hypotheses, we found that the combined effect of pre-drinking context and anticipatory anxiety moderated the link between SA and pre-drinking. Our findings were in partial support of our hypotheses. We extend prior work by demonstrating differential pre-drinking risk in various types of social contexts (i.e., group contexts vs. other contexts) when anxious mood is high. In partial support of our hypotheses, elevated SA predicted increased likelihood of pre-drinking in other contexts (e.g., restaurants, school, work functions) compared to intimate contexts when anxious mood was high. Although not previously hypothesized, group contexts protected against likelihood of pre-drinking and quantity of alcohol consumed during pre-drinking when anxious mood was high. The present study adds to the current literature as it provides support for an integrative model of SA and pre-drinking and identifies risk factors underlying the SA pathway to pre-drinking.

To date, little attention has been given to clarifying aetiological models of SA and pre-drinking, and more specifically to examining pre-drinking context and anticipatory anxiety simultaneously as factors that increase SA risk for pre-drinking. Cognitive models of SA (Clark & Wells, 1995) suggest that those high in SA would pre-drink to reduce anticipatory anxiety prior to social events. Anticipatory anxiety consists of thinking about the situation in detail, worrying about upcoming failures, poor performance, and rejection, and focusing on past failures and negative images of themselves in these situations (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997). According to previous studies, those high in SA experience increased anxious mood in less familiar contexts compared to intimate contexts (e.g., with a close friend) (e.g., Hur et al., 2019). Such findings suggest that these individuals may be at increased risk for pre-drinking to reduce anticipatory anxiety in less familiar social contexts. Guided by cognitive models of SA (Clark & Wells, 1995) and by tension reduction theory (Conger 1956), we hypothesized that elevated SA would predict increased likelihood of pre-drinking prior to the

main event (vs. going straight to the main event without pre-drinking) and increased quantity of alcohol consumed when pre-drinking. Contrary to our hypotheses, we found that elevated SA did not directly predict increased likelihood of pre-drinking nor did it predict increased quantity of alcohol consumed when pre-drinking. This is not surprising, given mixed evidence supporting the association between SA and alcohol use (Buckner et al., 2011; Buckner et al., 2013), which suggests the importance of identifying moderating variables of SA and pre-drinking. Our findings suggest that risk for pre-drinking differed as a function of both anxious mood and pre-drinking context among socially anxious undergraduates. In these analyses, pre-drinking risk was compared to going straight to the main event without pre-drinking. The comparison group was intimate contexts, therefore results below are reported in comparison to pre-drinking in intimate contexts. Although the slope was not different from zero, the direction of the effect of SA on risk for pre-drinking (vs. drinking at the main event) was in partial support of hypotheses.

In partial support of our hypotheses, findings suggest that those high in SA are more likely to pre-drink than go straight to the main event when in "other" social contexts (e.g., restaurants, work/school functions) and when anticipatory anxiety is high. Consistent with cognitive models of SA (Clark & Wells, 1995), those high in SA would experience increased anticipatory anxiety associated with upcoming interactions in less familiar contexts, and may thus be more likely to engage in pre-drinking in order to reduce anxious mood and facilitate ongoing and upcoming social interactions. Our results are consistent with previous work showing that SA is associated with alcohol use as a means to avoid social scrutiny (Stewart et al., 2006), with increased drinking to cope in social situations (Thomas et al. 2003; Buckner & Heimberg, 2010), and in contexts involving negative emotions (Buckner et al., 2006; Terlecki et al., 2014). Findings are also consistent with work indicating that young adults high in SA experience reduced negative affect, anxiety, and depression when with close companions (i.e., close friends, family members, romantic partners), which is not the case when they are with strangers, co-workers, and acquaintances (Hur et al., 2019). Our results also suggest that although these individuals are more likely to be in less familiar contexts when they pre-drink when anxious mood is high, they do not pre-drink more heavily. Consistently, individuals diagnosed with social anxiety disorder drink less alcohol and select weaker drinks when drinking in groups before a social anxiety challenge compared to a control task (Abrams et al., 2002). Therefore, although those high in SA may be more likely to pre-drink than go straight to the

main event without pre-drinking in less familiar context when experiencing high anticipatory anxiety, they may not pre-drink more heavily for fear of embarrassing themselves if intoxicated and impairing performance at the social event. In sum, convivial social contexts (e.g., drinking at a restaurant, at a school or work function) may be more anxiety-provoking for socially anxious individuals compared to intimate contexts and may increase likelihood of pre-drinking among undergraduates.

Although not previously hypothesized, the present study demonstrated that those high in SA are less likely to pre-drink (than go straight to the main event without pre-drinking), and pre-drink less heavily when in group contexts and when anxious mood is high. Cognitive models of SA suggest that pre-drinking with others (e.g., at a party, club) is a social event that should provoke anxiety among socially anxious individuals (Clark & Wells, 1995). As these individuals worry about intoxication that can lead to regretful and embarrassing behaviours which they fear (Schry & White, 2013), they may avoid pre-drinking in group contexts for fear of embarrassing themselves in front of others. Consistently, previous studies have shown that socially anxious individuals are less likely to pre-drink around others which in turn protects them from heavy drinking and related problems (Keough et al., 2016). When given a choice, socially anxious individuals consume very little alcohol before a speech task compared to a control silent reading task (Abrams et al., 2002) and do not consume elevated quantities of alcohol in social contexts (Terlecki et al., 2014). Overall, our findings and previous work suggest that when in group contexts (bar, club, parties), those high in SA tend to abstain from alcohol for fear of embarrassing themselves if intoxicated and of the adverse social consequences of displaying drunken behavior. Taken together, results from the present study suggest that risk for pre-drinking in different types of social contexts (i.e., less familiar vs. group contexts) varies for those high in SA when anticipatory anxiety is high. However, one of the limitations of the study is in how pre-drinking contexts were categorized. Although we were guided by the data and previous work, it is unclear who was present in these social contexts. As socially anxious individuals may feel more comfortable in the presence of a close friend vs. alone or with strangers (Hur et al., 2019; Pontari, 2009), intimate, group and other contexts may differ in how anxiety-provoking they are for those high in SA depending on who is present at these pre-drinking events. More research is needed to replicate the current study results and to continue disentangling the effect of anticipatory anxiety and social contexts on SA risk for pre-drinking.

Our study is not without its limitations. First, a non-clinical sample was used, including individuals who range in SA and denied past and current drinking problems. Future work should aim to replicate and expand our results with clinical samples of young adults who are high in SA. Nonetheless, SA and pre-drinking are on a continuum (Ruscio, 2010), therefore we may expect to find similar results in clinical samples. Second, one of the main challenges of the present study was grouping pre-drinking contexts into categories. In doing so, we were guided by cognitive models of SA and previous work on drinking context. However, to date, very little is known about pre-drinking contexts, and more specifically for those high in SA. To our knowledge, there are no measures that have been developed and validated to define and measure pre-drinking contexts in this population. Qualitative studies aimed at developing measures of context are needed to improve the assessment of pre-drinking contexts among those high in SA. Without such measures, future studies should assess who is present during pre-drinking, how many people are present, and assess the quality of relationships (e.g., McGill Friendship Questionnaire, Mendelson & Aboud, 1999) to test these factors as moderators of the association between SA and pre-drinking. Third, in recent years, pre-drinking motives questionnaires have been developed and validated (e.g., Pre-drinking Motives Questionnaire; Labhart & Kuntsche, 2017) and studies have shown that drinking alone has been common amongst those who drink for coping-related reasons (Christiansen et al., 2002; Keough et al., 2015). Given our sample size, we were unable to add complexity to our model. Future work should aim to expand our work by testing in-the-moment pre-drinking motives at the within-level as proximal predictors of pre-drinking across pre-drinking contexts and as a function of anticipatory anxiety. Such efforts would improve our understanding of cognitive factors involved in the decision to pre-drink across social contexts among those high in SA. Fourth, the complexity of our model precluded us from examining the potential role of gender. The relation between pre-drinking, pre-drinking motives and alcohol-related consequences has been shown to differ across gender (Napper et al, 2015). There is also support in the literature for the importance of looking at non-binary gender as marginalized individuals have been found to be at-risk for alcohol problems (Newcomb et al., 2020; Rimes et al., 2019). Future work should aim to test non-binary gender-specific models which would also require larger sample sizes. Last, experimental studies are needed to replicate our findings in controlled conditions by mimicking pre-drinking contexts in the laboratory. These studies would aim to induce anticipatory anxiety and examine pre-drinking in response to

anticipatory anxiety across different pre-drinking contexts. Such efforts would further shed light on the mechanisms underlying SA risk for pre-drinking.

The present study has clinical implications for improving evidence-based interventions aimed at reducing SA risk for pre-drinking among undergraduates. Our findings indicate that anticipatory anxiety is a cognitive process through which SA increases risk for pre-drinking in risky pre-drinking contexts. Evidence-based psychoeducational interventions are among the gold standard of clinical interventions with undergraduates (Merrill et al., 2013) and have been supported as effective in reducing risk for problem drinking (Cronce & Larimer, 2011). These interventions provide undergraduates with relevant information regarding their drinking habits. Incorporating information regarding risky pre-drinking practices, risky pre-drinking contexts and pre-drinking to reduce anticipatory anxiety may be central to adapting these preventative interventions. Moreover, findings also highlight the importance of adapting current interventions that target both alcohol misuse and social anxiety disorder. To date, treatment outcomes for individuals with comorbid conditions are poor (Kushner et al., 2005). Recent studies suggest that integrated treatment that recognize the complex relation between social anxiety disorder and alcohol use disorder may be the best approach in intervention efforts (Stapinski et al., 2015). Moreover, cognitive processes are malleable and targets for evidence-based interventions such as Cognitive Behaviour Therapy (Goldman, 1999; Heimberg, 2002). Our findings along with the current literature on treatment approaches for comorbid conditions indicate that individuals may require treatment that targets both anticipatory processing in different contexts and reasons for pre-drinking in these contexts. Such interventions would target negative self-appraisals, negative beliefs and predictions prior to social interactions. In addition, treatments should also include skills-based training, including distress tolerance and emotion regulation skills aimed at providing adaptive coping tools for those high in SA who would be more likely to pre-drink to reduce distress. These integrated interventions may be particularly promising in advancing clinical interventions for young adults presenting with comorbid social anxiety and alcohol use disorder.

In conclusion, this study is the first to utilize daily-diary methods and integrate both within and between-person levels of analysis to clarify the SA-pre-drinking link. The present study is novel as it assessed momentary levels of anticipatory anxiety and integrated pre-drinking context and anxious mood simultaneously into a theoretically sound model of SA and pre-

drinking. Within our model, some social contexts increased likelihood of pre-drinking compared to intimate contexts when anxious mood was high. Group contexts were identified as protective against heavy pre-drinking. Our study gives direction to clinical interventions and future research on SA and pre-drinking.

Table 2.1

Descriptive Statistics and Bivariate Correlations

	1	2	3	*M (N)*	*SD (%)*
1. SA	-	-	-	.53	.25
2. Anxious Mood	.31*	-	-	2.07	2.42
3. Pre-drinking	-.02	-.03	-	1.01	2.18
0*: Drinking but not pre-drinking*				*(921)*	*(68.4)*
1 or more: *Number of drinks consumed during pre-drinking*				*(345)*	*(31.6)*
Pre-drinking Contexts					
Intimate: *Home, Friend's home, Significant other's house*				*(290)*	*(84.1)*
Group: *Party, Bar, Club*				*(29)*	*(8.4)*
Other: *Restaurant, School function, Work function, Other*				*(25)*	*(7.3)*

Note. * $p < .01$; *M*: Mean; *N*: number of participants corresponding to each category; *SD*: Standard deviation; *%*: Percentage of participants corresponding to each category.

Table 2.2

Zero-Inflated Poisson Regression Model Summary: Effect of SA on Pre-drinking Occurrence Moderated by Anxious Mood and Contexts.

	Model 1				Model 2				Model 3			
	B	*SE*	*p*	*95% CI*	*B*	*SE*	*p*	*95% CI*	*B*	*SE*	*p*	*95% CI*
Intercept	.58	.10	.000	.38, .79	.56	.11	.000	.35, .77	.56	.10	.000	.36, .76
SA	-.17	.38	.662	.92, .58	-.18	.43	.671	-1.03, .66	-.22	.42	.590	-1.04, .59
Mood	.02	.04	.566	-.06, .10	.03	.04	.377	-.04, .11	.05	.05	.295	-.04, .15
Context1	1.32	.27	.000	.80, 1.84	2.09	.39	.000	1.33, 2.85	2.24	.40	.000	1.46, 3.01
Context2	1.27	.25	.000	.78, 1.76	1.05	.31	.001	.44, 1.66	1.08	.20	.000	.69, 1.46
Mood*SA					-.07	.21	.748	-.48, .34	-.25	.19	.192	-.63, .13
Context1*SA					-1.95	1.36	.151	-4.62, .72	-2.20	1.48	.136	-5.10, .69
Context2*SA					.73	1.03	.475	-1.28, 2.74	.83	.40	.040	.04, 1.61
Context1*Mood					-.16	.15	.296	-.46, .14	.01	.13	.931	-.24, .27
Context2*Mood					-.26	.23	.275	-.71, .20	-.056	.01	.000	-.06, -.05
Context1*Mood*SA									-.42	.08	.000	-.57, -.27
Context2*Mood*SA									.18	.01	.000	.16, .20

Note. *B* = unstandardized parameter estimate. *SA* = Social Anxiety (level-2 predictor). *Mood* = In-the-moment Anxious Mood. *Context1*: Dummy variable for pre-drinking context, *1* = Bar/Party/Club, *Context2*: Dummy variable for pre-drinking context, *1* = School function/Work event/Restaurant/Other. Pre-drinking context reference category is Intimate contexts (home/friend's home/significant other's house).

Table 2.3

Zero-Inflated Poisson Regression Model Summary: Effect of SA on Pre-drinking Quantity Moderated by Anxious Mood and Contexts.

	Model 1				Model 2				Model 3			
	B	*SE*	*p*	*95% CI*	*B*	*SE*	*p*	*95% CI*	*B*	*SE*	*p*	*95% CI*
Intercept	1.30	.06	.000	1.19, 1.41	1.27	.06	.000	1.16, 1.38	1.26	.06	.000	1.15, 1.37
SA	-.32	.23	.162	-.76, .13	-.21	.22	.334	-.63, .21	-.20	.22	.360	-.63, .23
Mood	-.05	.04	.152	-.12, .02	-.04	.04	.371	-.11, .04	-.03	.05	.605	-.13, .07
Context1	-.20	.15	.188	-.50, .10	-.41	.12	.001	-.63, -.18	-.32	.10	.001	-.51, -.13
Context2	-.25	.22	.251	-.67, .17	-.97	.43	.025	-1.82, -.12	-.81	.26	.002	-1.32, -.31
Mood*SA					-.07	.16	.667	-.38, .25	-.09	.20	.648	-.48, .30
Context1*SA					-2.93	.40	.000	-3.72, -2.15	.18	.18	.323	-2.63, -2.18
Context2*SA					.06	.84	.946	-1.58, 1.70	.14	.09	.140	-1.81, -.49
Context1*Mood					.03	.06	.601	-.09, .16	-2.40	1.48	.136	-.18, .54
Context2*Mood					-.34	.22	.122	-.77, .09	-1.15	.34	.001	-.04, .32
Context1*Mood*SA									-1.23	.27	.000	-1.77, -.69
Context2*Mood*SA									-.80	.40	.043	-1.58, -.03

Note. *B*= Unstandardized Parameter estimate. *Mood* = In-the- Moment Anxious Mood and Pre-drinking context (level-1 predictors). *SA* = Social Anxiety (level-2 predictor). *Context1*: Dummy variable for pre-drinking context, *1* = Bar/Party/Club, *Context2* : Dummy variable for pre-drinking context, *1* = School function/Work event/Restaurant/Other. Pre-drinking context reference category is Intimate contexts (home/friend's home/significant other's house).

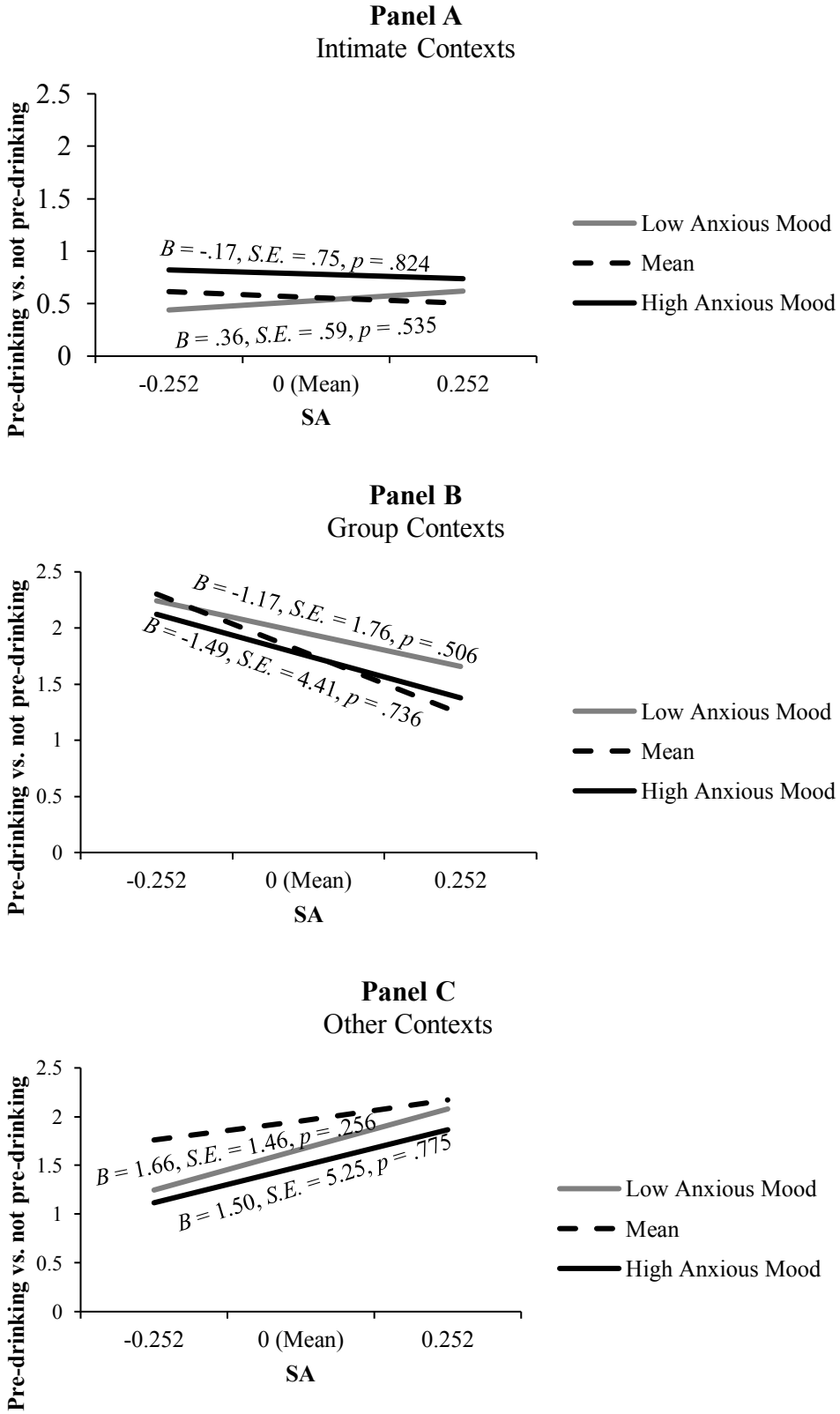

Figure 2.1. Simple slopes of SA predicting pre-drinking occurrence at high (+ 1SD) and low (-1SD) levels of anxious mood Across pre-drinking contexts.

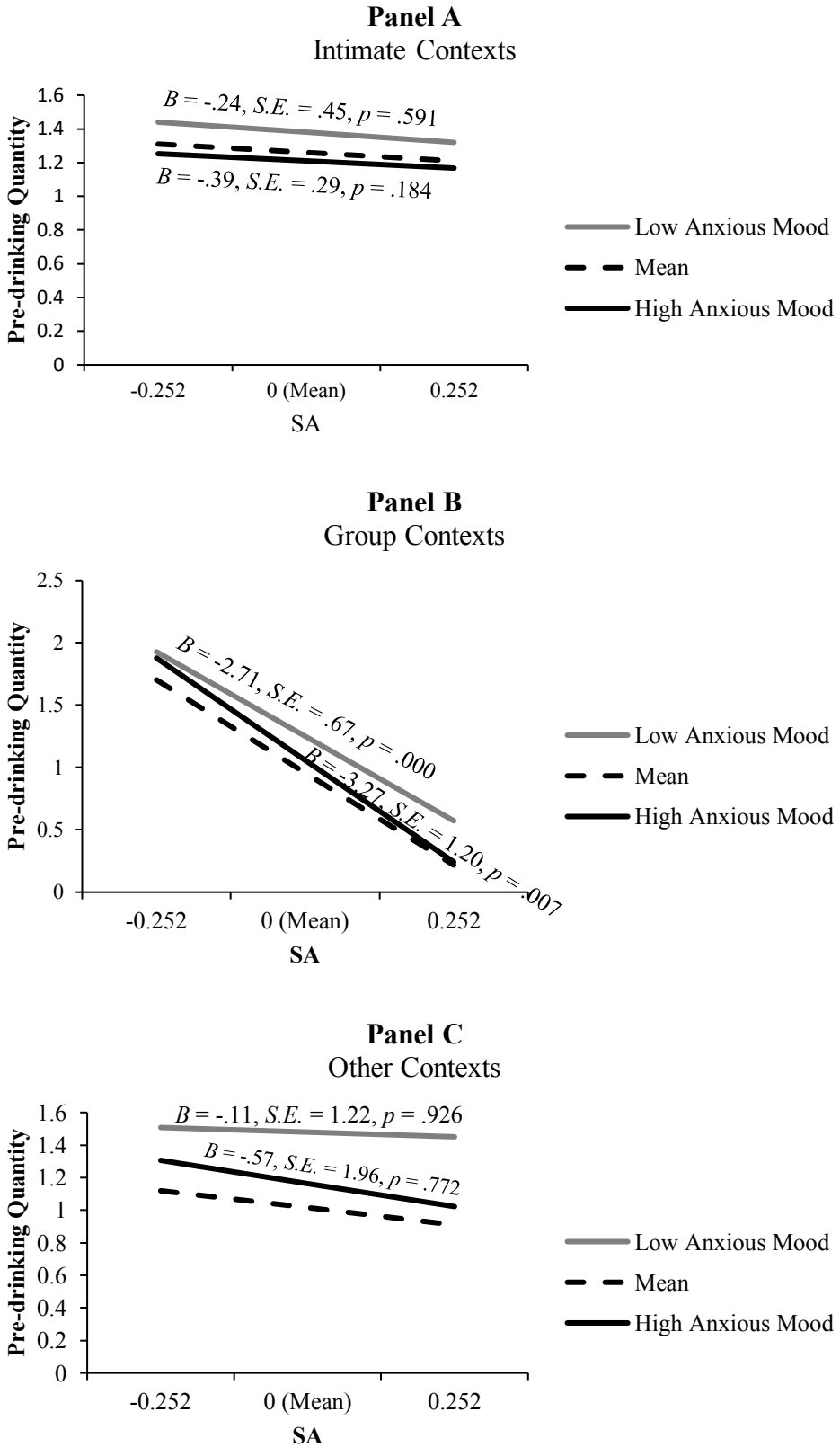

Figure 2.2. Simple slopes of SA predicting pre-drinking quantity at high (+ 1SD) and low (-1SD) levels of anxious mood across pre-drinking contexts.

CHAPTER 3:
TRANSITION TO STUDY 2

The first study was a daily diary longitudinal investigation of SA risk for pre-drinking in undergraduates. Using ecological momentary assessments through smartphones, pre-drinking contexts and anticipatory anxiety were captured in real time at the first decision to consume alcohol while also capturing pre-drinking over the course of the night. We investigated in the moment pre-drinking contexts and anticipatory anxiety as moderators of the SA-risk for pre-drinking. As expected, the combined effect of pre-drinking contexts and anticipatory anxiety moderated the SA risk for pre-drinking as measured by two outcomes: 1) likelihood of pre-drinking (vs. drinking at the main event) and 2) amount of alcoholic drinks consumed during pre-drinking. In partial support of our hypotheses, findings suggested that compared to intimate contexts, elevated SA predicted increased likelihood for pre-drinking in other contexts, such as restaurants, work function, school function, when anxious mood was high, but predicted decreased quantity of drinks consumed during pre-drinking. Although not previously hypothesized, group contexts such as parties, bars, clubs, protected against likelihood of pre-drinking and quantity of alcohol consumed during pre-drinking when anxious mood was high. This investigation adds to the current literature as it provides support for an integrative model of SA and pre-drinking and identifies risk factors underlying the SA pathway to pre-drinking.

Findings from the first study shed light on *in-the-moment* emotional processes and social context relevant to SA and pre-drinking. Although the first study examined *where* risk for pre-drinking occurred, we were unable to investigate *who* was present during pre-drinking in these social contexts. This is relevant as evidence indicates that social contexts differ in how anxiety-provoking they are depending on who is present in these situations for those high in SA (e.g., Hur et al., 2019) and risk for problem drinking varies depending on the context in which drinking takes place (e.g., Buckner et al., 2006). Pre-drinking occurs in a variety of contexts and can take place either alone, with close friends or with strangers (LaBrie et al., 2011; Pedersen et al., 2009). According to evidence, tension reduction theory (Conger, 1956) and cognitive models of SA (Clark & Wells, 1995), those high in SA would be more likely to experience increased anticipatory anxiety in specific contexts (e.g., alone or with strangers), which would in turn increase risk for pre-drinking. To date, there are no studies, to our knowledge, that have examined pre-drinking and specifically in relation to SA in the laboratory. Last, there are no experimental studies that have investigated risk

factors (anticipatory anxiety and social context) relevant to the SA risk for pre-drinking in the laboratory.

Using a controlled experimental study design, we were interested in isolating the role of social context and test its effect on the relation between 1) SA and anticipatory anxiety and 2) SA and urge to drink, prior to a social event (i.e., to pre-drink). To do so, we aimed to experimentally induce anticipatory anxiety of an upcoming social event in three social contexts (as individuals were alone, with a friend or with a stranger). This would allow us to track ratings of anticipatory anxiety and determine the relation between SA and anticipatory anxiety across social contexts. The period of time after inducing anticipatory anxiety but prior to the social event would be analogue to pre-drinking. Therefore, during this time, we aimed to have participants complete a taste rating task to give them the opportunity to pre-drink (i.e., drinking before a main event). This would enable us to mimic pre-drinking in the laboratory and to examine the relation between SA and urge to drink prior to a social event across social contexts while participants are experiencing anticipatory anxiety. For comparative purposes, we were interested in investigating the effect of SA on anticipatory anxiety and urge to pre-drink across social contexts in an alcohol vs. no alcohol condition. Last, we aimed to examine social context as moderating the SA effect on pre-drinking to cope with anxiety motives and breath alcohol concentration for those in the alcohol condition only. Doing so would allow us to test whether SA predicts increased pre-drinking to cope with anxiety motives and increased pre-drinking quantity in specific contexts. A lab-based design was therefore warranted to isolate and investigate risk factors relevant to the SA pathway to pre-drinking.

CHAPTER 4
STUDY 2

A lab Study of Pre-drinking Social Context: Social Anxiety Risk for Anticipatory Anxiety, Urge to Drink, and Coping Motives

Badawi, G., Mackinnon, S., & O'Connor, R.M., (manuscript in preparation).

Pre-drinking, also known as pre-partying or pre-gaming, is prevalent among university students. As many as 85% of students report pre-drinking in the past month (Brosari et al., 2007; LaBrie & Pederson, 2008). Pre-drinking is concerning as it predicts heavy alcohol use throughout the evening (Kuntsche & Labhart, 2013) and elevated blood alcohol concentration over the course of the night (Clapp et al., 2009). High quantities of alcohol consumed on pre-drinking nights places students at increased risk for alcohol-related problems, including blacking out and drunk driving (Labhart et al., 2013; Merrill et al., 2013, Pederson & LaBrie, 2007; Read et al, 2010). Although policy standards against heavy drinking have been enforced, pre-drinking continues to be normative and problematic among undergraduates (Mitchell et al., 2005). Furthering our understanding of undergraduate pre-drinking may move us forward in establishing effective policy, prevention, and intervention strategies aimed at young adult alcohol misuse.

Social Anxiety (SA) – characterized by marked fear or anxiety about social situations in which an individual is exposed to possible scrutiny by others (APA, 2013) – is a trait characteristic that has been linked to problematic alcohol use (see Schry &White, 2013 for meta-analysis; Stewart et al., 2006). SA is a complex construct. It consists of multiple facets that include negative affect, evaluation fears, and social avoidance. Reflecting this nuanced conceptualization, SA has been measured using various self-report questionnaires (e.g., the Social Interaction Anxiety Scale (SIAS); the Fear of Negative Evaluation scale (FNE)). Given these measures capture slightly different facets of SA, it is not surprising that the link between SA and alcohol misuse varies somewhat, depending on the measures used (Eggleston et al., 2004; Lewis & O'Neil, 2000; Thomas et al., 1999). For example, SA, when measured using the SIAS, has been negatively associated with heavy drinking but found to have no effect on alcohol-related problems (Eggleston et al., 2004; Ham & Hope, 2005). Whereas SA, when assessed using the FNE, has been positively associated with alcohol problems (Lewis & O'Neil, 2000; Morris et al., 2004). Looking beyond issues of measurement, in clinical populations, SA tends to onset prior to and more than quadruples the risk of developing an alcohol use disorder (Buckner, Timpano et al., 2008; Kushner et al., 2000). For undergraduates, SA may be a particularly relevant risk factor for alcohol misuse. SA is highly prevalent among this demographic (Purdon et al., 2001; Strahan, 2003), undergraduates are routinely faced with anxiety-provoking situations (e.g., parties, roommates), and drinking is a normative activity that not only serves as a social lubricant but is also seen as a developmental rite of passage (Johnston et al., 2009; Moffitt, 1993). Research has linked SA to alcohol misuse among undergraduates (e.g., Stewart et al.,

2006) and recent evidence indicates that SA may also increase risk for pre-drinking (Buckner et al., 2020; DeJong et al., 2010; Keough et al., 2016; Pederson & LaBrie, 2007).

The tension reduction theory (TRT; Conger, 1956) posits that those high in SA are particularly responsive to alcohol's tension-reducing effects and thus consume alcohol to reduce anxiety in social situations. Coping motives (i.e., drinking to reduce anxiety) are proximal reasons through which individual differences like SA influence alcohol use (Cooper, 1994; Cox & Klinger, 1988). The self-medication hypothesis (Carrigan & Randall, 2003; Khantzian, 1985) proposes that socially anxious individuals are at risk for continued alcohol use or misuse if alcohol is consumed to cope with negative affect. Furthermore, cognitive-behavioural models of SA (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997) suggest that socially anxious individuals not only experience distress in social situations, but also experience anticipatory anxiety prior to social events (i.e., when the possibility or prospect of interpersonal evaluation exists). Anticipatory anxiety involves recalling and ruminating about past social failures, engaging in negative self-imagery, and anticipating negative social experiences (Clark & Wells, 1995; Heimberg et al., 2010). Taken together, these theories propose that those high in SA may pre-drink to dampen anticipatory anxiety, disrupt the negative self-appraisal process, reduce self-focus, and increase the likelihood of attending the social event. Empirically investigating SA as a risk factor for pre-drinking will better position us in understanding the broader SA-alcohol use risk pathway.

Pre-drinking occurs in a variety of social contexts, including being alone or with others (e.g., with friends, with co-workers) (LaBrie et al., 2011; Pedersen et al., 2009). While studies have investigated how negative affect varies as a function of social context, research examining the role of contexts in SA risk for pre-drinking is scarce. Evidence demonstrates that those high in SA who are in the presence of close friends, compared to those who are alone or with strangers, experience reduced negative affect, negative self-focused thoughts, anxiety, and depression (Carron et al., 1999; Hur et al., 2019; Pontari, 2009). In addition, studies show that SA increases risk for heavy drinking in contexts that evoke unpleasant emotions (Buckner et al., 2006), to avoid social scrutiny (Stewart et al., 2006) and in situations considered intimate/personal (Terlecki et al., 2014). Evidence suggests that those who believe alcohol will help reduce anxiety are twice as likely as those without such beliefs to drink alone (Bourgault & Demers, 1997) and students that drink alone are found to consume alcohol more often, have more alcohol-related problems, and are more likely to drink to cope when compared to social drinkers (Christiansen et al., 2002; Gonzalez et al., 2009). Taken

together, findings suggest social contexts may differ in how anxiety-provoking they are for those high in SA. The link between SA and pre-drinking amount would thus depend on the context in which pre-drinking occurs. Specifically, those high in SA may experience elevated anticipatory anxiety and may be more likely to pre-drink heavily in specific social contexts (e.g., alone or with strangers vs. with a close friend) prior to the main social event. In order to further enhance aetiological models of SA and pre-drinking, research is needed to test the moderating role of social context on SA-related pre-drinking.

According to cognitive model of SA (Clark & Wells, 1995) and theories of addiction (Carrigan & Randall, 2003; Conger, 1956; Khantzian, 1985), those high in SA are at risk for heavy pre-drinking when experiencing anticipatory anxiety prior to social events. Anticipatory anxiety has been related to increased amount of alcohol consumed before a social event among individuals with clinically elevated SA (Buckner et al., 2020) in a cross-sectional study. Experimental studies have also found an association between anticipatory anxiety and alcohol use among those high in SA *before* an anxiety-provoking task; however, findings have been mixed. Indeed, some have found a positive relation (Kidorf and Lang, 1999; Samoluk & Stewart, 1996), others have found no link (Bernstein, 2014), and some have found a negative relation (Abrams et al., 2002). As part of these studies, participants consumed alcohol either alone (Kidorf & Lang, 1999; McNair, 1996), in the presence of other participants (Abrams et al., 2002), or with others in non-neutral lab spaces (Bernstein, 2014). Given what we know about social context effects on anxious mood and pre-drinking, these varying findings are not surprising. Social contexts may differ in how anxiety-provoking the situations are for those high in SA, which would in turn influence risk for pre-drinking. Considering context differences across these studies might help resolve the mixed support for the link between SA and pre-drinking. Today, research designed to investigate pre-drinking in the laboratory, specifically for those high in SA is needed to improve our understanding of SA risk for pre-drinking. Such research should aim to examine the effect of social context on SA-related increase in anticipatory anxiety and urge to pre-drink prior to a social-anxiety provoking task. In order to improve generalizability of results, studies should aim to examine SA on a continuum and utilize interaction-based tasks (e.g., task resembling small talk) as opposed to performance-based tasks (e.g. giving a speech in front of a panel, Kidorf & Lang, 1999; McNair, 1996) to induce SA-relevant anticipatory anxiety.

Our goal was to test social context effects on SA risk for increased anticipatory anxiety, urge to drink, coping with anxiety motives and heavy pre-drinking prior to a social interaction task. Undergraduate students participated in an experimental lab session. The use of laboratory-based, experimental methods is fundamental to enhancing our understanding of the mechanisms underlying SA risk for pre-drinking. This study incorporated measurement of SA that captured its multi-faceted nature. The study included an anticipated social event and examined how SA and social context influenced response to anticipatory anxiety manipulation and urge to drink. This period prior to the social event was analogue for pre-drinking. To provide the opportunity to ad lib pre-drink, participants were asked to complete a taste rating task. Participants were randomly assigned to complete this drinking portion of the experiment in one of three context conditions 1) alone, 2) with a close friend (i.e., familiar context) or 3) with a stranger (i.e., unfamiliar context). For comparative purposes, we examined how SA and social context influenced anticipatory anxiety and urge to drink prior to the main event for those in the alcohol vs. no alcohol condition. Anticipatory anxiety and urge to drink were measured at Baseline (Time 0), at the first anticipatory anxiety mood manipulation prior to drinking (T1), at the second anticipatory anxious mood manipulation half-way through the taste rating task (T2), at the third anticipatory anxiety manipulation at the end of the taste task but prior to the main event (T3), and following the main social event (T4). Coping motives were assessed retrospectively at T4 as they applied to the drinking portion of the experiment for those in the alcohol condition only. Peak Breath Alcohol Concentration (BrAC) was recorded as a measure of heavy pre-drinking following an alcohol absorption period. We tested social context as moderating the association between SA and both coping with anxiety motives, and heavy pre-drinking.

We hypothesized that elevated SA would be associated with increased anticipatory anxiety and increased urge to pre-drink in response to the anticipatory anxiety manipulation (Baseline to T1), which would gradually increase between T1 and T3 throughout the taste rating task and would then decrease at T4, for those in the alone and unfamiliar no alcohol conditions. We also hypothesized that elevated SA would be associated with increased anticipatory anxiety and urge to drink and this would be most pronounced from Baseline to T1, and that this effect would be strongest for those in the pre-drink alone and unfamiliar alcohol conditions. We hypothesized that SA would not be associated with this increase in anticipatory anxiety and urge to drink for those in the familiar condition, regardless of alcohol condition. Last, we hypothesized that elevated SA

would predict increased pre-drinking for coping motives, and heavy pre-drinking for those in the alone and unfamiliar alcohol conditions.

Methods

Procedure

Recruitment/Screening. All procedures were approved by the institutional Ethics Review Board. Undergraduate students were recruited through a psychology department participant pool, online ads, and flyers posted in Montreal universities. Those who contacted the lab for participation were emailed and informed about the in-lab study procedure, including the possibility of consuming alcohol, the possibility that they would be asked to bring a friend and the time commitment required (i.e., approximately 2 to 5 hours). They were sent a hyperlink to an online screening questionnaire. Eligible participants were full-time undergraduate students between the ages of 18 and 25 years old, fluent in English, self-identified as drinkers (i.e., consumed at least one drink per month), had no history of problematic drinking, did not have medical conditions contraindicated for alcohol use, were not taking medications for which alcohol consumption is contraindicated, were not advised by a physician not to consume alcohol, were not pregnant, trying to get pregnant, or breastfeeding and pre-drank at least once in the past month, given our interest in pre-drinking.

As part of the laboratory study and prior to arrival to the lab, participants were randomly assigned to one of three context conditions: Alone ($N = 48$), Familiar ($N = 47$), or Unfamiliar ($N = 48$) and to one of two alcohol conditions: Alcohol ($N = 71$) or No alcohol ($N = 72$). Overall, 33% of those in the no alcohol condition were alone, 33% completed the study with a friend and 33% completed the study with a stranger. Of those in the alcohol condition, 34% completed the study alone, 32% with a friend and 34% with a stranger. Participants assigned to the familiar condition were asked to send contact details of a close friend who could complete the study with them. Upon doing so, the nominated friend was sent an email containing a link to the online screening questionnaire. Prior to completing the questionnaire, friends were asked to consent to participate in the screening and were informed that they were free to discontinue the screening at any time. Eligibility criteria was the same as that used for participants. A lab session was only scheduled when both the participant and friend met eligibility criteria. All participants were instructed not to take medications, not to consume alcohol for 12 hours prior to the lab session and to not eat for three hours prior to the study start time. Given the possibility of consuming alcohol during the lab session, all scheduled participants were instructed not to drive a vehicle or ride a bicycle after the study.

A flow chart of study procedure is presented in Figure 4.1. The overall timeline of the study consisted of five Timepoints (T) (presented below). At each timepoint, measures of interest were administered.

Baseline (T0). Upon arrival to the lab, participants were placed in a lab space designed to resemble a living room. Depending on context condition assignment, participants either sat alone, with their friend (Familiar context) or with another individual posing as another participant but who in reality was a trained confederate (Unfamiliar context). To control for gender differences in drinking (Norberg et al., 2011), the confederates in the unfamiliar context was matched to the participant's self-identified gender. They presented as neutral and did not initiate conversation. If spoken to, they replied with brief answers. Participants' informed consent was obtained. Participants' Breath Alcohol Concentrations (BrACs) were assessed on the Alco-Sensor IV breathalyzer device (Intoximeters, Inc., 1997) to ensure a reading of 0.00gm%. Participants then completed baseline measures, including demographic questionnaires, measures of SA, anxious mood assessments using the Visual Analog Scale (VAS) (Martin, 1990; Mongrain & Trambakoulos, 2007), urge to drink alcohol "Right Now" (Singleton et al.,1994) and questionnaires assessing their usual drinking habits.

Anticipatory Anxious Mood Manipulation (T1). Upon completion of baseline measures and to induce a socially-relevant anticipatory anxious mood state, participants were told that the study was about first impressions and aimed to examine individual differences in sensitivity to others in new interactions. Participants were informed that as part of the study, they would be taking part in a social interaction task (i.e., a "Getting-to-know-you task") with another participant in the study. Participants were told that researchers were interested in how they would present themselves to one another and that after the getting to know you task, each will complete a questionnaire evaluating the other's interaction skills. Participants were informed that the task would be video recorded and that the research team would be scoring and evaluating their performance during the interaction on various social criteria. In reality, the other participant in the interaction task was a trained confederate. For those in the familiar and unfamiliar contexts, participants were informed that their friend or unfamiliar context confederate would not be taking part in the getting to know you task and would not be in the same room during the completion of this task. Once the mood manipulation completed, participants completed questionnaires assessing in the moment anxious mood using the

VAS (Martin, 1990; Mongrain & Trambakoulos, 2007) and urge to drink alcohol "Right Now" (Singleton et al.,1994).

Informing about Taste-Rating Task. Participants were informed that they would now be taking part in a taste rating task. The aim was to provide the opportunity to ad-lib drink prior to the getting to know you task (i.e., to pre-drink). To protect the integrity of the task, participants were told that researchers were interested in understanding individual differences in basic sensitivities, like taste, and how they extend to interpersonal interactions in order to find the links to better understand young adult social drinking. Those assigned to the alcohol condition were offered three alcoholic beverages, each drink containing a different brand of vodka (1:3 ratio of vodka and juice for a total of 6 ounces per drink). Those in the no alcohol condition were offered three non-alcoholic beverages (6 ounces of juice per drink), each drink containing a different brand of juice. Drinking glasses were labelled with the brand name of the vodka or juice depending on assigned alcohol condition. To maintain the face validity of the taste-rating task, one out of the three drinks was marked with an "X". For those in the familiar condition, participants and friends were assigned to the same alcohol condition. Unfamiliar context confederates were consistently offered non-alcoholic beverages. Their drinking glasses were labelled to match those of the participants'. Confederates mimicked the number of sips taken by the participants. Drinks were placed on a tray in front of participants, friends and confederates. They were asked to rate each drink on a 7-point scale ranging from "Not at all" to "Very Much" on a list of 54 adjectives (e.g., Delicious, Tangy, Bitter). Ad-lib pre-drinking was encouraged by telling participants to take their time making up their mind about each adjective and to have as much of the drinks as they would like and as much as they needed in order to make good and accurate ratings. Researchers left the room and observed the taste rating task through a camera.

Second Anticipatory Anxious Mood Manipulation (T2). Ten-minutes into the taste-rating task, a second anticipatory anxious mood manipulation was completed. Researchers entered the room and reminded participants about the upcoming getting to know you task. They highlighted the importance of making a good first impression and reminded participants that the unfamiliar context confederate or the friend in the familiar context, if applicable, would not be present during the getting to know you task. At this point, a second mood manipulation check was completed using the VAS (Martin, 1990; Mongrain & Trambakoulos, 2007) and urge to consume alcohol "Right Now"

was assessed (Singleton et al., 1994). Researchers left the room and participants continued the taste-rating task for another ten-minutes for a total of 20 minutes.

Third Anticipatory Anxious Mood Manipulation (T3). Once the taste rating task was completed, an alcohol absorption period (i.e., 20 minutes) was timed for participants and friends who had consumed alcohol. Researchers went back into the room and completed a third anticipatory anxious mood manipulation. Participants were informed that they would be completing the getting to know you task soon. They were told that it would be a good time to start thinking about what they might want to say to make a good first impression during the getting to know you task with the "other participant" (i.e., the getting to know you task confederate). They were informed that as part of this task, they would take turns asking each other questions on a list that will be handed to them. They were reminded that their performance would be evaluated and scored. A third anticipatory anxious mood manipulation check was completed using the VAS (Martin, 1990; Mongrain & Trambakoulos, 2007) and urge to consume alcohol "Right Now" was assessed (Singleton et al., 1994). At this point, friends in the familiar condition or unfamiliar context confederate were directed to another room in the lab. Friends in the alcohol condition were asked to stay in the lab until their BrAC dropped to below .04 gm%. Friends in the no-alcohol condition were debriefed and compensated for their time.

Getting to Know You Task. Participants were taken into a room where a video camera was set up. The interaction confederate was brought in. A list of questions adapted from Aron et al.'s (1997) gender interaction task (see Appendix A) was provided. Confederates gave pre-scripted responses in a natural manner and acted neutral. Ten minutes was allocated to this task.

Breath Alcohol Concentrations (BrACs). Once the 20-minute alcohol absorption period elapsed (i.e., period timed starting the end of the taste rating task) or the 10-minute getting to know you task completed, whichever preceded the other, participants were directed back to the original lab space. BrACs were measured on the breathalyzer device (Intoximeters, Inc., 1997) every 5 minutes until three consecutive measurements indicated decreasing BrACs. This allowed researchers to determine the peak BrAC reached.

Post-interaction measures (T4). Following the getting to know you task, a final mood check was completed using the VAS (Martin, 1990) and urge to drink "Right Now" were assessed (Singleton et al., 1994). Pre-drinking motives during the taste rating task (Cooper, 1994; Grant, Stewart, O'Connor, et al., 2007) were also assessed for those in the alcohol condition only. To

maintain the face validity of the getting to know you task, participants answered questions about first impressions formed during this task and rated the interaction confederate on various social aspects.

Detox/Debrief. Once peak BrAC was reached, measurements were taken every 10 minutes. Participants remained in the lab until their BrAC dropped to below .04gm/%. Participants and friends in the alcohol condition were offered snacks and water. At the end of the study, all participants were debriefed, given the opportunity to ask questions and report any experience of discomfort. Compensation was course credit or cash (10$ per hour spent in the lab).

Participants

The sample consisted of 143 full-time undergraduate students (73% women) who were between the ages of 18 and 25 (M = 20.83; SD = 1.73). The majority of participants identified as White (54%), 10% identified as East Asian, South-East Asian or Pacific Islander, 9% Middle Eastern, North African or Central Asian, 8% Latino or Hispanic, 5% Black, 4% South Asian and 10% identified as "Other". About half the sample reported living on their own off-campus (53%), 36% reported living at home with their family and 11% on campus. In terms of year of study, 32% reported being in their first year of study, 28% in their second year, 18% in their third year, 18% in their fourth year and 3% in the fifth year of university and beyond.

Friends in the familiar condition (N = 47) were undergraduate students (76.6% women) between the ages of 18 and 25 with an average age of 20.28 (SD = 1.60). The majority also identified as White (63.8%), 12.8% identified as East Asian, 8.5% as Latino or Hispanic, 6.4% South Asian, 4.3% Black and 4.3% Middle Eastern. Half of the sample (51.1%) reported living on their own, 31.9% reported living at home with their family and 17% reported living on campus. The majority (32.6%) were in the first year of the program, 26.1% in the second year, 23.9% in their third year and 17.3% in their fourth year or beyond.

Measures

Demographics. Demographics including age, gender and level at university were gathered through the screening and baseline questionnaires.

Social Anxiety. Given our interest in capturing the multiple aspects of SA, a higher-order SA factor combined SA scores as measured by four self-report measures of SA (described below). Factor scores were used in statistical models.

Fear of Negative Evaluation Scale (FNE, Watson & Friend, 1969). The FNE is a 30-item questionnaire that asks participants to rate their fear of being negatively evaluated by others (e.g., "I

am afraid that others will not approve of me"). Participants indicated, using dichotomous responding 1 = true; 0 = false), whether each statement applies to them. Reverse worded items were reverse coded. A mean score was calculated. This scale has demonstrated excellent internal consistency (α = .94) (Garcia-Lòpez et al., 2001; Watson & Friend, 1969), and adequate 1-month (r = .78; Watson & Friend), and 10-day (r = .84; Garcia-Lòpez et al., 2001) retest reliability. The FNE has demonstrated good validity and correlates with other measures of anxiety in college/university populations (r = .60) (Watson & Friend, 1969) as well as with measures of SA used with both clinical and university samples (Social Phobia Scale, Social Interaction Scale) (Mattick & Clark, 1998). The FNE showed excellent scale score reliability (α = .91) in the current sample.

The Liebowitz Social Anxiety Scale (LSAS; Heimberg et al., 1999). The LSAS is a 24-item self-report questionnaire assessing fear and avoidance experienced in a range of social and performance situations (e.g., "Talking with someone you don't know very well"). The LSAS differs from many of the other measures of social phobia in that it is explicitly situation-based. Participants rated on 4-point response scales the intensity of fear/anxiety they experienced (0 = None to 3 = Severe) and the degree to which they avoided (0 = Never to 3 = Usually) each social situation. The mean score was computed. The total score has demonstrated excellent internal consistency (α = .96) (Heimberg et al., 1999), 12-week retest reliability (r = .83) (Baker et al., 2002) and good convergent and discriminant validity (Baker et al., 2002). The total score correlates with other measures of social avoidance in clinical samples such as the Social Interaction Scale (r = .73) and less strongly with measures of depression (Heimberg et al., 1999). Elevated scores on the LSAS have been associated with problematic drinking (Morris, Stewart & Ham, 2005). In the current sample, the LSAS showed excellent scale score reliability (α = .95).

Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). The SIAS is a 20-item self-report questionnaire examining anxiety in different social situations (e.g., "I become tense if I have to talk about myself or my feelings"). Participants indicated on a 5-point response scale (0 = Not at all characteristic or true of me to 4 = Extremely characteristic or true of me) how well each statement described them. Reverse worded items were reverse coded. Mean scores were calculated for each participant. The SIAS has been shown to have good internal consistency (α = .83) and excellent retest reliability (r = .92) (Mattick & Clarke, 1998). The SIAS has also been shown to have satisfactory concurrent validity (Caballo et al., 2013). Scale score reliability in our study was satisfactory (α = .87).

Social Phobia Scale (SPS ; Mattick & Clarke, 1998). The SPS is a 20-item self-report questionnaire assessing fear of being observed. Participants indicated how characteristic each reaction to a social situation is for them (e.g., "I fear I may blush when I am with others") on a 5-point response scale (0 = Not at all characteristic or true of me to 4 = Extremely characteristic or true of me).The mean score was calculated. The SPS has been shown to have excellent retest reliability at 3, 4 and 12 weeks (r = .91-.96) (Mattick & Clarke, 1998; Stangier et al., 1999) and discriminant validity (Brown et al., 1997; Mattick & Clarke, 1998). Our scale score reliability was excellent (α = .91).

Both the SPS and SIAS originally developed by Mattick and Clarke (1998) are companion measures designed to assess different aspects of SA, those related to being observed by others (e.g., doing things, like speaking and writing in front of others), and those related to social interaction (e.g., mixing socially at parties).

Anticipatory Anxiety. A single item from the Visual Analogue Scale (VAS; Martin 1990; Mongrain & Trambakoulos, 2007) was used to assess momentary state levels of anxiety at each timepoint (i.e., T0 to T4). To rate their anxiety, participants answered to "At this moment I feel…" on a horizontal slider 100-point line (0 = Not at all anxious to 100 = Very anxious). Participants moved the slider across to the point that best corresponded to their anxious mood at that moment. This item is consistent with those used in other anxious/negative mood manipulations and drinking motives work (e.g., Abrams et al.,, 2001; Dannahy & Stopa, 2007; Grant, Stewart & Birch, 2007; George & Stopa, 2008; Haikal & Hong, 2010).

Alcohol Cravings Questionnaire (ACQ; Singleton et al.,1994). The ACQ is a 47-item questionnaire assessing the multidimensional aspects of cravings for alcohol on nine subscales. Of relevance in the current study is the 7-item urge and desire to use alcohol subscale (e.g., "I have an urge to drink right now"). Participants were prompted with the phrase "Right Now" to assess the degree to which they had the urge to drink in-the-moment and indicated how true each item was for them on a 7-point response scale (1 = Strongly Disagree to 7 = Strongly Agree). The original subscale by Singleton (1994) comprised of 9 items that included 2 reverse coded items, these items were not included in the study. A mean score was calculated at each time point reflecting in the moment urge to drink alcohol. In the current study, scale score reliability for these items was satisfactory (Baseline: α = .91; T1: α = .94; T2: α = .93; T3: α = .92; T4: α = .92).

The Modified Drinking Motives Questionnaire-Revised (Modified DMQ-R; Cooper, 1994; Grant, Stewart, O'Connor, et al., 2007). Pre-drinking to cope with anxiety was assessed using an adaptation of the coping with anxiety motives subscale of the 28-item modified DMQ-R (Grant, Stewart, O'Connor, et al., 2007). The 4-item cope with anxiety motives scale (e.g., "to relax") from the Modified DMQ-R was re-worded for the current study (Grant, Stewart, O'Connor, et al, 2007), such that the stem was: "Thinking about your own alcohol use during the taste rating task". Participants indicated how much each reason influenced their alcohol use during the taste rating task on a 5-point response scale (1 = Almost never/never to 5 = Almost always/always). A mean score was calculated to provide a composite score reflecting pre-drinking to cope with anxiety. In the current study, the internal consistency for this scale as measured at T4 was (α = .89).

Breath Alcohol Concentration (BrAC). BrACs were measured using handheld breath alcohol testing instruments (i.e., the Alco-Sensor IV, manufactured by Intoximeters, Inc., 1997). By breathing through a tube continuously until hearing a beep, the device indicated a digital numerical result as estimated % breath alcohol concentration. Each exhaled breath air reading was acquired using a new disposable mouthpiece to prevent residual alcohol contamination. Participants' BrACs were assessed at Baseline (T0) to ensure a reading of 0.00gm%. Once the taste rating task was completed, a 20-minute absorption period was timed for those in the alcohol condition. Once elapsed, BrACs were measured at 5-minute intervals until peak BrAC was reached. To reduce potential inflation of BrAC readings, breath samples were collected by a standard procedure. Participants were asked to rinse their mouth with water three times before giving the first breath sample. The goal was to remove residual alcohol before measuring and recording BrAC. Participants were instructed not to drink the water. Peak BrAC was identified following three consecutive decreasing measurements. Additional breath tests were administered at 10-minute intervals thereafter until participants' BrACs dropped to below .04gm/%. Studies comparing BrACs to Blood Alcohol Concentrations indicate that both measures are comparable and significantly related when intoxication is less than 0.08 g/210L of breath, the magnitude of the relation decreases as intoxication rises (Carey & Hustad, 2002; Hustad & Carey, 2005). The instruments were calibrated to the manufacturer's specifications.

Results

Data Screening and Preliminary Analyses

Prior to analyses, variables were screened for violation of assumptions. The data were inspected to ensure values were within reasonable range and proportion of missing values was assessed. Data screening revealed that predictor variables were normally distributed (Skew > 3.0, Kurtosis > 10) and that there were no outliers (i.e., +/- 3.29 SD of the mean) (Kline, 2015)

Descriptive statistics and zero-order correlations. Descriptive statistics and Pearson correlations for variables included in the hypothesized models are presented in Tables 4.1 and 4.2.

Mood Manipulation. A two-way ANOVA was used to test for baseline differences in SA scores across context condition and alcohol condition in order to determine whether groups were comparable at baseline. The predictors were context condition, alcohol condition and their interaction and the outcome was scores on the SA extracted factor scores. There was no support for main effects of context condition ($F(2, 137) = 1.24$, $p = .29$) or alcohol condition ($F(1, 137) = .72$, $p = .40$), nor support for the context condition by alcohol condition interaction effect on SA ($F(2, 137) = 1.19$, $p = .31$). As such, results indicated that there were no group differences in SA scores at baseline.

A manipulation check was conducted to assess the effectiveness of the anticipatory anxious mood manipulation (i.e., anticipation of the getting to know you task). A repeated measures ANOVA was used to test the effect of context condition on the difference in anxious mood ratings on the VAS from T0 (Baseline) to T1 (first anticipatory anxious mood manipulation). The within subjects variable was time (0 = Baseline and 1 = T1), the between subjects variables were context condition and alcohol condition and the outcome variable was the single item VAS anxious mood rating. Results indicated that there was a statistically significant main effect of time $F(1,137) = 36.02$, $p < .001$, suggesting that there was an increase in anxious mood from Baseline ($M = 28.75$, $SD = 25.14$) to T1 ($M = 41.10$, $SD = 29.63$). This supports the effectiveness of the anticipatory anxious mood manipulation. Results also showed that the three-way interaction between time, context condition, and alcohol condition was not statistically significant suggesting that change in anxious mood from Baseline to T1 did not differ across context condition and alcohol condition, $F(2, 137)= .47$, $p = .62$. This makes sense as we would not expect context condition and alcohol condition effects before participants are informed about the taste rating task and their assigned pre-drinking context. Studies using anxious mood inductions have found mean state anxiety scores as high as $M = 46.8$ (Grant, Stewart & Birch, 2007). Thus, the average state anxiety score post-mood manipulation found in the current study is consistent with extant research.

Confirmatory Factor Analysis (CFA). We were interested in determining whether a higher order SA factor captured the multiple aspects of SA as assessed by multiple self-report measures of SA (i.e., FNE, LSAS, SIAS, SPS). To test concurrent validity, we computed Pearson correlations between the four SA scale scores (i.e., FNE, SIAS, LSAS, SPS). Pearson correlation coefficients revealed statistically significant bivariate associations between measures of SA, all $p < .001$. Following data screening, a confirmatory factor analysis (CFA) was completed in Mplus version 8 (Muthén & Muthén, 2017) to test the single higher-order factor structure of the SPS, SIAS, FNE and LSAS. Each scale score was entered as an indicator. Given the moderate correlation between scores on the SIAS and those on the SPS ($r = .75$) and given that the SIAS and SPS were originally designed as companion measures (Mattick & Clarke, 1998), the model was estimated and scores on the SPS and SIAS were allowed to covary.

To evaluate model fit, the likelihood ratio $\chi 2$ test, the Comparative Fit Index (CFI) (Bentler, 1990), the Root Mean-Square Error of Approximation (RMSEA) (Weston & Gore, 2006) and the Tucker-Lewis Index (TLI) (Hu & Bentler, 1999) were used. Model fit was considered good if the CFI and the TLI were > .95 and the RMSEA was < .08. The higher-order CFA model provided good fit to the data $\chi 2$ (6) = 239.69, $p < .001$, CFI = .99, TLI = .98, RMSEA = .07 (90% CI = .00 , .25). Factor loadings were all statistically significant ($FNE : \beta = .77$, $S.E. = .04$, $p < .001$; $LSAS : \beta = .87$, $S.E. = .04$, $p < .001$; $SPS : \beta = .73$, $S.E. = .05$, $p < .001$; $SIAS : \beta = .81$, $S.E. = .04$, $p < .001$). CFA revealed that all four scales loaded on a single, higher-order SA factor. Standardized extracted factor scores were thus used as a measure of SA in the analyses.

Data Analysis

Data were analyzed in SPSS version 26 (IBM Corporation, 2019). We were interested in understanding whether the interaction between Level 2 variables (i.e., SA, context condition and alcohol condition) moderated the effect of time (Level 1 variable) on anxious mood and urge to drink. Individual Growth Curve (IGC) modeling was used to test the interaction between SA (factor scores derived from latent variable), context condition, alcohol condition, and time (coded as *0* = Baseline, *1* = T1 (first mood manipulation), *2* = T2 (mid-taste task), *3* = T3 (pre-interaction), *4* = T4 (post-interaction)) on anxious mood (single items on VAS) and urge to drink (mean scores on the ACQ). A marginal model or population-averaged model was used to analyze the data through Mixed Effects models with Maximum likelihood (ML) estimation and a first-order auto-regressive covariance structure. A marginal model estimates the regression parameters for the mean of the

outcome given a set of explanatory variables while accounting for repeated measurements on the same participants (Albert, 1999; Zeger & Liang, 1986). Instead of assuming that all observations are independent, as in the case of linear models, a marginal model assumes that residuals from a single participant are related. To account for non-independence, a marginal model allows the specification of a correlation structure, which represents the assumed correlation of the repeated measurements (Ballinger, 2004). The autoregressive structure assumes decreasing correlations as the time interval increases. The residual variances are not equal as they are in methods of repeated measures designs (e.g., ANOVA).

Nested model selection was used to determine the shape of time that provided best fit to the anxious mood and urge to drink data in three steps. The predictor was time entered as a repeated measure, the outcomes were anxious mood and urge to drink in separate models. In the first step, an unconditional linear model was estimated by entering the linear effect of time predicting each outcome. In the second step, the quadratic effect of time ($time^2$ = time*time) was added and in the third step, the cubic effect of time ($time^3$ = time*time*time) was added to the model. Chi-squared difference tests were used to evaluate model fit in each step. The higher-order polynomial model that provided best fit to the data (i.e., shape of time for anxious mood and urge to drink) was retained in subsequent model testing.

To examine the interaction between SA, context condition, alcohol condition, and time on anxious mood and urge to drink, two sets of analyses were conducted, each in three steps. The predictors were SA, context condition, alcohol condition, and time and the outcomes were anxious mood and urge to drink. In the first step (Model 1), we regressed anxious mood (single items on VAS) (Level 1 variable) and urge to drink (mean scores on the ACQ) (Level 1) on time (repeated measure), SA (factors scores extracted from latent variable) (Level 2), context condition (two dummy coded variables) (Level 2), and alcohol condition (0 = No alcohol, 1 = Alcohol) (Level 2) and the two-way interactions between SA and time, context condition and time, alcohol condition and time, and context condition and time. In the second step (Model 2), we added the three-way interactions between time, SA and context condition, Time, SA and alcohol condition, and time, context condition and alcohol condition. In the third step (Model 3), we added the four-way interaction terms to the model (SA X time X context condition X alcohol condition). Chi square statistics were used to assess model fit. Given the complexity of the model and in the presence of higher-order interactions, main effects and lower-order interaction effects were not interpreted. The

identification of statistically significant interaction effects were followed by an examination of simple slopes (Aiken & West, 1991).

In the study, we were also interested in understanding whether context condition moderated the effect of SA on coping motives and peak BrAC for those in the alcohol condition only. These outcomes were not assessed for those in the no alcohol condition given that participants had not been offered alcoholic drinks. Hierarchical multiple linear regression models were used to test the effect of predictors (SA and context condition) and the two-way interaction terms on both outcomes: coping motives (mean scores on the coping motives subscale of the modified DMQ-R assessed at T4) and peak BrAC (peak BrAC measured after a 20-minute absorption period) in two steps. In the first step, SA and context condition were entered as predictors in the model. In the second step, two-way interaction terms were added. The identification of statistically significant two-way interactions were followed by an examination of simple slopes (Aiken & West, 1991) conditioning the effect of SA predicting coping motives and peak BrAC on context condition.

Model Fit for Time. To determine the high-order polynomial model that best fit the anxious mood and urge to drink data, results from linear, quadratic, and cubic models predicting anxious mood were compared. In the linear model, the main effect of time predicting anxious mood was statistically significant (β = -3.89, *S.E.* = .74, $F(1,654.80) = 27.73$, $p < .001$). In the second step, the quadratic effect of time was added to the model and was also statistically significant (β = -4.46, *S.E.* = .42, $F(1, 605.54) = 113.24$, $p < .001$). The quadratic model improved model fit over the linear model ($\Delta\chi2$ (1) = 103.32, $p < .001$). In the third step, the cubic effect of time was added and was not statistically significant (β = -.24, *S.E.* = .33, $F(1,484.61) = 0.52$, $p = .47$). The cubic model did not improve model fit over the quadratic model ($\Delta\chi2$ (1) = .53, $p = .47$). Results suggest that a quadratic change trajectory for anxious mood over time provides better fit to the data. Quadratic parameters were retained.

Similarly, results from the linear and higher-order polynomial models predicting urge to drink were compared. In the first step, the linear effect of time was not statistically significant (β = -.02, *S.E.* = .02, $F(1,713.84) = .31$, $p = .58$). In the second step, the quadratic effect of time was added to the model. The linear effect of time became statistically significant (β = .17, *S.E.* = .05, $F(1, 603.17) = 12.75$, $p < .001$). The quadratic effect of time was also statistically significant and negative (β = -.05, *S.E.* = .01, $F(1, 559.52) = 17.78$, $p < .001$). The quadratic model improved model fit over the linear model ($\Delta\chi2$ (1) = 17.50, $p < .001$). In the third step, the cubic effect of time was added to

the model. The quadratic effect of time was not statistically significant (β = .07, *S.E.* = .05, $F(1,510.47) = 1.78$, $p = .18$) whereas the cubic effect of time was statistically significant (β = -.02, *S.E.* = .01, $F(1,508.26) = 5.29$, $p = .02$). Although, the cubic model improved model fit over the quadratic model ($\Delta\chi 2\ (1) = 5.26$, $p = .02$), the cubic and quadratic models are very similar and the chi-squared difference test for the cubic compared to the quadratic model was only statistically significant at the .05 level. As a result, quadratic parameters for urge to drink were retained in order to provide model parsimony.

Hypothesis Testing

We tested the interaction between SA, context condition, alcohol condition, and time on anxious mood and urge to drink assessed from Baseline (T0) to T4. Given the categorical nature of the pre-drinking context variable, pre-drinking contexts were included in the model as a set of two dummy variables coded (1) 1 for Familiar contexts and 0 otherwise and (2) 1 for Unfamiliar Contexts and 0 otherwise. The referent pre-drinking context in these models was Alone. Coefficients and 95% CI for three regression models predicting anxious mood and urge to drink are presented in Tables 4.3 and 4.4, respectively. Statistically significant interaction effects were followed by a test of simple slopes (Aiken & West, 1991).

Anxious Mood. Marginal models were used to test the effects of Level 2 variables (i.e., SA , context condition, alcohol condition) and Level 1 variable (i.e., time) on anxious mood ratings. The goal was to determine whether elevated SA would be associated with increased anticipatory anxiety in response to the mood manipulation (Baseline to T1) which would gradually increase between T1 and T3 and would decrease at T4, for those in the alone and unfamiliar no alcohol conditions. We also hypothesized that elevated SA would be associated with increased anticipatory anxiety and this would be most pronounced from Baseline to T1, and that this effect would be strongest for those in the pre-drink alone and unfamiliar alcohol conditions. Last, we hypothesized that elevated SA would not be associated with an increase in anticipatory anxious for those in the familiar condition.

In the first step, the predictors were SA, time, time^2 (i.e., quadratic shape of time), context condition dummy variables, alcohol condition, and all relevant two-way interactions. In this model, results indicated that the quadratic effect of time ($F(1, 628.08) = 82.46$, $p < .001$) and the main effect of SA ($F(1, 459.30) = 34.44$, $p < .001$) were statistically significant. Pre-drinking contexts ($F(2, 459.30) = .12$, $p = .89$) and alcohol condition ($F(1, 459.30) = .07$, $p = .80$) were not statistically significant predictors of anxious mood. The two-way interaction between SA and the quadratic

shape of time was statistically significant ($F(1, 628.08) = 14.93$, $p < .001$). The two-way interactions between context condition and quadratic shape of time ($F(2, 628.08) = 1.42$, $p = .24$) and alcohol condition and quadratic shape of time ($F(1, 628.08) = 1.84$, $p = .18$) were not statistically significant. In Model 2, three-way interactions were added. Results indicated that model fit did not significantly improve compared to the previous model ($\Delta\chi2\ (10) = 8.59$, $p = .57$). For exploratory purposes, four-way interactions were added to Model 2. In this third step, model fit did not significantly improve ($\Delta\chi2\ (4) = 7.45$, $p = .11$), providing further evidence that this model should not be retained. The current sample size may not be adequate for provision of sufficient power and given the number of predictors added in Model 2 and 3. It is possible that we may have been underpowered to detect a significant change in model fit and to detect the desired effect with adequate power (80% power). According to model fit statistics, the results from Model 1 were examined.

Simple slope analyses underpinning the two-way interaction between SA and time predicting anxious mood are presented in Figure 4.2. As a reminder, baseline anxious mood ratings were assessed prior to the mood manipulation. T1 ratings were assessed after the first mood manipulation but prior to the taste rating task. T2 ratings were assessed mid-way through the taste rating task (i.e., participants had been drinking for ten minutes and were reminded about the upcoming getting to know you task). T3 ratings were assessed at the end of the taste task but prior to the getting to know you task. T4 ratings were assessed after the interaction task. As we would expect, results indicated that those high on SA (regardless of context and alcohol conditions) reported elevated anxious mood at Baseline and reported increased anxious mood in response to the mood manipulation, which gradually decelerated after T2.

Although Model 2 and Model 3 were not statistically supported, given our interest in testing our hypotheses, we examined findings from an exploratory data analytic approach. However, results must be interpreted with caution. Results from Model 3 suggest that between subjects variables (i.e., SA, context condition and alcohol condition) may moderate the quadratic effect of time on anxious mood (context1 X alcohol condition X SA X time^2, $p = .03$; context2 X alcohol condition X SAX time^2, $p = .01$). Simples slope analyses underpinning these interactions were examined in an effort to explore the data further, see Figure 4.3. Results suggest a dampening of anxious mood in response to drinking alcohol for those in the alone alcohol condition when SA was high (see. Figure 4.3 Panel B). Thus, in partial support of our hypotheses, results suggest that pre-drinking alcohol alone may help undergraduate students with elevated SA reduce anxious mood prior to a social event. Results

also suggest decreased anxious mood from Baseline to T4 for those in the familiar no alcohol condition when SA was high (see. Figure 4.3 Panel C), which was not the case for those in the familiar alcohol condition (see. Figure 4.3 Panel D). Thus, in partial support of our hypotheses, findings suggest that being with a friend and not drinking prior to a social interaction may help decrease anxiety. However, when alcohol is available, being with a friend does not seem to reduce anxious mood prior to a social interaction. In partial support of our hypotheses, regardless of alcohol condition, elevated SA predicted increased anxious mood from Baseline to T1, which peaked at T2 (mid-taste rating task) and decelerated thereafter, for those in the unfamiliar condition.

Urge to drink. Marginal models were used to test the effect of Level 2 variables (i.e., SA , context condition, alcohol condition) and Level 1 variable (i.e., time) on urge to drink scores (i.e., subscale of the ACQ; Singleton et al.,1994). The goal was to determine whether elevated SA would be associated with increased urge to drink in response to the mood manipulation (Baseline to T1) which would gradually increase between T1 and T3 and would decrease at T4, for those in the alone and unfamiliar no alcohol conditions. We also hypothesized that elevated SA would be associated with increased urge to drink and this would be most pronounced from Baseline to T1, and that this effect would be strongest for those in the pre-drink alone and unfamiliar alcohol conditions. Last, we hypothesized that elevated SA would not be associated with an increase in urge to drink for those in the familiar condition.

In the first model, the predictors were SA, time, time^2 (i.e., quadratic shape of time), context condition dummy variables, alcohol condition and two-way interactions. In Model 1, results indicated that SA ($F(1,283.53) = 7.43$, $p = .01$*)* and alcohol condition ($F(1,283.53) = 8.57$, $p = .004$) were statistically significant predictors of urge to drink whereas context condition was not ($F(2,283.53) = .42$, $p = .66$). The two-way interactions between alcohol condition and quadratic shape of time ($F(1,560.75) = 6.32$, $p = .01$) and SA and quadratic shape of time ($F(1,560.54) = 3.84$, $p = .05$) were statistically significant. The two-way interaction between context condition and quadratic shape of time was however not statistically significant ($F(2,560.79) = .59$, $p = .55$). In Model 2, three-way interactions were added. Results indicated that model fit significantly improved compared to the previous model ($\Delta\chi 2\ (10) = 23.07$, $p = .01$). Results indicated that the three-way interaction between pre-drinking contexts (Context1: *1* = Familiar contexts; *0*= *U*nfamiliar and Alone), alcohol condition, and quadratic shape of time was statistically significant ($F(1,581.77) = 5.63$, $p = .02$). In Model 3, four-way interaction terms were added. Results indicated that model fit

did not significantly improve compared to the previous model ($\Delta\chi2$ (4) = 5.60, p = .23), thus results from Model 3 were not retained. Similar to the model predicting anxious mood, analyses may have been underpowered given the sample size and number of predictors added to the model, which might account for marginal support for four-way interaction effects.

Simple slope analyses underpinning the three-way interaction between context condition, alcohol condition, and time are presented in Figure 4.4. Results suggest that those in the alone alcohol condition reported slight increased urge to drink from baseline mid-way through the taste rating task when SA was high. There was no increase in urge to drink in response to the anticipatory anxiety mood manipulation in the alone no alcohol condition for those high in SA. Results also suggest that participants in the familiar no alcohol condition reported slight increases in urge to drink from Baseline until mid-way through the taste task which then decelerated for those high in SA. In the familiar alcohol condition, urge to drink decreased from Baseline until the end of the study when SA was high. Last, results indicated that in the unfamiliar alcohol condition, urge to drink increased from Baseline to T2, which then decelerated after participants were reminded about the upcoming getting to know you task mid-way into the taste rating task. In the unfamiliar no alcohol condition, there was no increase in urge to drink throughout the study for those high in SA.

Although model fit statistics indicated that results from Model 3 were not statistically supported and given our interest in testing our hypotheses, findings were examined from an exploratory data analytic approach. Results must be interpreted with caution. Findings suggest that the four-way interaction between SA, context condition (Context1: *1* = Familiar contexts; *0*= *U*nfamiliar and Alone), alcohol condition, and quadratic shape of time was somewhat supported at the trend level (F(1,580.50) = 3.53, p = .06). This suggests that between subjects variables may moderate the quadratic effect of time on urge to drink. To further explore the interaction, results from simple slope analyses underpinning the four-way interaction are presented in Figure 4.5. Results suggest that compared to participants in the alone and unfamiliar alcohol conditions (see. Figure 4.5 Panels B and D), those in the familiar alcohol condition reported decreased urge to drink from Baseline to T4 when SA was high (see. Figure 4.5 Panel F). Results also suggest that participants in the familiar no alcohol condition reported increased urge to drink from Baseline to T2 which then decelerated when SA was high (see. Figure 4.5 Panel C). Contrary to our hypotheses, these findings suggest that being in the presence of a close friend does not reduce urge to drink when alcohol is not available prior to a social interaction and when SA is high. However, when alcohol is

present, those who are with their friend experience decreased urge to drink compared to those who are alone or with a stranger when SA is high.

Coping motives. Hierarchical multiple regression was used to test SA and context condition in one step and their two-way interaction in another step as predictors of scores on the coping with anxiety motives subscale of the modified DMQ-R. This measure was completed following the getting to know you task. In the first step, SA was a statistically significant predictor of coping motives (β = .59, *S.E.* = .11, $p < .001$) whereas the main effects of pre-drinking context dummy variables were not (Context1: β = .25, *S.E.* = .25, p = .31; Context2: β = -.09, *S.E.* = .24, p = .73). The model was statistically significant ($F(3,67) = 11.30$, $p < .001$) and accounted for 33.6% of the variation in coping motives. In the second step, two-way interactions were added to the model. The interaction between SA and familiar context compared to alone was not statistically significant (β = -.10, *S.E.* = .28, p = .75) whereas the interaction between SA and unfamiliar context compared to alone contexts was somewhat supported at the trend level (β = .47, *S.E.* = .26, p = .07). The model accounted for an additional 4.9% of the variance in coping with anxiety motives, which was somewhat supported ($F_{Change}(2,65) = 2.61$, p = .08). Analyses were repeated using alternate codings of the dummy variables to assess the interaction between SA and familiar vs. unfamiliar contexts. Results showed that the two-way interaction between SA and familiar compared to unfamiliar context was statistically significant (β = -.56, *S.E.* = .27, p = .05). Simple slopes testing the effect of SA on coping with anxiety motives were examined by conditioning the model on context condition. As shown in Figure 4.6, elevated SA was associated with increased coping motives for those in the unfamiliar context and for those who pre-drank alone.

Peak Breath Alcohol Concentrations (BrAC). Hierarchical multiple regression was used to examine SA and context condition in one step and their two-way interactions in a second step as predictors of peak BrAC. In the first step, the main effects of SA and pre-drinking context dummy variables were not statistically significant (SA: β = -.00, *S.E.* = .00, $p > .05$; Context1: β = -.013, *S.E.* = .01, $p > .05$; Context2: β = .01, *S.E.* = .01, $p > .05$). The model was not statistically significant ($F(3, 67) = 1.65$, p = .19) and accounted for 6.9% of the variation in BrAC. In the second step, the two-way interaction between SA and unfamiliar context compared to familiar and alone was somewhat supported at the trend level (β = .02, *S.E.* = .01, p = .07). The two-way interaction between SA and familiar context compared to alone and unfamiliar was not statistically significant (β = .01, *S.E.* = .01, p = .23). The model accounted for an additional 4.8% of the variation in measures of BrAC,

however the model was not statistically significant (F (5, 65) = 1.71, p = .15). Analyses were repeated using alternate codings of the dummy variables to assess the interaction between SA and familiar compared to unfamiliar contexts. Results showed that the two-way interaction between SA and familiar compared to unfamiliar context was not statistically significant (β = -.00, *S.E.* = .01, p = .63). In an effort to explore the data further, simple slopes testing the effect of SA on peak BrAC as moderated by context condition are presented in Figure 4.7. However, results should be interpreted with caution. Results indicated that as SA increased, peak BrAc statistically significantly decreased for those in the alone context condition (β = -.01, *S.E.* = .01, p = .03), suggesting that as SA increased, those who pre-drank alone did not pre-drink more heavily.

Discussion

A cognitive model of SA (Clark & Wells, 1995) along with tension reduction theory (Conger, 1956) and the self-medication hypothesis (Carrigan & Randall, 2003; Khantzian, 1985) provided the theoretical framework for the present study. These theories posit that those high in SA may be at increased risk for pre-drinking to reduce anticipatory anxiety in specific social contexts prior to encountering others. Our goal was to test theory-driven models of SA and pre-drinking in a controlled experimental study. We were interested in testing context effects on SA risk for increased anticipatory anxiety, urge to pre-drink, pre-drinking for coping motives and heavy pre-drinking prior to a social event among undergraduate students. To our knowledge, this is the first study to examine SA risk for pre-drinking in an experimental study design. This is also the first study to manipulate and measure SA risk for in the moment anticipatory anxiety and urge to drink across experimentally manipulated pre-drinking contexts prior to an anxiety-provoking social event in the laboratory (i.e., getting to know you task). The present study adds to current knowledge as it advances our understanding of theoretically-relevant risk factors in the SA pathway to pre-drinking.

Consistent with our hypotheses, findings suggest that those high in SA experienced increased anxious mood from Baseline to the first anticipatory anxiety manipulation which increased and peaked mid-way through the pre-drinking analogue irrespective of context and alcohol condition. Pre-drinking alcohol alone or with a stranger increased urge to drink peaking mid-way through the pre-drinking analogue irrespective of SA. Consistent with previous work (Christiansen et al., 2002; Holyfield et al., 1995), exploratory data analysis suggests that those high in SA may be at risk for pre-drinking alcohol to cope with anticipatory anxiety when alone. Results suggest that even though alcohol may dampen anticipatory anxiety for those who pre-drank alcohol alone, these individuals

reported increased urge to pre-drink, suggesting that they may have continued to seek the relieving effects of alcohol. Results also suggest that pre-drinking with a friend may help those high in SA feel more comfortable when alcohol is not available. This is consistent with previous work showing that being with a friend compared to being alone or with strangers normalizes signs of anxiety and reduces negative self-focused thoughts in socially anxious adults prior to a speech challenge (Hur et al., 2019; Pontari, 2009). However, when alcohol is available, and despite the presence of a friend, those high in SA report decreased urge to pre-drink but increased anxious mood, which may possibly be due to having to separate from their friend in order to attend the main social event. Last, in partial support of our hypotheses, results suggest that pre-drinking with a stranger may constitute a risky pre-drinking context for those high in SA. Findings suggest that pre-drinking with a stranger induces increased anticipatory anxiety prior to a main event for those high in SA regardless of whether alcohol is available or not. However, when alcohol is available, those high in SA do not report a dampening of urge to consume alcohol, but rather report increased urge to pre-drink throughout pre-drinking, suggesting that they may have continued to seek the tension-reducing effects of alcohol.

Cognitive theories of SA (Clark & Wells, 1995; Hofman, 2007; Rapee & Heimberg, 1997) posit that those high in SA experience anticipatory anxiety when the prospect of interpersonal evaluation exists. Anticipatory processing is a cognitive process theorized to be an integral maintenance factor of SA and consists of thinking about the situation in detail, focusing on past social failures, negative self-imagery and making prediction of poor performance, rejection and embarrassment (Hinrichsen & Clark, 2003; Rapee & Heimberg, 1997). Our findings are consistent with theoretical models suggesting that those high in SA report increased anxious mood as a result of the mood manipulation prior to a social event, irrespective of context or alcohol condition. These results are consistent with previous work indicating that individuals high in SA report increased anticipatory anxiety before a social event (Buckner et al., 2020) and experience significant emotion regulation difficulties (Helbig-Lang et al., 2014). We provide further evidence that anticipatory processing may be a cognitive process that may serve to maintain SA and can therefore be an important target for intervention strategies. We also found that undergraduate students in the alone and unfamiliar alcohol conditions reported increased urge to drink irrespective of SA. Results are consistent with previous research indicating that those who drink alone tend to consume alcohol more often and have more alcohol-related problems than social drinkers (Christiansen et al., 2002;

Holyfield et al., 1995) and that drinking alone predicts increased alcohol problems later in life (Abbey et al., 1993; Creswell et al., 2014; Gonzalez & Skewes, 2012).

The moderation effect of social context on the link between SA and anticipatory anxiety and urge to drink was not supported, however we examined these interaction effects for exploratory purposes. Consistent with previous work (Hur et al., 2019; Pontari, 2009) and cognitive models of SA (Clark & Wells, 1995), findings suggest that those high in SA may have felt more comfortable prior to the social interaction when in the presence of their friend and may have experienced reduced anticipatory processing regarding the main event. Interestingly, results suggest that those high in SA reported increased urge to drink despite the presence of their friend in the no alcohol condition. It can be argued that these individuals may have experienced positive (e.g., increased sociability) rather than negative (e.g., cognitive/behavioural impairment, negative self-perception) alcohol outcomes expectancies (Wall, et al., 2001). In other words, those high in SA may want to consume alcohol with their friend when alcohol is not available to have fun and/or to enhance the experience. When alcohol was available, the presence of a close friend no longer protected against increased anticipatory anxiety for those high in SA. However, these individuals reported decreased urge to drink in this context prior to the main social event, suggesting that they may not want to impair their performance during the upcoming social interaction if intoxicated. This is consistent with research showing that socially anxious individuals tend to abstain from alcohol for fear of embarrassing themselves if under the influence of alcohol when the situation requires them to perform in some manner (Abrams et al, 2002; Morris et al., 2005). It is possible that although individuals high in SA who pre-drank with their friend did not want to keep pre-drinking, they may have been increasingly anxious during the drinking portion of the experiment as they knew they would have to separate from their friend in order to attend the main event. This is consistent with studies indicating that those high in SA tend to adopt an insecure attachment style in their close relationships (Nielsen, 2009; Read et al., 2018). In real life settings, it may be likely that two friends who pre-drink together would also go to a novel context together, for example in the case of pre-drinking before heading out together to a party or bar. Future studies could aim to provide a more realistic situation where the friend would accompany the participant to the social event to determine whether these effects would be replicated.

In partial support of our hypotheses, results suggest that pre-drinking alcohol alone may consist of a high risk pre-drinking context for those high in SA. These individuals may be at

increased risk for engaging in anticipatory processing when alone and may pre-drink to cope with anticipatory anxiety. According to findings, those high in SA experienced a dampening of anxious mood and increased pre-drinking to cope with anxiety motives when pre-drinking alcohol alone but interestingly reported a slight increase in urge to drink prior to the anxiety-provoking social interaction. The increase in urge to pre-drink may suggest that those high in SA may have continued to chase the feeling of relief from alcohol when pre-drinking alone prior to the social interaction. This is consistent with previous work showing that drinking alone is associated with the tendency to use alcohol to escape negative emotions in a way that leads to elevated frequency and quantity of alcohol use and future alcohol problems (Christiansen et al., 2002; Holyfield et al., 1995). However, we also found that elevated SA predicted decreased peak breath alcohol concentration for those who pre-drank alcohol alone, although results must be interpreted with caution. Previous research has shown that SA predicts increased pre-drinking alone which in turn predicts increased alcohol-related problems, but not heavy drinking throughout the evening (Keough et al., 2016). Taken together, our findings and previous research suggest that those high in SA who pre-drink alcohol alone may be at increased risk for pre-drinking to cope with anticipatory anxiety, however it is unclear whether they may be at risk for heavy pre-drinking. It may be that pre-drinking alone when anticipating a social event may put those high in SA at increased risk for alcohol misuse and/or experiencing alcohol-related problems later on in the evening rather than being at risk for heavy pre-drinking. However, this remains to be tested in future investigations.

In partial support of our hypotheses, findings suggest that being with a stranger may be overall anxiety-provoking for those high in SA and may be particularly concerning when alcohol is available, as these individuals may be at increased risk for pre-drinking to cope. Results suggest that those high in SA who completed the pre-drinking analogue with a stranger reported increased anxious mood and decreased urge to drink when alcohol was not available. When alcohol was available, these individuals reported increased anxious mood, urge to drink and pre-drinking to cope with anxiety motives in this context but not predict heavy pre-drinking. Previous research has shown that individuals diagnosed with social anxiety disorder who drank in groups with other participants consumed less alcohol and selected weaker drinks before a social anxiety challenge compared to a control task (Abrams et al., 2002). It could be argued that although these individuals experience increased anticipatory anxiety and urge to drink when pre-drinking with a stranger, they may worry about embarrassing themselves in front of this person and/or impairing their interaction skills with

the stranger and during the upcoming social event and may thus avoid pre-drinking. It could also be argued that pre-drinking with a stranger may be perceived as the main social event for those high in SA. However, previous research has indicated that pre-drinking occurs in a variety of contexts, including with strangers or acquaintances (e.g., LaBrie et al., 2011; Pedersen et al., 2009). Pre-drinking contexts are complex and to date, little is known about pre-drinking contexts for those high in SA. Research is needed to define pre-drinking contexts in this population.

The present findings should be considered in light of limitations that can inform future work in the area. First, one concern could be the small sample size and concerns with power. Although models that tested our hypotheses were not statistically supported, we were able to conduct exploratory analyses and discuss preliminary findings. However, this is the first study, to our knowledge, to examine pre-drinking in the laboratory and to examine pre-drinking contexts and anticipatory anxiety in theoretically-based models of SA-related pre-drinking. Future work is necessary to test these models with larger sample sizes and determine if results are replicable. Second, because we were interested in university drinking, these findings may not generalize to individuals who do not attend university. We were interested in examining SA-risk for pre-drinking among undergraduates as SA and pre-drinking are both prevalent among undergraduates (LaBrie & Pederson, 2008; Purdon et al., 2001), drinking is normative (Johnston et al., 2009) and students are commonly faced with anxiety-provoking social situations. A strength of the present study is that we examined SA on a continuum, however results may not generalize to clinical samples but may be similar to the present findings. Future research should aim to replicate results with clinical samples of young adults diagnosed with social anxiety disorder. Third, we were not able to run mediation models to test causal inferences due to concerns with power and were unable to include variables of theoretical importance (e.g., gender, pre-drinking norms, negative affect such as ratings of depressed mood, (e.g., Brown et al., 1998). Therefore, we could not test the role of anticipatory anxiety, coping motives, and urge to drink (Kuntsche & Labhart, 2013; Labhart & Kuntsche, 2017) as predictors of pre-drinking in a single model. We did however test these variables as outcomes in separate analyses. Future laboratory-based studies with larger samples could help remedy these limitations. Last, we did not include measures of alcohol outcome expectancies, defined as outcomes that an individual expects to occur as a result of consuming alcohol (Jones, et al., 2001). Individuals who hold positive alcohol expectancies would be more likely to drink, whereas those who anticipate negative effects of drinking would be at decreased risk for heavy drinking (Fromme et al., 1993;

Jones, et al., 2001). Studies suggest that alcohol expectancies may moderate the effect of SA on anticipatory anxiety (Abrams & Kushner, 2004) and on alcohol consumption prior to an anxiety-provoking task, (Knight and Godfrey, 1993) and may differ across drinking context (Wall et al., 2000). As such, those high in SA may hold different alcohol outcome expectancies if they are alone, with a close friend or with a stranger, which would impact anticipatory anxiety and urge to pre-drink. It is recommended that future studies examine their moderating effect on the SA risk for anticipatory anxiety and urge to pre-drink across pre-drinking contexts.

Despite study limitations, this line of research may extend to implications for prevention and treatment of problematic drinking for those high in SA. Psychoeducational interventions that provide undergraduates with necessary information regarding risky drinking habits are commonly used to reduce risk for problem drinking with undergraduates (Cronce & Larimer, 2011; Merrill et al., 2013). Our findings suggest that those high in SA experience increased anticipatory anxiety prior to a main event, highlighting the importance of incorporating information regarding anticipatory processing to current prevention efforts. Our results also suggest that SA risk for pre-drinking may increase in pre-drinking contexts that are more anxiety-provoking for those high in SA. Such findings suggest the importance of educating undergraduates regarding risky pre-drinking contexts that would increase risk for pre-drinking to reduce anticipatory anxiety. These efforts may be central to improving preventative interventions. Findings also have clinical implications. To date, individuals presenting with comorbid social anxiety disorder and alcohol use disorder have poor treatment outcomes and high relapse rates (Kushner et al., 2005; McEvoy & Schand, 2008). Research suggests the integration of therapeutic techniques to treat individuals presenting with comorbid conditions. Anticipatory anxiety is a cognitive process that is malleable and is a target for evidence-based interventions, such as Cognitive Behaviour Therapy (Heimberg, 2002). Such interventions target thoughts, emotions, beliefs and behaviours that serve to maintain coping-motivated problematic alcohol use. The present study underscores the importance of identifying and targeting context-specific anticipatory anxiety processes, including automatic thoughts, negative predictions and negative self-perceptions that occur in various pre-drinking contexts. The present findings also highlight the importance of providing skills training, such as distress tolerance and emotion regulation strategies as some pre-drinking contexts may be more anxiety-provoking than others (i.e., alone, with a stranger) for those high in SA. Such integrative efforts would aim to challenge anticipatory processing, and help those high in SA regulate distress in contexts where they

would experience increased anticipatory anxiety, which would thus reduce urge to pre-drink to cope before going out. The goal would be to decrease risky pre-drinking practices that may put undergraduate students at increased risk for problem drinking.

In conclusion, this study is the first to examine SA risk for pre-drinking across pre-drinking contexts in a laboratory experiment. Our findings highlight the importance of including pre-drinking contexts and anticipatory anxiety into cognitive models of SA and pre-drinking. This study tested a theoretically sound model of SA-related pre-drinking and our findings directly point to future directions for research and clinical implications on SA and problematic drinking.

Table 4.1

Descriptive Statistics for Model Outcome Variables at each Timepoint Across Pre-drinking Contexts and Alcohol Condition.

		Baseline		T1		T2		T3		T4	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Anxious											
No Alcohol											
Alone	*(24)*	22.79	23.05	34.42	29.60	32.38	28.27	31.83	29.34	9.83	13.99
Familiar	*(24)*	26.92	20.95	41.75	28.07	31.08	25.96	42.21	28.53	14.04	15.53
Unfamiliar	*(24)*	33.17	27.55	46.54	30.32	36.83	31.71	39.92	31.84	18.42	23.46
Alcohol											
Alone	*(24)*	29.58	23.13	37.63	26.35	28.42	25.55	29.37	28.85	14.42	20.55
Familiar	*(23)*	31.87	26.25	50.52	28.91	40.09	30.22	42.35	32.05	16.52	24.39
Unfamiliar	*(24)*	28.29	30.11	36.13	33.72	24.00	23.12	22.67	25.38	5.00	10.68
Urge											
No Alcohol											
Alone	*(24)*	1.46	.64	1.55	.90	1.63	.97	1.61	.89	1.37	.56
Familiar	*(24)*	1.99	1.13	2.17	1.26	2.34	1.42	2.03	1.20	1.55	.71
Unfamiliar	*(24)*	1.79	1.30	1.83	1.32	1.79	1.32	1.52	.73	1.39	.70
Alcohol											
Alone	*(24)*	1.40	.87	1.46	1.14	1.58	.96	1.68	.89	1.43	.66
Familiar	*(23)*	1.32	.44	1.32	.52	1.44	.55	1.57	.66	1.66	1.09
Unfamiliar	*(24)*	1.29	.57	1.27	.61	1.59	1.14	1.74	1.43	1.60	1.24
Cop-Motives											
Alcohol											
Alone	*(24)*									1.84	.70
Familiar	(23)									2.22	.88
Unfamiliar	(24)									1.84	1.07
BrAC											
Alcohol											
Alone	*(24)*									.04	.03
Familiar	*(23)*									.03	.03
Unfamiliar	*(24)*									.03	.03

Note. N = 143. Anxious Mood = Anxious mood Ratings assessed using the VAS; Urge = Urge to drink alcohol; Cop-Motives = Pre-drinking to cope with anxiety motives; BrAC = Peak Breath Alcohol Concentration. T1 = first anticipatory anxious mood manipulation (Pre-Taste Task), T2 = Second anticipatory anxious mood manipulation (Mid-Taste Task), T3 = Third anticipatory anxious mood manipulation (pre-interaction), T4 = Post-interaction task.

Table 4.2

Bivariate Correlations

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14†	15†
1. SA	1	.10	.07	.45**	.55**	.49**	.49**	.40**	.22**	.20*	.25**	.28**	.22**	.56**	-.17
2. Context		1	.00	.07	.07	.00	.01	-.01	.05	.02	.03	-.01	.05	-.03	-.12
3. Condition			1	.05	.01	-.05	-.11	-.06	-.23**	-.24**	-.17*	-.03	.07		
4. Mood T0				1	.61**	.58**	.59**	.59**	.18*	.15	.18*	.22**	.16	.37**	-.12
5. Mood T1					1	.76**	.74**	.56**	.21*	.21*	.23**	.29**	.21*	.52**	-.07
6. Mood T2						1	.88**	.58**	.09	.14	.14	.21*	.13	.38**	-.16
7. Mood T3							1	.60**	.09	.12	.11	.18*	.09	.36**	-.15
8. Mood T4								1	.07	.10	.10	.15	.08	.18	-.12
9. Urge T0									1	.89**	.84**	.51**	.40**	.20	.25*
10. Urge T1										1	.86**	.55**	.39**	.22	.18
11. Urge T2											1	.80**	.61**	.39**	.26*
12. Urge T3												1	.84**	.55**	.23*
13. Urge T4													1	.55**	.33**
14. Coping														1	.10
15. BrAC															1

Note. N= 143. SA = Social Anxiety factor scores, Context = Assigned Context Condition (Alone, Familiar, Unfamiliar), Condition = Assigned Alcohol Condition (Alcohol, No Alcohol), Mood = Anxious mood ratings on VAS, Urge = Urge to drink alcohol, Coping = Pre-drinking to cope with anxiety motives, BrAC = Peak Breath Alcohol Concentration, T0 = Baseline, T1 = First anticipatory anxious mood manipulation (Pre-Taste task), T2 = Second anticipatory anxious mood manipulation (Mid-Taste Task), T3 = Third anticipatory anxious mood manipulation (pre-interaction), T4 = Post-interaction task.

** $p < 0.01$, * $p < .05$

†Pearson Correlations for coping with anxiety motives, BrAC and other variables in the model based on individuals in the alcohol condition only ($N = 71$).

Table 4.3

Effect of the Interaction between Context Condition, Alcohol Condition and SA on Time Predicting Anxious Mood

	Model 1				Model 2				Model 3			
	B	*S.E.*	*p*	*95% C.I.*	*B*	*S.E.*	*p*	*95%C.I.*	*B*	*S.E.*	*p*	*95% C.I.*
Intercept	30.39	6.06	.000	18.47,42.31	30.39	6.03	.000	18.53,42.25	30.39	6.01	.000	18.58,42.20
T	12.50	5.60	.026	1.50,23.50	14.24	7.05	.044	.41,28.08	13.89	7.06	.049	.03,27.75
T^2	-4.37	1.30	.001	-6.93,-1.81	-5.10	1.71	.003	-8.46,-1.73	-5.02	1.72	.004	-8.39,-1.64
Context1	.17	4.69	.971	-9.03,9.38	.17	4.66	.970	-8.99,9.33	.17	4.64	.970	-8.95,9.30
Context2	-1.86	4.65	.690	-11.00,7.29	-1.85	4.63	.689	-10.95,7.24	-1.85	4.61	.688	-10.91,7.21
Alcohol	-.99	3.80	.795	-8.46,6.48	-.99	3.78	.794	-8.42,6.44	-.99	3.77	.794	-8.39,6.42
SA	12.04	2.05	.000	8.01,16.08	12.04	2.04	.000	8.03,16.05	12.04	2.03	.000	8.05,16.04
Context1*T	-5.05	4.33	.244	-13.55,3.45	-7.95	5.76	.168	-19.25,3.36	-7.47	5.78	.197	-18.82,3.88
Context2*T	2.88	4.30	.503	-5.56,11.31	2.58	5.60	.645	-8.42,13.58	2.14	5.57	.701	-8.80,13.09
Alcohol *T	5.58	3.51	.113	-1.32,12.47	1.70	9.32	.855	-16.60,19.99	.23	9.30	.981	-18.03,18.48
SA*T	5.87	1.90	.002	2.15,9.59	6.20	5.50	.260	-4.60,17.01	18.47	7.21	.011	4.32,32.62
Context1*T^2	1.19	1.01	.239	-.79,3.17	1.95	1.41	.168	-.82,4.72	1.83	1.42	.196	-.95,4.62
Context2*T^2	-.45	1.00	.654	-2.41,1.52	.05	1.37	.970	-2.64,2.74	.17	1.36	.903	-2.51,2.84
Alcohol *T^2	-1.11	.82	.175	-2.71,.50	.46	2.39	.847	-4.23,5.15	.85	2.38	.721	-3.82,5.52
SA*T^2	-1.71	.44	.000	-2.57,-.84	-1.97	1.41	.164	-4.74,.81	-5.17	1.86	.006	-8.82,-1.52
Context1* Alcohol *T					6.89	7.51	.359	-7.86,21.64	8.70	7.53	.248	-6.08,23.48
Context2* Alcohol *T					-.09	7.38	.990	-14.58,14.40	2.02	7.39	.785	-12.49,16.53
Context1*SA*T					-2.27	4.26	.595	-1.62,6.09	-11.00	6.02	.068	-22.82,.83
Context2*SA*T					4.25	3.94	.281	-3.48,11.99	-5.27	5.54	.342	-16.16,5.62
Alcohol *SA*T					-2.67	3.28	.416	-9.12,3.78	-27.23	9.91	.006	-46.70,-7.77
Context1* Alcohol *T^2					-1.83	1.95	.348	-5.66,2.00	-2.31	1.95	.237	-6.15,1.52
Context2* Alcohol *T^2					-.79	1.92	.682	-4.55,2.98	-1.33	1.92	.487	-5.10,2.43
Context1*SA*T^2					.63	1.11	.571	-1.54,2.80	2.87	1.56	.067	-.20,5.94
Context2*SA*T^2					-1.07	1.02	.295	-3.08,.94	1.46	1.44	.312	-1.37,4.28
Alcohol *SA*T^2					.89	.85	.299	-.79,2.56	7.30	2.57	.005	2.25,12.36

Context1* Alcohol *SA*T	18.29	8.49	.032	1.61,34.96
Context2* Alcohol *SA*T	19.65	7.86	.013	4.22,35.08
Context1* Alcohol *SA*T^2	-4.71	2.20	.033	-9.04,-.39
Context2* Alcohol *SA*T^2	-5.21	2.04	.011	-9.21,-1.20

Note. Intercept is set at baseline. *B*= Unstandardized Parameter Estimate. *T* = Time, T^2 = Time*Time. *Context1*: Dummy variable for pre-drinking context, *1* = Familiar Context, *Context2*: Dummy variable for pre-drinking context, *1* = Unfamiliar context. Pre-drinking context reference category is Alone. Alcohol = Assigned alcohol condition (1= Alcohol, 0 = No Alcohol), *SA* = Social Anxiety.

Table 4.4

Effect of the Interaction Between Context Condition, Alcohol Condition and SA on Time Predicting Urge to Drink

	Model 1				Model 2				Model 3			
	B	*S.E.*	*p*	*95% C.I.*	*B*	*S.E.*	*p*	*95% C.I.*	*B*	*S.E.*	*p*	*95% C.I.*
Intercept	1.47	.24	.000	1.00,1.94	1.47	.24	.000	1.00,1.94	1.47	24	.000	1.01,1.94
T	.06	.15	.684	-.24,.36	-.05	.20	.787	-.44,.34	-.01	.20	.949	-.40,.38
T^2	.00	.03	.934	-.07,.07	.03	.05	.462	-.06,.12	.02	.05	.610	-.07,.11
Context1	-.17	.19	.370	-.53,.20	-.17	.18	.364	-.53,.19	-.17	.18	.364	-.53,.19
Context2	-.06	.18	.764	-.42,.31	-.06	.18	.761	-.41,.30	-.06	.18	.761	-.41,.30
Alcohol	.44	.15	.004	.14,.74	.44	.15	.003	.15,.73	.44	.15	.003	.15,.73
SA	.22	.08	.007	.06,.38	.22	.08	.006	.06,.38	.22	.08	.006	.06,.38
Context1*T	.01	.12	.959	-.23,.24	.24	.16	.140	-.08,.56	.20	.16	.218	-.12,.52
Context2*T	.10	.12	.388	-.13,.33	.05	.16	.752	-.26,.36	.05	.16	.750	-.26,.36
Alcohol*T	.08	.10	.402	-.11,.27	.31	.27	.266	-.23,.84	.30	.27	.280	-.24,.83
SA*T	.08	.05	.106	-.02,.19	.05	.16	.749	-.27,.37	-.08	.21	.724	-.49,.34
Context1*T^2	.00	.03	.988	-.05,.05	-.06	.04	.106	-.14,.01	-.05	.04	.178	-.13,.02
Context2*T^2	-.02	.03	.351	-.08,.03	-.02	.04	.520	-.10,.05	-.02	.04	.505	-.10,.05
Alcohol*T^2	-.05	.02	.012	-.10,-.01	-.13	.06	.053	-.25,.00	-.13	.06	.052	-.25,.00
SA*T^2	-.02	.01	.050	-.05,.00	.01	.04	.762	-.06,.09	.06	.05	.230	-.04,.16
Context1*Alcohol*T					-.47	.22	.035	-.91,-.03	-.46	.22	.041	-.90,-.02
Context2*Alcohol*T					.12	.22	.574	-.31,.55	.10	.22	.651	-.33,.53
Context1*SA*T					.10	.13	.439	-.15,.35	.28	.18	.113	-.07,.64
Context2*SA*T					-.05	.12	.668	-.28,.18	-.06	.17	.703	-.39,.26
Alcohol*SA*T					.01	.10	.891	-.18,.21	.26	.30	.374	-.32,.84
Context1*Alcohol*T^2					.13	.05	.018	.02,.23	.13	.05	.019	.02,.23
Context2*Alcohol*T^2					-.01	.05	.784	-.12,.09	-.01	.05	.919	-.11,.10
Context1*SA*T^2					-.04	.03	.143	-.10,.02	-.10	.04	.017	-.19,-.02
Context2*SA*T^2					.01	.03	.747	-.05,.06	.00	.04	.951	-.08,.07
Alcohol*SA*T^2					-.02	.02	.330	-.07,.02	-.12	.07	.088	-.26,.02

Context1*Alcohol*SA*T	-.35	.25	.161	-.85,.14
Context2*Alcohol*SA*T	.00	.23	.990	-.46,.46
Context1*Alcohol*SA*T^2	.11	.06	.061	-.01,.23
Context2*Alcohol*SA*T^2	.03	.06	.600	-.08,0.14

Note. Intercept is set at baseline. *B*= Unstandardized Parameter Estimate. *T* = Time, T^2 = Time*Time. *Context1*: Dummy variable for pre-drinking context, *1* = Familiar Context, *Context2*: Dummy variable for pre-drinking context, *1* = Unfamiliar context. Pre-drinking context reference category is Alone. *Alcohol* = Assigned alcohol condition (1= Alcohol, 0 = No Alcohol), *SA* = Social Anxiety.

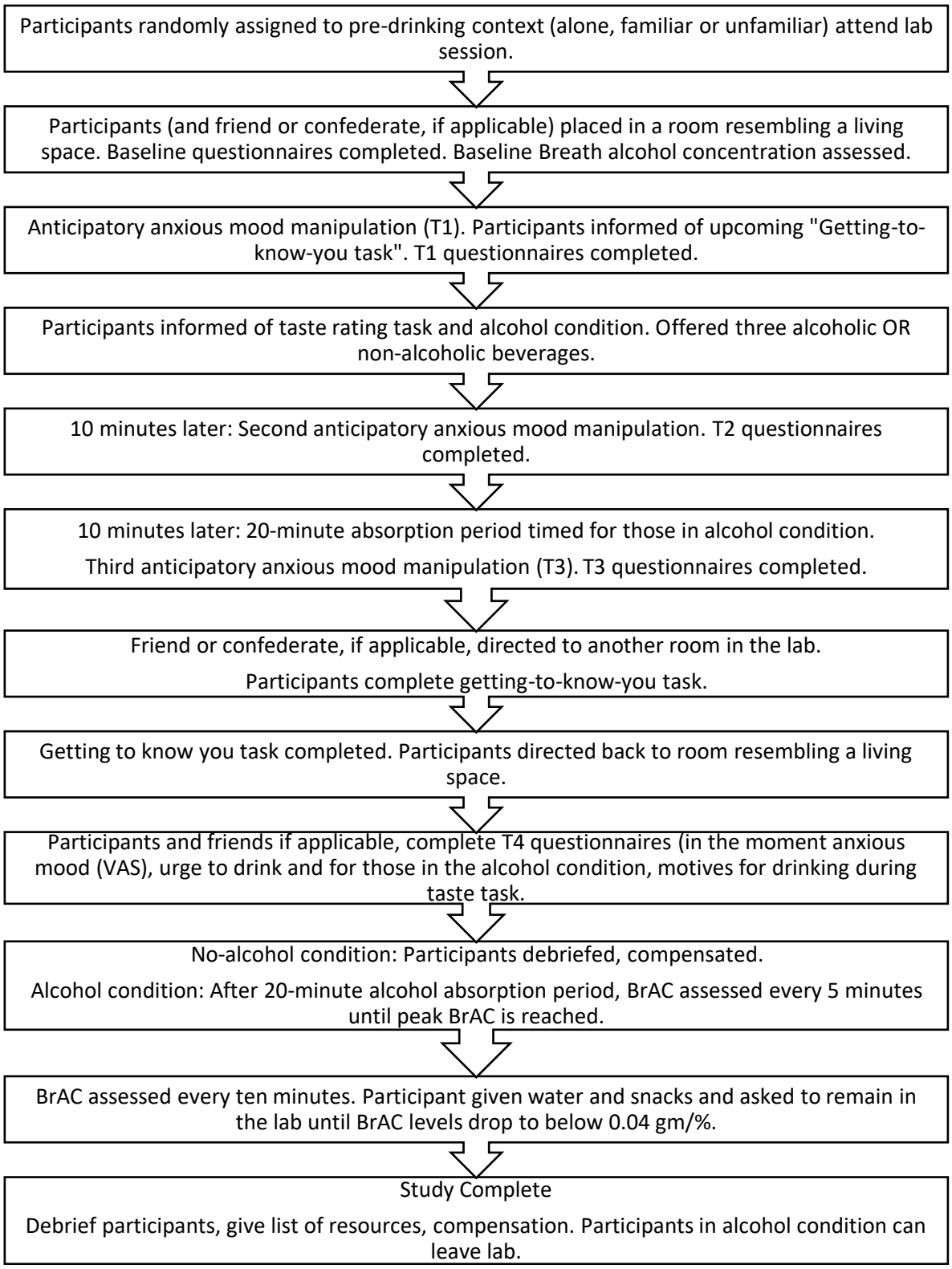

Figure 4.1. Study Procedures

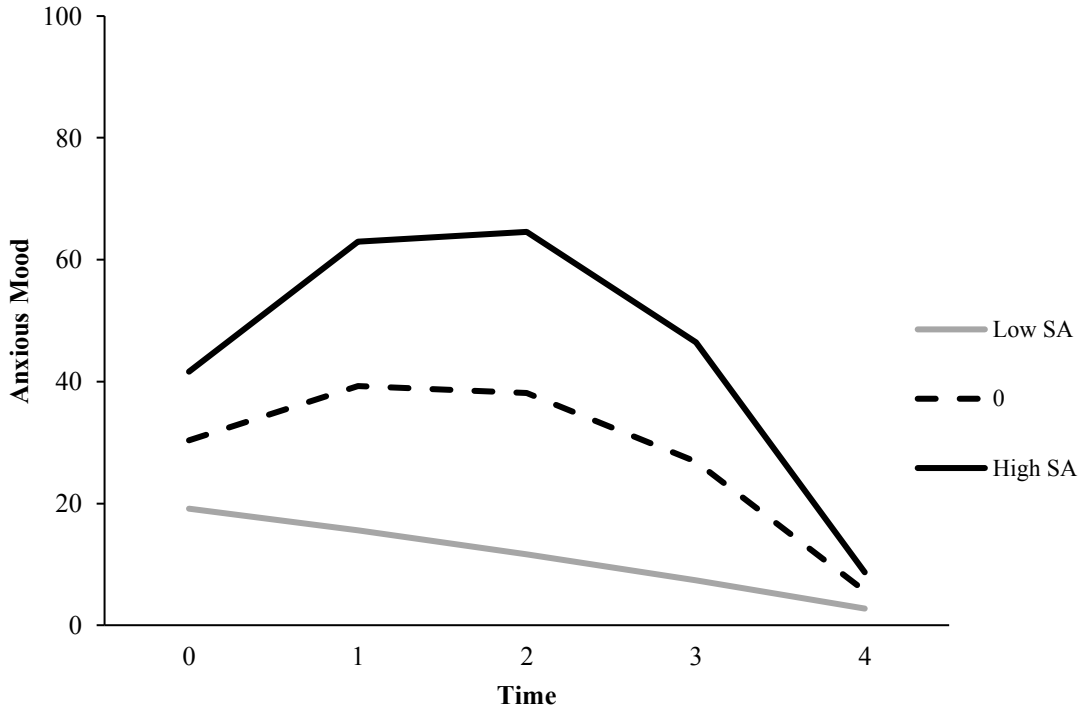

Figure 4.2. Effect of time on anxious mood conditioned at high (+1 *SD*) and low (-1 *SD*) SA.

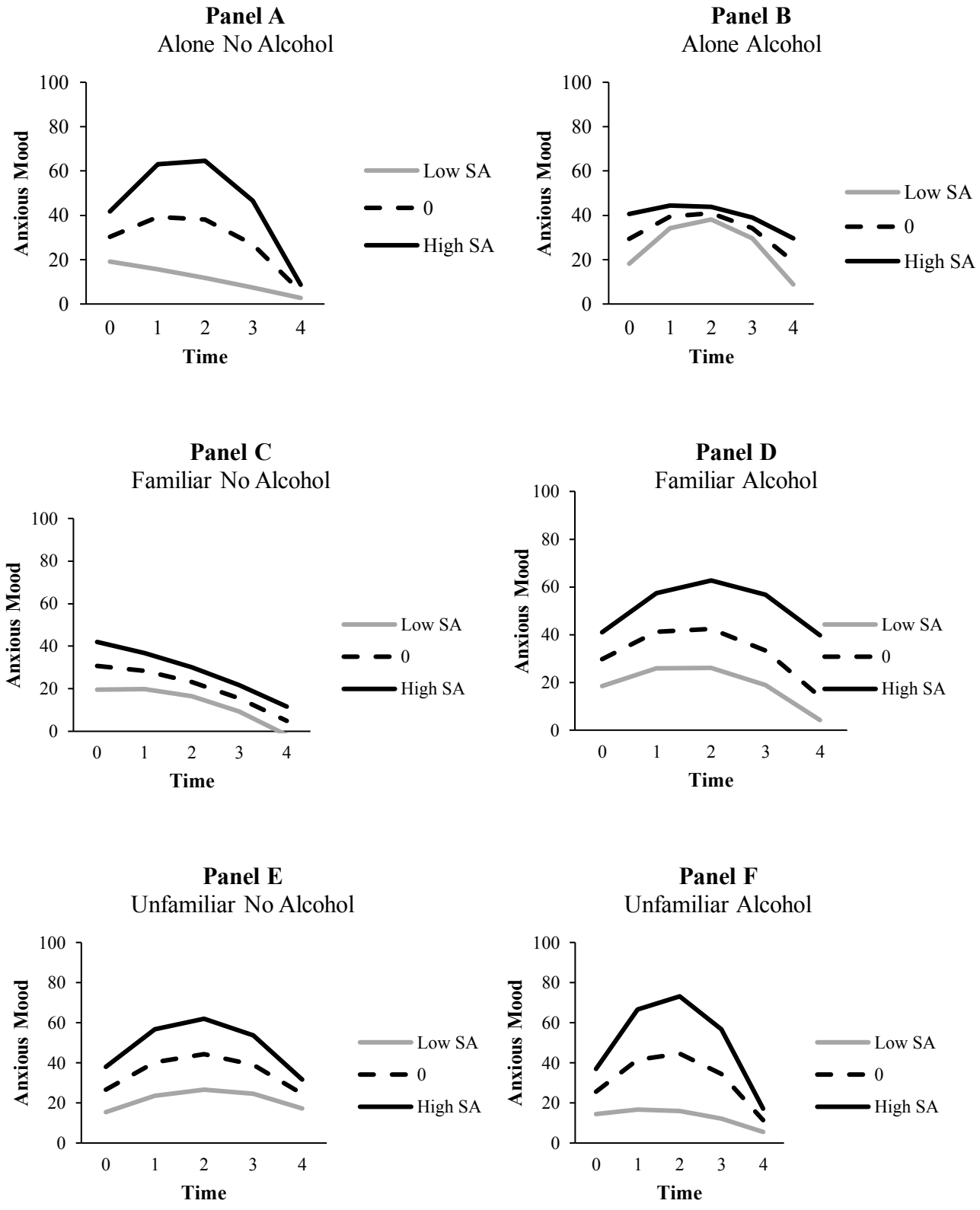

Figure 4.3. Effect of the interaction between context condition, alcohol condition and time on anxious mood conditioned at high (+1 *SD*) and low (-1 *SD*) SA.

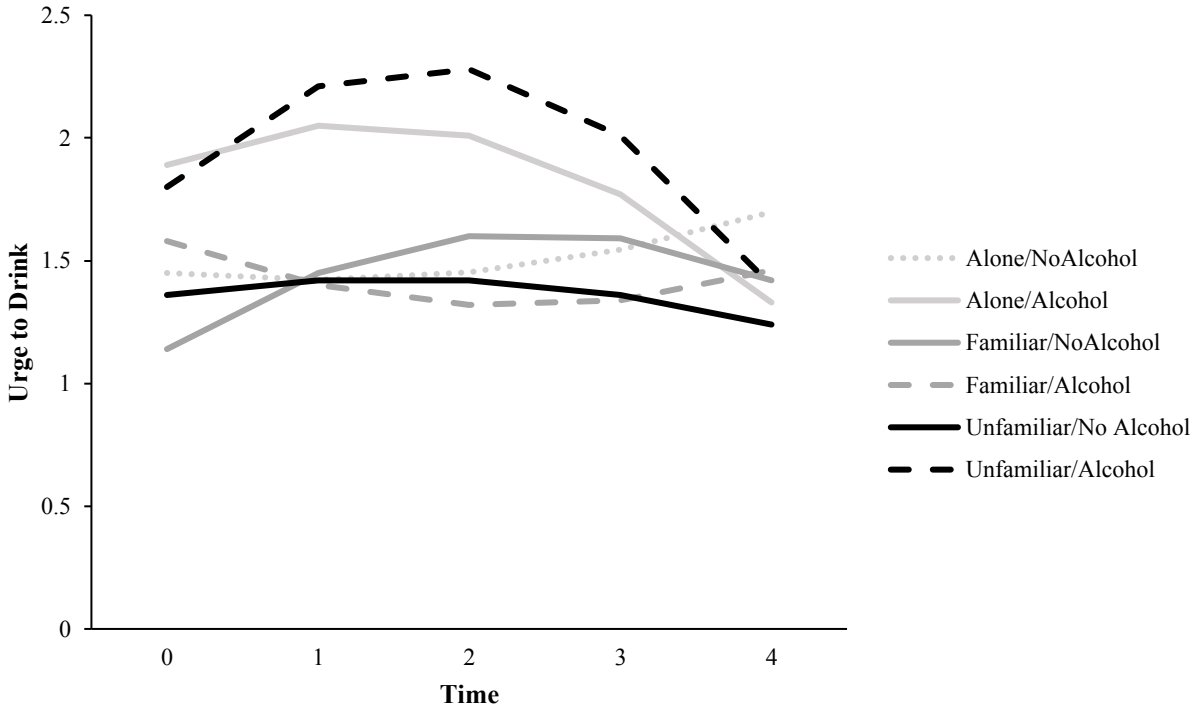

Figure 4.4. Effect of the interaction between context condition, alcohol condition, and time on urge to drink.

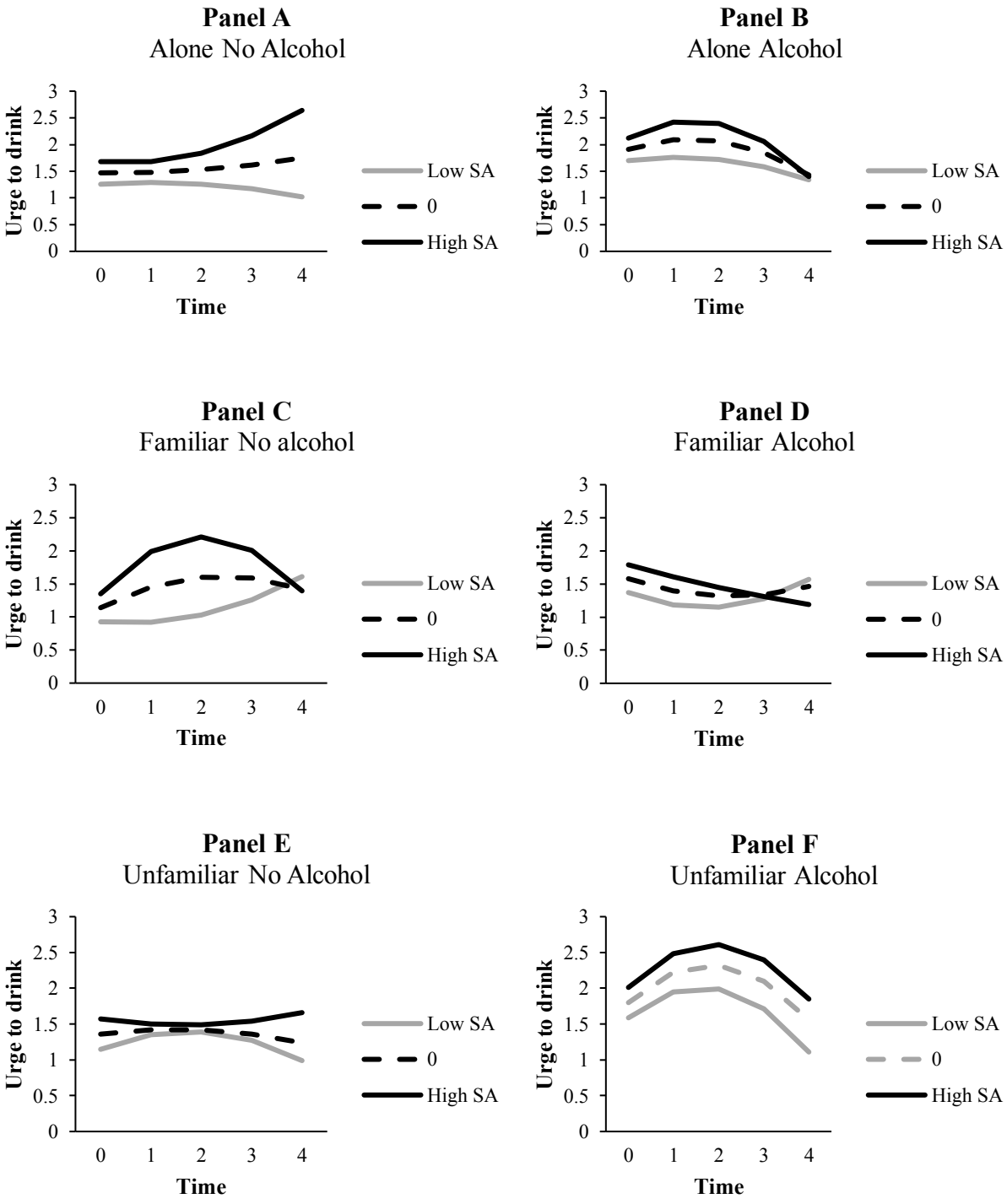

Figure 4.5. Effect of the interaction between context condition, alcohol condition, and time on urge to drink conditioned at high (+1 *SD*) and low (-1 *SD*) SA

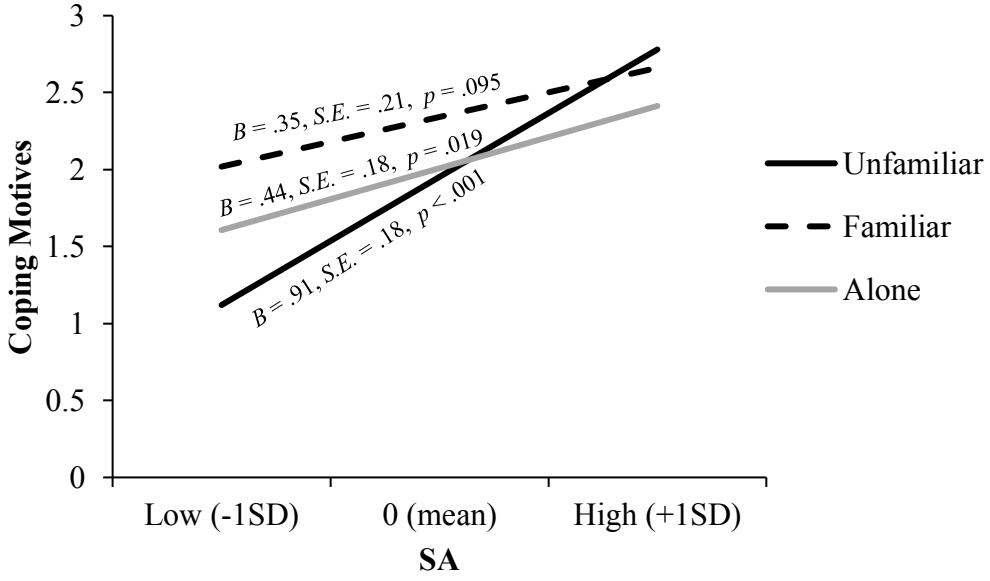

Figure 4.6. Simple slopes for the effect of the interaction between SA and context condition predicting coping motives.

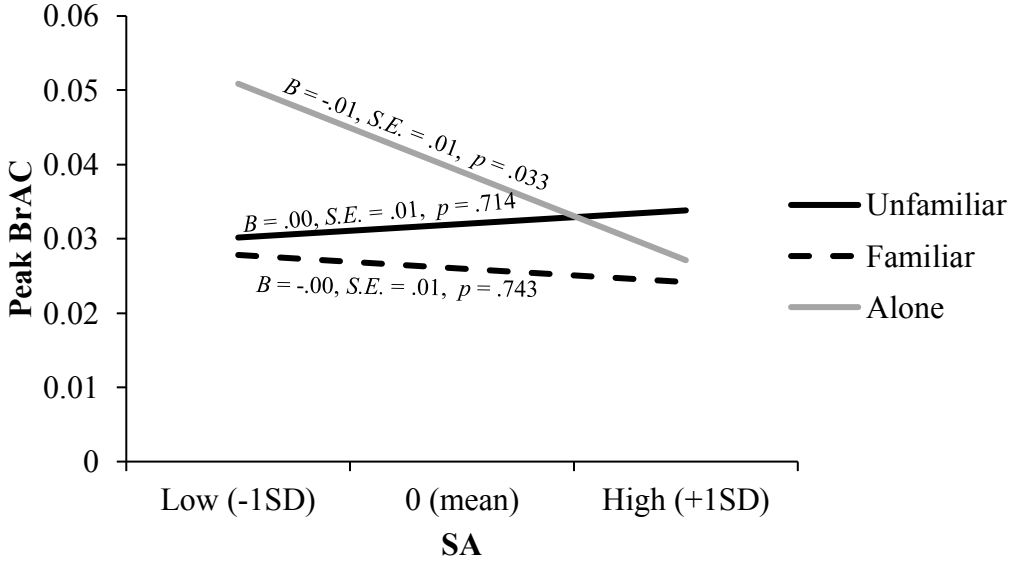

Figure 4.7. Simple slopes for the effect of the interaction between SA and context condition predicting Peak BrAC (Breath Alcohol Concentration).

GENERAL DISCUSSION

Summary of Findings

The present dissertation focused on a specific aspect of problem drinking, this being pre-drinking. We were interested in examining the link between SA and pre-drinking, particularly in the university environment, a time when students are faced with many social situations involving alcohol and when problematic patterns of drinking can be solidified (Johnston et al., 2009). Pre-drinking is prevalent among undergraduate students (Brosari et al., 2007), and leads to overall heavy drinking and increased number of alcohol-related problems (LaBrie & Pedersen, 2008; Real et al., 2010). Research has examined factors that increase risk for pre-drinking among undergraduates (e.g., Kuntsche & Labhart, 2013; Pederson & Labrie, 2007), however few studies have investigated SA as a predictor of pre-drinking. This is concerning as those high in SA learn to use alcohol to reduce their anxiety, leading them to consume alcohol prior to social events (Ham & Hope, 2005; Pedersen et al. 2009), and SA predicts increased alcohol-related problems among undergraduates (e.g., Buckner et al, 2011; Gilles et al., 2006). The goal of this dissertation was to integrate emotional processes and social context into theoretically and empirically-rooted risk models of SA and pre-drinking. With this aim in mind, we tested the effect of anxious mood and pre-drinking contexts on the SA pathway to pre-drinking.

A cognitive model of SA provided the theoretical framework for both studies proposing that socially anxious individuals may be at increased risk for pre-drinking to reduce momentary anticipatory anxiety and may be more likely to do so in specific contexts prior to encountering others at the main social event (Clark & Wells, 1995; Conger, 1956; Hofmann, 2007). Using ecological momentary assessments administered on smartphones, the first study captured pre-drinking contexts and anticipatory anxiety in real time at the first decision to consume alcohol while also capturing drinking over the course of the night. We tested the combined effect of pre-drinking contexts and anticipatory anxiety as moderators of the SA-risk for pre-drinking. Findings suggest that for those with elevated SA, pre-drinking contexts and anticipatory anxiety are critical risk factors that increase risk for pre-drinking. In this first study, we investigated a specific aspect of pre-drinking contexts, focusing on where pre-drinking was occurring. However, pre-drinking not only occurs in different contexts, but with different people (LaBrie et al., 2011; Pedersen et al., 2009; Zamboanga et al., 2011. Those high in SA report less anxiety when with a close companion, compared to when with a stranger or alone (Pontari, 2009; Hur et

al., 2019). Therefore, we were interested in examining the effect of another aspect of pre-drinking contexts; specifically who pre-drinking was occurring with, on the SA risk for pre-drinking.

Using an experimental design, Study 2 examined the effect of social context, particularly the effect of being in presence of different people, prior to a main social event on pre-drinking for those high in SA. To our knowledge, this is the first study to examine pre-drinking in the laboratory and furthermore to experimentally manipulate situational factors and cognitive processes that could increase risk for pre-drinking among those high in SA. We manipulated pre-drinking contexts by having participants drink alcohol or no alcohol either alone, with a friend or with an unfamiliar individual (this drinking period was analogue to pre-drinking), and induced anticipatory anxiety of an upcoming social event prior to and during the drinking portion of the study. Of interest, was the anticipatory anxiety experienced prior to the main social event. We examined social contexts as moderating the SA-related increase in anticipatory anxiety, urge to pre-drink, pre-drinking to cope with anxiety motives and heavy pre-drinking prior to the social event. Exploratory data analysis suggested that the effect of pre-drinking contexts may moderate SA risk for increased anticipatory anxiety, urge to drink and pre-drinking to cope. Taken together, our findings help clarify the process of SA risk for pre-drinking among undergraduate students. The present dissertation underscored the role of situational factors and cognitive processes relevant to advancing aetiological risk models of SA-related pre-drinking and holds implications for clinical interventions.

Study 1. The main goal of this study was to examine pre-drinking contexts and anticipatory anxiety as moderating the effect of SA risk for pre-drinking. A daily diary study was used to assess these risk factors as they unfolded in the moment. Participants were assessed over a four-week period, during which they used smartphones to record their drinking, indicate if they were engaging in pre-drinking, the number of drinks consumed during pre-drinking, and the social context in which pre-drinking occurred. They also rated in the moment anxious mood. Consistent with our hypotheses, findings suggested that the combined effect of pre-drinking contexts and anxious mood moderated SA risk for pre-drinking as measured by two outcomes 1) likelihood for pre-drinking (vs. drinking at the main event) and 2) amount consumed during pre-drinking. While, the simple slopes underpinning the interactions predicting likelihood for pre-drinking were not statistically significant, the direction of the slopes was visually inspected and described. Statistically significant simple slopes underpinning the interactions predicting amount

consumed during pre-drinking were also described. Findings add to the current literature on pre-drinking, not only by examining pre-drinking as it relates to SA specifically, but also by identifying risk factors that increase risk for pre-drinking among those high in SA. Taken together, results from Study 1 highlight the importance of considering moderators in the SA pathway to pre-drinking.

Consistent with cognitive models of SA (Clark & Wells, 1995) and tension-reduction theory (Conger, 1951; 1956), findings from Study 1 suggest that not all those high in SA are at increased risk for pre-drinking. Rather, risk for pre-drinking increases when in the moment anxious mood is high and when in specific contexts, specifically convivial social contexts such as restaurants, work functions, and school functions prior to a main social event. Findings also add to theoretical models of SA by suggesting that those high in SA are protected against risky pre-drinking when anticipatory anxiety is high in group contexts such as bars, clubs, and parties. To date, studies examining the relation between anxious mood and drinking prior to a social event for those high in SA have provided mixed results (Abrams et al., 2002; Buckner et al., 2020; Kidorf & Lang, 1999). Findings from Study 1 suggest that considering social context may help resolve the mixed support for the link between SA and pre-drinking. This study also adds to existing yet scarce literature on SA and pre-drinking. Keough et al. (2016) found that pre-drinking alone mediated the link between SA and problem drinking (Keough et al. 2016). Although this study did not examine risk factors in the link between SA and pre-drinking, consistent with our findings, it highlights the importance of incorporating pre-drinking contexts into aetiological models of SA-related problem drinking. Buckner et al. (2020) found that anticipatory anxiety predicted more drinking before a social event among those with clinically elevated SA (Buckner et al., 2020). Although results are not generalizable to non-clinical samples, consistent with our results, they found that anticipatory anxiety is a cognitive process that increases risk for pre-drinking among socially anxious individuals. The present study adds to this research by demonstrating the importance of considering the combined effect of both pre-drinking contexts and anticipatory anxiety together as they moderate SA-risk for pre-drinking among undergraduate students.

The social context we examined in Study 1 may have consisted of a mix of people present, including close friends, strangers, acquaintances and others. The presence of others during pre-drinking may have impacted the link between SA and pre-drinking. Those high in SA

experience decreased anxiety and reduced negative self-focused thoughts when with close companions compared to when alone or with strangers/acquaintances (e.g., Pontari, 2009; Hur et al., 2019). Such findings along with cognitive models of SA (Clark & Wells, 1995) suggest that those high in SA may experience increased anticipatory anxiety when alone or in the presence of certain individuals (e.g., a stranger), which would impact risk for pre-drinking differently.

Study 2. The goal of the second study was to test the moderating effect of pre-drinking contexts (i.e., contexts that differ in who is present during pre-drinking) on SA-related increase in anticipatory anxiety, urge to drink, pre-drinking to cope with anxiety and heavy pre-drinking in an experimental study. In order to mimic pre-drinking in the laboratory, participants were provided the opportunity to ad-lib drink as part of a taste-rating task prior to a social-anxiety provoking interaction task. Participants were randomly assigned to complete the taste rating task in one of three pre-drinking contexts, alone, with a friend or with an unfamiliar person. Mood manipulation consisted of inducing anticipatory anxiety of an upcoming social interaction task prior to and throughout a drinking period that was analogue to pre-drinking. Findings further highlight the importance of incorporating situation factors and mood into aetiological models of SA and pre-drinking.

Consistent with cognitive models of SA (Clark & Wells, 1995), main findings indicate that those high in SA experience increased anticipatory anxiety in response to the mood manipulation, regardless of assigned context or alcohol condition. Undergraduates who pre-drank alone or with a stranger reported increased urge to pre-drink, irrespective of SA, suggesting that consuming alcohol alone or with a stranger may overall be a more risky practice in this population. In line with evidence indicating that those high in SA feel more comfortable in the presence of a close companion (Hur et al., 2019; Pontari, 2009), results suggest that being with a friend may help those high in SA experience reduced anticipatory processing regarding an upcoming social interaction when alcohol is not available, and decreased urge to drink during the drinking phase of the study when alcohol is available. Drinking alone has been identified as a context that increases risk for using alcohol to escape negative emotions, for problem drinking and future alcohol problems (Christiansen et al., 2002; Holyfield et al., 1995). Pre-drinking alone for those high in SA has also been shown to predict increased alcohol-related problems (Keough et al., 2016). Consistently, findings add to this literature and to cognitive models of SA (Clark & Wells, 1995) suggesting that pre-drinking alcohol alone may increase risk for coping-motivated

pre-drinking for those high in SA. Findings suggest that those high in SA experienced a dampening of anxious mood and increased pre-drinking to cope with anxiety motives when pre-drinking alone. However, despite decreases in anticipatory anxiety prior to the main social event, these individuals reported a slight increase in urge to pre-drink, and SA predicted decreased peak breath alcohol concentrations for those who pre-drank alone. This suggest that these individuals did not pre-drink more heavily when alone prior to the main social event despite having the urge to pre-drink more. Increased urge to consume alcohol may suggest that those high in SA may have continued to chase the feeling of relief from alcohol when pre-drinking alone prior to the social interaction. More research is needed to determine whether the effect of pre-drinking alone on increased anticipatory anxiety predicts increased heavy pre-drinking and/or problem drinking throughout the evening, as this urge may translate to more drinking later in the night. Last, in partial support of with hypotheses, findings suggest that being with a stranger may be overall anxiety-provoking for those high in SA and may be particularly concerning when alcohol is available. In this situation, these individuals may be at increased risk for pre-drinking to cope and experience increased urge to pre-drink, but do not pre-drinking heavily. In fact, SA did not predict increased peak breath alcohol concentrations for those who pre-drank with a stranger prior to the main social event. Consistent with previous research (Abrams et al., 2002), those high in SA may want to pre-drink when experiencing increased anticipatory anxiety in the presence of a stranger, but may not necessarily pre-drink more heavily as they may worry about embarrassing themselves in front of this person and/or impairing their interaction skills with the stranger and during the upcoming social event if intoxicated.

Theoretical Contributions

According to cognitive models of SA (Clark & Wells, 1995), SA is maintained by several cognitive processes, including anticipatory anxiety. These models posit that socially anxious individuals experience considerable anxiety prior to social events due to anticipatory negative self-appraisals, beliefs about upcoming rejection from peers, and a thought process focused on past social failures and negative images of themselves at upcoming social events. Findings from Study 2 support cognitive models of SA, suggesting that those high in SA experience increased anticipatory anxiety prior to social interactions. The tension reduction theory (Conger, 1951; 1956) and the self-medication hypothesis (Carrigan & Randall, 2003) propose that socially anxious individuals consume alcohol to cope with anxiety at and prior to social events. Pre-

drinking may thus serve to dampen anticipatory anxiety and disrupt this negative thought process, increasing the likelihood of attending the social event and reducing self-focus (Clark, 2001; Eckman & Shean, 1997). However, pre-drinking occurs in variety of social contexts and can take place either alone or in the presence of others (e.g., with friends or with strangers) and in various places, including at home, at a get together, or at a party (LaBrie et al., 2011; Pedersen et al., 2009; Zamboanga et al., 2011). Previous research suggests that being in familiar social contexts (e.g., with close friends) compared to being alone or being in unfamiliar contexts (e.g., with strangers, co-workers) helps to decrease anxious mood for those high in SA (e.g., Hur et al., 2019; Pontari, 2009). Taken together, theory and evidence suggest that socially anxious undergraduates may be at increased risk for pre-drinking to reduce anticipatory anxiety in contexts that are more anxiety provoking (e.g., alone, with strangers, at a restaurant) prior to encountering others at social events (Clark & Wells, 1995). Results from Study 1 and Study 2 provide support for theoretical propositions by indicating that pre-drinking contexts and anticipatory anxiety are risk factors that increase risk for SA-related pre-drinking.

Results from the present dissertation suggest that pre-drinking with others in restaurants, at school function or work functions and/or in the presence of strangers may increase anticipatory anxiety and thus increase SA-risk for pre-drinking. Findings from Study 2 suggest that pre-drinking alcohol in unfamiliar contexts leads to increased urge to pre-drink regardless of SA. Results from Study 1 suggest that elevated SA predicted increased likelihood of pre-drinking but decreased quantity of alcohol consumed during pre-drinking when anticipatory anxious mood was high in contexts such as restaurants, work functions, and school functions. Similarly, results from Study 2 suggest that pre-drinking alcohol with a stranger may increase anticipatory anxiety, urge to drink, and coping motives, but not heavy pre-drinking for those high in SA prior to the main social event. Results are consistent with previous research indicating that those high in SA report greater negative affect when assigned to a more superficial social interaction compared to an intimate closeness-generating interaction (Kashdan & Roberts; 2006). Consistently, these individuals experience lower levels of anxiety when with close companions but not in the presence of strangers, co-workers, and acquaintances (Hur et al., 2019). Individuals diagnosed with social anxiety disorder drink less alcohol and select weaker drinks when drinking in groups before a social anxiety challenge compared to a control task (Abrams et al., 2002). Findings align with cognitive models of SA (Clark & Wells, 1995) and tension reduction theory (Conger, 1956)

suggesting that in social contexts that are more convivial, such as restaurants, school functions or work functions, where strangers or acquaintances may be present, there may be more opportunities to interact with others. In these contexts, those high in SA may be at increased risk for pre-drinking to dampen anticipatory anxiety prior to the main social event, and to facilitate ongoing social interactions. However, these individuals may be less likely to pre-drink heavily as they may worry about intoxication that would lead to embarrassing and feared regretful behaviours in front of others (Clark & Wells, 1995).

Results from Study 1 also indicated that pre-drinking in group contexts (e.g., party, club, bar) protected against likelihood of pre-drinking and quantity of alcohol consumed during pre-drinking when anxious mood was high. However, one of the limitations of this study lies in the fact that there is no indication of who was present at these pre-drinking events. Therefore, there is no certainty as to whether close friends were attending these social contexts or acquaintances or a mix of both. This is relevant as evidence shows that those high in SA feel less anxious when in the presence of close friends compared to strangers (Hur et al., 2019), which would thus impact risk for pre-drinking differently. The results however suggest that group contexts may be protective against risky pre-drinking for those high in SA. It may be that in group contexts (e.g., party, club), social interactions may be less convivial. Those high in SA may worry about their performance and may avoid pre-drinking altogether when anxious mood is high for fear of being judged and negatively evaluated by others if under the influence of alcohol (Clark & Wells, 1995).

Exploratory findings from Study 2 suggest that being with a friend and not drinking alcohol prior to a social interaction may protect against increased anticipatory anxiety but not against increased urge to drink. Integrating this finding into theoretical models of SA, those high in SA may feel more comfortable prior to a social event when in the presence of their friend, which may reduce anticipatory processing and anticipatory anxious mood regarding the upcoming interaction (Cox & Klinger, 1988). This is consistent with previous work showing that being with a friend compared to being with strangers decreases levels of anxious mood (Hur et al., 2019) and being with a friend compared to being alone reduces negative self-focused thoughts prior to a speech challenge (Pontari, 2009) among socially anxious adults. Being with friends compared to being alone has also been associated with decreased SA due to diffusion of evaluation and perceptions of security among women (Carron et al., 1999). The finding that those

high in SA reported increased urge to drink when in the presence of a close friend may be attributed to positive (e.g., increased sociability) rather than negative (e.g., cognitive/behavioural impairment, negative self-perception) alcohol outcomes expectancies (Wall et al., 2001). Based on previous work, it is thus possible that these individuals may experience urge to pre-drink with their friend when alcohol is not available as they expect alcohol will help them be more sociable and may enhance the experience (Morris et al., 2005). When alcohol was available, findings suggest that those high in SA reported increased anxious mood but decreased urge to pre-drink when with a close friend. This is consistent with research showing that if the situational demands require socially anxious individuals to perform in some manner, they tend to abstain from alcohol for fear of embarrassing themselves if intoxicated (Abrams et al, 2002; Morris, Stewart & Ham, 2005). It is also possible that these individuals may have experienced increased anticipatory anxiety during the drinking portion of the experiment, as they may have anticipated separating from their friend to attend the main social event. In fact, studies indicate that those high in SA tend to adopt an insecure attachment style in their close relationships (Nielsen, 2009; Read et al., 2018). Research is needed to replicate findings in a more realistic situation, where the friend would be likely to be accompany the individual to the main social event.

Findings from study 2 provide support for cognitive theories of SA (Clark & Wells, 1995) and theories of addiction (Conger, 1956) which propose that those high in SA may experience increased anticipatory processes prior to social interactions when alone and may pre-drink to reduce anticipatory processes and physiological symptoms of anxiety (Clark & Wells, 1995; Conger, 1956). Findings are also consistent with previous research identifying drinking alone as a risk factor for using alcohol to escape negative emotions and for problem drinking (Abbey et al., 1993; Christiansen et al., 2002; Holyfield et al., 1995). Exploratory data analysis suggests that although pre-drinking alcohol alone may help undergraduate students high in SA reduce anxious mood prior to a social event, they report increased pre-drinking motives and continue to experience urge to pre-drink when alcohol is available. Results suggest that those high in SA may continue to seek the relieving effects of alcohol prior the main event but do not pre-drink more heavily despite alcohol being available. Interestingly, Keough et al. (2016) found that SA predicted increased pre-drinking alone which in turn predicted increased alcohol-related problems but not heavy alcohol use. It may be that being alone when experiencing anticipatory anxiety may increase risk for pre-drinking but this may not necessarily involve heavy pre-

drinking. More research is needed to determine whether the effect of pre-drinking alone to reduce anticipatory anxiety predicts increased heavy pre-drinking and/or problem drinking throughout the evening.

Taken together, results from Study 1 and Study 2 add to current knowledge and support cognitive models of SA (Clark & Wells, 1995) and tension-reduction theory (Conger, 1956) by demonstrating that SA is an individual-level factor that merits careful attention in pre-drinking research. We add to the literature by showing that the effect of SA on pre-drinking is better explained by state affect and social context such that those high in SA are at increased risk to pre-drink to cope with anticipatory anxiety in specific contexts (alone, convivial or unfamiliar contexts) and as a function of in the moment anticipatory anxiety. This is not surprising, given considerable research that has generated mixed findings on the relation between SA and alcohol misuse among undergraduates (Buckner et al., 2011; 2013) and that has highlighted the importance of examining moderators. Findings from both studies are consistent in that they both support the importance of integrating anticipatory anxiety and pre-drinking contexts into models of SA and pre-drinking. Overall, findings help inform aetiological models of SA related pre-drinking and may help improve prevention efforts and intervention strategies aimed at reducing problem drinking among undergraduate students.

Limitations and Future Directions

Although the current findings improve our understanding of the SA risk for pre-drinking, findings should be interpreted in light of limitations that can guide future research in this area. The current dissertation adds to gaps in the literature by investigating pre-drinking specifically as it relates to SA among undergraduates. One of the main limitations of the current project lies in the way pre-drinking was defined. To date, it is unclear how to best define pre-drinking. There are various definitions in the literature, including "the consumption of alcohol at a domestic residence prior to attending licensed premised" (Foster & Ferguson, 2013), "drinking in a pair or group preparatory to a night out" (Bancroft, 2012) or "consuming alcohol prior to attending one's intended destination at which more alcohol may or may not be consumed" (Pederson & LaBrie, 2007). The notion of pre-drinking when defined by researchers is therefore complex. Although adopting researcher definitions may enable us to better compare findings across studies, research has yet to define pre-drinking for those high in SA. In Study 1, pre-drinking was user-defined. We asked participants to identify themselves whether they were pre-drinking or not. As a result,

participants reported pre-drinking in a variety of social contexts, at parties, clubs, bars, in restaurants, at work or school functions, suggesting that pre-drinking for those high in SA occurs in places outside the home and may occur in the presence of others. For researchers, it may look like pre-drinking is in fact the main social event, as it can occur with people that participants do not know. Asking participants to define pre-drinking themselves was a strength of Study 1, however doing so did not allow us to account for variations in how pre-drinking was defined across individuals. Using user-defined pre-drinking adds to current literature by providing insight into the various contexts in which pre-drinking can take place, particularly in relation to SA. Future research is needed to shed light on how to best define pre-drinking for socially anxious individuals.

One of the main challenges of this research was also grouping pre-drinking contexts into different categories. The present dissertation provides support for differential pre-drinking risk across pre-drinking contexts and as a function of anticipatory anxiety. However, these contexts can be diverse depending on their characteristics including but not limited to who is present in these situations, the nature and quality of relationships with others in these contexts and perceived peer pre-drinking norms (i.e., behaviours and beliefs about others' approval or disapproval of drinking behavior (Lewis & Neighbors, 2004)) that influence drinking behavior (Ham & Hope, 2006). To date, little is known about pre-drinking contexts for socially anxious individuals and there are no measures, to our knowledge, that have been developed and validated for use with this population. Based on previous research and guided by the data, we categorized pre-drinking contexts into intimate, group and other contexts in Study 1 and focused on three types of pre-drinking contexts in Study 2. Qualitative studies aimed at developing measures of pre-drinking context specifically for those high in SA will aid in overcoming this limitation.

The present studies did not include an upper risk group in the sample. A non-clinical sample was used, including individuals who range in SA and who denied past and current drinking problems, allowing us to investigate risk on a continuum, which is a strength in the present dissertation. Studies should be replicated with clinical samples of young adults who meet diagnostic criteria for social anxiety disorder. Given that this research aimed to clarify the complex link between SA and pre-drinking, future research should also include participants with problematic pre-drinking patterns. Nonetheless, SA severity and pre-drinking are on a continuum (Ruscio, 2010), therefore we may expect to find similar results in clinical samples.

Despite these limitations, the present dissertation adds considerably to the SA and pre-drinking literature and makes significant contributions to cognitive models of SA and pre-drinking. Findings suggest that risk for problem drinking (i.e., heavy and frequent drinking and experiencing alcohol-related negative consequences) can start earlier in the night for undergraduates who are high in SA. In fact, elevated SA has not been consistently associated with problem drinking (Buckner et al.; 2011;, 2013). Findings from the present dissertation suggest that mixed findings may be clarified by investigating and including pre-drinking, a risky drinking behavior that precedes problem drinking throughout the evening, into models of SA and drinking. Understanding the risk factors in the SA risk for pre-drinking have important implication for prevention and intervention strategies.

Clinical Implications

In addition to theoretical implications, results of this two-study dissertation points to clinical applications for evidence-based interventions aimed at reducing SA-related pre-drinking risk among undergraduates. A more precise understanding of risk factors and cognitive processes contributing to pre-drinking and thus potentially to problem drinking risk can inform psychoeducational, cognitive and skills-based interventions. Findings from this dissertation indicating that anticipatory anxiety is a cognitive process through which SA increases risk for pre-drinking in specific contexts can help improve existing interventions, by pointing to ways in which treatments can be adapted to target specific drinking behaviours.

Evidence-based psychoeducational interventions have been supported as effective in reducing risk for problem drinking (Cronce & Larimer, 2011) and are among the most widely used clinical interventions with undergraduates (Merrill et al., 2013). Incorporating information regarding risky pre-drinking practices, risky pre-drinking contexts and pre-drinking to cope with anticipatory anxiety may be central to adapting these preventative interventions. In general, studies show that clinical interventions that integrate psychoeducation decrease problematic drinking in high school students (Conrod et al., 2006). One possible application may be to adapt these interventions to undergraduates high on SA who tend to pre-drink alone or in unfamiliar contexts prior to social events. Adapting psychoeducational interventions may be advantageous for reducing context-specific pre-drinking to cope with anticipatory anxiety among undergraduates.

Findings also point to the importance of incorporating adapted methodologies in clinical interventions that target both alcohol misuse and anxiety disorders. The study of specific treatments for anxiety-alcohol use disorder comorbidity is still in its infancy. Those who suffer from comorbid substance use disorder and anxiety disorders present a challenging population with respect to treatment. Studies have shown poorer treatment outcomes for individuals with SA who received treatment for alcohol use disorder only (Kushner et al., 2005) and for individuals with alcohol use problems who received treatment for social anxiety disorder only (McEvoy & Schand, 2008). Recent studies suggest that integrated treatments that recognize the complex relation between anxiety disorders and alcohol use disorder may be the best approach to intervention in individuals with comorbid conditions. An integrated problem formulation and integrated therapeutic techniques may be necessary when treating socially anxious individuals who engage in problem drinking (Stapinski et al., 2015). Specifically, the moderation effect of anticipatory anxiety and pre-drinking context on SA risk for pre-drinking suggests that these factors combined can be mutually reinforcing. Anticipatory anxiety is a cognitive process that is malleable, amenable to interventions (Goldman, 1999) and targeted in evidence-based interventions such as Cognitive Behaviour Therapy (CBT) (Heimberg, 2002). Such interventions target thoughts, emotions, beliefs and behaviours that serve to maintain coping-motivated problematic alcohol use. The present dissertation underscores the importance of targeting both context-specific anticipatory anxiety processes, including automatic thoughts, negative predictions and negative self-perceptions, while also providing skills training, such as distress tolerance and emotion regulation. Such integrative efforts would aim to challenge anticipatory processing while also providing those high in SA with adaptive skills necessary to cope with anticipatory anxiety in certain contexts, as opposed to using pre-drinking to reduce distress. Such integrated interventions may be particularly promising avenues for reducing pre-drinking and problem drinking risk among socially anxious undergraduates.

Conclusion

The present dissertation investigated SA risk for pre-drinking among university students – the undergraduate period is-a time during which new social experiences and drinking are prevalent. This program of research identifies key risk factors in SA-related pre-drinking. The findings suggest that those high in SA are at risk for pre-drinking alcohol prior to attending upcoming social events in specific contexts and when in the moment anxious mood is high.

Together, these studies offer insight into the complex link between SA and pre-drinking in university, demonstrating that it's not in every social context that those high in SA are at increased risk for pre-drinking. This work also suggests that risk for problem drinking throughout the evening may be initiated early in the night during pre-drinking. The present dissertation provides future direction for modeling SA-pre-drinking risk trajectories and implementing clinical interventions for undergraduate students.

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Appendix A.

Getting-to-Know-You Interaction Task Questions

1. Given the choice of anyone in the world, whom would you want as a dinner guest?

2. Would you like to be famous? In what way?

3. For what in your life do you feel most grateful?

4. If you could wake up tomorrow having gained any one quality or ability, what would it be?

5. What do you value most in a friendship?

6. What, if anything, is too serious to be joked about?

7. Your house, containing everything you own, catches fire. After saving your loved ones and pets, you have time to safely make a final dash to save any one item. What would it be? Why?

8. Complete this sentence: "I wish I had someone with whom I could share _____"

9. Tell your partner something that you like about them already.

10. If you knew that in one year you would die suddenly, would you change anything about the way you are now living? Why?

11. If you were able to live to the age of 90 and retain either the mind or body of a 30-year-old for the last 60 years of your life, which would you want?

12. What would constitute a "perfect" day for you?

13. If a crystal ball could tell you the truth about yourself, your life, the future, or anything else, what would you want to know?

14. Is there something that you've dreamed of doing for a long time? Why haven't you done it?

15. What does friendship mean to you?

16. If you were going to become a close friend with your partner, please share what would be important for him or her to know?